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PRE-FEASIBILITY STUDY FOR THE PROPOSED SEPTAGE MANAGEMENT PROGRAM FOR ZAMBOANGA CITY

**USAID Strengthening Urban Resilience for Growth
with Equity (SURGE) Project**

September 30, 2021

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Acronyms

4Ps	Pantawid Pamilyang Pilipino Program
A&D	Alienable and Disposable
ABC	Association of Barangay Captains
ADC	Alternative Daily Cover
AMORE	Alliance for Mindanao Off-Grid Renewable Energy
APIS	Annual Poverty Indicators Survey
ASEAN	Association of Southeast Asian Nations
BCR	Benefit to Cost Ratio
BIMP-EAGA	Brunei, Indonesia, Malaysia, and Philippines East Asia Growth Area
BLGF	Bureau of Local Government Finance
BOQ	Bill of Quantities
CBD	Central Business District
CDI	Cities Development Initiative
CENRO	City Environment and Natural Resources Office
CEST	CEST, Incorporated
CHO	City Health Office
CLUP	Comprehensive Land Use Plan
COA	Certificate of Analysis
CPI	Consumer Price Index
CV	Contingent Valuation
CWA	Philippine Clean Water Act
DA	Department of Agriculture
DAO	DENR Administrative Order
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DOF	Department of Finance
DOH	Department of Health
DPWH	Department of Public Works and Highways
DRRMO	Disaster Risk Reduction & Management Office
DSCR	Debt Service Coverage Ratio
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
ECB	Economic Cost-Benefit
ECC	Environmental Compliance Certificate
ECP	Environmentally Critical Project
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMB	Environmental Management Bureau
FAO	Food and Agriculture Office of the United Nations
FIRR	Financial Internal Rate of Return
FOG	Fat, Oil, and Grease
FPA	Fertilizer and Pesticide Authority
FY	Fiscal Year
GBV	Gender-Based Violence
GDP	Gross Domestic Product
GES	General Effluent Standards
GIS	Geographic Information System
HGDG	Harmonized Gender and Development Guidelines
HUC	Highly Urbanized City
ICED	Infrastructure & Cities for Economic Development
ICMA	International City/County Management Association
IEC	Information, Education, and Communication
IEE	Initial Environmental Examination
INFRACOM-SCWR	Infrastructure Sub-Committee on Water Resources
IRA	Internal Revenue Allotment

ISO	International Organization for Standardization
LDRRMP	Local Disaster Risk Reduction and Management Plan
LGC	Local Government Code
LGU	Local Government Unit
LIG	Low-Income Group
LSI	Locally Sourced Income
LSSP	Local Sustainable Sanitation Plan
LTO	Local Transportation Office
LWUA	Local Water Utilities Administration
MCM	Million Cubic Meters
MGB	Mines and Geosciences Bureau
MRF	Materials Recovery Facility
MSDS	Materials Safety Data Sheet
NAPOCOR	National Power Corporation
NCCA	National Commission for Culture and the Arts
NEDA	National Economic and Development Authority
NG	National Government
NGT	National Government Transfers
NHCP	National Historical Commission of the Philippines
NIA	National Irrigation Administration
NIPAS	National Integrated Protected Areas System
NPV	Net Present Value
NRW	Non-Revenue Water
NSSMP	National Sewerage and Septage Management Program
NWRB	National Water Resources Board
O&M	Operations and Maintenance
OCENR	Office of the City Environment and Natural Resources
OFW	Overseas Filipino Worker
OMW	Organic Municipal Waste
PCW	Philippine Commission on Women
PD	Presidential Decree
PDP	Philippine Development Plan
PDST	Philippine Dealing System Treasury
PEISS	Philippine Environmental Impact Statement System
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PPE	Personal Protective Equipment
PRECUP	Philippine Registry of Cultural Property
Pre-FS	Pre-Feasibility Study
PSA	Philippine Statistics Authority
PSSR	Philippine Sustainable Sanitation Roadmap
PWSSMP	Philippine Water Supply and Sanitation Master Plan
RA	Republic Act
ROW	Right-of-Way
RRF	Residuals Recovery Facility
RROW	Road Right-of-Way
SAU	Septage Acceptance Unit
SBR	Sequencing Batch Reactor
SDF	Social Development Framework
SDG	Sustainable Development Goals
SDR	Social Discount Rate
SMP	Septage Management Program
SOW	Scope of Work
SP	<i>Sangguniang Panlungsod</i>
SpTP	Septage Treatment Plant
SURGE	Strengthening Urban Resilience for Growth with Equity
UNDP	United Nations Development Programme
US EPA	United States Environmental Protection Agency

USAID	United States Agency for International Development
VAWG	Violence Against Women and Girls
VTU	Vacuum Truck Unit
WACC	Weighted Average Cost of Capital
WD	Water District
WHO	World Health Organization
WMS	Wastewater Management Section
WQMA	Water Quality Management Area
WSP	Water Service Provider
WTP	Willingness to Pay
WWTP	Wastewater Treatment Plant
Z3R	Zamboanga City Roadmap to Recovery and Reconstruction
ZAMCELCO	Zamboanga City Electric Cooperative
ZAMSURECO II	Zamboanga del Sur Electric Cooperative II
ZCWD	Zamboanga City Water District
ZCWSC	Zamboanga City Water Security Council
ZSCMST	Zamboanga State College of Marine Sciences & Technology

1 Summary and Recommendations

1.1 Introduction

This section summarizes the contents of the pre-feasibility study (Pre-FS), mainly focusing on the rationale of the project, findings, results, and recommendations significant to decision making and planning. Detailed assumptions, findings, and decision processes are presented in the succeeding sections of the report and appendices.

1.1.1 Rationale

The Strengthening Urban Resilience for Growth with Equity (SURGE) Project is an award of the U.S. Agency for International Development (USAID) to the International City/County Management Association (ICMA). The SURGE Project supports the USAID/Philippines' Cities Development Initiative (CDI) by supporting the Philippines to shift to a sustained and more inclusive growth trajectory at par with other high-performing emerging economies. The SURGE Project has three objectives: (1) improve local capacity in inclusive and resilient urban development; (2) improve environment for local economic development; and (3) expand economic connectivity and access between urban and rural areas.

USAID supports eight partner cities included in the CDI, which are being provided with support following a “whole-of-mission” approach in which all other USAID projects are encouraged to converge for an integrated delivery of assistance. These cities are Batangas, Legazpi and Puerto Princesa in Luzon, Iloilo and Tagbilaran in the Visayas, and Cagayan de Oro, General Santos and Zamboanga in Mindanao.

SURGE fundamentally assists cities and adjacent areas to plan effectively, guarantee basic public services, reduce business transaction costs, promote competitiveness, support sustainable development, and reduce disaster and climate change risks.

Among the measures of success of the project includes improvement in access to safe drinking water, sanitation facilities, and social services for the city; to which the SURGE Project focuses on providing technical assistance aimed at improving access to sustainable and resilient water and sanitation services. Technical assistance includes capacity development, pre-feasibility studies, water supply and sanitation system concept designing, Geographic Information System (GIS) Mapping and database establishment, review of funding options, and geo-resistivity surveys among others.

The SURGE Project aims to assist the Zamboanga City Water District (ZCWD) in the conduct of a Pre-FS for a proposed septage management program (SMP) for the CDI City of Zamboanga including a Resource Recovery Facility (RRF). This intervention is aligned and consistent with the national government's key reform agenda action plan on water supply and sanitation and help achieved universal access to sanitation by 2030.

1.1.2 Project Objectives

The key objective of the Study is to conduct a Pre-FS to propose a finalized scheme for the establishment of the SMP, and an RRF as a complementary facility to the septage treatment system in Zamboanga City. The project is to be coordinated with the ZCWD.

In line with the Scope of Work (SOW), the study shall perform the necessary assessments and investigations to provide the best possible options for developing an SMP which include:

- assessment and evaluation of the project area;
- identification and verification of the service area through reconnaissance and household and commercial surveys;
- site evaluation for the nominated sites for the septage treatment plant and RRF;
- proposal of the best solution based on a technical, financial, economic, and socio-environmental and institutional impact considerations;
- adoption and application of relevant national and international design standards, legislations and codes;
- incorporation of the planning framework of the Department of Health (DOH) which include the Local Sustainable Sanitation Plan, Five Functional Areas of Sanitation, the Three-Pronged Approach to Sanitation Program, and the Sanitation Ladder Approach.

Planning, programming, implementation and monitoring will be based on the application of systems techniques in order to ensure that all project activities are directed towards the attainment of project objectives in a timely and cost-effective manner. The final Pre-FS report must include the description of the study area and market conditions, technical, institutional and socio-environmental analysis of septage collection, transport, treatment systems, and the RRF, financial and economic analyses of the system, and the preparation of the implementation plan and study results.

The project shall be implemented by the ZCWD and is expected to reduce pollution load to receiving water bodies, and improve access to sanitation services; which in turn will reduce health costs related to poor environmental conditions and water-borne diseases, increase productivity of marine resources, and support sustainable, resilient and inclusive growth of the city in line with the objectives of the USAID SURGE Project.

1.2 Baseline Conditions

1.2.1 The Study Area

Zamboanga City is located at the southwestern section of the Zamboanga Peninsula and is the third largest city in the country in terms of land area at 145,327 hectares and comprising a total of 98 barangays. The city hosts seven watershed reserves, with several river systems emanating them, among which have Sulu Sea, Basilan Strait, and Moro Gulf as the outfall of these river systems. The Pasonanca Watershed is one of the watershed reserves located in the city which is declared under National Integrated Protected Areas System (NIPAS) as a national park.

The City of Zamboanga is the second most populous city in Mindanao with a total population of 977,234 based on the latest 2020 Census of Population and Housing. The population density of the city is 609 persons per km². This figure has been increasing for the past decades with the population density increasing by about 50 percent from its population density of 425 persons per km² in 2000. The population growth rate from 2015 to 2020 is at 2.68 percent. The ratio between men and women is fairly equal with 50.2 percent of the population being male.

Along with the rest of Zamboanga Peninsula, the city falls under Climate Type III of the Modified Coronas Classification, pertaining to seasons that are not very pronounced, with periods between November to April being relatively dry, while the rest of the year are wet. While the city is generally

found to be less vulnerable to typhoons due to its geographical location and being surrounded by the mountainous areas in Basilan Island, Sulu Archipelago, Palawan Island, and the main island of Mindanao, the city still faces various hazard susceptibilities. For hydrometeorological hazards, coastal barangays have high flood susceptibility. On the other hand, barangays located at the northern and central portions of the city have moderate to high rain-induced landslide. For seismic hazards, the areas with susceptibility to liquefaction are those that are located near the coasts and shorelines.

Development in the city is primarily concentrated in the southern area of the city where the urban areas are located. The urban core of the city hosts various economic, institutional, and educational activities. Zamboanga City's local economy is largely driven by the agricultural sector with its major crops as banana, mango, corn, and rubber for crops; *matangbaka*, *tulingan*, and *galunggong* for fisheries; and carabao, cattle, and hog for livestock. Industries and manufacturing are also a significant economic driver of the city, especially with its links to the vast fishery activities in the city. Additionally, the city is also located in the Greater Sulu-Sulawesi Corridor of the Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA), which serves as its maritime corridor for faster agriculture and aquaculture trade between the member countries.

1.2.2 Existing Water Supply & Sanitation Facilities

Based on the census conducted between 2017 to 2018 by Community-Based Monitoring System (CBMS) Network (2019) in Zamboanga City, over 79 percent of households have access to safe water. The ZCWD is the primary provider of water supply services in the city covering 61 out of the 98 barangays, with a total of 66,462 service connections as of December 2020. ZCWD utilizes a mix of groundwater, surface water, and bulk water sources with a total capacity of 1,840 lps, based on the 2021 water production data.

The remaining 20 percent of the household population without access to safe water, source their water supply from dug wells, protected and unprotected springs, peddlers, water refilling stations, lakes, and rivers, among others. Among the barangays with the lowest water supply access are Pangapuyan (0 percent), Tigtabon (0.4 percent), and Mariki (2.1 percent). The census found that there were 27 waterless barangays in the city, pertaining to areas with less than 50 percent of its total households with access to safe water supply coverage (CBMS Network, 2019).

In terms of sanitation, 90.3 percent of households have access to sanitary toilet facilities. Two in five households (21.5 percent) share sanitary facilities with at least one other. Based on the 2010 data of the Philippine Statistics Authority (PSA), about 71 percent of the households in the city have access to septic tanks or other types of wastewater depository structures (Philippine Statistics Authority, 2010).

Desludging services for these septic tanks are provided by two private desludging companies, namely, Christine Haresco Wastewater Treatment Services and Veteran Builder Enterprises. However, not all septic tanks in the area are regularly desludged.

Zamboanga City is also served by sewer systems. The existing sewer system consists of 11,400 linear meters of vitrified clay pipes constructed in the 1930s. As of 2021, commissioning is ongoing for a 4,000 m³/day sewage treatment plant (STP) for this sewer network and its potential expansion.

Two separate sewer systems are also proposed to be constructed to serve barangays Rio Hondo and Mariki and barangay Kasanyangan, respectively. STP capacities for these systems are

proposed at 1,500 m³/day for the Rio Hondo System and 2,000 m³/day for the Kasanyangan (Vale Vista) System.

1.3 Projections

1.3.1 Service Area and Planning Period

Population and septage volumes were projected for a planning period of 20 years or from Year 2021 to 2040. The planning horizon considered for the SMP was divided into four desludging cycles of four years each, in line with the DOH Order No. 2019-0047, recommending that septic tanks be desludged once every four years (2019). With the start of operations considered at Year 2025, the SpTP was designed for implementation in two phases with two cycles each. The second phase is expected to begin in 2032. These projections served as the bases for the formulation of the proposed design for the proposed SMP and RRF.

Population, service connection, and septage volumes were projected for the entire City of Zamboanga to show the full picture of the study area.

1.3.2 Population Projection

The population projection methods considered in the study are the NSCB Ratio Method – which distributes the PSA population projections at the provincial level to the city level based on historical trends of the ratio of city population to provincial population – and mathematical extrapolation methods by Linear Regression, Logarithmic Regression, Polynomial Regression, and Exponential Regression. The historical data used in the population projections were the censuses conducted by the PSA from 2000 to 2020.

Among the projection methods used, Linear Regression yielded mid-level and increasing projections, and was adopted for this Study. This resulted in projected populations of 1,194,036 and 1,338,581 for Year 2030 and Year 2040, respectively.

1.3.3 Service Connection Projection

The projections for service connections were established based on the ten-year projections obtained from the ZCWD forecasted up to Year 2040. This considered a projected annual increase of 2,000 service connections. Projections were distributed by barangay and into residential and non-residential service connections based on historical data from the ZCWD. This resulted in a total of 80,963 and 95,283 residential service connections for Year 2032 and Year 2040, respectively; and 9,499 and 11,179 non-residential service connections.

1.3.4 Septage Volume Projection

Septage volume is among the most crucial factors in developing sanitation concept designs – particularly for SMPs. It determines several design components such as the septage treatment plant (SpTP) capacity and the required number of vacuum truck units per type according to capacity (i.e., 3 m³, 5 m³, 10 m³).

Septage volume was estimated using the “typical tank volume and pump-out frequency” method. This is given by the following formula:

$$\text{Potential Septage Volume (m}^3\text{/day)} = \frac{\text{No. of Desludgeable Septic Tanks} * \text{Septage Volume per Septic Tank (m}^3\text{)}}{\text{Desludging Frequency (year)} * \text{Operational Days per Year (days/year)}}$$

The computation of these potential septage volumes were computed considering the different classifications of the service connections (residential or non-residential, and served or unserved by ZCWD). For the purposes of proper planning of the SMP, Zamboanga City was also divided into three Service Areas: Service Area 1 referring to inland barangays unserved by existing and proposed septage and sewerage systems under the ZCWD, Service Area 2 referring to the barangays covered by these existing sanitation systems, and Service Area 3 referring to island barangays. Among these service areas, Service Area 1 was identified as the potential service area for the proposed SMP.

From the potential septage volume projections for this potential SMP service area, collection targets were also applied. With the ZCWD as the main proponent of this proposed SMP, a collection target of 100 percent was assumed for the ZCWD customers and considering a stricter implementation of sanitation ordinances, collection for non-residential non-ZCWD customers was also assumed at 100 percent. For residential non-ZCWD customers, collection is expected to be low during the initial years at 10 percent. This is in line with the three-pronged approach to sanitation rooted in the principle that behavior change is affected by three major factors, namely: (a) infrastructure, products & services; (b) appropriate promotional approaches; and (c) a supportive environment. This low target collection is also expected to gradually increase as appropriate improvements to the services, promotional campaigns, and enabling environment are implemented. These were assumed to increase to up to 25 percent by the end of the planning period.

The target septage volumes for the proposed SMP is about 190 m³/day in Year 2032 and 260 m³/day in Year 2040. The projected septage volumes were also used to provide the generation rates of sanitation residuals for reuse or resource recovery processing.

1.4 Recommendations

1.4.1 Septage Management Program

Phase 1 or the initial phase of the SpTP will be constructed in Year 2024 with a capacity of 190 m³/day and will be capable of treating the target septage volumes up to Year 2032 or the end of the 2nd desludging cycle. By Year 2032, Phase 2, with an additional capacity of 70 m³/day (total capacity: 260 m³/day) will begin construction with its start of operations in Year 2033. Considering the useful life of machineries and equipment, the replacement of these was considered at the 15th year of operations or in 2039.

The treatment processes for the SpTP were identified considering the needs and conditions of the Study Area. Due to the large volume of the target volume, the availability of space within the proposed site in Barangay Cabatangan, as well as the highly urbanized nature of Zamboanga City, a fully-mechanized system was considered. This involves the following units/processes: Septage Acceptance Unit, Screw Press with Polymer Dosing, Sequencing Batch Reactor, and Chlorination. The design of the SpTP is capable of treating the septage in line with the general effluent standards for Class C water bodies.

The total capital cost for the construction of the SpTP was estimated at PhP107.5 million for Phase 1 and 29.8 million for the additional tanks required in Phase 2.

1.4.2 Resource Recovery

Potential applications for reuse in Zamboanga City were determined through consultations and short surveys with institutions that were initially identified by the Study Team to be potential end-users of the byproducts. As per the recommendations of local offices and agencies, it was determined that these byproducts may be used for agricultural purposes. The Class C effluent from the SpTP shall be treated further to be applied for crop irrigation, while the dewatered sludge can be processed into biosolids to be applied as organic soil amendments (fertilizer, soil conditioner). Additionally, biosolids may also be productively disposed of as earth fill for the sanitary landfill in the city.

The estimated volume of sanitation byproducts that can be processed for reuse from SpTP were assumed to be at 90 percent and 10 percent of the raw septage volume for the treated effluent and dewatered sludge, respectively. This is based on the mass balance equation for dry solids, with the assumption that raw septage typically contains two percent of solids while the dewatered sludge from the screw press may contain 20 to 25 percent solids.

Effluent shall undergo disinfection by chlorination with a contact time of 90 minutes, to reduce the fecal coliform. A chlorine contact chamber tank is recommended to be constructed with a volume of 15 m³ and a design capacity of 240 m³/day to accommodate the volume of effluent until the end of the planning horizon. The disinfected effluent to be used for irrigation shall comply with the standards by the Department of Agriculture (DA) Administrative Order No. 2019-11.

The dewatered sludge, on the other hand, shall be composted to remove pathogens and be processed into soil amendments, in accordance with Philippine National Standards/Bureau of Agriculture and Fisheries (PNS/BAF) provisions for organic soil amendments. The proposed composting facility requires 4,200 m² of land area, including the composting area, and the storage warehouses for the bulking agent and end-product. Composting time is 80 days with the municipal solid waste materials as the potential bulking agent.

Total capital cost for the Reuse Facilities during Phase 1 is about PhP3.7 million. An additional cargo truck will be purchased in Year 1 amounting to PhP1.7 million. The composting facility will be expanded in 2032 to meet the projected dewatered sludge until 2040, requiring another PhP1.2 million in capital.

2 Description of the Study Area and Market Conditions

This section discusses the physical characteristics of Zamboanga City, including the topography, geology, climate, hazards, and the land use of the area. Additionally, it also presents the latest statistics, including the population, demography, health, governance profile, and local economy. Lastly, it features the existing conditions of water supply and sanitation facilities and other infrastructure in the area.

2.1 Study Area Location and General Description

Zamboanga City is a highly urbanized city located in the southern-most part of the Zamboanga Peninsula (Region IX), on the western side of Mindanao Island, specifically at the coordinates 6°54'16.433" N and 122°4'35.110" E. The city is bounded by the provinces of Zamboanga del Norte and Zamboanga Sibugay on the north, and by the Basilan Island on the south. It is also bounded by the Sulu Sea on the west, by the Moro Gulf on the east, and by the Basilan Strait and Celebes Sea in the south.

The city is the south terminus end of the Pan-Philippine Highway, and accessible via various transportation modes from all other major cities in the country. Zamboanga City is approximately 505 nautical miles south of Manila, about 270 nautical miles from Cebu City, and is 320 nautical miles from Davao City. It is also 365 nautical miles northeast of Kota Kinabalu, Malaysia, and 345 nautical miles northeast of Manado, Indonesia.

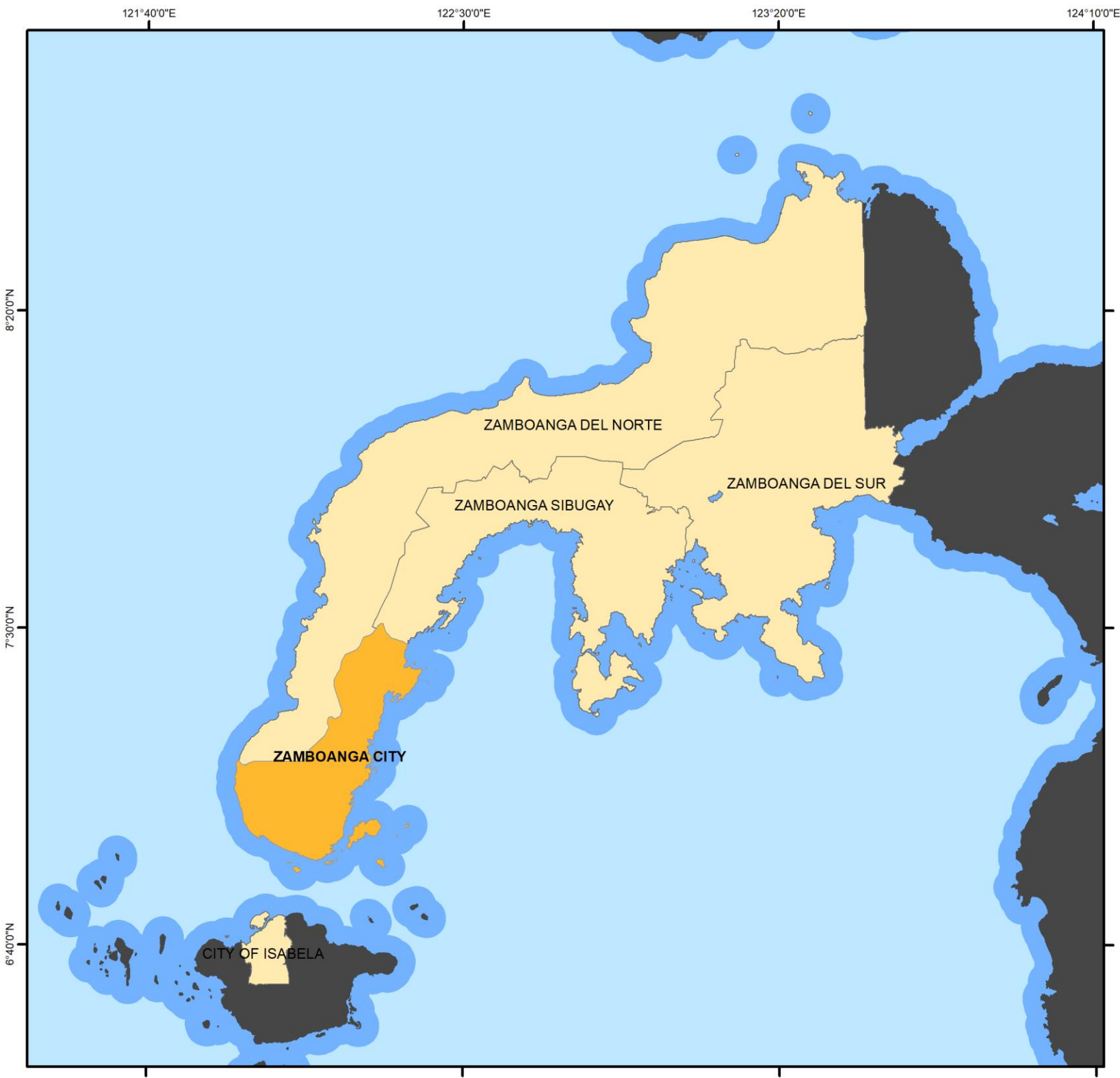
With its strategic location in the Basilan Strait, Zamboanga City is a busy port catering to local and international shipping vessels and ferries, exporting products such as rubber, pearls, fine hardwoods, fish, and fruit. The city also caters to daily international flights due to its location within the Brunei, Indonesia, Malaysia, and Philippines East Asia Growth Area (BIMP-EAGA) Region, increasing the airport's air traffic from participating countries in the region (City Government of Zamboanga, 2018). **Figure 1** shows the location of Zamboanga City.

2.2 Land Area and Political Distribution

Zamboanga City is composed of 98 barangays with a total land of 145,327.02 hectares, its total land area accounts for approximately 10 percent of the total land area of the Zamboanga Peninsula; and is considered the third largest city in the Philippines by land area (2015).

The entire city is mainly divided into two political districts: District I and District II. District I, or the West Coast area, faces the Sulu Sea and is bounded on the north by the Municipality of Sibuco in Zamboanga del Norte; while District II, or the East Coast area, faces the Moro Gulf is bounded on the north by the Municipality of Tungawan in Zamboanga Sibugay. District I and II have 37 and 61 barangays, respectively. The distribution of barangays by district is shown in **Figure 2**.

To disperse economic activities in all 98 barangays of the city, these are divided into seven Development Planning Units (DPUs) namely: the Central Business District (CBD) or DPU 1 covering 30 barangays; Mercedes or DPU 2 covering another 30 barangays; Ayala or DPU 3 with 10 barangays, Labuan or DPU 4 with 3 barangays; Sangali or DPU 5 with 8 barangays; Curuan or DPU 6 with 7 barangays; and Vitali or DPU 7 with 10 barangays. **Figure 3** shows the coverage of the DPUs in Zamboanga City.



LOCATION MAP
ZAMBOANGA CITY

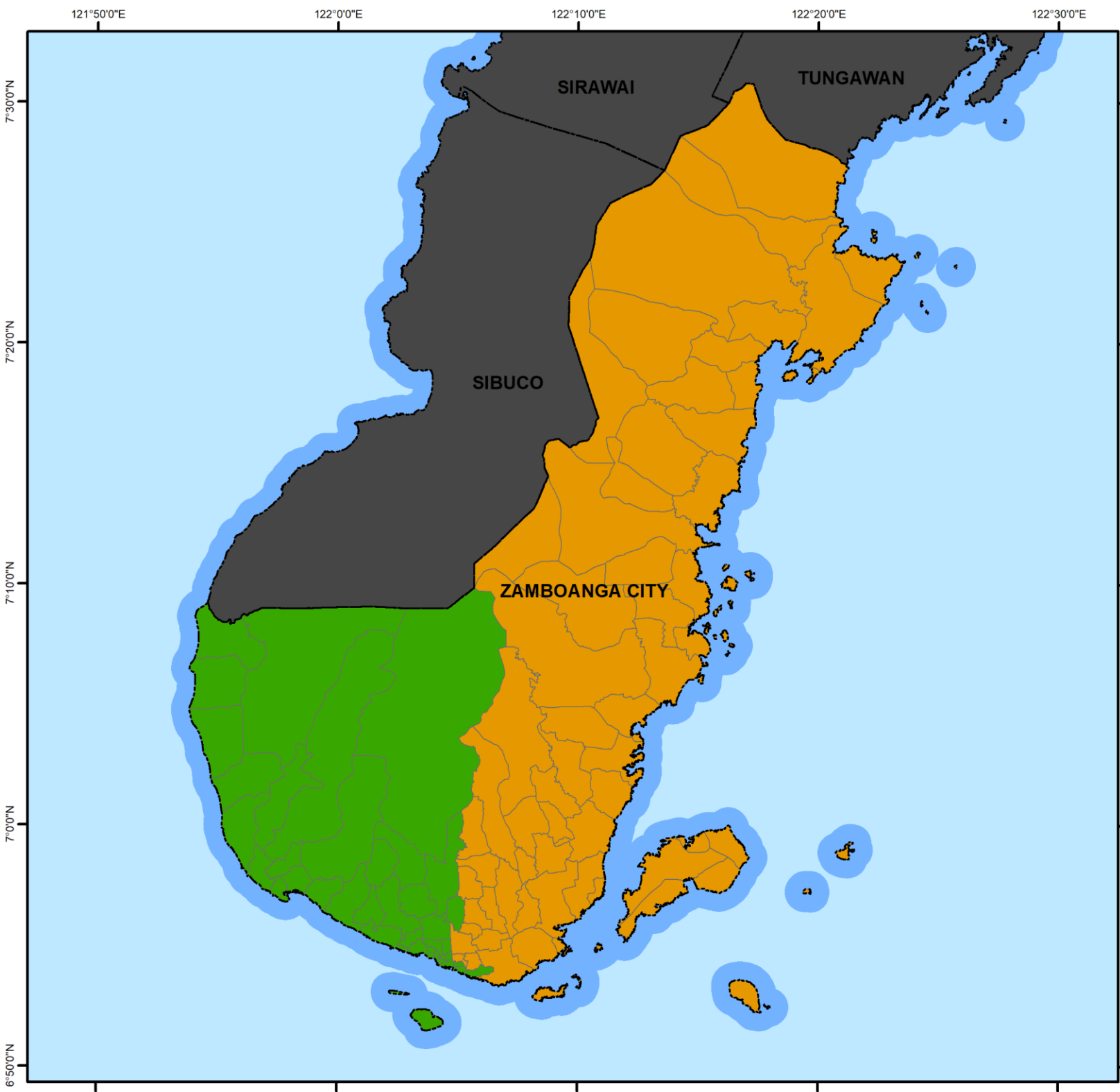
- LEGEND:
- Zamboanga City
 - Zamboanga

1:1,500,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES
Administrative Maps (OCHA, 2016)

FIGURE 1
Zamboanga City
Location Map



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

[] City/Municipal Boundaries

BARANGAY BOUNDARIES

Congressional Districts

District I

District II

N
W E
S

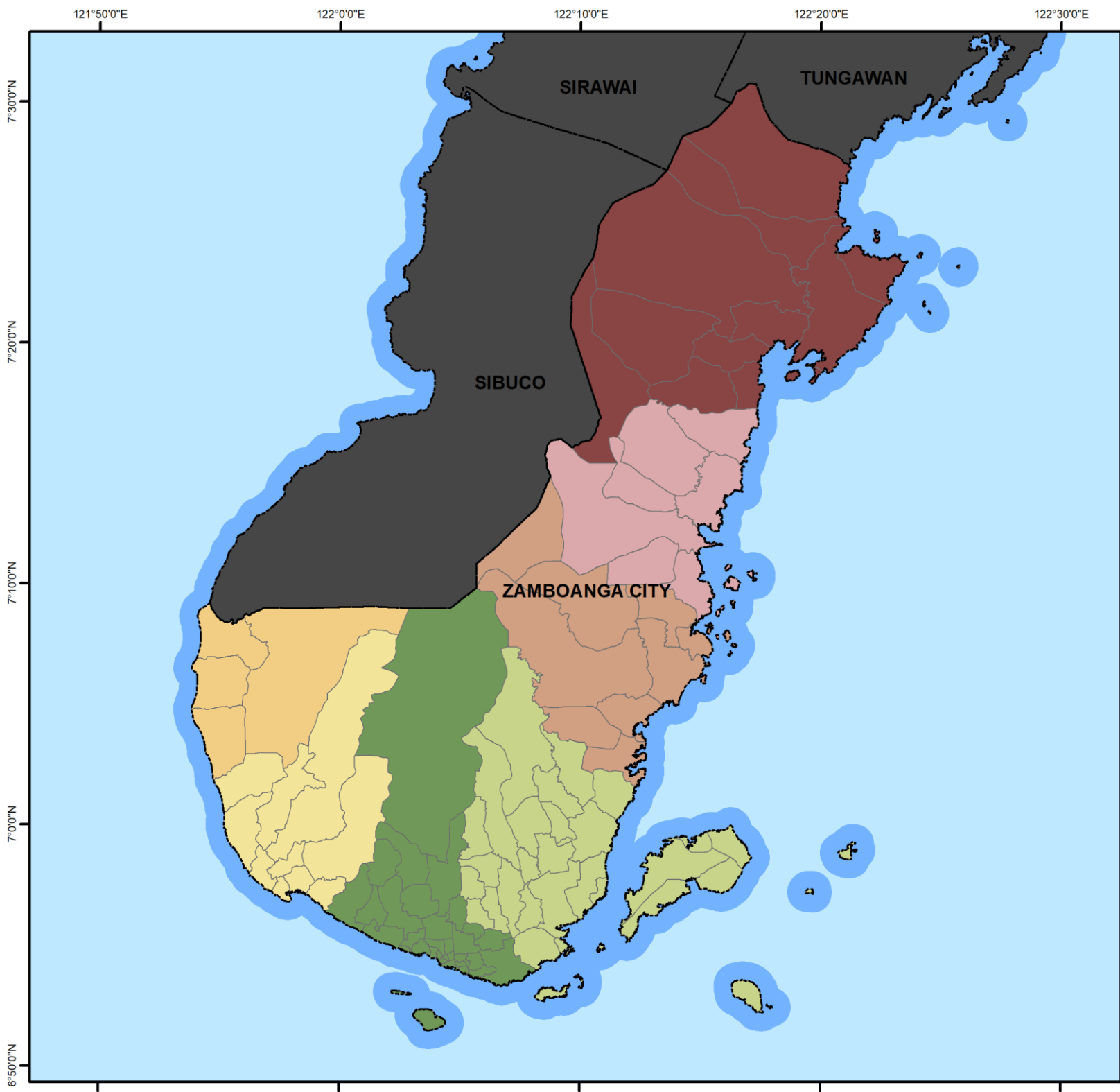
1:400,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
Congressional District Coverage (CPDO, 2016)

FIGURE 2
Zamboanga City
Congressional District Map



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

City/Municipal Boundaries

BARANGAY BOUNDARIES

Development Planning Units

- DPU 1 - Central Business District (CBD)
- DPU 2 - Mercedes
- DPU 3 - Ayala
- DPU 4 - Labuan
- DPU 5 - Sangali
- DPU 6 - Curuan
- DPU 7 - Vitali

1:400,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
DPU Coverage (CPDO, 2016)

FIGURE 3

Zamboanga City
Development Planning Unit Map

2.3 Physical Description of Study Area

2.3.1 Topography

The topography of Zamboanga City is mostly flat along its coast, rising towards the center of the southwestern tip of the Zamboanga Peninsula; where Mount Nancy is located and stands at approximately 1,360 meters above sea level. Most of the barangays in Zamboanga City are generally situated within the flat lying coastal zone, alluvial plains, and marshlands.

Majority of the city have level to undulating slopes ranging from 0 to 8 percent, comprising of about 49,000 hectares. Meanwhile, undulating to rolling slopes at 8 to 18 percent have the least area at around 14,000 hectares. The highest elevation in the city is the Batorampon Point, a rocky cliff at the westernmost point of Mindanao, with an elevation of 1,335 meters above sea level.

Table 1: Zamboanga City Topography

Slope	Description	Area (hectares)	Percent Share (%)
0% to 8%	Level to Undulating	48,643.82	34.21
8% to 18%	Undulating to Rolling	14,345.28	10.09
18% to 30%	Rolling to Hilly	26,055.80	18.32
30% to 50%	Hilly to Mountainous	33,848.72	23.81
50% and above	Mountainous	19,297.97	13.57
Total		142,191.59	100.00

Source: NAMRIA, 2015 (Island Barangays are not included)

2.3.2 Soil and Geology

Soil

According to a 2007 geological and geomorphology study by the Mines and Geosciences Bureau (MGB), the soils in the east coast are largely marshland, swamps, mudflats and extensive estuarine environments, mostly due to tide movements. On the west coast, the soil was observed to be composed of sediments and silt formed mainly by wave movement. In general, the areas in both coastal areas are very soft and lightly compacted material that would encounter ground settling over time.

Soils in the land of Zamboanga City are generally categorized into three main groups, which are observed in certain topographies and used for specific purposes as shown on **Table 2**.

Table 2: Zamboanga City Soil Classification

Soil Category	Topography of Area	Function
Residual Soil	Undulating and Mountainous	-
Alluvial Soil	Level to Nearly Level	Agricultural Crop Cultivation
Swamp Lands	-	Fishpond Development

Source: Zamboanga City CLUP 2016-2025

The type of soil found in the city, according to its texture are also observed to occur under specific areas in Zamboanga City as shown on **Table 3**. In the upland areas, the soil has been identified to have parent materials characterized as pyroclastic sandstone basalt and andesite.

Table 3: Soil Textures in Zamboanga City

Area	Soil Texture
Lowlands	Fine Grain/Clay Type
Alluvial Plains and River Terraces	Medium to Fine Grain
Upland Areas	Medium to Coarse Grain

Source: Zamboanga City CLUP 2016-2025

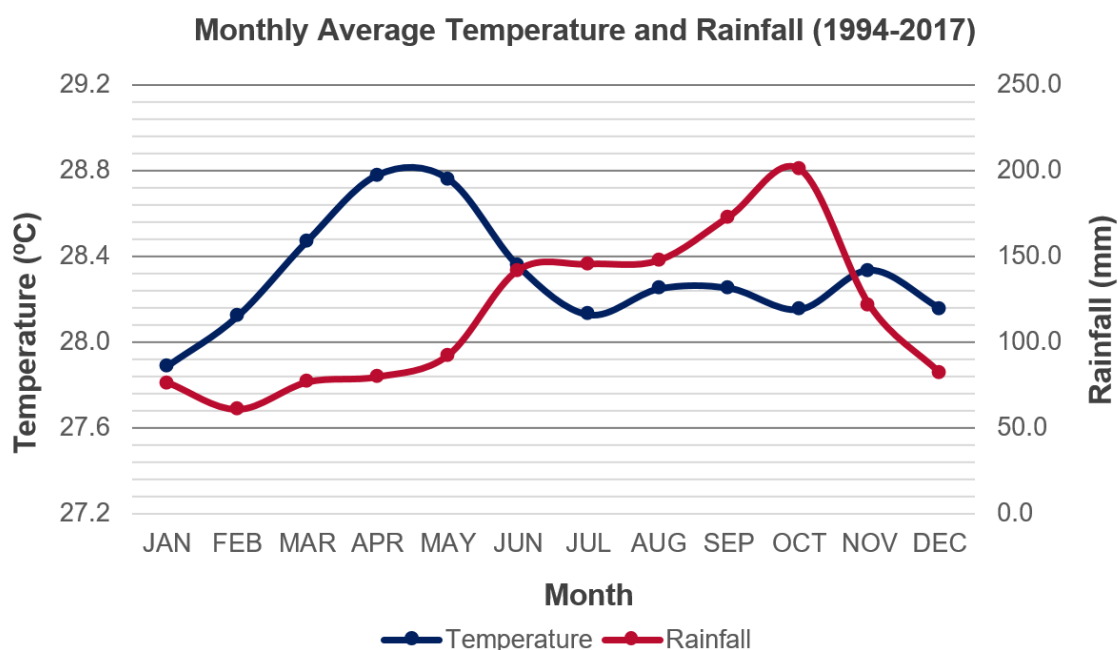
Geology

Zamboanga City has an irregularly-shaped rocky coastline with stretches of sandy and gravelly beaches. Most of the lower alluvial lowlands and low-lying areas situated along the northeastern coast show the presence of cold-water sediments subjected to daily inundation by tidal movements. Areas in higher elevations were observed to have younger rock formations and those areas along rivers are filled up with alluvial materials producing small coastal and broad plains due to embayment.

2.3.3 Climate

The climate in Zamboanga City falls under Type III, based on the Modified Coronas Classification. Its seasons are not very well pronounced; and is relatively dry from November to April and wet for the rest of the year. The city is generally less vulnerable to typhoons due to its location outside the typhoon belt and being geographically shielded by the mountainous areas in Basilan Island, Sulu Archipelago, Palawan Island, and the main island of Mindanao. The monthly average rainfall and temperature in Zamboanga City from 1994-2017 are shown in **Figure 4**.

Figure 4: Average Climatological Data of Zamboanga City (1994-2017)



Source: PAGASA Monthly Mean and Annual Climatic Data 1994-2017

Temperature in the city usually peaks in April and May, making these the warmest months, while the coolest months are January and February. In terms of rainfall, the months of May to November mark the rainy season, peaking in July; while the dry period is experienced from February to April (Local Climate Change Action Plan, 2015).

2.3.4 Water Bodies and Natural Drainage System

Seven watershed reserves, have been identified in Zamboanga City namely, the watersheds of Vitali, Curuan, Bolong, Manicahan, Culianan, Pasonanca and Ayala. The largest in terms of area is the Vitali Watershed with about 12 percent of its area covered by Zamboanga Del Norte. Additionally, the Pasonanca Watershed is part of the NIPAS-declared protected area.

Several river systems emanate from the watershed forest reserves and consist of a group of rivers discharging water through a common flow or a system of channels into a sea or bay as their outfall. **Table 4** shows the major river systems from the watershed forest reserves, with their respective barangay service areas, and outfall or discharge point.

Table 4: Major River Systems in Zamboanga City

Major River System	Watershed Forest Reserve	Service Area (Barangay)	Outfall
Ayala River / Dumalon River	Ayala	Talisayan, Tulungatung, Ayala, Recodo, Cawit	Sulu Sea
San Ramon River	Ayala	La Paz, Pamucutan, Talisayan	Sulu Sea
Patalon River	Ayala	-	Sulu Sea
Saaz River	Ayala	-	Sulu Sea
Tumaga River	Pasonanca	Pasonanca, Sta. Maria, Tumaga, Guiwan, Tugbungan, Talon-talon, Mampang	Basilan Strait
Culianan River	Culianan	Tolosa, Culianan, Zambowood	Moro Gulf
Mercedes River	Culianan		Moro Gulf
Bolong River	Bolong	Bunguiao, Bolong	Moro Gulf
Manicahan River	Manicahan	Victoria, Manicahan, Lamisahan	Moro Gulf
Curuan River	Curuan	Curuan	Moro Gulf
Vitali River	Vitali	Vitali	Moro Gulf
Cabaluay River	Manicahan	Bunguiao, Manicahan, Victoria, Lamisahan, Tolosa	Moro Gulf

Source: Zamboanga City CDP 2016-2021

The natural drainage flow of the city follows a quasi-radial pattern from its highest point, Mount Nancy, branching out towards coastal and low-lying areas. The river systems in the city naturally drain most of the barangays.

2.3.5 Water Quality Conditions

Water quality monitoring is conducted regularly by the Environmental Management Bureau of the Department of Environment and Natural Resources (EMB-DENR). The results of the water quality monitoring report for July 2021 are presented in **Table 5**. The presented results are taken from the sampling stations found approximately at the center of the total length of the river. It may be observed that all these major rivers greatly exceed the standard limits for fecal coliform.

Table 5: Water Quality Results in Zamboanga City (2021)

Water Body	Mercedes River	Saaz River	Patalon River	Tumaga River	Ayala River
Classification	C	B	B	C	B
Station	M2	SZ2	P2	2	3
DO (mg/L)	8.2	7.8	7.5	4.6	9.1
BOD (mg/L)	2.2	1	1	5.2	1.6
TSS (mg/L)	35	17.25	1900	25	10
pH	7	7	7	7	7
Temp (°C)	29.5	29.08	29	29	30
Chloride (mg/L)	98.69	2.45	4.48	20.79	3.7
Color (TCU)	5	5	8	7	5
Phosphate (MPN/ 100 mL)	0.086	0.1	0.085	0.137	0.091
Fecal Coliform (MPN/ 100 mL)	350,000	110,000	33,000	140,000	35,000

Source: EMB-DENR IX Monthly Assessment Report as of July 2021

2.3.6 Natural Hazards

Geological Hazards

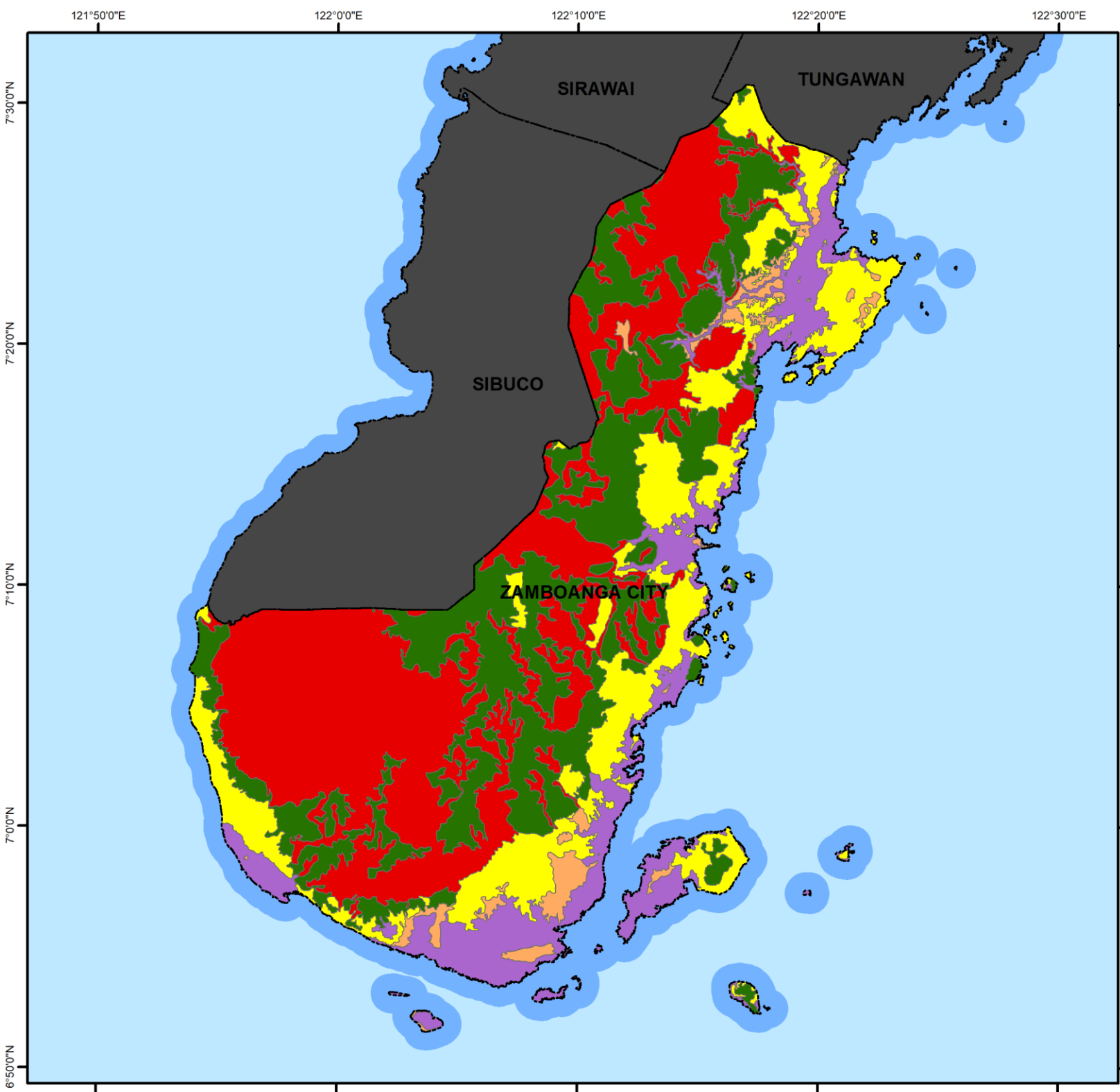
Earthquakes and Tsunamis

Zamboanga City is susceptible to earthquakes and tsunamis due to the presence of trenches and faults in Zamboanga region as illustrated in **Figure 6**. Two prominent convergence zones, namely the Sulu-Negros Trench, and the Cotabato Trench, are easily found within the proximity of Zamboanga Peninsula. The Sulu-Negros Trench has the closest proximity to Zamboanga City and is 580 kilometers long, 45 kilometers wide, with a depth of about 4.5 kilometers, and is situated at northwest of the city. These faults and trenches can potentially produce major earthquakes and destructive tsunamis putting the city at high risk.

Historically, the Cotabato and Sulu trenches produce destructive tsunamis which are giant sea waves generated by earthquakes and volcanic eruptions underwater. A 7.5-magnitude tsunamigenic earthquake occurred in 1897 along the Sulu Sea, sweeping market and local settlements in the West Coast in Zamboanga. While in 1976, an 8.1-magnitude earthquake was generated by the Cotabato Trench and set off a 6-meter-high tsunami wave, hitting the 700 kilometers of coastline along the Moro Gulf. This was considered one of the most devastating events of the country in the 20th century. Due to this risk, Zamboanga City is also highly susceptible to earthquake-associated hazards such as liquefaction, ground fissuring, and landslides.

Liquefaction

Considering the soil condition and geology of the coastal areas, the occurrence of an earthquake in these areas could lead to liquefaction or ground collapse as a result of ground shifting.



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

City/Municipal Boundaries

GEOHAZARD SUSCEPTIBILITY

Flood Susceptibility

- High
- Low to Moderate

Landslide Susceptibility

- High
- Moderate
- Low



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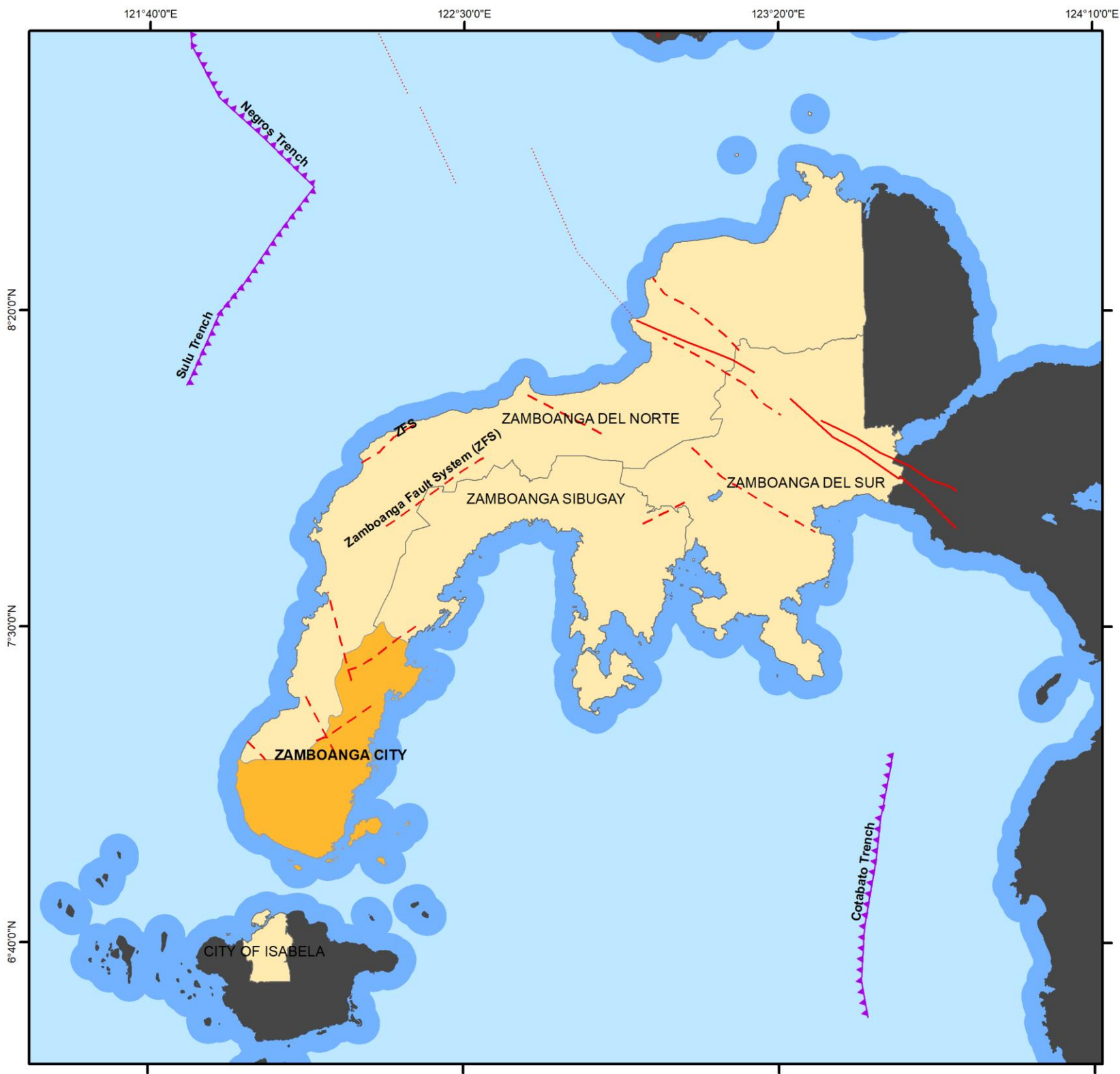
Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
Flood and Landslide Susceptibility (MGB, 2010)

FIGURE 5

Zamboanga City
Natural Hazard Map



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

Zamboanga City
Zamboanga Peninsula

EARTHQUAKE SOURCES

Active Faults

- Approximate offshore projection
- Dashed line - trace is approximate
- Solid line - trace is certain

Convergence Zone

- Trench

1:1,500,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
Earthquake Sources (PHIVOLCS, 2015)

FIGURE 6

Zamboanga Peninsula
Earthquake Sources

Earthquake-Induced Landslide

Upland areas in the city are considered prone to landslides or land-mass movement and subsidence due to earthquakes. The type of landslide that can occur include soil creep, mud slide, and rock falls – depending on the steepness of slope and the land material involved. Generally, areas that are hilly and mountainous, or considered escarpments, steep riverbanks, sea cliffs, limestone overhangs, crater and caldera walls, mine open pits, and deep road cuts are prone to landslides.

Hydrometeorological Hazards

Tropical Cyclones and Storm Surges

Zamboanga City has generally low susceptibility to the passage and landfall of tropical cyclones or typhoons; however, its indirect effects such as rains and strong winds are still experienced when this phenomenon passes within the proximity of the area.

Storm surges or an abnormal rise in sea level are caused by the strong winds brought about by these tropical cyclones. The low atmospheric pressure and wind cause the raised sea level to approach the coastal areas, and eventually accumulate along the shoreline. This eventually encroaches the hinterlands and can push several kilometers inland causing devastating floods in low-lying areas.

Flooding

The city center is susceptible to flooding and has been plagued by several flooding events in the past, since it is situated on a low-lying flood plain area typically at an elevation 5 meters above mean sea level. Four of the main river systems in Zamboanga City, greatly contribute to flooding in certain areas, as summarized in **Table 6**.

Table 6: Flooding by River Systems

River System	Affected Areas
Tumaga River	Riverbanks and floodplains of Barangays Tumaga, Sta. Maria, Tetuan, Tugbungan and Mampang
Putik River	A&W Subdivision, Low lying areas within Sitio Caputatan; Areas downside of Marcos Drive in Putik; Sitio Tibak; and all other areas along the floodplain delta transected by the river.
Culianan River	Barangay Pasobolong
Baliwasan River	Barangays San Jose Gusu, San Roque and Baliwasan

Source: Zamboanga City Enhanced Local Disaster Risk Reduction and Management Plan (LDRRMP) 2019-2020

Aside from storm surges, Zamboanga City is also prone to coastal flooding and flash floods. Coastal flooding is caused by the sea overtopping flood control structures such as seawalls and dikes, due to heavy storms, high tides, or tsunamis. Flash floods, on the other hand, usually result from intense rainfall over a relatively small area, causing a flood that rises and falls rapidly with little to no warning.

Rain-Induced Landslides

Heavy rains over mountainous and hilly areas can result to landslides and mudflows. Rain-induced landslides are very hazardous to people's lives and properties as they can be buried

under the land masses. Continuous rains may also cause soil erosion and flash floods in landslide prone areas. MGB has identified six areas in the city, highly susceptible to landslides. These include Carmen Valley Subdivision in Pasonanca, Cambodia in Putik, and the villages of Quiniput, Curuan, Vitali, and Tulungatung.

Climatological Hazards

Extreme Temperatures

A study by the Manila Observatory in 2016 showed that the average temperature in Zamboanga City will rise by 2.1°C in 2050. The uncertainty shade suggests that a 4°C and 5°C annual temperature increase may be likely experienced by 2025 and 2050, respectively. Historical spatial variations in temperature suggests large heating in the north easternmost and southernmost sides of the city. However, the southernmost and southwestern parts will experience the highest averaged warming due to human-induced climate change by as much as 1.4°C to 2.7°C in climate projections.

The same study projected that the precipitation rate shall decrease by 0.6 percent in 2025, and by 5.2 percent by 2050. The climate projections strongly suggest that consecutive droughts may possibly be experienced in Zamboanga City, due to the impacts of climate change. These projections generally imply that the city will become warmer and drier in the next 30 years, posing a great degree of threat to the city's ecosystems including: agriculture; coastal; upland; and urban, in turn affecting livelihood of locals .

El Niño

The Philippines is often influenced by the El Niño and La Niña phenomena, associated with increased dry and wet conditions, respectively. El Niño is generally caused by the abnormal warming of the ocean temperature, causing significant reduction in rainfall and results into dry conditions, dry spells, or droughts. This phenomenon can cause crises in water supply, agricultural activity, and public health, among others. In 2019, Zamboanga City was declared under a State of Calamity due to its water supply crisis brought about by the drying up of river water sources.

El Niño can occur every three to five years but may happen as frequently as every two years or as rarely as every seven years; occurring in considerably varying intensities between cycles. The increasing trend of the temperature in the city implies that more frequent and more intense droughts are anticipated in the coming decades.

2.4 Land Use and Classification

2.4.1 Land Classification

Zamboanga City has three identified land classifications: forestlands, alienable and disposable (A&D) lands, and national parks. Majority of their land area is divided into forestland and A&D land, covering 43.46 percent and 43.08 percent, respectively. The national park covers 12.23 percent while 1.23 percent is still unclassified. **Table 7** shows the general land classification of Zamboanga City and its area coverage.

Table 7: Land Classification of Zamboanga City

Land Classification	Area (hectares)	Percent Share (%)
Timberland/Forestland	63,156.70	43.46
Alienable and Disposable Land	62,604.99	43.08
Unclassified Land	1,793.83	1.23
National Park	17,771.50	12.23
Total	145,327.02	100.00
Contested (Proclamation 70)	8,828.40	

Source: Zamboanga City Comprehensive Land Use Plan (CLUP) 2016-2025.

Included among its national parks, are the proclaimed protected areas under the National Integrated Protected Areas System (NIPAS), pursuant to the Republic Act (RA) 7586. These protected areas are the Pasonanca Natural Park, the Great & Little Sta. Cruz Islands Protected Landscape and Seascape, and the Mangrove Swamps Forest Reserve. **Table 8** shows the NIPAS proclaimed protected areas in Zamboanga City.

Table 8: Protected Areas under NIPAS

Proclamation No.	Protected Area	NIPAS Category	Core Area & Buffer Zone (hectares)	Management Authority
132	Pasonanca Watershed Forest Reserve	Natural Park	17,414	PAMB
271	Great & Little Sta. Cruz Islands	Protected Landscape and Seascape	1,877	PAEMB
2152	Mangrove Swamps Forest Reserve*	Protected Landscape and Seascape		Interim PAMB

Note. *Initial NIPAS component subject for final assessment and recommendation situated at Barangays Vitali, Mangusu, Limaong, Tictapul, and Sacol Island

Aside from the Pasonanca Natural Park Reserve, the city also has six identified watershed forest reserves recommended for proclamation per Sangguniang Panlungsod (SP) Resolution No. 566 in June 5, 2002. **Table 9** shows the proclaimed and identified watershed forest reserves in Zamboanga City. The Ayala and Manicahan watersheds are in co-management agreement between the City Government of Zamboanga and the DENR Region IX. There are 11 major river systems from the watershed forest reserves, with at least 19 communal irrigation systems, used for agricultural purposes.

Table 9: Watershed Forest Reserves

Watershed	Area (hectares)	Percent Share (%)	Status
1. Pasonanca Natural Park	17,414	31.04	NIPAS Proclamation No. 132
<i>Strict protection zone (watershed)</i>	12,107		
<i>Buffer zones (multiple use zone)</i>	5,307		
2. Ayala Watershed Forest Reserve	1,469	2.62	Identified with Co-Management
3. Culianan Watershed Forest Reserve	3,395	6.05	Identified
4. Manicahan Watershed Forest Reserve	4,035	7.19	Identified with Co-Management

Watershed	Area (hectares)	Percent Share (%)	Status
5. Bolong Watershed Forest Reserve	3,280	5.85	Identified
6. Curuan Watershed Forest Reserve	5,499	9.80	Identified
7. Vitali Watershed Forest Reserve	21,002	37.44	Identified
Total	56,094	100.00	

Source: DENR IX and ICFRMP

2.4.2 Land Use Trends

The growth and development of the City of Zamboanga is heavily concentrated along the major urban areas in the southern part of the city. Various land uses comprise the entire city of Zamboanga, majority of which are currently used for agriculture. **Table 10** shows the comparative land use in Zamboanga City from 1997-2012 to 2016-2025. The data shows that forest protection lands decreased by 44.46 percent while agricultural production lands increased by 68.72 percent.

Table 10: Comparative Land Uses, 1997-2012 and 2016-2025

General Land Use (1997-2012)		General Land Use (2016-2025)		Land Use Change (%)
Category	Area (hectares)	Category	Area (hectares)	
Forest	88,991.15	Forest	68,014.49	-23.57
Protection	68,836.78	Protection	38,231.30	-44.46
Production	4,455.10	Production	14,201.80	218.78
Ecozone (Reserve)	15,699.27	Ecozone (Reserve)	15,581.39	
Agriculture	31,632.81	Agriculture	51,375.49	62.48
Protection	3,004.17	Protection	2,553.49	-15.00
Production	28,628.64	Production	48,322.99	68.72
		Agri-Industrial	519.47	
Water/Fishery	10,807.66	Water/Fishery	11,434.43	5.18
Fishpond	4,506.02	Aquaculture	4,896.87	8.67
Mangrove	6,301.64	Mangrove	6,453.59	3.48
		Agri-Industrial	16.55	
Urban Use	16,566.65	Urban Use	13,634.16	-17.42
Residential	8,678.25	Residential	5,290.73	-39.58
Commercial	3,286.24	Commercial	3,708.73	12.86
Industrial	3,194.75	Industrial	2,056.51	-35.63
Institutional	305.82	Institutional	453.77	48.38
Ecozone (Industrial)	736.92	Ecozone (Industrial)	801.66	
Proposed Airport	364.67	Utilities/Transport	707.44	
		Tourism	662.27	
Other Uses	322.17	Other Uses	868.45	169.56
Waterfront	2.85	Rivers & Creeks	166.00	
Bog Lake	113.49	Lake	140.38	
Parks & Recreational	88.74	Parks & Recreation	165.37	86.35
Salt Bed	100.70	Buffer/Greenbelt	242.58	

General Land Use (1997-2012)		General Land Use (2016-2025)		Land Use Change (%)
Category	Area (hectares)	Category	Area (hectares)	
Historical Preservation	16.39	Cemetery/Memorial Park	154.12	
Total	148,320.44	Total	145,327.02	
		Contested Area	8,828.40	

Source: Zamboanga City Comprehensive Land Use Plan (CLUP) 2016-2025.

Despite the significant decrease in forest areas, the forest lands in the city take up 60 percent of the total land area. These include the forest and watershed reserves and protected areas in the city. On the other hand, the significant increase in agricultural production lands show how Zamboanga City is heavily reliant on their agricultural industry for livelihood. These lands are primarily used for crop and livestock production.

Urban land areas consist of residential, commercial, industrial, institutional uses, tourism areas, utilities and transportation services, and ecozone industrial area. Lands for residential use total to about 5,290.73 hectares; 55 percent of which are located within the lowlands. A significant amount of land still contains vegetation of coconut trees while around 1,205.84 hectares are identified as idle and may be prioritized for future residential developments to avoid further land conversions. **Table 11** shows the residential land use distribution per land category in 2016. Other land uses include heritage sites, recreational and leisure establishments, mixed use waterfront developments, and the like. Additional land uses such as tourism areas, utilities, and transportation were identified in 2016.

Table 11: Residential Land Use, 2016

Land Use Category	Area (hectares)			
	High Density	Medium Density	Others	Total
Coastal	285.45	477.45	669.09	1,431.99
Coconut		23.04	34.21	57.25
Idle		140.56	148.33	288.89
Residential	285.45	313.85	486.55	1,085.85
Lowland	1,205.50	1,120.53	588.73	2,914.76
Coconut		150.23	128.39	278.62
Idle	53.26	346.45	342.71	742.42
Residential	1,152.24	623.85	117.63	1,893.72
Upland	85.28	344.24	514.46	943.98
Coconut		65.02	242.75	307.77
Idle	25.03	127.80	21.70	174.53
Residential	60.25	151.42	250.01	461.68
Grand Total	1,576.23	1,942.22	1,772.28	5,290.73

Source: Phil-Lidar, Tax Maps, Land Cover Map 2010, Google Earth, NAMRIA Maps

The commercial area of Zamboanga City includes those occupied by public markets, retail stores, restaurants, banks, and other establishments engaged in commercial activities. The bulk of these are those businesses engaged in wholesale, retail, repair of motor vehicles, and household goods. Commercial areas are located in coastal and lowland areas as shown in **Table 12**.

Table 12: Commercial Land Use, 2016

Land Use Category	Area (hectares)			
	High Density Commercial	Medium Density Commercial	Light Density Commercial	Total
Coastal	753.21	567.80	50.54	1,371.55
Commercial	546.32	258.10	25.24	829.66
Idle	56.85	148.25	10.22	215.32
Residential	150.04	161.45	15.08	326.57
Lowland	264.14	1,916.83	156.21	2,337.18
Commercial	189.43	1,104.33	120.07	1,413.83
Idle	12.05	465.55	12.14	489.74
Residential	62.66	346.95	24.00	433.61
Grand Total	1,017.35	2,484.63	205.75	3,708.73

Source: Phil-Lidar, Tax Maps, Land Cover Map 2010, Google Earth, NAMRIA Land Classification Maps, NAMRIA Bathymetry Maps

Manufacturing plants, factories, and oil depots comprise the industrial area covering over 2,000 hectares of land. Majority of this area is allocated for heavy industrial use and are zoned in the coastal area as shown in **Table 13**.

Table 13: Industrial Land Use, 2016

Land Use Category	Heavy Industrial	Medium Industrial	Light Industrial	Total
Coastal	1,102.58	696.22	257.71	2,056.51
Idle	54.04	10.12	13.86	78.02
Residential	106.92	42.23	47.56	196.71
Commercial	102.67	250.02	38.04	390.73
Industrial	838.95	393.85	158.25	1,391.05
Grand Total	1,102.58	696.22	257.71	2,056.51

Source: Phil-Lidar, Tax Maps, Land Cover Map 2010, Google Earth, NAMRIA Land Classification Maps, NAMRIA Bathymetry Maps

The urban core of Zamboanga City is crucial in the development of the city, wherein settlements, establishments, and economic activities are concentrated. Establishments such as educational institutions, religious and government institutions, service utility facilities, commercial and business establishments, residential subdivisions, and areas for leisure and recreation are often developed in the urban area. As a result, this urban area continues to be attractive to locals and migrants, leading to high density developments and increasing land values.

The city recognizes that the development of the urban area may result in detrimental issues such as traffic congestion, uncontrolled agricultural land conversion, rural area neglect, and environment degradation. Currently, the urban area continues to expand toward the eastern and western coastal area of the city. Further development of the city must consider the city's vulnerability to natural calamities and disasters due to its coastal nature. The inland areas of the city should be given more focus to move the urban development away from the coastal areas.

In summary, the further development pattern of Zamboanga City should be directed inland as mitigation from costal and environmental hazards. Idle lands, open grasslands, and underutilized agricultural and industrial lands shall be converted to other land uses to cater to crop cultivation or mixed-use purposes as these were identified as development opportunity lands. Overall, there

is still much space for development and expansion for all land use types that will be able to accommodate the current and projected population of Zamboanga. Potential land uses should be properly organized and planned in adherence to the best urban planning strategies.

2.5 Demography and Socio-Economic Conditions

2.5.1 Population and Demography

As of the May 2020 census by the PSA, Zamboanga City recorded a total population of 977,234, and is considered the sixth largest city in the Philippines, by population. The average density of the city is about 691 persons per square kilometer¹ with a growth rate of 2.68 percent from 2015 to 2020. The historical population, density and growth rate of Zamboanga City is shown on **Table 14**.

Table 14: Zamboanga City Population Density and Growth (2000-2020)

	May-2000	May-2010	Aug-2015	May-2020
Total Population	601,794	807,129	861,799	977,234
Population Density (per km ²)	425	547	571	609
		2000-2010	2010-2015	2015-2020
Population Growth (%)	-	2.98	1.26	2.68

Source: PSA

Among Zamboanga City's 98 barangays, Barangay Talon-talon, located near the coastal urban area, is the most populous with 37,350 persons. On the other hand, Barangay Pangapuyan, an island barangay, is the least populous, recording a population of only 767. **Table 15** below shows the population distribution of Zamboanga City per barangay.

Table 15: Population Distribution per Barangay (2020)

City/Barangay	Total Population (2020)
CITY OF ZAMBOANGA	977,234
Arena Blanco	13,671
Ayala	26,658
Baliwasan	17,932
Baluno	3,865
Boalan	11,541
Bolong	8,068
Buenavista	8,154
Bunguiao	7,952
Busay (Sacol Island)	2,290
Cabaluay	8,849
Cabatangan	17,812
Cacao	1,311
Calabasa	2,936
Calarian	33,563

¹ Based on recorded land area of 1414.7 km² from Region IX RSET 2019

City/Barangay	Total Population (2020)
Campo Islam	11,730
Canelar	10,512
Cawit	10,244
Culianan	10,851
Curuan	11,954
Dita	2,028
Divisoria	13,172
Dulian (Upper Bunguiao)	2,569
Dulian (Upper Pasonanca)	1,489
Guisao	2,583
Guiwan	13,231
La Paz	8,724
Labuan	16,095
Lamisahan	2,764
Landang Gua	3,154
Landang Laum	3,095
Lanzones	3,689
Lapakan	1,868
Latuan (Curuan)	2,615
Limaong	4,766
Limpapa	6,060
Lubigan	3,249
Lumayang	1,999
Lumbangan	4,461
Lunzuran	13,232
Maasin	9,267
Malagutay	8,265
Mampang	31,975
Manalipa	2,588
Mangusu	5,608
Manicahan	11,999
Mariki	6,310
Mercedes	22,321
Muti	3,420
Pamucutan	4,404
Pangapuyan	767
Panubigan	982
Pasilmanta (Sacol Island)	3,138
Pasonanca	27,215
Patalon	11,127
Barangay Zone I (Pob.)	4,806
Barangay Zone II (Pob.)	1,802
Barangay Zone III (Pob.)	1,146

City/Barangay	Total Population (2020)
Barangay Zone IV (Pob.)	1,174
Putik	22,271
Quiniput	4,015
Recodo	23,254
Rio Hondo	8,827
Salaan	3,623
San Jose Cawa-cawa	4,292
San Jose Gusu	16,260
San Roque	28,829
Sangali	26,758
Santa Barbara	6,711
Santa Catalina	16,644
Santa Maria	24,133
Santo Niño	3,888
Sibulao (Caruan)	4,167
Sinubung	3,601
Sinunoc	22,918
Tagasilay	3,998
Taguiti	1,328
Talabaan	5,907
Talisayan	11,428
Talon-talon	37,350
Taluksangay	9,437
Tetuan	29,621
Tictapul	3,527
Tigbalabag	2,109
Tigtabon	5,365
Tolosa	3,859
Tugbungan	26,538
Tulungatung	11,741
Tumaga	33,399
Tumalutab	3,436
Tumitus	2,731
Vitali	10,716
Capisan	1,488
Camino Nuevo	7,421
Licombo	5,888
Kasanyangan	28,819
Pasobolong	5,624
Victoria	3,393
Zambowood	12,870

Source: PSA, 2020, Census of Population and Housing

Figure 7 shows the age-sex distribution in Zamboanga City. Based on the 2015 census², the ratio between men and women indicates relatively equal distribution with the total male population making up 50.2 percent while the total women population make up 49.7 percent. Among the age groups, the working age outnumber the young and old dependents, comprising an aggregate of 548,744 for both males and females. The male population tends to dominate from the age groups of young dependents to the working age. On the other hand, the female population starts to hold a lead from the age of 65 years old and above. **Table 16** shows the breakdown of the age-sex distribution in the city.

Figure 7: Age-Sex Pyramid of Zamboanga City (2015)

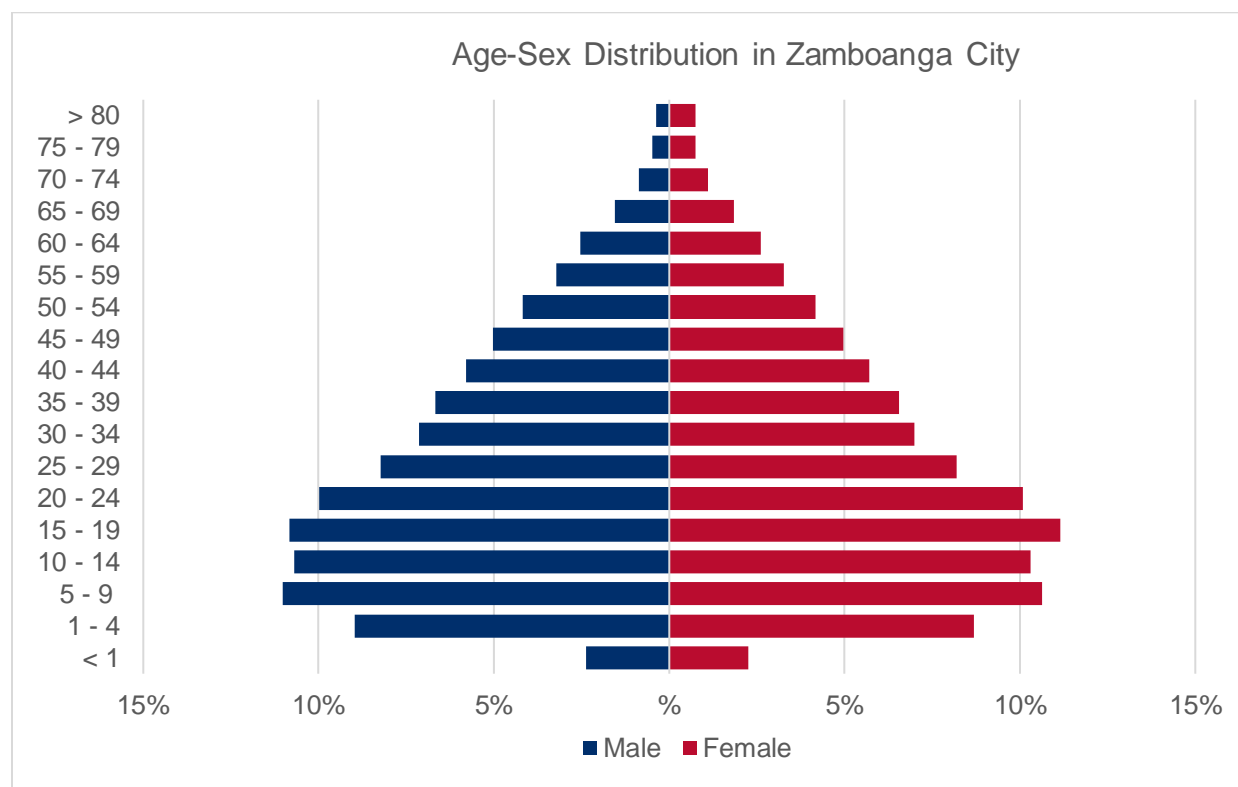


Table 16: Age-Sex Distribution in Zamboanga City (2015)

Age Group	Both Sexes	Male	Female	Sex ratio
All Ages	861,799	432,677	429,122	100.83
Young Dependents (0-14)	279,764	143,060	136,704	104.65
< 1	19,903	10,269	9,634	106.59
1 - 4	76,085	38,835	37,250	104.26
5 - 9	93,276	47,673	45,603	104.54
10 - 14	90,500	46,283	44,217	104.67
Working Age (15-64)	548,744	275,426	273,318	100.77
15 - 19	94,716	46,920	47,796	98.17
20 - 24	86,578	43,254	43,324	99.84

² The PSA 2020 Census does not yet include socio-economic data

Age Group	Both Sexes	Male	Female	Sex ratio
25 - 29	70,718	35,612	35,106	101.44
30 - 34	60,836	30,866	29,970	102.99
35 - 39	57,067	28,896	28,171	102.57
40 - 44	49,575	25,093	24,482	102.50
45 - 49	43,039	21,753	21,286	102.19
50 - 54	35,969	18,089	17,880	101.17
55 - 59	27,984	13,913	14,071	98.88
60 - 64	22,262	11,030	11,232	98.20
Old Dependents (65-over)	33,291	14,191	19,100	74.30
65 - 69	14,564	6,703	7,861	85.27
70 - 74	8,542	3,765	4,777	78.82
75 - 79	5,377	2,114	3,263	64.79
80 years and over	4,808	1,609	3,199	50.30

Source: RSET 2019

2.5.2 Health

Zamboanga City has 14 hospitals in the city, eight of which are privately owned while six are government-owned. As of 2019, all barangays have a barangay health center. The Cristino Paragas Memorial Hospital is under the City Health Office and is located in Barangay Quiniput. The city also has 16 Main Health Centers among which are the 13 main health centers that function as lying-in clinics. Main Health Centers cover mostly preventive, promotive, and curative aspects of health care services including referrals from Barangay Health Stations. **Table 17** below shows the list of privately and government-owned hospitals in Zamboanga City

Table 17: List of Hospitals in Zamboanga City

Hospitals
Private
1 Brent Hospital and Colleges, Inc.
2 Ciudad Medical Zamboanga
3 Hospital de Zamboanga
4 Universidad de Zamboanga Medical Center
5 West Metro Medical Center
6 Zamboanga City Puericulture
7 Zamboanga Doctor's Hospital
8 Zamboanga Peninsula Medical Center
Government
1 Cristino Paragas Memorial Hospital
2 Edwin Andrews Airbase Hospital
3 Labuan Public Hospital
4 Mindanao Central Sanitarium
5 Zamboanga City Medical Center
6 Camp Navarro General Hospital

In 2015, the ratio of physician to population was 1:41,277 while the nurse to population was at 1:38,984. These ratios are lower than the standard of a 1:20,000 and 1:10,000 ratio of physicians and nurses to population respectively. The common causes of morbidity in the city for the past five years include acute respiratory infections and animal bites, while heart disease is the leading cause for mortality. **Table 18** shows the top ten leading causes of morbidity and mortality in Zamboanga City in the year 2020.

Table 18: Leading Causes of Morbidity and Mortality (2020)

Rank	Morbidity		Mortality	
	Cause	Incidence	Cause	Incidence
1	Animal Bite	10691	Diseases of the Heart	1610
2	Acute Respiratory Infection	8024	Diseases of the Vascular System	499
3	Wounds/Injuries	4178	Cancer (All Types)	492
4	Systemic Viral Illness	1864	Pneumonia	419
5	Hypertension	1603	Hypertension and its complications	219
6	Acute Gastroenteritis	1398	Tuberculosis (All forms)	202
7	Skin Diseases	1221	Renal Disease	182
8	Tooth ache	1113	COVID-19 confirmed	174
9	Urinary Tract Infection	586	Diabetes and its complications	133
10	Headache	558	Chronic Obstructive Pulmonary Disease	84

2.5.3 Local Economy

The agriculture sector is the primary economic driver of Zamboanga City, as evident in the vast agricultural lands. The local residents have relied on agriculture and fishery as their main source of livelihood. Major crop products of the city are banana, mango, corn, rubber; while major fishing products include seaweeds, fish such as the big-eyed scad (*matangbaka*), frigate tuna (*tulingan*) and roundsad (*galunggong*). Livestock production especially carabao, cattle and hog have been declining since 2015 while poultry has remained to be the leading product in terms of volume. This may be attributed to the diverse religious backgrounds that observe abstinence from pork.

Another major economic driver of the city is industry and manufacturing, specifically canning and fish processing. Zamboanga City is considered the Sardines Capital of the Philippines, supporting 75 percent of the domestic demand for canned sardines. The city has over 104 dried fish processors, and 12 major canned sardines and tuna manufacturing plants, generating approximately PhP5 billion for 5 million cartons. Shipbuilding and repair are also a strong manufacturing venture in Zamboanga City, attributed to its coastal nature and strategic port location. The city was declared a ship building and ship repair hotspot in the Philippines by the Maritime Industry Authority.

Tertiary economic activities in Zamboanga City are in the wholesale and retail businesses, and tourism. Its strategic location in the Association of Southeast Asian Nations (ASEAN) and BIMP-EAGA Region contributes to the development in these sectors. Most trade, however, still occurs within the local and domestic market. The beautiful natural features of the city are known tourist destinations. Popular sites include the pristine beaches in the Sta. Cruz Islands and Bolong, the Merloquet Falls, and the Latuan Caves. Culture and heritage sites, showing the vibrant and diverse traditions in the city are also considered as their priority tourism products.

2.5.4 Local Fiscal Governance Profile

Fiscal data from the Department of Finance - Bureau of Local Government Finance (DOF-BLGF) shows that the total income of Zamboanga City for fiscal year (FY) 2020 was PhP4,375.00 million, most of which came from National Government Transfers (NGT) -- amounting to PhP3,431.13 million or 78.43 percent. Internal Revenue Allotment (IRA) made up 92.27 percent of the NGTs. The remaining 21.57 percent of the total income or PhP943.87 million came from Locally Sourced Income (LSI). **Table 19** presents the complete income and expenditure information of Zamboanga City for FY 2020 and the average income and expenditure from FY 2010 to 2020.

Total expenditure for FY 2020 was PhP2,310.37 million. The largest share was spent on General Public Services at PhP726.46 million or 31.44 percent. Other notable expenditure items were Health Nutrition and Population (29.85 percent) and Social Services and Welfare (18.99 percent). The average spending from 2010 to 2020 shows a similar trend in allocation with General Public Services receiving the largest shares. However, the average showed higher expenditures on Economic Services and then followed by Health Nutrition and Population and Social Services and Welfare.

Table 19: Zamboanga City Income and Expenditure Information (2020)

Key Income and Expenditure Items	FY 2020		FY 2010-2020 Average	
	Amount (Million PhP)	Share (%)	Amount (Million PhP)	Share (%)
I. TOTAL INCOME	4,375.00	100%	2,835.94	100%
A. Locally Sourced Income	943.87	21.57%	739.28	26.07%
1. Local Tax Revenue	725.84	76.90%	530.06	71.70%
1.1 Real Property Tax	216.48	29.82%	162.68	30.69%
1.2 Business Tax	478.59	65.94%	341.60	64.44%
1.3 Other Tax	30.77	4.24%	25.79	4.87%
2. Local Non-Tax Revenue	218.03	23.10%	209.22	28.30%
2.1 Regulatory Fees (Permits and Licenses)	51.04	23.41%	46.68	22.31%
2.2 Service/ User Charges (Service Income)	43.23	19.83%	42.57	20.35%
2.3 Receipts from Economic Enterprises (Business Income)	45.41	20.83%	57.77	27.61%
2.4 Other Receipts (Other General Income)	78.36	35.94%	62.19	29.73%
B. National Government Transfers	3,431.13	78.43%	2,096.66	73.93%
1. Internal Revenue Allotment (IRA)	3,165.80	92.27%	2,061.93	98.34%
2. Other Shares from National Tax Collections	1.52	0.04%	10.75	0.51%
3. Inter-Local Transfers	0.00	0.00%	0.00	0.00%
4. Extraordinary Receipts/ Grants/ Donations/ Aids	263.82	7.69%	23.98	1.14%
II. TOTAL EXPENDITURE	2,310.37	100%	1,362.88	100%
A. General Public Services	726.46	31.44%	545.09	40.00%
B. Education, Culture and Sports	132.45	5.73%	87.40	6.41%
C. Health Nutrition and Population	689.65	29.85%	216.36	15.88%
D. Labor and Employment	0.00	0.00%	0.00	0.00%
E. Housing and Community Development	76.08	3.29%	77.42	5.68%
F. Social Services and Welfare	438.77	18.99%	192.22	14.10%
G. Economic Services	246.96	10.69%	244.39	17.93%
H. Debt Service	0.00	0.00%	0.00	0.00%
III. NET OPERATING INCOME/ (LOSS) FROM CURRENT OPERATIONS	2,064.63		1,473.07	
A. Net Operating Income/(Loss) from Current Operations	289.32			
1. Non-Income Receipts	0.00			
2. Non-Operating Expenditures	289.32			
B. Net Increase/(Decrease) in Funds	1,775.30			

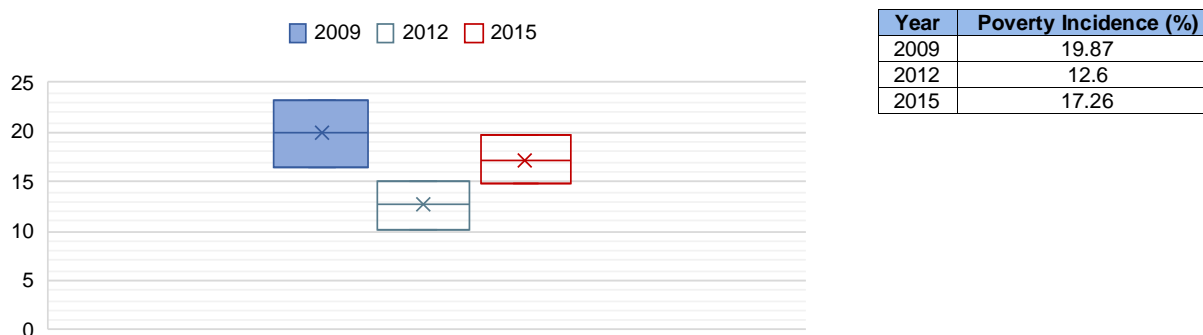
Key Income and Expenditure Items	FY 2020		FY 2010-2020 Average	
	Amount (Million PhP)	Share (%)	Amount (Million PhP)	Share (%)
C. Add: Cash Balance, Beginning	5,889.04			
D. Fund/Cash Available	7,664.35			
E. Less: Payment of Prior Year/s Accounts Payable	380.20			
F. Continuing Appropriation	656.11			
IV. FUND/ CASH BALANCE, END	6,628.03			

Note. Data for the income and expenditure of Zamboanga City (FY-2010 to FY-2020) (Department of Finance - Bureau of Local Government Finance, 2020)

2.5.5 Poverty Incidence

Poverty incidence refers to the proportion of families/individuals with per capita income less than the defined per capita poverty threshold to the total number of families/individuals. According to the PSA Small Area Poverty Estimates, which has identified the city-level poverty incidence, poverty incidence in Zamboanga City saw a decrease in the number of poor families between 2009 and 2012 and then increased from 2012 to 2015 to 17.26 percent of the total population of the city (PSA, 2015). This is illustrated in **Figure 8**.

Figure 8: Poverty Incidence in Zamboanga City,



Source: City and Municipal Level Poverty Estimates, Philippine Statistics Authority (2015).

Poverty incidence decreased again from 2015 to 2018 according to the 2018 First Semester Official Poverty Statistics of the Philippines. Zamboanga City's poverty incidence was at 18 percent among the population and at 12.4 percent among families as presented in **Table 20**.

Table 20: 2018 First Semester Poverty Incidence of Zamboanga City

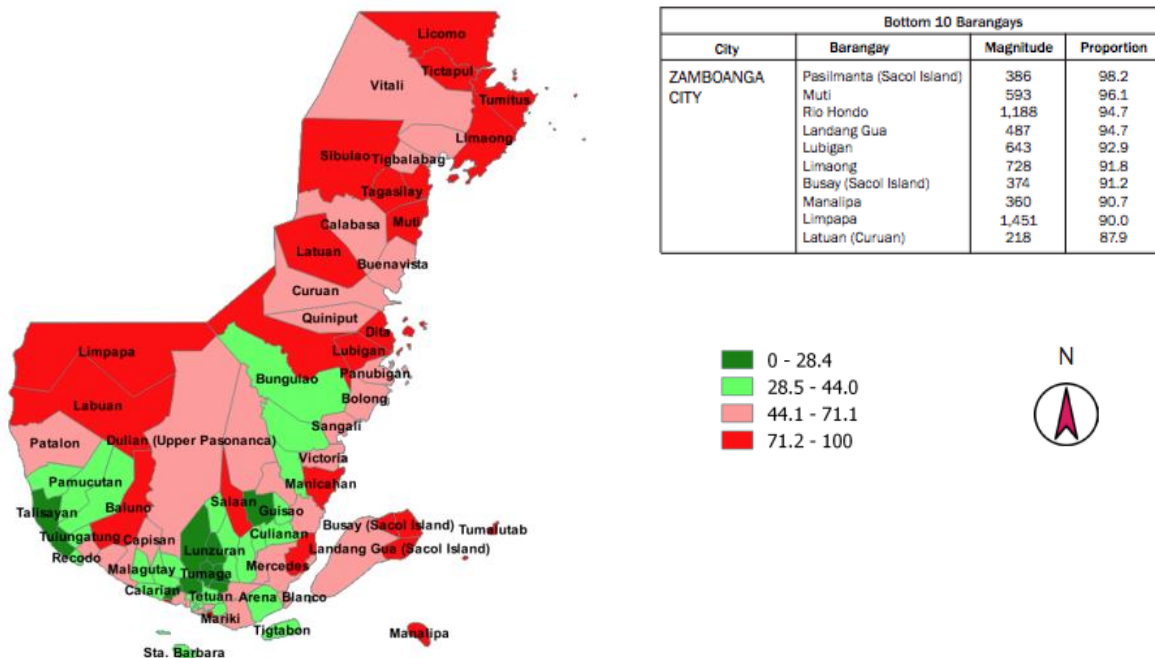
	Per Capita Poverty Threshold (in PhP)	Poverty Incidence among Families (%)	Poverty Incidence among Population (%)
Zamboanga City	11,829	12.4	18

Source: PSA 2018 First Semester Official Poverty Statistics of the Philippines

On the other hand, the findings from the census conducted by the Community-Based Monitoring System (CBMS) Network (2019) collected between 2017 to 2018 saw higher figures on the proportion of poor households. About two in five (44 percent) households were found to be living below the poverty threshold, or those households that do not earn sufficient income for basic food and non-food needs of their respective households. Among the barangays with the highest poverty incidence include Pasilmanta (98.2 percent), Muti (96.1 percent), and Rio Hondo (94.7 percent). The share of households who are income poor per barangay is illustrated in **Figure 9**.

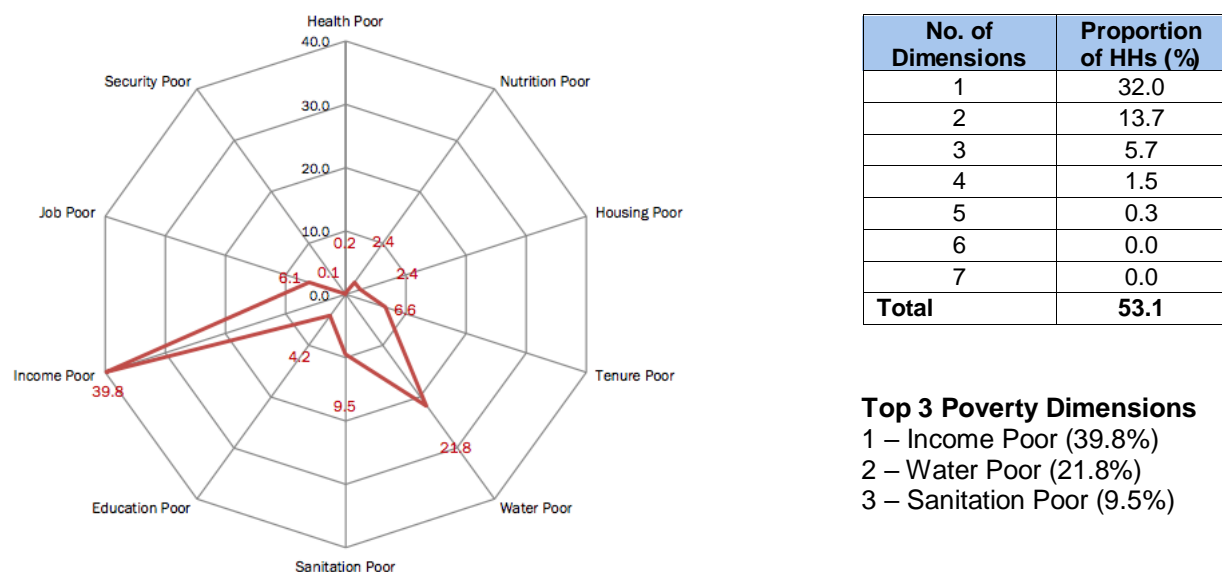
Based on the poverty analysis of CBMS Network (2019), more than half (53.1 percent) of the total household population experience at least one dimension of poverty. One in five households (21.2 percent) experience multiple dimensions of poverty. Among the dimensions covered by the analysis, the issues with the highest prevalence are those concerning income, water, and sanitation, respectively. These findings are presented in **Figure 10**.

Figure 9: Proportion of Households with Income Below Poverty Threshold, 2017-2018



Source: *Many Faces of Poverty Volume 10, CBMS Network (2019)*.

Figure 10: Dimensions of Poverty in Zamboanga City (2019)



Top 3 Poverty Dimensions

- 1 – Income Poor (39.8%)
- 2 – Water Poor (21.8%)
- 3 – Sanitation Poor (9.5%)

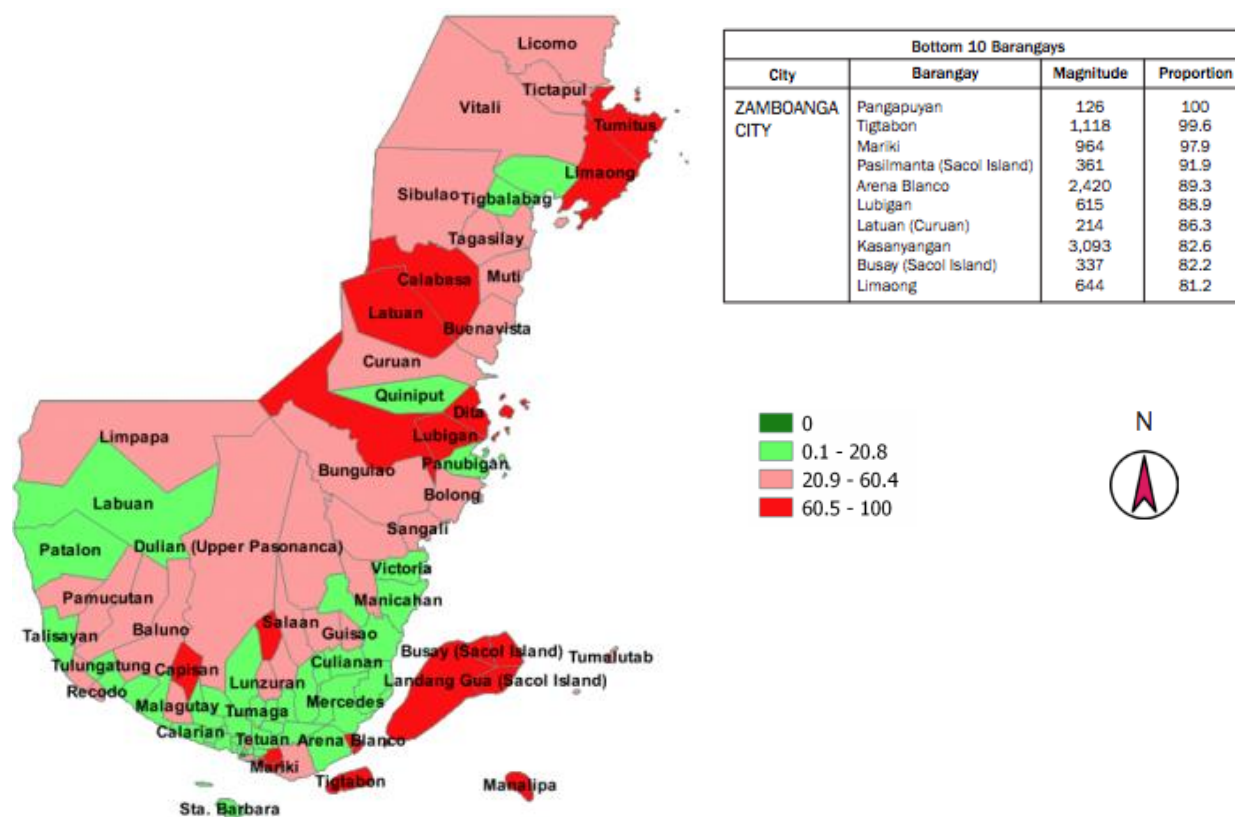
Source: *Many Faces of Poverty Volume 10, CBMS Network (2019)*.

2.6 Existing Conditions of Water Supply and Sanitation Facilities

2.6.1 Access to Water Supply Facilities

Based on the census conducted between 2017 to 2018 by CBMS Network (2019) in Zamboanga City, about 79.2 percent of households have access to safe water. The Zamboanga City Water District (ZCWD) is the primary provider of water supply services in the city covering 61 out of the 98 barangays as of December 2020. ZCWD utilizes groundwater, surface water and bulk water sources to supply to its serviced households. This implies that about one in five households do not have access to safe water. This figure is broken down by barangay in **Figure 11**. These households source their water supply from dug well, protected and unprotected springs, peddlers, water refilling stations lakes, and rivers, among others. Among the barangays with the lowest water supply access are Pangapuyan (0 percent), Tigtabon (0.4 percent), and Mariki (2.1 percent). The census found that there were 27 waterless barangays in the city, pertaining to areas with less than 50 percent of its total households with access to safe water supply coverage (CBMS Network, 2019).

Figure 11: Proportion of Households without Access to Safe Water Supply, 2017-2018



Source: *Many Faces of Poverty Volume 10*, CBMS Network (2019).

According to the 2019 Annual Sanitation Accomplishment Report by the City Health Office (CHO), a total of 168,661 households had access to improved or safe water, in varying levels of service as shown on **Table 21**. Majority of those with access to Level III water supply are provided for by the ZCWD.

Table 21: Household Access to Water Supply by Service Level

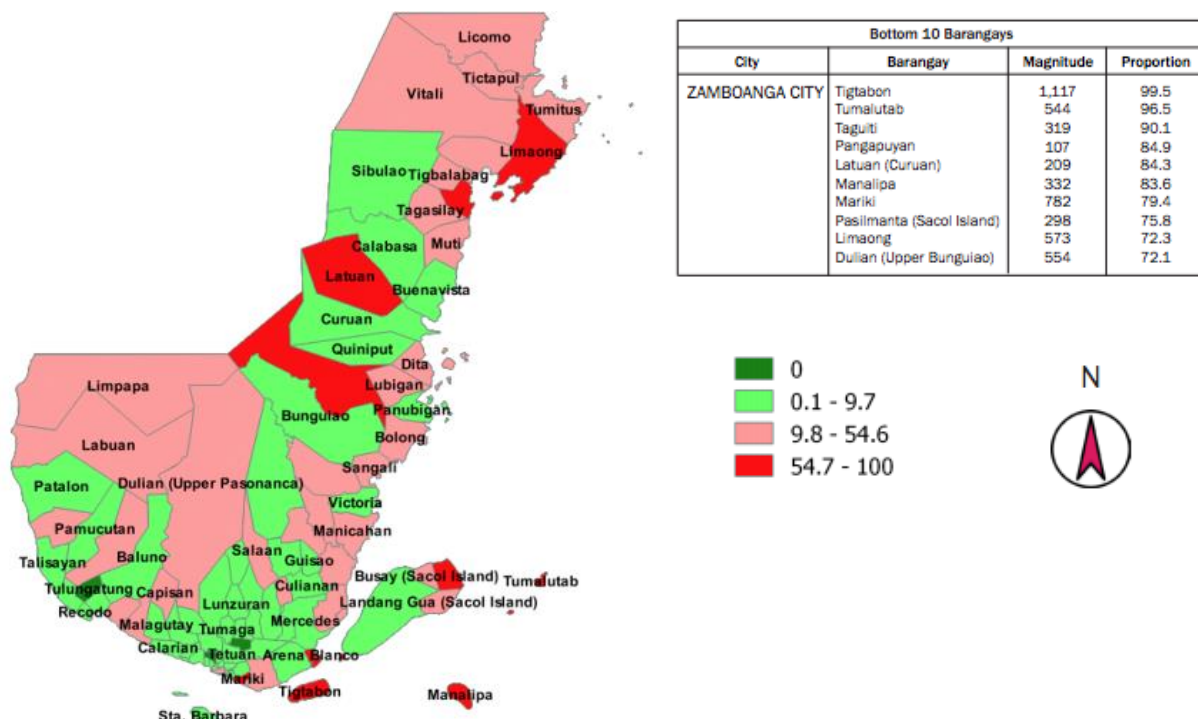
Service Level	Households	Percentage
Level I	22,489	13%
Level II	23,367	14%
Level III	122,805	73%
Total	168,661	100%

As of 2020 records, ZCWD covers 61 out of the 98 barangays in Zamboanga City with a total of 66,462 service connections, composed of 59,483 residential connections, 6,412 commercial connections, and 567 institutional connections. The distribution of service connections by barangay are discussed further in **Subsection 4.4.1** of this report.

2.6.2 Toilet Facilities

According to the CBMS census, 90.3 percent households have access to sanitary toilet facilities. Two in five households (21.5 percent) share sanitary facilities with at least one other household (CBMS Network, 2019). On the other hand, one in ten households (9.7 percent) do not have access to sanitary toilet facilities, as illustrated in **Figure 12**.

Figure 12: Proportion of Households without Access to Sanitary Toilet Facilities, 2017-2018



Source: *Many Faces of Poverty Volume 10, CBMS Network (2019)*.

Based on the 2010 data of the PSA³, about 71 percent of the households in the city have access to septic tanks or other types of wastewater depository structures (Philippine Statistics Authority, 2010). Apart from sanitary facilities with septic tanks, Zamboanga City is also served by sewer systems consisting of vitrified clay pipes which were constructed in the 1930s.

³ No updated data on access to septic tanks.

2.6.3 Desludging Services

Desludging services in Zamboanga City are provided by two private desludging companies, namely, Christine Haresco Wastewater Treatment Services (CHWTS) and Veterans Builder Enterprises. Details on the operations of both companies are further discussed in **Subsection 4.5.2** of this report.

2.6.4 Septage and Sewage Treatment Facilities

Septage collected by the two private desludging companies are transported to their own treatment facilities. CHWTS reportedly dispose of sludge as fertilizer and no details were collected for the treatment. As for Veterans Builder Enterprises, treatment facilities reportedly include a 330 m³ treatment plant in the East Coast (Barangay Cabaluay) and a 1,000 m³ treatment plant in the West Coast (Barangay Pamucutan).

Apart from septage collection, sewerage systems are also utilized in Zamboanga City. The existing sewer system is located in the urban center of Zamboanga City and consists of approximately 11,400 linear meters of vitrified clay pipes, covering an area of about 80 hectares. As of the writing of this report, commissioning is ongoing for the 4,000 m³/day Sewage and Septage Treatment Plant in Magay Street, Barangay Zone I which will provide treatment for the existing sewer system and potential expansion areas. Further discussions of proposed sanitation projects under the ZCWD are found in **Subsection 4.5.3** of this report.

2.6.5 Local Practices on Handling of Sanitation Residuals including Reuse

Based on consultations with ZCWD, there are no current reuse practices for wastewater residuals. Effluent and biosolids are discharged and disposed of. As for private desludgers, similar to ZCWD, Veteran Builders Enterprises has no current use for residuals and resort to disposal only. CHWTS, on the other hand, is currently working together with the Western Mindanao State University to process their biosolids as fertilizer.

2.7 Other Infrastructure

2.7.1 Solid Waste Management

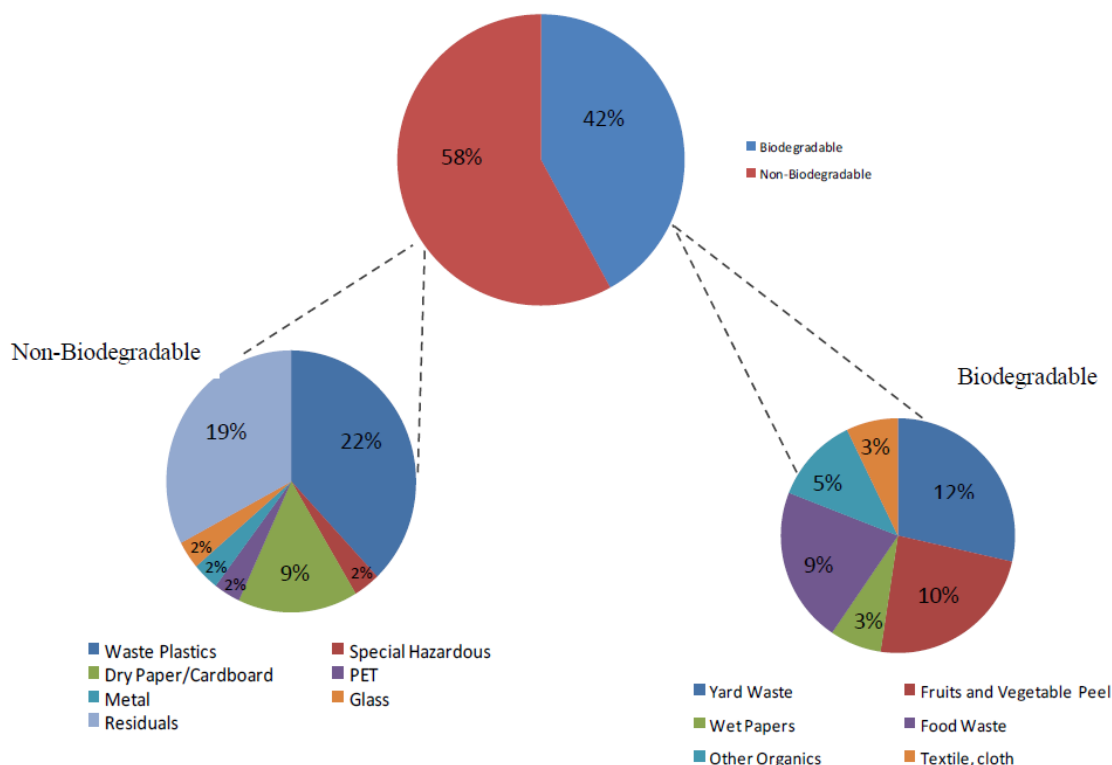
Based on studies conducted by the Office of the City Environment and Natural Resources (OCENR), the city generates about 235 tons of waste daily, from all sectors within the collection area. The breakdown of the type of waste based on its source is shown on **Table 22**. Majority of the waste comes from the residential areas, followed by marketed recyclables.

Table 22: Waste Generation per Waste Type

Waste Type	Waste Generation (tons)	Percentage of Waste Stream (%)
Residential Waste	177.00	75.32
Commercial Waste	12.00	5.10
Market Waste (Bagsakan)	9.80	4.17
Market Waste (Public Markets)	9.20	3.92
Marketed Recyclables from Source Separation	27.00	11.49
Total	235.00	100.00

Biodegradable or compostable wastes account for 42 percent of the waste generated by the city, while non-biodegradables or recyclables account for 58 percent of the total volume. **Figure 13** shows the waste composition of biodegradable and non-biodegradable wastes generated by Zamboanga City.

Figure 13: Average Waste Composition of Generated Wastes



Waste collection is covered by the OCENR and some barangay units. Considering the 235 tons of waste generated per day, the estimated Collection Efficiency is 65 percent. The city is operating a Sanitary Landfill Facility at Barangay Salaan in a 10.6-hectare land owned by the local government unit (LGU). There are also five Material Recovery Facilities (MRF) at: the Bagsakan Center in Sta. Cruz Market, the Main Public Market-Magay, City Abattoir at Barangay San Roque, the Lumbangan Controlled Disposal Facility at Barangay Lumbangan, and the Sanitary Landfill Facility-MRF at Barangay Salaan.

2.7.2 Power Supply

The National Power Corporation (NAPOCOR) is the primary electricity provider of Zamboanga City, distributed mainly by Zamboanga City Electric Cooperative (ZAMCELCO) which serves 90 barangays with 53 sitios. ZAMCELCO has seven substations in the city at the following areas: Putik, San Jose Gusu, Sangali, Ayala and Recodo, Cabatangan, and Camanchile. **Table 23** shows the capacity of each substation.

Table 23: ZAMCELCO Substations

Substation	Capacity (MVA)
Putik	40
San Jose Gusu	20
Sangali	10
Ayala & Recodo	20
Cabatangan	20
Camanchile	45

Source: ZAMCELCO On Grid Power Supply Procurement Plan 2020

As of 2018, the electric cooperative had a total of 121,208 captive customers, including residential, commercial, and industrial connections. **Table 24** shows the number of customers per sector, with their total energy sales.

Table 24: Energy Connections and Consumption per Sector (2018)

Sector	Captive Customers	Energy Sales (MWh)
Residential	108,810	205,767
Commercial	10,237	172,107
Industrial	171	112,667
Others	1,990	48,336
Total	121,208	537,878

Source: DOE Distribution Development Plan 2019-2028

The city also has two other power providers namely: Alliance for Mindanao Off-Grid Renewable Energy (AMORE) and Zamboanga del Sur Electric Cooperative II (ZAMSURECO II). Despite this, the city looks to increase its power supply coverage to provide electricity to outlying areas, and to address frequent blackouts in the area. The peak power demand in Zamboanga City increases annually, implying an increasing deficit in supply.

With this, Zamboanga City is on the frontline of implementing initiatives towards renewable energy, with the planning of the construction of a solar powerplant in Barangay Talisayan and the development and enactment of policies for renewable energy, to provide a sustainable solution for their power supply deficit.

2.7.3 Transportation and Road Network

The primary road of Zamboanga City runs parallel to the coast of the peninsula, enhancing its tourism value but may limit developments. Bypass roads are necessary to ease the expansion of growth centers. The road density of the city is 0.83 kilometers of road per 100 m² of land area, which is quite less than the standard of 1 kilometer road per 100 m² land; implying that additional road linkages may still be developed. As of 2015, the total length of road in Zamboanga City is 1,214 kilometers. **Table 25** presents the length of roads available in the city, according to its classification and surface type. It may be observed that most roads in Zamboanga are composed of unpaved barangay roads.

Table 25. Road Network Conditions in Zamboanga City

Classification	Surface Type (km)			Total	Percent Share (%)
	Concrete	Asphalt	Gravel/ Unpaved		
National	82.4	15.1	94.3	191.8	12.6
City	28.0	1.1	1.9	31.0	2.5
Barangay	168.8	17.8	804.5	991.1	84.9
Total	279.2	34.0	900.7	1,214.0	100.0
Percent Share (%)	23.0	2.8	74.2	100.0	

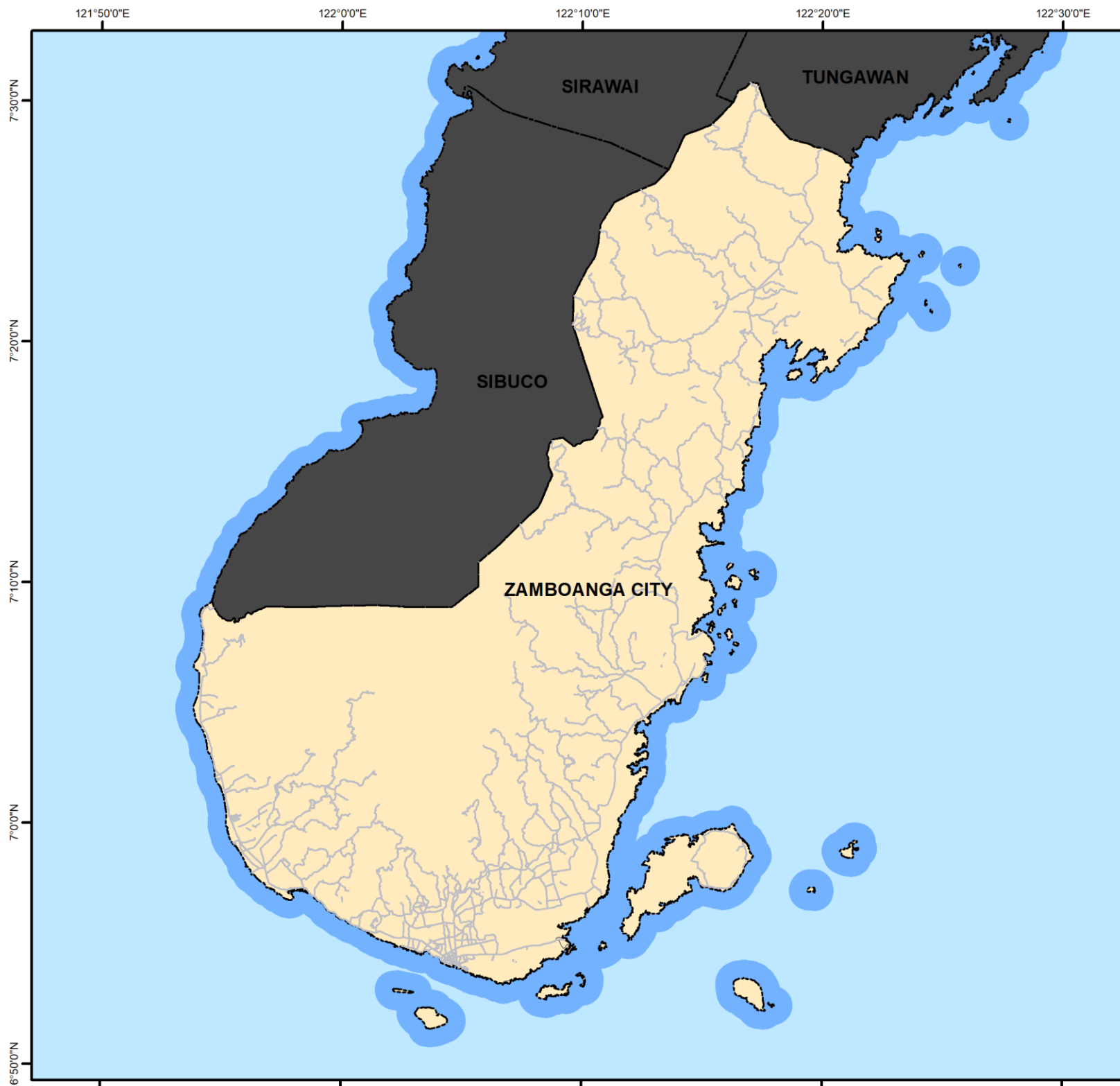
Source: Zamboanga City CDP 2016-2021

The road network map of the city is presented in **Figure 14**.

2.7.4 Drainage System

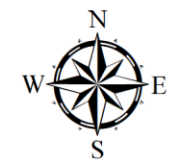
Zamboanga City primarily relies on its natural drainage and river systems to mitigate stormwater flows and prevent flooding in the area. The development of a master drainage plan and a comprehensive drainage system, with supporting local ordinances, are included in the future programs and plans of the city according to its Comprehensive Development Plan 2016-2021. The design and construction of the drainage system is planned to primarily prevent flooding in the city, prioritizing the following barangays:

- Locomo,
- Tigbalabag,
- Tumitus,
- Limaong,
- Muti,
- Dita,
- Bolong,
- Sangali,
- Victoria,
- Manicahan,
- Cabaluay,
- Culianan,
- Talabaan,
- Mercedes,
- Boalan,
- Arena Blanco,
- Mampang,
- Talon-Talon,
- Kasanyangan,
- Zone IV,
- San Jose Cawa-Cawa,
- Baliwasan,
- Calarian,
- San Roque,
- Malagutay,
- Sinunuc,
- Maasin,
- Cawit,
- Patalon, and
- Labuan



LOCATION MAP
ZAMBOANGA CITY

- LEGEND:
- Road Network
 - City/Municipal Boundaries
 - Zamboanga City



1:400,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES
Administrative Maps (OCHA, 2016)
Philippine Road Network (OSM, 2020)

FIGURE 14
Zamboanga City
Road Network Map

3 Framework for Sanitation and Reuse Planning

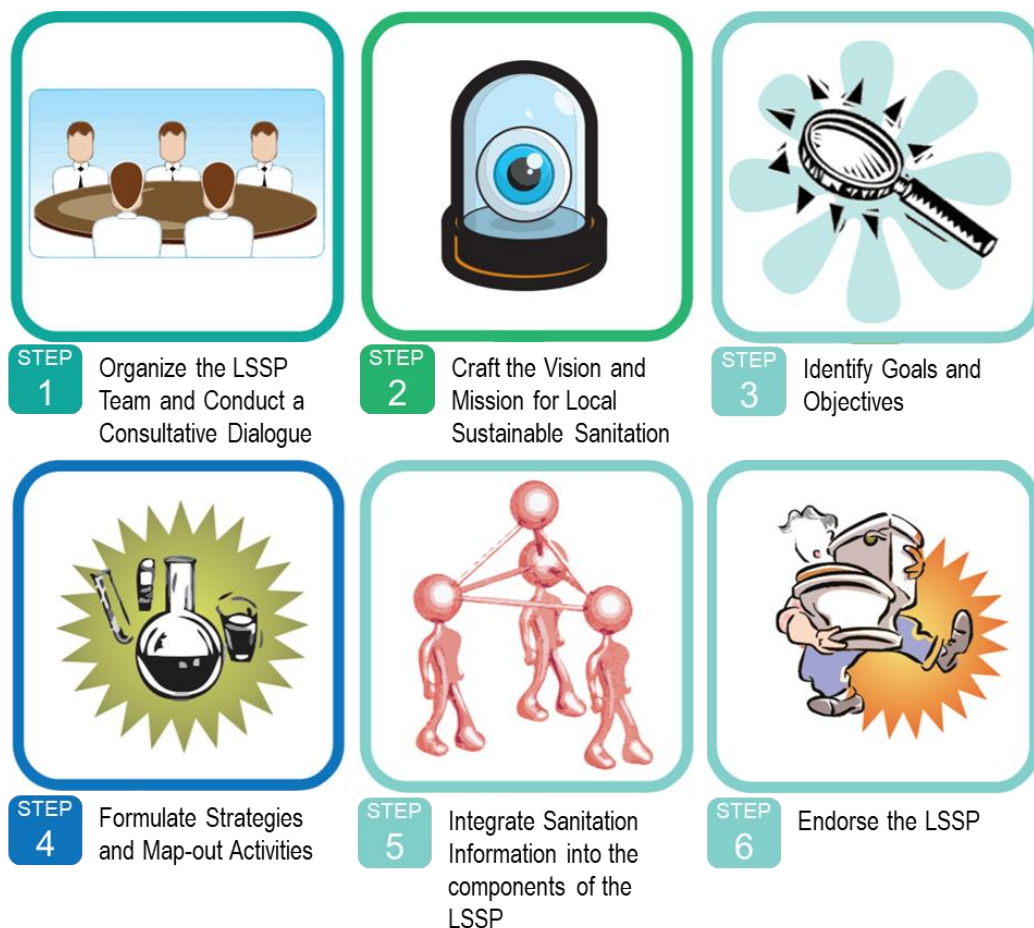
This section discusses the different concepts and approaches used by the Department of Health (DOH) for Sanitation Planning. This also includes discussions on international and national development plans and guidelines used by the Study Team as bases for the project's sanitation goals and targets. Existing sanitation processes and reuse practices used in the Philippines are also presented in this section.

3.1 Sanitation and Reuse Planning Framework

3.1.1 Local Sustainable Sanitation Plan

In 2010, the DOH published the Guidebook for a Local Sustainable Sanitation Strategy as part of a series of publications under the Philippine Sustainable Sanitation Knowledge Series. This guidebook serves as a guide for LGUs and other local sanitation planners to formulate the Local Sustainable Sanitation Plan and help them respond to the challenge of increasing access, especially to the poor, to sustainable sanitation (Pasaporte, 2010). The guidebook summarizes the formulation of the Local Sustainable Sanitation Plan (LSSP) into a six-step process as shown in **Figure 15**.

Figure 15: Steps in Developing a Local Sustainable Sanitation Plan



Note. Adapted from *Guidebook for a Local Sustainable Sanitation Strategy* (Pasaporte, 2010).

3.1.2 Five Functional Areas of Sanitation

Sanitation Systems are a combination of different functional units that together allow managing and reusing or disposing the different waste flows from households, institutions, agriculture or industries in order to protect people and the environment (Gensch, et. al, 2008). These systems can be broken down into the five function areas of sanitation as enumerated below.

1. **User Interface** - refers to toilets/urinals that serve as the primary sanitation technology that users interact with. These are used as the access points of the users to the sanitation system and where the “input products” such as urine and feces are introduced to the system.
2. **Collection and Storage** - refers to collection and on-site treatment technologies such as septic tanks and ventilated improved pits (VIPs). Treatment using these technologies are often passive and do not require energy, thus, products from these technologies often require subsequent treatment.
3. **Conveyance** - refers to technologies used to transport products to the (semi-) centralized treatment. Most common of these technologies are the use of vacuum trucks and sewer networks.
4. **(Semi-) Centralized Treatment** - this refers to sanitation technologies used to treat large quantities of wastewater or sludge prior to reuse and/or disposal.
5. **Use and/or Disposal** - this refers to the methods by which products are disposed or reused.

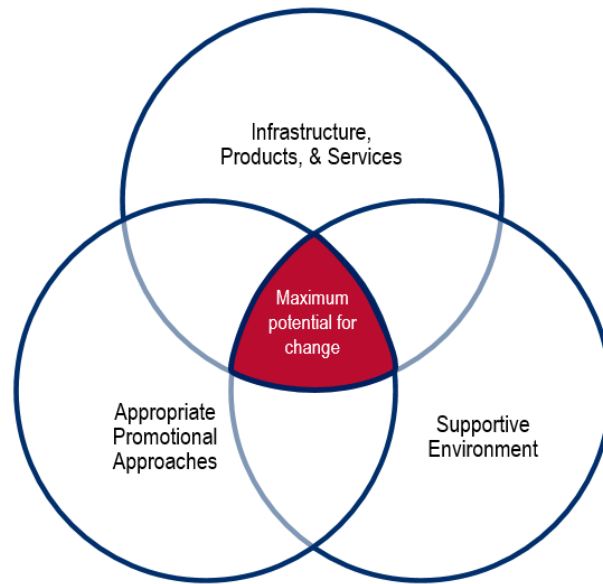
In line with this framework, this Pre-FS follows all five functional areas of sanitation: starting from the user interface or the availability of toilet facilities in the Study Area, followed by the storage/containment through septic tanks. The proposed technology will mainly focus on the functional areas from conveyance to the reuse and/or disposal of residuals. Conveyance will be through the use of vacuum truck units; centralized treatment will consider a centralized septage treatment plant (SpTP) for the coverage area; and reuse and/or disposal will be considered based on the identified intended uses of the constituents.

3.1.3 Three-Pronged Approach

The Three-Pronged Approach to Sanitation Program is rooted in the concept of behavior change. As illustrated in **Figure 16**, the potential for change is primarily affected by three major factors: (a) infrastructure, products, & services; (b) appropriate promotional approaches; and (c) a supportive environment. The overlap of these three areas illustrates the likelihood of change. Therefore, to increase the likelihood of behavior change, all three areas must be maximized at the same time and in the same place.

Applying this approach, this Study aims to (a) recommend the best options for the infrastructure based on appropriate treatment options and costing, (b) assist the ZCWD in the formulation of their promotional and marketing plan, and lastly, (c) to recommend institutional set-ups and improvements to existing ordinances to foster a supportive environment,

Figure 16: Three-Pronged Approach to Sanitation

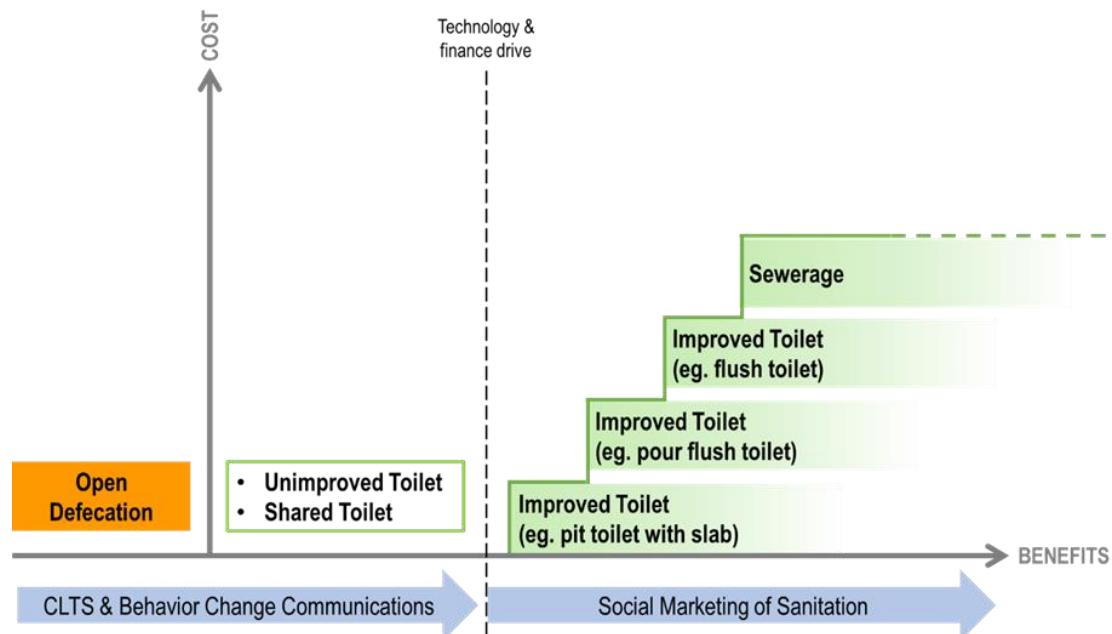


Note. Adapted from 10-Step Promotion Program Toolkit (USAID, 2009)

3.1.4 Sanitation Ladder Approach

The Sanitation Ladder (see **Figure 17**) presents sanitation intervention measures in order of increasing sophistication. Each step up the ladder provides increasing benefits to the public health and environment of the community but also requires larger investments. This ladderized approach to sanitation planning gives emphasis to this relationship and the need to build up the demand for sanitation services before introducing higher levels of sanitation.

Figure 17: Sanitation Ladder



Note. Adapted from Live & Learn Environmental Education (2017).

To address the basic problem of open defecation, intervention should begin at the basic level by introducing on-site capture facilities (i.e., toilets). As the demand for sanitation services increases, sanitation interventions become more sophisticated with the introduction of on-site treatment like septic tanks.

In Zamboanga City, about 70 percent of households have septic tanks (Philippine Statistics Authority, 2010). At this point in the sanitation ladder, a Septage Management Program (SMP) may be explored to provide off-site treatment of the sludge from the septic tanks.

3.1.5 Principle of Circular Economy

There is a need to adopt a paradigm change, from linear to circular economy, to ensure the sustainability of water and sanitation services. Rapid urbanization and population growth have increased the demand for water sources. By 2040, it is projected that the country's total water demand will be approximately 21 million cubic meters (MCM) per day. This does not only entail the possibility of depleting the water resources but may also cause potential contamination of the water sources due to the increase in the wastewater generated and disposed by the population. It is estimated that in 2040, about 17 MCM per day of wastewater will be generated in the country (NEDA, 2017).

At present, the water sector's economic model has been linear which follows the "Take-Use-Discharge" strategy wherein the water is withdrawn from the water sources, used by the population and wastewater is discharged to the environment. This model constraints the availability of water sources and increases the wastes disposed to the environment.

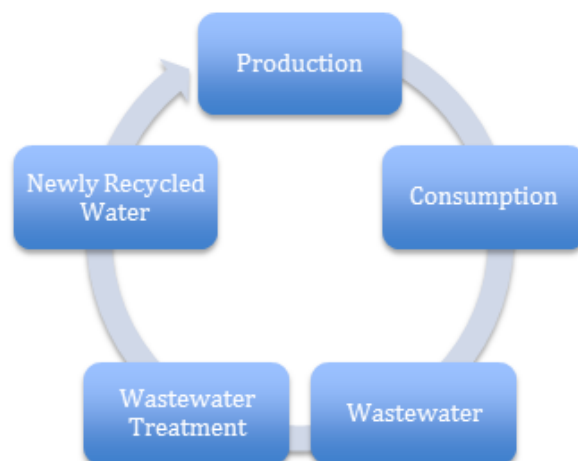
On the other hand, the concept of circular economy promotes the recovery of resources from the waste and the reuse of wastes as raw material, to create a closed loop within the cycle. The advantages of this approach are enumerated in **Figure 18**.

Figure 18: Benefits of Circular Economy



In the context of water resources and wastewater management, the circular economy aims to minimize or reduce the consumption of fresh water supply by using wastewater as additional water source that can be processed for reuse and resource recovery, as illustrated in **Figure 19**.

Figure 19: Water and Wastewater Circular Economy



The wastewater treatment plant (WWTP) is an important component in attaining a circular economy in the water sector. A water resource recovery facility must be integrated in the WWTP to treat the wastewater to meet the required quality of its intended reuse. The by-products (i.e., sludge) of the wastewater treatment can also be further processed to recover the nutrient content and reuse in agriculture.

3.2 Considerations for Sanitation Improvement through a Sanitation Program

3.2.1 National Targets for Sanitation

Targets to improve sanitation (see **Table 26**), as a priority concern of the Philippine Government, are embodied in sectoral roadmaps and development framework plans – the Philippine Water Supply & Sanitation Master Plan (PWSSMP), Philippine Development Plan (PDP), and Philippine Sustainable Sanitation Roadmap (PSSR) (superseded by PWSSMP), among others.

Table 26: Sanitation Targets

Source Document	Sanitation Development Targets
PWSSMP 2019-2030	<ul style="list-style-type: none"> • Increase percentage of households with septic tanks from 84% in 2018 to 97% in 2022 and to 100% in 2030; • Increase percentage of households with access to septage collection service from 18% in 2018 to 69% in 2022 and 100% in 2030; • Increase percentage of households with access to sewerage system from 15% in 2018 to 23% in 2022 and 60% in 2030; • Increase percentage of households connected to sewerage system from 11% in 2018 to 20% in 2022 and 50% in 2030;

Source Document	Sanitation Development Targets
	<ul style="list-style-type: none"> • End open defecation by 2022; • Increase percentage of Highly Urbanized Cities (HUCs) with improved sewerage provision from 61.76% in 2018 to 94.12% in 2022 and 100% in 2030; • Increase percentage of non-HUCs with improved sewerage provision from 1.35% in 2018 to 61.2% in 2022 and 100% in 2030 • Increase percentage of utilities complying with national standards for sanitation (e.g., Department of Environment and Natural Resources (DENR), Department of Health (DOH), Local Government Units (LGUs)) from 18% in 2018 to 67% in 2022 and 100% in 2030, and • Introduce and implement 8 major reform agenda in improving the WSS sector.
PDP 2017-2022	<ul style="list-style-type: none"> • Increase percentage of households with access to basic sanitation from 94.10% in 2014 to 97.46% by 2022; • Enactment of a law creating an apex body for Water Resources Sub-sector; and • Enactment of law creating an independent economic or financial regulator for water supply and sanitation. • Under the Basic Education Facilities Fund (BEFF), school buildings will be furnished with complementary sanitation facilities. • Improve the living conditions in congested prisons by providing them with proper sanitation facilities.
Sustainable Development Goals (SDG) 2015-2030 of the United Nations Development Programme (UNDP)	<ul style="list-style-type: none"> • By 2030, achieve universal access to adequate and equitable sanitation and hygiene and the end of open defecation, paying special attention to the needs of women and girls and those in vulnerable situations; • By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally; and • By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technology.
PSSR 2010-2028	<ul style="list-style-type: none"> • Achieve the Millennium Development Goals (MDG)¹ target of halving the proportion of the population without sustainable access to basic sanitation by 2015; • At least 70% of the LGUs with sanitation plans and budgets under their Province-wide Investment Plan for Health/ Annual Investment Plan for Health/ City-wide Investment Planning for Health by 2016; • Improve basic sanitation coverage in 9 priority cities² and provinces by ensuring at least 85% of the population have sanitary toilets by 2016; • Sewerage and/or septage management services available in 57 HUCs by 2016; and • Attain universal access (100%) to safe and adequate sanitary facilities by 2028. • Superseded by the PWSSMP.
NSSMP, 2010-2020	<ul style="list-style-type: none"> • By 2020, all LGUs have developed septage management systems and all 17 HUCs³ outside Metro Manila have developed sewerage systems for their urban; • By 2020, approximately 43.6 million people have access to septage treatment facilities and about 3.2 million will have access to sewerage treatment facilities; • By 2020, PhP26.3 billion will have been invested in sanitation improvement projects; and

Source Document	Sanitation Development Targets
	<ul style="list-style-type: none"> By 2020, about 346 million kg of Biochemical Oxygen Demand (BOD) will be diverted from the environment per year as a result of the sewerage and septage management projects. Program extended and counterpart financing coverage amended to include all cities and first-class municipalities Deadline and targets superseded by the PWSSMP.

Notes.

¹Millennium Development Goals, or MDG, is the predecessor of SDG.

²According to the PDP 2017-2022, this target was achieved – in 2015, 5.9% of households in the Philippines had no access to basic sanitary toilet facilities. (PSA, 2013. National Demographic and Health Survey [NDHS])

³The 17 HUCs include: Angeles, Bacolod, Baguio, Butuan, Cagayan de Oro, Cebu, Davao, General Santos, Iligan, Iloilo, Lapu-lapu, Lucena, Mandaue, Olongapo, Puerto Princesa, Tacloban, and Zamboanga.

In monitoring sanitation targets, sanitation service levels have been classified into: No Service, Unimproved Sanitation, Limited Sanitation, Basic Sanitation, and Safely Managed Sanitation. Each service level was also characterized by three data attributes: (1) Facility – referring to the infrastructure for the sanitation service; (2) Usage – referring to the availability of the facility for a household; and (3) Management – referring to the proper disposal of excreta (NEDA, 2021). The 2020 Annual Poverty Indicators Survey (APIS) of the PSA was conducted to monitor these service levels and is presented in **Table 27** (PSA, 2021).

Table 27: 2020 APIS - Service Level of Sanitation Facilities in the Philippines

Service Level of Sanitation Facilities	% of Families	Definition	Facility (With Toilet?)	Usage (Private/ Shared?)	Management
Basic Sanitation	80.4	Use of improved facilities that are not shared with other households	Yes	Private (not shared)	Maybe
Limited Sanitation	13.5	Use of improved facilities shared between two or more households	Yes	Shared	Maybe
Unimproved Sanitation	2.6	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines	Yes	Maybe private or shared	No
No Service	3.3	Open defecation.	No	N/A	N/A

Note:

*Values from PSA Press Release: Results from the 2020 Annual Poverty Indicators Survey (APIS)

**Definitions from PSA and PWSSMP

*** In the conduct of the PSA Survey, disposal and treatment of excreta were not very common within household levels; or that the families were not aware how the excreta were treated, whether on site or transported and treated offsite. Hence, families using improved sanitation facilities were not classified as safely managed sanitation services.

Monitoring of access to sanitation facilities based on the SDG definitions is poorly implemented. The current statistics do not show households with safely managed sanitation, which was defined as Use of improved facilities which are not shared with other households and where excreta are safely disposed of in situ or transported and treated off-site. The DOH, designated as the lead agency for sanitation, needs to devise and implement critical guidelines, procedures, standards, and policies to improve compliance and implementation at the local level

From the above targets and other numerous challenges facing the sector, it is therefore imperative for LGUs, water districts (WDs), and other water service providers (WSPs), in particular, to implement sanitation projects that will contribute to improving health conditions and quality of life, and the protection of the environment and vital water resources.

3.2.2 Legal and Policy Framework

A review of the existing legal and policy framework concerning sanitation, septage management, and resource recovery from wastewater treatment was conducted to determine the concerned government entities and their respective responsibilities, and to characterize the legal environment of the sector and identify the permissible practices in line with the proposed project. This section presents the national and local-level laws covered by the review, while **Appendix A** enumerates the specific provisions and sections of key policies of the sector.

Philippine laws follow the following hierarchy by its degree of authority:

- Philippine Constitution;
- National Laws and International Treaties: includes Acts, Commonwealth Acts, Republic Acts, Presidential Decrees ⁴;
- Statutes: intended to supply the details which the Constitution, because of its nature, must leave unprovided for;
- Administrative Issuances: policies which predicate the implementation of national laws includes Presidential Proclamations, Executive Orders, Administrative Orders, Memorandum Circulars; and
- Local Ordinances: enacted to supplement national laws through the passage of the respective local councils (ASEAN Law Association, 2019; Environmental Legal Assistance Center , 2009).

National Policies and Standards in Sanitation and Wastewater Management

Laws and Decrees

There are various laws and decrees that govern the sanitation and wastewater management in the Philippines, including the 1987 Philippine Constitution, 1991 Local Government Code and the Clean Water Act (CWA), among others. The relevant laws and decrees in sanitation and wastewater management at the national level are summarized in **Table 28**.

Table 28: Relevant Laws and Decrees in Sanitation and Wastewater Management

National Laws and Decrees	Relevant Provisions/ Mandates
Presidential Decree 198 - Local Water Districts Law (1973)	<p>Provided the framework for the formation of water districts and the establishment of the Local Water Utilities Administration (LWUA):</p> <ul style="list-style-type: none"> • <i>Establishes the legal basis of water districts:</i> Provided for the formation of Water Districts to operate water supply and distribution systems, wastewater collection, treatment and disposal facilities, and to conduct other functions and operations incidental to water resource development, utilization and disposal (Title II, Section 5) • <i>Defines the mandates of water district:</i> among its functions and powers of are as follows:

⁴ Only pertains to PDs enacted under Martial Law from 1972 to 1986.

National Laws and Decrees	Relevant Provisions/ Mandates
	<ul style="list-style-type: none"> ○ Purchase, construction or acquisition of works, water, water rights, land, rights and privileges useful or necessary to convey, supply, store, collect, treat, dispose of, or make other use of water (Section 27) ○ Require, construct, operate and furnish facilities and services for the collection, treatment and disposal of sewerage, waste, and storm water (Section 29) ○ Commence, maintain, intervene in, defend, and compromise actions and proceedings to prevent interference with or deterioration of water quality or the natural flow of any surface, stream or ground water supply (Section 32) ○ Prescribe and collect rates and other charges for sewer services furnished, or fix, levy and collect a sewerage and wastewater service stand-by or availability charge in the event sewer service is available, and no connections are made (Section 38) ● <i>Provides the mandates of LWUA:</i> Creating LWUA as a specialized lending institution for the promotion, development, and financing of local water utilities (Title III, Chapter II)
Presidential Decree No. 1067 – Water Code of the Philippines (1976)	<ul style="list-style-type: none"> ● Defines the policies relating to appropriation, development, exploitation and conversation of water resources owned by the state and mandating the National Water Resources Council, the precursor of NWRB to be primarily responsible for the implementation of the Code. ● Specifies the reuse of wastewater to be limited to uses other than human consumption as much as possible, and that its safety must be prior established before distribution and public consumption (Chapter IV Article 36)
Presidential Decree 856 - Code on Sanitation of the Philippines (1976)	Under its Chapter XVII: Sewage Collection and Disposal, Excreta Disposal and Drainage, the Code provides the guiding principles for the establishment of sewerage and septage management programs in the Philippines. It specifies the requirements in the operation of sewage treatment works and sewage treatment plants, septic tanks, disposal of septic tank effluent, and determination of septic tank capacity, sanitary privies and drainage. In 2021, a revised implementing rules and regulations for this specific chapter of the Code has been released.
Presidential Decree No. 1586 -Establishing an Environmental Impact Statement System (1978)	Establishes a mechanism to ensure balance between the environment and socioeconomic development in the projects and undertakings of all agencies and instrumentalities of the national government, including government-owned or controlled corporations, as well as private corporations, firms and entities through an environmental impact statement (EIS) system.
The Constitution of the Republic of the Philippines (1987)	<p>Establishes the obligation of the state to promote health, welfare and quality of life, and to protect the natural resources of the country:</p> <ul style="list-style-type: none"> ● <i>Right to health:</i> The State shall protect and promote the right to health of the people and instill health consciousness among them (Article II Section 15-16). ● <i>Role in protecting the State's natural resources:</i> The State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature. The right to health and to a balanced and healthful ecology call for, among others, the proper management, conservation, or protection of all matters that would have an effect on these rights (Article II Section 16). ● <i>Mandate of local governments in sanitation service provision:</i> Recognition of the responsibility of the government to provide basic services for

National Laws and Decrees	Relevant Provisions/ Mandates
	<p>constituents within their respective jurisdictions, including septage and sewerage systems (Article II, Section 25)</p> <ul style="list-style-type: none"> • <i>Clustering of LGUs</i>: local government units may group themselves, consolidate or coordinate their efforts, services, and resources for purposes commonly beneficial to them in accordance with law (Article X, Section 13).
<p>Republic Act No. 7160 – Local Government Code (1991)</p>	<p>Establishes policies to promote local autonomy and self-reliance of local governments at the provincial, city, municipal, and barangay levels, and devolves various powers and functions of the national government to LGUs, namely:</p> <ul style="list-style-type: none"> • <i>Functions and responsibilities in basic services and facilities, including water supply and sanitation</i>: LGUs are mandated to effectively provide basic services and facilities to their constituents in line with existing standards, including water supply systems and development of infrastructure of water resources (Section 3, 17). Their respective local councils (i.e., <i>Sangguniang Panlalawigan</i>, <i>Sanggunang Panlungsod</i>, <i>Sangguniang Bayan</i>, and <i>Sangguniang Barangay</i>) also have mandates perform oversight and regulatory functions through the passage of ordinances in their respective areas of jurisdiction (Section 391, 447, 458, 468) • <i>Power to impose charges</i>: LGUs have the power to generate sources of revenue, such as the imposition of reasonable charges for infrastructure, including sanitation (Section 18) • <i>Shared responsibility for protection of resources</i>: The responsibility in the management and maintenance of ecological balance is shared between the national and local governments (Section 3). • <i>Partnership with the private sector</i>: The participation of the private sector in local governance, particularly in the delivery of basic services and financing, construction, maintenance, operation, and management of infrastructure projects is supported by the Code (Section 3, 17, 302). • <i>Capacity-building of local governments</i>: Among the operative principles of the code includes the enhancement of the capabilities of LGUs by providing them with opportunities to participate actively in the implementation of national programs and projects (Section 3).
<p>Republic Act No. 9003- Philippine Ecological Solid Waste Management Act of 2000 (2001)</p>	<p>Sets criteria and parameters for establishing sanitary landfills, including a pipe system for leachate collection to prevent run-off contamination; designates that DENR establishes leachate standards and criteria should leachate be discharged to a receiving water body (Section 41)</p>
<p>Republic Act No. 9275 – Philippine Clean Water Act (2004)</p>	<p>Establishes a framework for a comprehensive water protection, preservation and revival of water resources in the country, including</p> <ul style="list-style-type: none"> • <i>Guidelines and standards in septage and sewerage</i>: DOH has been designated formulate guidelines and standards for the collections, treatment, and disposal of sewage as well as the guidelines for the establishment and operation of a centralized sewage treatment system. • <i>Powers of local government units</i>: to ensure implementation of the Act, LGUs are directed to appropriate the necessary land, including the rights-of way/road access to the land for the construction of the sewage and/or septage treatment facilities; and, authorized to raise funds to subsidize necessary expenses for the operation and maintenance of sewerage

National Laws and Decrees	Relevant Provisions/ Mandates
	<p>treatment or septage facility through local property taxes and enforcement of a service fee system.</p> <ul style="list-style-type: none"> • <i>Role of DPWH, DENR and LGUs in sewerage and septage management:</i> The DPWH, through its relevant attached agencies and in coordination with DENR, LGUs, and other concerned agencies, should prepare a national program on sewerage and septage management. • <i>Role of water service providers and regulators:</i> The MWSS and other agencies mandated to provide water supply and sewerage facilities are required to connect existing sewage lines, subject to the payment of sewerage service charges/fees within five years following effectivity of the Act. • <i>Septage and sewerage requirements by administrative division:</i> distinction has been made in implementing the program for highly-urbanized cities, and those outside HUCs: <ul style="list-style-type: none"> ○ Concerned agency/ies vested to provide water supply and sewerage facilities in highly urbanized cities (HUCs), in coordination with LGUs, to connect the existing sewage line found in all subdivisions, condominiums, and commercial centers, among other establishments, to available sewerage system, subject to sewerage services charge/fees ○ In areas not considered as HUCs, the DPWH, in coordination with the Department of Health (DOH) and other concerned agencies, is mandated to employ septage or combined sewerage-septage management system, with DOH spearheading the formulation of guidelines and standards for the collection, treatment and disposal of sewage.
<p>Presidential Decree 856 – Revised Implementing Rules and Regulations of Chapter XVII- “Sewage Collection and Disposal, Excreta Disposal, and Drainage” of the Code on Sanitation of the Philippines (2021)</p>	<ul style="list-style-type: none"> • Provides all the revisions for the implementation of rules and regulations related to sewerage and septage management under Chapter 17 of Presidential Decree 856. • For reuse and disposal, specific requirements for on-site and off-site sanitation facilities have been established: <ul style="list-style-type: none"> ○ For onsite, every establishment is required to provide a plan for sewage and septage management treatment. The plan for construction of the sewage disposal system will be approved by the local health office. ○ For offsite, the document sets the requirements for the disposal of waste and sewage. This document also outlines how sludge can be reused and disposed based on the available options. The DA, DOH, DENR, and other agencies are involved in the creation of these requirements.

Policies and Regulations

The DENR, EMB, DA, DOH, Department of the Interior and Local Government (DILG) have released several administrative orders and memorandum circulars that provide information about legal documents that talk about wastewater management. The relevant regulations and policies in sanitation and wastewater management at the national level are summarized in **Table 29**.

Table 29: Existing Policies and Regulations in Sanitation and Wastewater Management

Legal Document	Highlights Relevant to Wastewater Management
DENR Administrative Order No. 2001-34 - Implementing Rules and Regulations of Republic Act 9003 (2001)	<ul style="list-style-type: none"> Provides the necessary guidelines and procedures to implement the Philippine Ecological Solid Waste Management Act of 2000. The agencies involved in the implementation of this administrative order includes the Department of Environment and Natural Resources, the Department of Trade and Industry, and other concerned LGUs and stakeholders. Sets the standards and guidelines for the construction of effective waste management systems.
DENR Administrative Order No. 2005-10 Implementing Rules and Regulations of the Philippine Clean Water Act of 2004 (2005)	<p><u>Article 2 Section 13.3</u></p> <ul style="list-style-type: none"> States that wastewater shall be reused for irrigation and other agricultural activities. Guidelines should be implemented by the agencies in order to assure a safe process of reusing wastewater.
DOH Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage (2008)	<ul style="list-style-type: none"> Serves as a guide for public and private entities engaged in sludge and septage management activities, including desludging, treatment system, disposal facilities, and land application (i.e., for agricultural purposes and for soil amendment). Provides the procedures for the required regulatory requirements of sludge and septage management programs, including permits and environmental sanitation clearances, and septic tank permits. Includes guidelines to secure environmental sanitation clearance requirement of all new, expansion or modification of septage management activities from the DOH Center for Health Development. Outlines the roles and responsibilities of actors in the sector, including DOH, DENR, DA, service providers, local governments, households, and building owners.
DENR Administrative Order No.2016-08 – Water Quality Guidelines and General Effluent Standards of 2016 (2016)	<ul style="list-style-type: none"> Defines the intended beneficial use of Philippine waterbody classification. Provides modified water quality guidelines for each waterbody classification. Includes criteria on primary/physical parameters as well that on concentration of significant organics, inorganics, and metals. Identifies significant effluent quality parameters per category/ activity including that for water supply, sewerage, wastewater management, and remediation (Table 8.E); Enforces effluent standards of the applicable parameters according to the waterbody classification.
DA Bureau of Agriculture and Fisheries Standards - Philippine National Standard Wastewater Reuse for Irrigation (2017)	<ul style="list-style-type: none"> Includes the different sources of wastewater and information about the quality and quantity of treating wastewater for irrigation. Sets specific guidelines and requirements before the treatment wastewater for irrigation.
DILG Memorandum Circular No. 2018-47 – Guidelines for the Implementation of the Provision of Potable Water Supply Local Government Support Fund – Sagana at Ligtas na Tubig sa Lahat (LGSF	<ul style="list-style-type: none"> Sets the guidelines and processes for the implementation of projects about water supply being handled by the LGSF-SALINTUBIG program. Emphasizes on the goal of providing potable and improved water supply all throughout the Philippines based on specific targets, namely, the Philippine Water Supply Sector Roadmap for 2008-2025, the Philippine Development Plan for 2017-2022, and Goal 6 of the Sustainable Development Goals for 2017-2030 where the world can have access to universal access to potable water.

Legal Document	Highlights Relevant to Wastewater Management
– SALINTUBIG) Program for FY 2018 (2018)	<ul style="list-style-type: none"> Includes information on fund allocation and management, project implementation, specific requirements, procurement by the city, implementation of the project, responsibilities of the involved parties, and sanctions for violations and non-compliance.
DA Administrative Order No. 2019-11– Revised Guidelines on the Procedures and Technical Requirements for the Issuance of a Certification Allowing the Safe Reuse of Wastewater for Purposes of Irrigation and Other Agricultural Uses, Pursuant to the Philippine Clean Water Act (2019)	<ul style="list-style-type: none"> Covers the protection for environment, human, animal, and plants in the treatment and off-site and onsite reuse of wastewater originating for the agriculture sector, such as livestock, food and agro-industrial processes, aquaculture, and municipal/domestic wastewater. The policy applies to all establishments where they have to reuse wastewater for agriculture purposes, specifically for fertilization, irrigation and aquaculture. All wastewater generators must secure proper certification for wastewater reuse for irrigation, fertilization, and aquaculture purposes. The specific guidelines: <ul style="list-style-type: none"> <i>Fertilization</i>: The AO specifies the requirements for certification for commercial and non-commercial fertilization purposes, which is to be secured from the Fertilizer and Pesticide Authority (FPA). The quality of the reclaimed wastewater for fertilization uses the standards by the Association of Official Analytical Chemists (AOAC) and the Fertilizer and Pesticide Authority (FPA) will be used for sample analysis. General parameters on quantity and distribution of wastewater for reuse was provided, and no specific prohibitions on types of crops were indicated. <i>Irrigation</i>: The AO presents the main requirements and limitations for irrigation. If these limitations are surpassed, crop productivity, human health, animal, health, and the environment may experience negative effects. The testing methods and analysis for wastewater will be coming from the standards of the American Public Health Association (APHA) / American Water Works Association (AWWA)/ Water Environment Federation (WEF). <i>Aquaculture</i>: The AO outlines the limitations for fish productivity and human health. It also emphasizes that ponds have to be free of heavy metals, chemicals and microorganisms that may cause harm to marine life. An AOAC method of analysis combined with laboratory protocols will be used to analyze the quality for aquaculture operations. An oversight committee within DA has been created to oversee the implementation of the AO, while the National Technical Working Group was reconstituted to update and monitor the implementation under the Guidelines.
DOH Administrative Order No. 2019-0047 – National Standard on the Design, Construction, Operation and Maintenance of Septic Tank Systems (2019)	<p><u>Section VI. Specific Guidelines</u></p> <ul style="list-style-type: none"> Sets specific and updated standards and criteria for design of septic tanks. These includes basis of septic tank size and volume computation, emphasis on structure stability and water-tightness, and need for desludging once every three to five years. <ul style="list-style-type: none"> Sets guidelines on construction and installation. Provides emphasis on location and accessibility of the septic tank, as well as testing to ensure water-tightness of the septic tank. Provisions on operation and maintenance of septic tanks such as requirement to be deslugged every four years. Also indicates materials and substances that are prohibited to be discharged into the septic tank.

Legal Document	Highlights Relevant to Wastewater Management
	<p><u>Section VII. Roles and Responsibilities</u></p> <ul style="list-style-type: none"> • <i>Local Governments</i>: Provides the roles and responsibilities of concerned actors such as the LGU who are instructed to facilitate IEC on septic tank operation and maintenance to households and pass a local ordinance that would implement and enforce the provisions in the AO including prescribing fines and other penalties for violation. • <i>Households and Building Owners</i>: Ensure that their septic tanks conform to the standards set by the AO and are desludged regularly within the designed cycle period.
DILG Memorandum Circular No. 2019-62 – Policy and Guidelines on Sewage Treatment and Sewage Management System (2019)	<ul style="list-style-type: none"> • Reiteration of the roles and responsibilities of the LGUs in providing for the implementation of sewage/ septage management programs in their respective city or municipality as mandated by the CWA. • Emphasizes on the enactment of a sanitation ordinance (Section 6.1) and its responsibility to assist and provide support to water service providers and other appropriate authorities in implementing the sewage/ septage management program. • Emphasized the mandatory desludging of all septic tanks at least once every five years (Section 6.4). • Includes the provisions on administrative liability and imposition of disciplinary actions as sanctions to non-compliance to the memorandum circular.
EMB Memorandum Circular No. 004-20- Clarification on the Reporting Requirements for Specific Parameters under DENR Administrative Order No. 2016-08 or the Revised Water Quality Guidelines and General Effluent Standards of 2016 (2020)	<ul style="list-style-type: none"> • Contains the additional clarifications of DENR Administrative Order No.2016-08. The reporting requirements for phosphate, phenol and phenolic substances, xylenes, chlordane, and fecal coliforms analyzed in class AA waters are elaborated in this document.
DENR Administrative Order No. 2021-19 – Updated Water Quality Guidelines (WQG) and General Effluent Standards (GES) for Selected Parameters (2021)	<ul style="list-style-type: none"> • Amends the threshold for some environmental parameters of the water quality guidelines and general effluent standards, namely ammonia as NH₃-N, boron, copper as dissolved copper, fecal coliform, phosphate as phosphorus, and sulfate. <p><u>Section 4.7</u></p> <ul style="list-style-type: none"> • The general effluent standards for wastewater for BOD will be applied to establishments that have the prescribes values found in Table 10 of DAO 2016-18 within the last twelve months. A laboratory of DENR has to perform the analysis, and this shall be submitted to the EMB Central Office.

Local Regulations and Legislation on Sanitation Programs

The City of Zamboanga has released local ordinances related to sewage and septage waste management, as summarized in **Table 30**.

Table 30: Local Regulations and Legislation on Sanitation and Wastewater Management

Local Ordinances	Relevant Provisions/ Mandates
Office of the Sangguniang Panlungsod Ordinance No. 2009-152 – An Ordinance Establishing a Septage Management System in the City of Zamboanga (2009)	<ul style="list-style-type: none"> Provides information on how to manage and operate septic tanks which include desludging, treating, disposing, and transporting procedures. Sets specific requirements and specifications for the design and construction of the treatment facilities. Emphasizes on the specific functions of the city septage management council.
City Septage Management Council – Implementing Rules and Regulations for the Septage Management System in Zamboanga City in Accordance with Ordinance No. 2009-152 (2009)	<ul style="list-style-type: none"> Makes sure that wastewater should undergo proper treatment and sanitation before discharge and introduction to the environment. The policy shall apply to all buildings, facilities, and structures whether public or private except for those establishments that have an on-site wastewater treatment facility that is approved by the City Government and the Environmental Management Bureau. Residential areas that produce over 1000m³ of sewage are obligated to set up a treatment facility or seek assistance from accredited wastewater treatment facility servers. Sets guidelines for the design and construction of treatment facilities. Includes corresponding sanctions to violations and non-compliance
EO BC 661-2021	<ul style="list-style-type: none"> Creating the Zamboanga City Water Security Council

International Agreements related to Sanitation and Wastewater Reuse

Several international policies such as the UN SDGs and the Paris Climate Agreement are listed in **Table 31** to outline the global agreements related sanitation, water reuse, and wastewater management.

Table 31: International Agreements on Policies Related to Sanitation and Wastewater Management

International Agreements	Relevant Provisions/ Mandates
UN Sustainable Development Goals 6: Universal Right to Sanitation (2015)	<p>The Philippines is among the members of the UN who adopted the 2030 Sustainable Development agenda in 2015, a global commitment towards addressing the challenges of poverty, inequality, and climate change towards a more equitable and sustainable development. Two SDGs are aligned with sanitation and wastewater reuse:</p> <ul style="list-style-type: none"> <i>Goal 6: Ensure availability and sustainable management of water and sanitation for all</i> – targeted to be accomplished through investment in infrastructure and services that make access to water, sanitation and hygiene facilities accessible across the globe. The policy is also intended to allow international collaboration in order to help developing countries achieve this goal. <i>Goal 12: Ensure sustainable consumption and production patterns</i> – including substantially reducing waste generation through prevention, reduction, recycling and reuse that include wastewater treatment and greywater reuse and recycling as a strategy.
Paris Climate Agreement (2015)	<ul style="list-style-type: none"> The Paris Climate Agreement is a collaboration of different countries that strive to reduce emissions and report their actions and contributions on their progress in objective every 5 years to promote transparency and accountability.

Standard	Description
WHO Guidelines for the Safe Use of Wastewater, Excreta and Greywater (2006)	<ul style="list-style-type: none"> Provides guidelines for safe use wastewater, excreta and greywater, particularly in the aspects of policy and regulation, wastewater use in agriculture, and excreta and greywater use in Agriculture Provides knowledge on how wastewater use in agriculture can impact the health of the community, the workers, and their families. The policy aims to maximize health protection for the public and make sure that wastewater is safely used for agriculture. Adapts national and international standards in order to mitigate the hazards of wastewater reuse. Provides a preventive management framework and sets requirements for the safe reuse of wastewater.
FAO Wastewater Treatment and Use in Agriculture (1992)	<p>Specifies application of reclaimed water and sewerage sludge in agriculture:</p> <ul style="list-style-type: none"> <i>Agricultural use of recycled water:</i> Specifies application and fecal coliform standards of recycled water in (1) Irrigation of crops likely to be eaten uncooked, sports fields, and public parks, (2) Irrigation of cereal crops, industrial crops, fodder crops, pasture, and trees, and (C) localized irrigation of crops. <i>Agricultural use of sewage sludge:</i> identifies examples of effective sludge treatment processes, provides maximum permissible concentrations of potentially toxic elements in sludge application, provides constraints treated and untreated sludge application in planting, grazing and harvesting and must not be applied in: (1) growing soft fruit or vegetable crops within 10 months of crop harvesting, (2) crops grown under permanent glass or plastic structures, (3) applied to growing turf within 3 months of harvesting or to fruit trees within 10 months of harvesting, provides that
US EPA Guidelines for Water Reuse (2012)	<ul style="list-style-type: none"> Provides guidelines in required treatments, recycled water quality, recycled water monitoring, setback distances, and chemical constituents' limits, and specifies standards for agricultural water reuse into use for (1) food crops and water reus, and (2) for processed food crops/nonfood crops irrigation. Aligns its water quality criteria for irrigation with that of FAO Standards
EU Minimum Requirements for Water Reuse (2020)	<ul style="list-style-type: none"> Sets out and harmonizes the minimum requirements in the use of reclaimed water for agricultural reuse for agricultural irrigation to promote the practice of water reuse in the European Union and promote the implementation of its Circular Economy Action Plan: <ul style="list-style-type: none"> <i>Definition of reclaimed water use for the established minimum requirements:</i> specified that the requirements are intended for water reuse in agricultural irrigation, particularly for food crops consumed raw, processed food crops, and non-food crops <i>Minimum requirements for water quality:</i> defined the quality requirements (i.e., E. coli, BOD, TSS, turbidity) for four levels of reclaimed water quality class and the respective crop category and irrigation methods they can be used for <i>Obligations of reclamation facility operator:</i> ensure compliance to minimum water quality requirements and routine monitoring frequency per reclaimed water quality class <i>Permitting requirements:</i> obliges member states to establish permit parameters and obligations for production and supply of reclaimed water for agricultural irrigation Takes effect by June 2023

Benchmarking of International Practices on Wastewater Reuse

Other international practices such as the Water Cycle Basic Act and other Australian policies are benchmarked to show how water is being reused in their country.

Table 33: Benchmarking of International Practices on Wastewater Reuse

International Policies	Relevant Provisions/ Mandates
Milestones in Water Reuse: The Best Success Stories (Lazarova, 2013)	<ul style="list-style-type: none"> Discusses the benefits of re-using water and how it plays an important part in developing a sustainable city, managing a good water cycle, and fighting climate change. The Metropolitan Water Plan in Sydney was created to balance water demand and supply by conserving water, re-using water, protecting natural bodies of water, and educating the public about these initiatives. In terms of water efficiency, all households, establishments, and organizations in the city follow a program implemented by the leaders to help save 145M m³/yr of water by 2015. Under water recycling, projects such as The Replacement Flows Project at St Marys and The Wollongong Recycled Water Plant aims to treat wastewater, greywater, and stormwater to help reduce the drinking water demand by 70 M m³/yr by 2015.
Water reuse and recycling in Australia — history, current situation and future perspectives (Radcliffe, 2020)	<ul style="list-style-type: none"> Describes the history of water reuse in Australia and explains how the millennium drought pushed policy makers to create policies and expand water treatment plants to diversify the water sources for the country. The Intergovernmental Agreement on the National Water Initiative (NWI) aims to develop pricing policies for wastewater aligned to the pricing policies of drinking water, review the current models for urban water cycle planning and management and adapt the best practices, and create guidelines for the elements of water sensitive urban designs.
Water Cycle Basic Act (No.16 of 2014) – Japan (InforMEA, 2014)	<ul style="list-style-type: none"> The law emphasizes on the importance of re-using waste water. It aims to implement measures to maintain and restore the water cycle of the country. By recognizing the importance of maintaining a healthy water cycle, the country is able to improve the environment, the daily lives of the citizens, and the economy.

3.2.3 Applicable Wastewater Management Systems Potential Pollution Reduction Efficiency and Cost Comparison

The LGU and WD of Zamboanga City may undertake septage management projects and/or either separate or combined sewerage systems, consistent with the mandates of the Local Government Code (LGC), Presidential Decree (PD) 198, the CWA of 2004, and NSSMP. A comparison of their pollution reduction potential and corresponding cost implications are in **Table 34**.

Table 34: Wastewater Management System Description and Pollution Reduction Efficiency

Wastewater Management System	System Rationale and Description	Description of Pollution Reduction Efficiency
Septage Management Program (SMP)	In the Philippines, most of the households and establishments rely on septic tanks as means of collecting and partially treating wastewater.	A properly designed and constructed septic tank, which is regularly desludged, can remove up to 50% of the BOD

Wastewater Management System	System Rationale and Description	Description of Pollution Reduction Efficiency
Please refer to Figure 20	<p>Proper septage management refers to the regular removal of septage from septic tanks, proper treatment of the collected septage, and disposal of the treated effluent and biosolids by-products. According to the 2008 DOH Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage, septic tanks must be “desludged before the solids exceed 50% of the tank volume, or desludged every three to five years, whichever comes first”.</p>	<p>pollution load. However, in the Philippines, many of the septic tanks are not properly designed, and many are not accessible. Moreover, many of the septic tanks are “bottomless” or not water-tight, allowing the sewage to seep into the ground.</p> <p>In reality, the average BOD reduction in a septage management service area will be much less than 50%. Proper septic tank maintenance through regular desludging is expected to provide additional 10% reduction in BOD pollution load.</p>
<p>Combined Sewerage System/Settled Sewerage System</p> <p>Please refer to Figure 20</p>	<p>In a combined sewerage system, storm water and wastewater are both collected using a single pipe network system. In the Philippines, the default system is the public drainage system which is designed mainly to carry storm runoffs. Prior to discharge to open water bodies, the combined flow is intercepted at several points. Solid waste is found in most of the drainage systems in the Philippines which complicates the operation and maintenance of the interceptor system.</p> <p>During dry weather conditions, when the flow will be mainly wastewater, all flow is intercepted and directed to a sewage or a septage-sewage treatment plant (STP). However, during wet weather or rainy conditions, the flow will be significantly greater and can exceed the capacity of the STP. To address this, only part of the flow is intercepted. Part of the pollution load is allowed to overflow and be discharged to natural water bodies during these periods.</p> <p>In terms of infrastructure requirements, the combined sewerage system is less extensive than that for a separate sewerage system. When the storm drainage infrastructure is in place, only</p>	<p>Assuming that 100% of households and establishments are connected to a combined sewerage system with a secondary wastewater treatment system (i.e., STP), around 90% of the BOD load within the sewered area can be reduced during dry weather conditions.</p> <p>However, during wet weather conditions, only part of the flow is conveyed to the treatment plant, and the remainder is discharged directly to the natural drains or water bodies. It is difficult to generalize the net amount or percent of BOD that is conveyed for treatment: it will be dependent on the design of the interceptor system, rainfall duration, timing, and amount.</p>

Wastewater Management System	System Rationale and Description	Description of Pollution Reduction Efficiency
	interceptors, pumping stations, and the STP are necessary.	
Separate Sewerage System Please refer to Figure 20	<p>In a separate sewerage system, wastewater is directed to a sewerage network, dedicated to receive only wastewater. The sewers are laid along all streets in the service area. The separate sewerage system, which includes pumping stations, conveys all the flow to an STP.</p> <p>Aside from the more common conventional gravity sewer system which adopts a more stringent design criteria, there are other systems with varying degrees of application such as pressure and vacuum sewers, and the less costly small bore/community sewers, among others.</p>	Assuming that 100% of households and establishments are connected to a separate sewerage system with a secondary wastewater treatment system (i.e., STP), around 90% of the BOD load can be reduced. However, unlike the combined sewerage system, the separate sewerage system is not affected by rainfall as it is dedicated only to collect wastewater. It is the most effective system in terms of BOD reduction.

In terms of cost, the options can be compared in terms of capital cost per household and cost per kg-BOD removed.

Table 35: Cost Comparison of Wastewater Management Systems

Sanitation System	Capital Cost per Household Served	Cost per kg-BOD Removed
Septage Management Program ¹	PhP4,500	PhP110-130 (10% additional BOD reduction) PhP55-65 (20% additional BOD reduction)
Combined Sewerage System ²	PhP35,000	PhP90
Separate Sewerage System ³	PhP90,000	PhP185

Notes. ¹ Based on the Metro Bangued Water District and Bocaue Water District Concept Design for Sanitation Project Final Reports, August 2016, under the project "Conduct of Feasibility Studies of the Various Projects under the Feasibility Studies Fund: Non-revenue Water Reduction and Control Projects and Concept Design for Sanitation Projects".

² Based on the Sewerage Master Plan and Feasibility Study for the Marikina River Basin, September 2008.

³ CAPEX assumed at 2.5x Combined Sewerage System CAPEX. In Manila Third Sewerage Project, separate sewerage system cost was estimated to be 3x combined sewerage system cost. Manila Water estimates, comparing East Ave. STP and Poblacion STP, the cost per kg-BOD removed for separate sewerage system at 2x that for a combined sewerage system.

Zamboanga City already has an existing sewerage system covering several barangays in the población area; as well as proposed SpTPs in the planning stage. There are also privately-owned desludging services that provide their service, as required. The plan to be developed in this study will not consider the provision for sewerage facilities for the immediate term due to the prohibitive cost as outlined above. However, to safeguard public health and water quality which will be influenced by the planned increases in water demand specifically in urban/urbanizing areas, it is proposed to implement an SMP with a larger service coverage area that are unserved by the current services available.

Figure 20: Wastewater Management Systems



Source: ADB Case Study: Cleaning Update Business of Septage Management

3.2.4 Existing Reuse Practices in the Philippines

The reuse of sanitation residuals is not a new practice in the country but is also not yet widely practiced. There are some facilities in the Philippines that reuse the byproducts of the wastewater treatment process: treated effluent and biosolids. **Table 36** and **Table 37** summarize the existing local practices of wastewater reuse and biosolids applications of some septage/sewage management facilities operating in the Philippines, respectively.

It may be observed from the listed practices that wastewater is commonly reused in agriculture for irrigation and as liquid fertilizer, as well as urban uses such as toilet flushing, firefighting and cleaning; while the biosolids are commonly used as fertilizers or soil conditioners.

3.2.5 International Practices and Policies on Reuse of Effluent and Biosolids

Sanitation residual reuse is already being widely practiced around the world. In fact, countries such as the USA, Canada, and Australia have established policies and guidelines on wastewater and biosolids reuse. Other countries such as Spain, India, Japan and Vietnam also have their national policies on the reuse of treated effluent. **Table 38** and **Table 39** list some examples of sanitation residual reuse practices in other countries.

The treated effluent is commonly reused in agriculture, for irrigating food and non-food crops, and urban reuse, for toilet flushing, firefighting and cleaning. There are also some countries that reuse the treated effluent as process water in the industrial operations.

Because of its nutrient content, biosolids are more commonly used as soil amendments for agriculture or rehabilitation. Multiple countries such as the USA, India, and Iran use biosolids as soil amendments, be it fertilizers to enhance soil phosphorous concentrations for corn or soil conditioners for agriculture. Other countries such as China, Canada, and Spain use biosolids to rehabilitate abandoned mining sites and deforested areas. Some countries such as Spain, Australia, Brazil, and Poland are exploring the use of biosolids as additives to construction materials. Biosolids are being used as additives to cement, bricks, and lightweight aggregates.

Table 36: Existing Wastewater Reuse Practices in the Philippines

Facility and Location	Treatment Process	Details	Uses/Application
Domestic Effluent Reuse			
Constructed Wetland in Fishermen's Gawad Kalinga Village, Barangay Villareal, Bayawan City, Negros Oriental	<ul style="list-style-type: none"> Three chamber ABR Vertical and horizontal flow wetlands 	<ul style="list-style-type: none"> Treatment capacity: 50 m³/day 	<ul style="list-style-type: none"> Construction work Organic cut flower and vegetable farming Firefighting Home gardening
Septage Treatment Plant in Barangay San Roque, Baliwag, Bulacan	<ul style="list-style-type: none"> Maceration and primary screening Thickening and dewatering Biological treatment using the SBR technology Disinfection 	<ul style="list-style-type: none"> Treatment Capacity: 30 m³/day Operated by Baliwag Water District 	<ul style="list-style-type: none"> Irrigation and landscaping Cleaning within the treatment plant
Septage Treatment Plant in Isabela City, Basilan	Tertiary Treatment: Chlorine Dioxide Dosing and Flow Meter	<ul style="list-style-type: none"> Treatment Capacity: 10 m³/day Operated by Isabela City Water District 	<ul style="list-style-type: none"> Irrigation purposes
Institutional Wastewater Reuse			
Sewage treatment plant in University of Santo Tomas, Manila	Sedimentation, aeration, filtration		<ul style="list-style-type: none"> Flushing of toilets Watering of plants
Sewage treatment plant in De La Salle University, Manila	Sequence Batch Reactor		<ul style="list-style-type: none"> Irrigation
Commercial Wastewater Reuse			
Decentralized Wastewater Treatment Facility for the Lilo-an Public Market in Cebu	Rotating biological contactor	Treatment Capacity: 60m ³ /day	<ul style="list-style-type: none"> Toilet flushing Gardening
Wastewater treatment plant in the Bureau of Animal Industry Plant in Valenzuela City, Metro Manila	DEWATS <ul style="list-style-type: none"> 8-chamber ABR, anaerobic filter, planted gravel filter and indicator pond 	Treatment Capacity: 10m ³ /day	<ul style="list-style-type: none"> Gardening
Wastewater treatment facility in Dumaguete City Public Market	Anaerobic Baffled Reactor System	Toilet user fees are collected in the public market	Watering of plants at Quezon Park
Wastewater Treatment Facility for the Muntinlupa Public Market in Montillano St., Barangay Alabang, Muntinlupa City	<ul style="list-style-type: none"> Anaerobic baffled reactor Cocopeat is used as an alternative filter 	User fee collected from the market stall owners: PhP5.00 per day per stall owner	<ul style="list-style-type: none"> Irrigation Flushing toilets Street cleaning

Facility and Location	Treatment Process	Details	Uses/Application
Industrial Wastewater Reuse			
Sewage treatment plant in Mactan ECOZONE		<ul style="list-style-type: none"> Treatment Capacity: 4,700 m³/day 	<ul style="list-style-type: none"> Cleaning of toilets Watering of plants Cleaning of drainage canals and pipes Fire fighting
United Pulp & Paper Corporation (UPPC) in Barangay Iba Este, Calumpit, Bulacan		<ul style="list-style-type: none"> Treatment Capacity: 11,000m³/day 	<ul style="list-style-type: none"> Cleaning the facilities. the grounds, wastepaper Watering lawns and garden Replenishing koi and tilapia ponds
Absolut Distillers in Batangas	Sequence Batch Reactor System		<ul style="list-style-type: none"> Liquid fertilizer
San Carlos BioPower Inc. (SCBI), San Carlos City, Negros Occidental	Anaerobic digester, pond system		<ul style="list-style-type: none"> Irrigation Liquid fertilizer Cooling tower make-up

Table 37: Existing Domestic Biosolid Applications in the Philippines

Facility and Location	Technology and Processes	Biosolids Application
Manila Water Company, Inc.'s (MWCI) North Septage Treatment Plant in San Mateo, Rizal and South Septage Treatment Plant in Taguig City	<ul style="list-style-type: none"> Primary Treatment: screening, grit, and scum removal Secondary Treatment: activated sludge process Coagulant-assisted mechanical dewatering in screw presses 	Dewatered sludge or biosolids are brought to lahar-affected areas in Central Luzon for composting. The composted biosolids are used as organic soil conditioners for corn and sugarcane plantations.
Septage Treatment Plant of Baliwag Water District in Barangay San Roque, Baliwag, Bulacan	The typical moisture content of dewatered biosolids is 85%. The biosolids are put into sacks and dried in a draining area to reduce the moisture content to about 75-80%.	Transports its biosolids to multiple end-users in the vicinity. Majority of the end-users further process the biosolids through vermicomposting to produce soil conditioners. A small percentage of the biosolids is used as earth fill.
Constructed Wetland in Fishermen's Gawad Kalinga Village in Barangay Villareal, Bayawan City, Negros Oriental	Sludge from septic tanks is composted in the drying beds at the city's sanitary landfill.	The final product is biofertilizer.
Veterans Water Reclamation Facility by Maynilad Water Services, Inc. (MWSI) in Project 7, Quezon City	MWSI has a third-party contracted who processes sludge into fertilizer	Enlisted a third-party contractor to process their sludge into fertilizers through vermicomposting. The product is then distributed to farmers.

Facility and Location	Technology and Processes	Biosolids Application
City-managed Septage Treatment Plant Dumaguete City, Negros Oriental	<ul style="list-style-type: none"> Stabilization ponds composed of anaerobic, facultative and maturation ponds A planted gravel filter and wetland are used for polishing operations 	The LGU processes its dried sludge and uses it as soil conditioner. ³
Septage Treatment Plant of Isabela City Water District in Isabela City, Basilan	<ul style="list-style-type: none"> Secondary Treatment: Equalization Tank/Transfer Pump, Submersible Aerator, Decanter Pump, and WAS Transfer Pump Tertiary Treatment: Chlorine Dioxide Dosing and Flow Meter 	Reused as natural fertilizer.

Table 38: International Wastewater Reuse Applications

Location	Facility	Policy	Standards	Tertiary Treatment Processes	Application
El Segundo, California, USA	Edward C. Little Water Recycling Facility	-	<ul style="list-style-type: none"> USEPA WHO Standards based on the technology and reuse application 	<ul style="list-style-type: none"> coagulation flocculation clarification filtration and disinfection (UV + Cl₂) 	<ul style="list-style-type: none"> toilet flushing golf course irrigation and landscaping cooling towers
	Chevron Nitrification Facility			<ul style="list-style-type: none"> microfiltration (MF) reverse osmosis (RO) advanced oxidation process (AOP – hydrogen peroxide/ UV) 	<ul style="list-style-type: none"> groundwater recharge
	ExxonMobil Water Recycling Facility			<ul style="list-style-type: none"> biological fixed film process that converts ammonia in the Title 22 recycled water to nitrate 	<ul style="list-style-type: none"> low-pressure and high-pressure boilers
	Carson Regional Water Recycling Facility			<ul style="list-style-type: none"> biological nitrification and MF/RO processes that further treats Title 22 Water 	<ul style="list-style-type: none"> industrial cooling towers boiler applications
Orange County, California, USA	GWRS Advanced Water Purification Facility	-	<ul style="list-style-type: none"> USEPA WHO 	<ul style="list-style-type: none"> microfiltration (MF) reverse osmosis (RO) 	<ul style="list-style-type: none"> groundwater recharge

Location	Facility	Policy	Standards	Tertiary Treatment Processes	Application
			<ul style="list-style-type: none"> Standards based on the technology and reuse application 	<ul style="list-style-type: none"> ultraviolet (UV) light with hydrogen peroxide 	
Honolulu, Hawaii	R1 Reclaimed Water, Honouliuli Water Reclamation Facility	<ul style="list-style-type: none"> U.S. Environmental Protection Agency Hawaii State Department of Health 	<ul style="list-style-type: none"> USEPA WHO standards based on the technology and reuse application 	<ul style="list-style-type: none"> rapid mix tank floculators sand filters UV disinfection 	<ul style="list-style-type: none"> landscaping recreational/ golf course irrigation
	High-purity RO Water, Honouliuli Water Reclamation Facility			<ul style="list-style-type: none"> microfiltration (MF) reverse osmosis (RO) 	<ul style="list-style-type: none"> industrial use (refiners, manufacturers, power companies)
Costa Brava, Spain	Empuriabrava Constructed Wetlands	<ul style="list-style-type: none"> Spanish regulations (Royal Decree RD 1620/2007) 	<ul style="list-style-type: none"> USEPA WHO standards based on the technology and reuse application 	<ul style="list-style-type: none"> Constructed Wetlands 	<ul style="list-style-type: none"> nature reserve water wetland maintenance
	Port de la Selva Reclamation Treatment			<ul style="list-style-type: none"> coagulation flocculation multi-media filtration disinfection (UV+ Cl₂) 	<ul style="list-style-type: none"> non-crop irrigation agricultural use urban use
	Blanes, Costa Brava Reclamation Treatment			Title 22 - <ul style="list-style-type: none"> coagulation flocculation clarification filtration disinfection (UV + Cl₂) 	<ul style="list-style-type: none"> aquifer recharge
	Tossa de Ma Reclamation Treatment			Title 22 - <ul style="list-style-type: none"> coagulation flocculation clarification filtration disinfection (UV + Cl₂) 	<ul style="list-style-type: none"> non-crop irrigation agricultural use urban use
	Llanca Reclamation Treatment			<ul style="list-style-type: none"> coagulation flocculation multi-media filtration disinfection (UV+ Cl₂) 	<ul style="list-style-type: none"> non-crop irrigation agricultural use urban use

Location	Facility	Policy	Standards	Tertiary Treatment Processes	Application
	Lloret de Mar Reclamation Treatment			Title 22 - <ul style="list-style-type: none"> coagulation flocculation clarification filtration disinfection (UV + Cl₂) 	<ul style="list-style-type: none"> non-crop irrigation agricultural use urban use
India	Soil Biotechnology plant, Naval Civilian Housing Colony	<ul style="list-style-type: none"> National Water Policy 2012 	<ul style="list-style-type: none"> USEPA WHO standards based on the technology and reuse application 	<ul style="list-style-type: none"> raw water collection tank constructed soil filter bioreactor reactor bed effluent collection tank 	<ul style="list-style-type: none"> recreational irrigation horticultural needs
	Phytorid Treatment plant, NEERI, Worli, Mumbai			<ul style="list-style-type: none"> treatment bed with filter media and plant roots (anaerobic and aerobic zones) treated water collection tank 	<ul style="list-style-type: none"> recreational irrigation horticultural needs
	Fixed Film Biofilter Technology plant, Sangli City			<ul style="list-style-type: none"> screening grit chamber/settler/septic tanks equalisation tank fixed biofilter 	<ul style="list-style-type: none"> gardening and landscaping
Bora Bora, French Polynesia	Bora Bora Water Reclamation Facility	-	<ul style="list-style-type: none"> The Water Supply Master Plan standards based on the technology and reuse application 	<ul style="list-style-type: none"> clarification ultrafiltration chlorination 	<ul style="list-style-type: none"> industrial use recreational irrigation fire protection gardening cleaning purposes
Australia	Wollong Water Recycling Plant	<ul style="list-style-type: none"> Reclaimed Water Guidelines from the National Water Quality Management Strategy (NWQMS 2000) 	<ul style="list-style-type: none"> 2014 Metropolitan Water Plan Australian guidelines for water recycling 	<ul style="list-style-type: none"> filtration disinfection additional disinfection via ultraviolet and chlorination (irrigation for golf courses) microfiltration/reverse osmosis (manufacturing) 	<ul style="list-style-type: none"> industrial use golf course irrigation coal washing fire protection manufacturing

Location	Facility	Policy	Standards	Tertiary Treatment Processes	Application
	Yarra Park Water Recycling Facility, Australia	<ul style="list-style-type: none"> • Victoria (EPA Victoria 2003) • South Australia (DHS-SA 1999) 		<ul style="list-style-type: none"> • coagulation for phosphate removal • filtration via membrane • bioreactor and ultra-filtration membrane systems • disinfection via ultraviolet and chlorination 	<ul style="list-style-type: none"> • non-crop irrigation • cleaning • toilet flushing
Tehran, Iran	Tehran Sewerage System	-	<ul style="list-style-type: none"> • standards based on the technology and reuse application 	<ul style="list-style-type: none"> • aeration tank • final clarifier • chlorination • trickling filter for nitrification of sludge liquor 	<ul style="list-style-type: none"> • non-crop irrigation
Buon Ma Thuot, Vietnam	Buon Ma Thuot Wastewater Reclamation System	<ul style="list-style-type: none"> • Vietnam Effluent Standards: QCVN 40:2011/BTNMT 		<ul style="list-style-type: none"> • maturation ponds • pumping station 	<ul style="list-style-type: none"> • agriculture use
Singapore	Changi NEWater Project Phase 2		<ul style="list-style-type: none"> • WHO Drinking Water Guidelines • USEPA Drinking Water Standards; • NEWater guidelines 	<ul style="list-style-type: none"> • two-stage microfiltration membrane (MF) • reverse osmosis (RO) process • UV disinfection 	<ul style="list-style-type: none"> • indirect potable use • industrial use • commercial use

Table 39: International Practices of Biosolid Applications

Location	Policy	Standards	Sludge Treatment Processes	Application
Blacklands Prairie, Central Texas	-	-	<ul style="list-style-type: none"> • anaerobic digestion • drying beds 	<ul style="list-style-type: none"> • agriculture (soil conditioning)
Fulton County, Western Illinois	-	USEPA	<ul style="list-style-type: none"> • anaerobic digestion • stabilization • drying beds 	<ul style="list-style-type: none"> • agriculture (phosphorus nutrient for corn)
Tehran, Iran	-	-	<ul style="list-style-type: none"> • static pre-thickening • mechanical thickening • anaerobic digestion • sludge dewatering 	<ul style="list-style-type: none"> • agriculture (soil conditioning)

Location	Policy	Standards	Sludge Treatment Processes	Application
Haridwar, India	-	-	• drying beds	• agriculture (soil conditioning)
Vancouver, Canada	• Government of BC • Ministry of Environment 2007	-	• anaerobic digestion	• abandoned mine site (soil conditioning)
Sanxi, China	-	-	• dewatering	• abandoned mine site (soil conditioning)
Spain	-	-	• dewatering • aerobic digestion	• abandoned mine site (soil conditioning)
			• anaerobic digestion	• environmental use (deforestation)
			• lime stabilization	• construction (cement additive)*
Melbourne, Australia	-	EPA Victoria	• sludge thickener • anaerobic/aerobic digestion • drying beds	• construction (brick-making, construction fill material)*
Cabanga, Brazil	-	-	• air-dried sewage sludge	• road construction*
Poland	• Polish Act on Waste of 2001 • Polish Ordinance of the Minister of Environment of 2011 • Polish Regulation of the Minister of Environment of 2006	-	• mechanical dewatering	• construction (lightweight aggregates)*

Note: * – academic study

4 Projections

This section presents the projected septage volume for the proposed service area, along with the assumptions used in the projections of population and septage volume. Data from this section served as a guide for the development and design of the proposed facilities.

4.1 Approach

In determining the future infrastructure investment requirements for this Pre-FS, septage projections were performed. This serves as the starting point in determining future demand and corresponding system design capacities and costs. The approach adopted in this Study is the “typical tank volume and pump-out frequency” method. The following steps were undertaken in projecting the septage volume:

- Setting the planning horizon;
- Projecting population of the study area;
- Water District service connection projection;
- Defining the service coverage;
- Setting assumptions for septage volume projection; and
- Septage volume projection.

4.2 Planning Horizon

For planning purposes, the planning horizon was set to 20 years, or from 2021 to 2040. Population and septage volumes were projected up to year 2040 and will serve as the primary bases for determining the capacity of the facilities and truck requirements.

This planning period considers planning and design of the system from 2022 to 2023, construction of the system by 2024, and the start of operations by 2025. In line with the recommendation from the DOH Administrative Order No. 2019-0047, (2019, p. 4) operations considered in this study covers a total of four desludging cycles.

4.3 Population Projection

4.3.1 Historical Population and Population Growth Rate

Historical population and growth rates for Zamboanga City and its barangays are shown in **Table 40**. These records from the PSA exhibited non-uniform growth rates for the total population of Zamboanga City, decreasing from 2000-2015 and increasing from 2015-2020.

Table 40: Zamboanga City Historical Population and Growth Rates

Province/City/Barangay	Historical Population				Past Population Growth Rate		
	May-2000	May-2010	Aug-2015	May-2020	May-00 to May-10	May-10 to Aug-15	Aug-15 to May-20
Zamboanga City	601,794	807,129	861,799	977,234	2.98%	1.26%	2.68%
Arena Blanco	8,297	10,016	12,589	13,671	1.90%	4.45%	1.75%
Ayala	11,323	20,096	22,547	26,658	5.90%	2.21%	3.59%
Baliwasan	19,763	27,070	25,042	17,932	3.19%	-1.47%	-6.78%

Province/City/Barangay	Historical Population				Past Population Growth Rate		
	May-2000	May-2010	Aug-2015	May-2020	May-00 to May-10	May-10 to Aug-15	Aug-15 to May-20
Baluno	1,549	2,315	3,155	3,865	4.10%	6.07%	4.36%
Boalan	5,709	7,435	8,696	11,541	2.68%	3.03%	6.14%
Bolong	4,793	5,862	6,460	8,068	2.03%	1.87%	4.79%
Buenavista	5,664	5,837	6,485	8,154	0.30%	2.02%	4.94%
Bunguiao	6,215	7,368	7,287	7,952	1.72%	-0.21%	1.85%
Busay (Sacol Island)	1,694	2,931	3,359	2,290	5.63%	2.63%	-7.74%
Cabaluay	3,313	5,802	6,350	8,849	5.76%	1.73%	7.23%
Cabatangan	5,384	9,944	13,680	17,812	6.32%	6.26%	5.71%
Cacao	1,204	1,045	1,347	1,311	-1.41%	4.95%	-0.57%
Calabasa	2,235	2,685	3,222	2,936	1.85%	3.53%	-1.94%
Calarian	19,027	25,331	28,899	33,563	2.90%	2.54%	3.20%
Campo Islam	10,004	11,237	12,552	11,730	1.17%	2.13%	-1.41%
Canelar	12,192	11,160	11,100	10,512	-0.88%	-0.10%	-1.14%
Cawit	4,063	9,124	9,249	10,244	8.42%	0.26%	2.17%
Culianan	5,464	8,524	8,318	10,851	4.54%	-0.46%	5.75%
Curuan	6,259	7,378	8,796	11,954	1.66%	3.40%	6.67%
Dita	1,801	3,831	2,085	2,028	7.84%	-10.93%	-0.58%
Divisoria	5,323	9,042	9,218	13,172	5.44%	0.37%	7.80%
Dulian (Upper Bunguiao)	1,475	2,023	2,570	2,569	3.21%	4.66%	-0.01%
Dulian (Upper Pasonanca)	1,039	1,363	1,325	1,489	2.75%	-0.54%	2.49%
Guisao	1,879	2,560	3,398	2,583	3.14%	5.54%	-5.61%
Guiwan	12,317	15,323	14,302	13,231	2.21%	-1.30%	-1.62%
La Paz	4,494	5,606	7,557	8,724	2.23%	5.85%	3.07%
Labuan	7,121	11,470	11,457	16,095	4.88%	-0.02%	7.41%
Lamisahan	2,761	2,995	2,289	2,764	0.82%	-4.99%	4.05%
Landang Gua	1,754	2,980	2,993	3,154	5.44%	0.08%	1.11%
Landang Laum	1,518	4,803	4,768	3,095	12.20%	-0.14%	-8.69%
Lanzones	2,215	2,743	3,287	3,689	2.16%	3.50%	2.46%
Lapakan	1,772	1,529	1,378	1,868	-1.46%	-1.96%	6.61%
Latuan (Curuan)	1,413	2,125	2,457	2,615	4.16%	2.80%	1.32%
Limaong	3,068	3,445	4,000	4,766	1.17%	2.88%	3.75%
Limpapa	3,465	5,160	5,782	6,060	4.06%	2.19%	0.99%
Lubigan	1,698	1,149	2,945	3,249	-3.83%	19.62%	2.09%
Lumayang	1,256	1,377	1,471	1,999	0.92%	1.26%	6.66%
Lumbangan	1,693	3,308	3,235	4,461	6.92%	-0.42%	6.99%
Lunzuran	4,393	8,221	9,931	13,232	6.46%	3.66%	6.22%
Maasin	4,758	7,978	8,958	9,267	5.30%	2.23%	0.72%
Malagutay	5,015	5,654	6,657	8,265	1.21%	3.16%	4.66%
Mampang	15,705	22,857	34,312	31,975	3.82%	8.04%	-1.47%
Manalipa	1,098	1,922	2,143	2,588	5.76%	2.09%	4.05%
Mangusu	3,427	4,776	4,783	5,608	3.37%	0.03%	3.40%
Manicahan	7,702	9,129	10,081	11,999	1.71%	1.91%	3.73%

Province/City/Barangay	Historical Population				Past Population Growth Rate		
	May-2000	May-2010	Aug-2015	May-2020	May-00 to May-10	May-10 to Aug-15	Aug-15 to May-20
Mariki	4,612	5,895	1,775	6,310	2.48%	-20.42%	30.58%
Mercedes	8,064	12,050	14,721	22,321	4.10%	3.88%	9.15%
Muti	2,132	3,123	2,983	3,420	3.89%	-0.87%	2.92%
Pamucutan	2,270	3,764	4,059	4,404	5.18%	1.45%	1.73%
Pangapuyan	573	534	590	767	-0.70%	1.92%	5.67%
Panubigan	610	982	1,610	982	4.87%	9.87%	-9.88%
Pasilmanta (Sacol Island)	787	1,480	2,122	3,138	6.52%	7.10%	8.58%
Pasonanca	18,011	27,231	27,374	27,215	4.22%	0.10%	-0.12%
Patalon	4,841	7,187	8,128	11,127	4.03%	2.37%	6.83%
Barangay Zone I (Pob.)	2,245	3,405	4,112	4,806	4.25%	3.66%	3.34%
Barangay Zone II (Pob.)	1,782	2,865	2,143	1,802	4.86%	-5.38%	-3.58%
Barangay Zone III (Pob.)	1,888	2,030	1,519	1,146	0.73%	-5.37%	-5.76%
Barangay Zone IV (Pob.)	4,854	3,046	1,309	1,174	-4.55%	-14.85%	-2.26%
Putik	12,865	19,653	19,681	22,271	4.33%	0.03%	2.64%
Quiniput	3,241	2,647	3,329	4,015	-2.00%	4.46%	4.02%
Recodo	16,591	18,172	17,395	23,254	0.91%	-0.83%	6.30%
Rio Hondo	9,182	10,565	3,326	8,827	1.41%	-19.74%	22.79%
Salaan	2,342	3,310	4,073	3,623	3.52%	4.03%	-2.43%
San Jose Cawa-cawa	5,182	7,991	6,173	4,292	4.42%	-4.79%	-7.36%
San Jose Gusu	15,732	24,542	16,723	16,260	4.54%	-7.04%	-0.59%
San Roque	14,788	25,531	27,889	28,829	5.61%	1.70%	0.70%
Sangali	13,605	19,230	20,766	26,758	3.52%	1.47%	5.48%
Santa Barbara	5,946	7,961	4,762	6,711	2.96%	-9.32%	7.48%
Santa Catalina	13,700	17,955	17,294	16,644	2.74%	-0.71%	-0.80%
Santa Maria	19,543	21,926	25,185	24,133	1.16%	2.67%	-0.89%
Santo Niño	5,317	6,790	4,129	3,888	2.47%	-9.03%	-1.26%
Sibulao (Caruan)	2,715	2,748	4,244	4,167	0.12%	8.62%	-0.38%
Sinubung	2,007	2,690	4,689	3,601	2.97%	11.15%	-5.40%
Sinunoc	9,436	16,942	16,507	22,918	6.02%	-0.49%	7.15%
Tagasilay	2,949	2,607	2,971	3,998	-1.22%	2.52%	6.45%
Taguiti	883	899	1,460	1,328	0.18%	9.67%	-1.97%
Talabaaan	3,282	4,181	5,340	5,907	2.45%	4.77%	2.15%
Talisayan	5,030	7,285	8,220	11,428	3.77%	2.32%	7.18%
Talon-talon	20,712	30,535	34,916	37,350	3.96%	2.58%	1.43%
Taluksangay	6,783	8,108	10,237	9,437	1.80%	4.54%	-1.70%
Tetuan	28,731	29,082	29,785	29,621	0.12%	0.46%	-0.12%
Tictapul	2,122	3,515	3,817	3,527	5.17%	1.58%	-1.65%
Tigbalabag	1,202	1,491	1,803	2,109	2.18%	3.68%	3.35%
Tigtabon	3,276	5,071	5,292	5,365	4.46%	0.82%	0.29%
Tolosa	2,481	3,157	2,773	3,859	2.44%	-2.44%	7.20%
Tugbungan	16,594	23,001	23,837	26,538	3.32%	0.68%	2.28%
Tulungatung	2,792	6,055	9,246	11,741	8.04%	8.39%	5.15%

Province/City/Barangay	Historical Population				Past Population Growth Rate		
	May-2000	May-2010	Aug-2015	May-2020	May-00 to May-10	May-10 to Aug-15	Aug-15 to May-20
Tumaga	21,487	25,184	30,824	33,399	1.60%	3.92%	1.70%
Tumalutab	1,572	2,048	2,417	3,436	2.68%	3.20%	7.68%
Tumitus	1,716	2,494	3,026	2,731	3.81%	3.75%	-2.13%
Vitali	8,917	8,895	9,406	10,716	-0.02%	1.07%	2.78%
Capisan	762	1,090	1,408	1,488	3.64%	4.99%	1.17%
Camino Nuevo	11,815	8,295	7,739	7,421	-3.47%	-1.31%	-0.88%
Licombo	5,040	5,727	5,317	5,888	1.29%	-1.40%	2.17%
Kasanyangan	6,438	8,425	14,114	28,819	2.72%	10.32%	16.20%
Pasobolong	2,641	3,257	3,758	5,624	2.12%	2.76%	8.85%
Victoria	1,718	2,326	2,802	3,393	3.07%	3.61%	4.11%
Zambood	3,678	7,627	10,166	12,870	7.56%	5.62%	5.09%

4.3.2 City and Barangay Projected Population

Methods of Projections

At the provincial level, the PSA released the 2015 census census-based projections⁵ utilizing the cohort-component method. This method projects the population size based on the analysis of three major components: fertility/birth, morbidity, and migration. PSA Board Resolution No. 11 Series of 2015 endorses the use of the said method for “official figures to be utilized for planning and programming purposes.”

In the unavailability of data needed to construct local projections utilizing the cohort-component method, the National Statistical Coordination Board (NSCB) prescribes the use of the Ratio Method. This method analyzes the historical trend of the ratio of the city/municipal population to the provincial population. The ratio is then projected with the assumption that its rate of change will stabilize after some years.

However, application of the NSCB Ratio Method utilizing the updated medium⁶ series PSA 2010 census-based projections may not always result in a rational projection given the several factors that may have affected the growth rate at the local level (e.g., economic conditions, extreme natural and man-made events, etc.). Given that the next census-based projection will not be available in the foreseeable future, projections at the municipal level were analyzed using other trend-based mathematical extrapolation methods.

Table 41 presents the different population projection methods utilized in this study. At the municipal level, when the resulting projections using the ratio method does not fully deviate from the other methods, the resulting figures will be adopted.

⁵ The PSA projects population size up to the provincial-level for 35-years based on a decennial census. The last population projection provided by the PSA was released on October 2019 updating the 2010-Census Based Population Projection which projected population up to year 2045 in accordance with PSA Board Resolution No. 11 Series of 2015.

⁶ There are three series of population projections done by the PSA, namely low, medium, and high series, each varying in assumptions adopted. Medium series

Table 41: Population Projection Methods

Method	Description	Equation
NSCB Ratio Method	City/Municipal Level Projection: Distributes the provincial projection, which was projected using Cohort-Component Method, to city/ municipal level.	
	Barangay Level Projection: Distributes the adopted city/municipal projection (any method used) to barangay level.	
Linear Regression	Assumes that growth rates remain constant.	$y = mx + b$
Logarithmic Regression	A best-fit curved line that is applicable when the rate of change in the data increases or decreases quickly and then levels out.	$y = m * \ln(x) + b$
Polynomial Regression	Assumes that growth rates change either positively or negatively without a limit.	$y = ax^2 + bx + c$
Regression	Assumes that constant growth rate is compounded; it is most useful when data values rise or fall at increasingly higher rates.	$y = ae^{\beta x}$

City Level Population Projections

The total population of Zamboanga City was projected using different mathematical extrapolation methods for purposes of comparison. Among the compared growth trends, linear regression yielded mid-level and increasing projections, and was adopted for this Study (see **Figure 21** and **Table 42**).

Figure 21: Zamboanga City Historical Population and Comparative Growth Trends

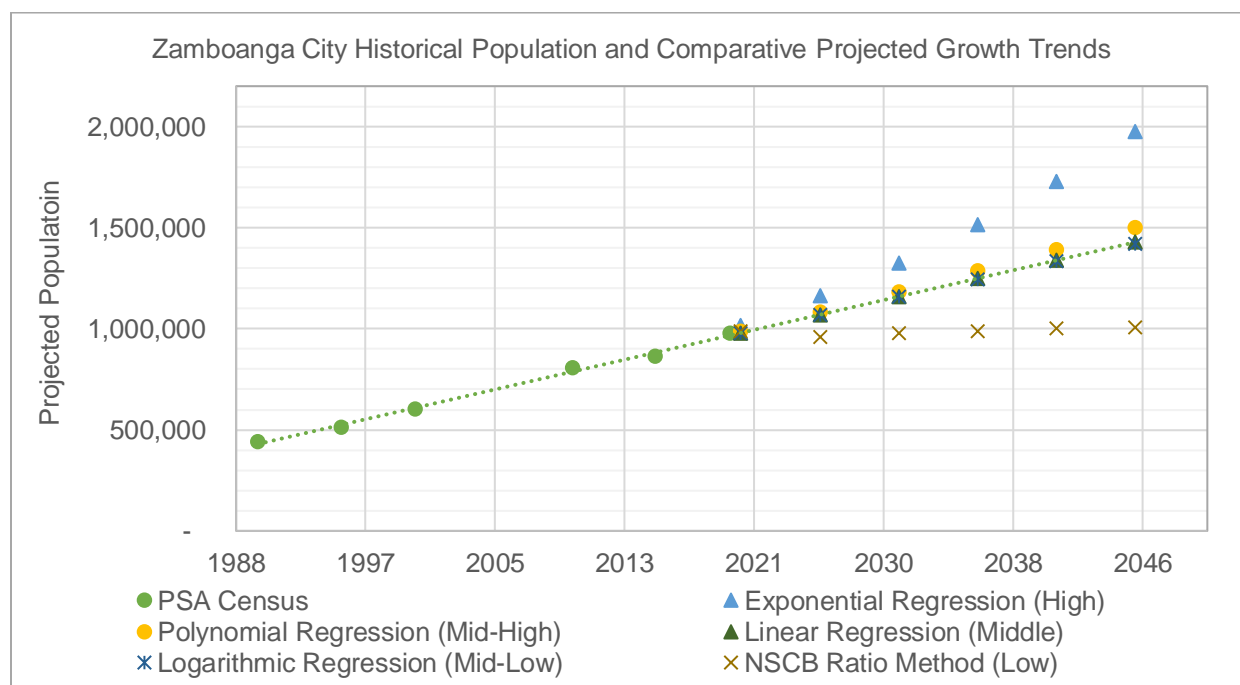


Table 42: Zamboanga City Historical Population and Comparative Growth Trends

Year (x-value)	PSA Historical Population	Projected City Population (y-value)				
		Exponential Regression (High)	Polynomial Regression (Mid-High)	Linear Regression (Middle)	Logarithmic Regression (Mid-Low)	NSCB Ratio Method (Low)
May-1990	442,345					
Sep-1995	511,139					
May-2000	601,794					
May-2010	807,129					
Aug-2015	861,799					
May-2020	977,234					
Dec-2020		1,016,974	985,615	979,682	979,104	986,896
Dec-2025		1,161,326	1,083,756	1,069,357	1,067,973	956,627
Dec-2030		1,326,264	1,184,290	1,159,082	1,156,672	975,430
Dec-2035		1,514,628	1,287,164	1,248,807	1,245,152	989,306
Dec-2040		1,729,870	1,392,438	1,338,581	1,333,464	999,345
Dec-2045		1,975,412	1,499,935	1,428,256	1,421,463	1,006,323
Dec-2050		2,255,971	1,609,832	1,517,981	1,509,295	1,010,759
Notes:						
Method of Projection		Equation				R ²
NSCB Ratio Method						-
Linear Regression		y = (17944.963 * x) + -35287088.264				0.99
Logarithmic Regression		y = 35984908.41 * ln(x) + -272914546.17				0.99
Exponential Regression		y = 4.95E-18 * EXP(0.0266 * x)				0.99
Polynomial Regression		y = 46.811 * x^2 + -169806.5 * x + 1.53E+08				0.99
Adopted for the Study: Linear Regression, wherein projected population are rounded off to zero						

Barangay Level Population Projection

From the Zamboanga City population projections, the population per barangay was estimated using the ratio method and correction factors were applied to correct negative growth rates. This method assumes that the barangay's past and current share of the city's total population will be the basis upon which to project its future population. The resulting projected population by barangay is presented in **Table 43**.

Table 43: Zamboanga City Projected Population

City/Barangay	Projected Population					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Zamboanga City	979,682	1,069,357	1,122,101	1,194,036	1,266,235	1,338,581
Arena Blanco	13,705	14,503	14,983	15,643	16,329	17,051
Ayala	26,725	29,651	31,333	33,592	35,813	37,996
Baliwasan	17,977	18,225	18,408	18,700	19,074	19,556
Baluno	3,875	4,337	4,601	4,955	5,300	5,636
Boalan	11,570	13,005	13,823	14,919	15,986	17,022
Bolong	8,088	8,946	9,441	10,107	10,763	11,411
Buenavista	8,174	9,061	9,572	10,258	10,932	11,596
Bunguiao	7,972	8,822	9,312	9,971	10,621	11,261
Busay (Sacol Island)	2,296	2,567	2,722	2,929	3,133	3,330
Cabaluay	8,871	9,897	10,484	11,272	12,042	12,795
Cabatangan	17,857	20,395	21,846	23,791	25,674	27,481

City/Barangay	Projected Population					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Cacao	1,314	1,314	1,317	1,325	1,340	1,366
Calabasa	2,943	2,948	2,958	2,980	3,019	3,078
Calarian	33,647	37,078	39,067	41,747	44,402	47,032
Campo Islam	11,759	11,811	11,870	11,983	12,158	12,413
Canelar	10,538	11,888	12,658	13,688	14,689	15,658
Cawit	10,270	10,650	10,887	11,223	11,591	12,003
Culianan	10,878	12,074	12,761	13,684	14,591	15,483
Curuan	11,984	13,545	14,434	15,625	16,782	17,900
Dita	2,033	2,072	2,099	2,140	2,189	2,250
Divisoria	13,205	14,825	15,749	16,986	18,192	19,364
Dulian (Upper Bunguiao)	2,575	2,842	2,996	3,204	3,410	3,613
Dulian (Upper Pasonanca)	1,493	1,638	1,722	1,837	1,950	2,064
Guisao	2,589	2,856	3,010	3,218	3,423	3,627
Guiwan	13,264	14,839	15,739	16,944	18,121	19,268
La Paz	8,746	9,697	10,244	10,978	11,702	12,413
Labuan	16,135	18,076	19,184	20,667	22,115	23,525
Lamisahan	2,771	2,777	2,787	2,810	2,847	2,904
Landang Gua	3,162	3,174	3,188	3,217	3,263	3,330
Landang Laum	3,103	3,104	3,112	3,134	3,173	3,233
Lanzones	3,698	4,007	4,190	4,438	4,689	4,943
Lapakan	1,873	1,900	1,920	1,952	1,992	2,043
Latuan (Curuan)	2,622	2,910	3,076	3,299	3,518	3,733
Limaong	4,778	5,297	5,595	5,996	6,391	6,779
Limpapa	6,075	6,715	7,085	7,582	8,072	8,556
Lubigan	3,257	3,486	3,622	3,808	3,999	4,195
Lumayang	2,004	2,192	2,303	2,453	2,603	2,753
Lumbangan	4,472	4,998	5,299	5,702	6,096	6,480
Lunzuran	13,265	15,036	16,045	17,397	18,708	19,973
Maasin	9,290	10,334	10,932	11,735	12,523	13,295
Malagutay	8,286	9,253	9,807	10,549	11,274	11,982
Mampang	32,055	36,066	38,353	41,415	44,396	47,287
Manalipa	2,594	2,882	3,048	3,269	3,487	3,701
Mangusu	5,622	6,161	6,476	6,903	7,329	7,753
Manicahan	12,029	13,257	13,969	14,929	15,878	16,820
Mariki	6,326	6,400	6,457	6,550	6,673	6,836
Mercedes	22,377	25,227	26,853	29,028	31,143	33,191
Muti	3,429	3,747	3,935	4,189	4,444	4,699
Pamucutan	4,415	4,858	5,116	5,463	5,808	6,150
Pangapuyan	769	853	902	967	1,031	1,094
Panubigan	984	1,132	1,217	1,331	1,440	1,546

City/Barangay	Projected Population					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Pasilmanta (Sacol Island)	3,146	3,652	3,944	4,338	4,719	5,083
Pasonanca	27,283	27,350	27,458	27,686	28,060	28,622
Patalon	11,155	12,426	13,154	14,130	15,087	16,023
Barangay Zone I (Pob.)	4,818	5,339	5,639	6,042	6,438	6,828
Barangay Zone II (Pob.)	1,807	1,838	1,860	1,894	1,937	1,989
Barangay Zone III (Pob.)	1,149	1,335	1,443	1,587	1,727	1,861
Barangay Zone IV (Pob.)	1,177	1,432	1,589	1,807	2,023	2,231
Putik	22,327	23,966	24,941	26,269	27,623	29,011
Quiniput	4,025	4,502	4,775	5,141	5,498	5,845
Recodo	23,312	23,482	23,637	23,909	24,299	24,841
Rio Hondo	8,849	9,039	9,166	9,357	9,585	9,860
Salaan	3,632	4,026	4,252	4,556	4,856	5,151
San Jose Cawa-cawa	4,303	4,313	4,329	4,364	4,423	4,512
San Jose Gusu	16,301	16,497	16,647	16,891	17,212	17,634
San Roque	28,901	31,973	33,745	36,127	38,476	40,793
Sangali	26,825	29,522	31,089	33,201	35,297	37,376
Santa Barbara	6,728	7,104	7,330	7,643	7,969	8,314
Santa Catalina	16,686	18,470	19,499	20,882	22,244	23,587
Santa Maria	24,193	24,262	24,363	24,571	24,909	25,412
Santo Niño	3,898	4,398	4,683	5,064	5,436	5,795
Sibulao (Caruan)	4,177	4,197	4,218	4,259	4,322	4,413
Sinubung	3,610	3,629	3,649	3,686	3,742	3,822
Sinunoc	22,975	25,700	27,257	29,342	31,380	33,365
Tagasilay	4,008	4,489	4,764	5,132	5,491	5,841
Taguiti	1,331	1,332	1,336	1,346	1,363	1,389
Talabaaan	5,922	6,350	6,605	6,953	7,307	7,671
Talisayan	11,457	12,741	13,478	14,467	15,438	16,389
Talon-talon	37,445	41,456	43,767	46,876	49,941	52,958
Taluksangay	9,461	9,518	9,574	9,677	9,828	10,041
Tetuan	29,695	33,144	35,118	37,762	40,350	42,878
Tictapul	3,536	3,900	4,111	4,395	4,676	4,955
Tigbalabag	2,114	2,343	2,474	2,651	2,824	2,996
Tigtabon	5,378	5,450	5,503	5,588	5,698	5,840
Tolosa	3,869	3,890	3,912	3,952	4,012	4,099
Tugbungan	26,604	28,064	28,945	30,160	31,430	32,779
Tulungatung	11,770	13,577	14,616	16,012	17,364	18,656
Tumaga	33,483	35,375	36,515	38,085	39,722	41,454
Tumalutab	3,445	3,903	4,164	4,513	4,853	5,180

City/Barangay	Projected Population					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Tumitus	2,738	3,043	3,218	3,453	3,684	3,910
Vitali	10,743	11,070	11,279	11,579	11,918	12,307
Capisan	1,492	1,661	1,758	1,887	2,015	2,140
Camino Nuevo	7,440	8,518	9,136	9,964	10,765	11,533
Licombo	5,903	6,545	6,915	7,412	7,900	8,381
Kasanyangan	28,891	36,358	41,225	48,200	55,363	62,342
Pasobolong	5,638	6,382	6,806	7,373	7,924	8,456
Victoria	3,401	3,743	3,942	4,210	4,476	4,739
Zambowood	12,902	14,725	15,766	17,161	18,513	19,811

Adopting the household sizes posted during the 2015 census, the projected number of households per barangay are shown in **Table 44**.

Table 44: Zamboanga City Projected Number of Households

City/Barangay	Projected Number of Households					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Zamboanga City	219,287	239,177	250,850	266,766	282,734	298,734
Arena Blanco	2,928	3,099	3,201	3,343	3,489	3,643
Ayala	6,394	7,094	7,496	8,036	8,568	9,090
Baliwasan	4,706	4,771	4,819	4,895	4,993	5,119
Baluno	873	977	1,036	1,116	1,194	1,269
Boalan	2,515	2,827	3,005	3,243	3,475	3,700
Bolong	1,935	2,140	2,259	2,418	2,575	2,730
Buenavista	1,820	2,018	2,132	2,285	2,435	2,583
Bunguiao	1,978	2,189	2,311	2,474	2,635	2,794
Busay (Sacol Island)	564	631	669	720	770	818
Cabaluay	2,174	2,426	2,570	2,763	2,951	3,136
Cabatangan	4,031	4,604	4,931	5,370	5,795	6,203
Cacao	310	310	311	313	316	322
Calabasa	707	709	711	716	726	740
Calarian	7,880	8,683	9,149	9,777	10,399	11,015
Campo Islam	3,094	3,108	3,124	3,153	3,199	3,267
Canelar	2,261	2,551	2,716	2,937	3,152	3,360
Cawit	2,038	2,113	2,160	2,227	2,300	2,382
Culianan	2,355	2,613	2,762	2,962	3,158	3,351
Curuan	2,833	3,202	3,412	3,694	3,967	4,232
Dita	478	488	494	504	515	529
Divisoria	2,941	3,302	3,508	3,783	4,052	4,313
Dulian (Upper Bunguiao)	659	727	766	819	872	924

City/Barangay	Projected Number of Households					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Dulian (Upper Pasonanca)	348	382	401	428	455	481
Guisao	619	683	720	770	819	868
Guiwan	2,974	3,327	3,529	3,799	4,063	4,320
La Paz	1,914	2,122	2,242	2,402	2,561	2,716
Labuan	3,554	3,981	4,226	4,552	4,871	5,182
Lamisahan	703	705	707	713	723	737
Landang Gua	663	665	668	674	684	698
Landang Laum	612	612	614	618	626	638
Lanzones	953	1,033	1,080	1,144	1,209	1,274
Lapakan	438	444	449	456	465	477
Latuan (Curuan)	713	791	836	896	956	1,014
Limaong	1,067	1,182	1,249	1,338	1,427	1,513
Limpapa	1,329	1,469	1,550	1,659	1,766	1,872
Lubigan	759	813	844	888	932	978
Lumayang	436	477	501	533	566	598
Lumbangan	1,055	1,179	1,250	1,345	1,438	1,528
Lunzuran	2,988	3,386	3,614	3,918	4,214	4,498
Maasin	2,069	2,302	2,435	2,614	2,789	2,961
Malagutay	1,987	2,219	2,352	2,530	2,704	2,873
Mampang	6,953	7,823	8,320	8,984	9,630	10,257
Manalipa	559	621	657	705	752	798
Mangusu	1,191	1,305	1,372	1,463	1,553	1,643
Manicahan	2,538	2,797	2,947	3,150	3,350	3,549
Mariki	919	930	939	952	970	994
Mercedes	4,886	5,508	5,863	6,338	6,800	7,247
Muti	725	792	832	886	940	993
Pamucutan	1,024	1,127	1,187	1,268	1,348	1,427
Pangapuyan	173	192	203	218	232	246
Panubigan	205	236	254	278	301	323
Pasilmanta (Sacol Island)	764	886	957	1,053	1,145	1,234
Pasonanca	6,201	6,216	6,240	6,292	6,377	6,505
Patalon	2,457	2,737	2,897	3,112	3,323	3,529
Barangay Zone I (Pob.)	648	718	758	812	865	918
Barangay Zone II (Pob.)	413	420	425	432	442	454
Barangay Zone III (Pob.)	265	308	332	366	398	429
Barangay Zone IV (Pob.)	265	323	358	407	456	502
Putik	5,051	5,422	5,643	5,943	6,250	6,564
Quiniput	999	1,117	1,185	1,276	1,364	1,450

City/Barangay	Projected Number of Households					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Recodo	5,524	5,564	5,601	5,666	5,758	5,886
Rio Hondo	1,698	1,735	1,759	1,796	1,840	1,893
Salaan	814	903	953	1,022	1,089	1,155
San Jose Cawa-cawa	864	866	869	876	888	906
San Jose Gusu	3,881	3,928	3,964	4,022	4,098	4,199
San Roque	6,123	6,774	7,149	7,654	8,152	8,643
Sangali	6,138	6,756	7,114	7,597	8,077	8,553
Santa Barbara	1,121	1,184	1,222	1,274	1,328	1,386
Santa Catalina	3,565	3,947	4,166	4,462	4,753	5,040
Santa Maria	5,653	5,669	5,692	5,741	5,820	5,937
Santo Niño	999	1,128	1,201	1,298	1,394	1,486
Sibulao (Caruan)	965	969	974	984	998	1,019
Sinubung	574	577	580	586	595	608
Sinunoc	5,175	5,788	6,139	6,609	7,068	7,515
Tagasilay	941	1,054	1,118	1,205	1,289	1,371
Taguiti	295	295	296	298	302	308
Talabaan	1,302	1,396	1,452	1,528	1,606	1,686
Talisayan	2,064	2,296	2,428	2,607	2,782	2,953
Talon-talon	8,284	9,172	9,683	10,371	11,049	11,716
Taluksangay	1,634	1,644	1,654	1,671	1,697	1,734
Tetuan	7,332	8,184	8,671	9,324	9,963	10,587
Tictapul	737	813	856	916	974	1,032
Tigbalabag	539	598	631	676	720	764
Tigtabon	1,174	1,190	1,202	1,220	1,244	1,275
Tolosa	939	944	950	959	974	995
Tugbungan	6,245	6,588	6,795	7,080	7,378	7,695
Tulungatung	2,473	2,852	3,071	3,364	3,648	3,919
Tumaga	7,424	7,844	8,096	8,445	8,808	9,192
Tumalutab	781	885	944	1,023	1,100	1,175
Tumitus	594	660	698	749	799	848
Vitali	2,558	2,636	2,685	2,757	2,838	2,930
Capisan	326	363	385	413	441	468
Camino Nuevo	1,668	1,910	2,048	2,234	2,414	2,586
Licomo	1,306	1,448	1,530	1,640	1,748	1,854
Kasanyangan	5,410	6,809	7,720	9,026	10,368	11,675
Pasobolong	1,389	1,572	1,676	1,816	1,952	2,083
Victoria	800	881	928	991	1,053	1,115
Zambowood	3,087	3,523	3,772	4,106	4,429	4,739

4.4 Zamboanga City Water District Service Coverage

4.4.1 Water Supply Service Coverage by Barangay

As of 2020 records, ZCWD covers 61 out of the 98 barangays in Zamboanga City with a total of 66,462 service connections. The ZCWD service coverage is illustrated in **Figure 22**. The distribution of service connections by barangay are presented in **Table 45**.

Table 45: ZCWD 2020 Number of Service Connections

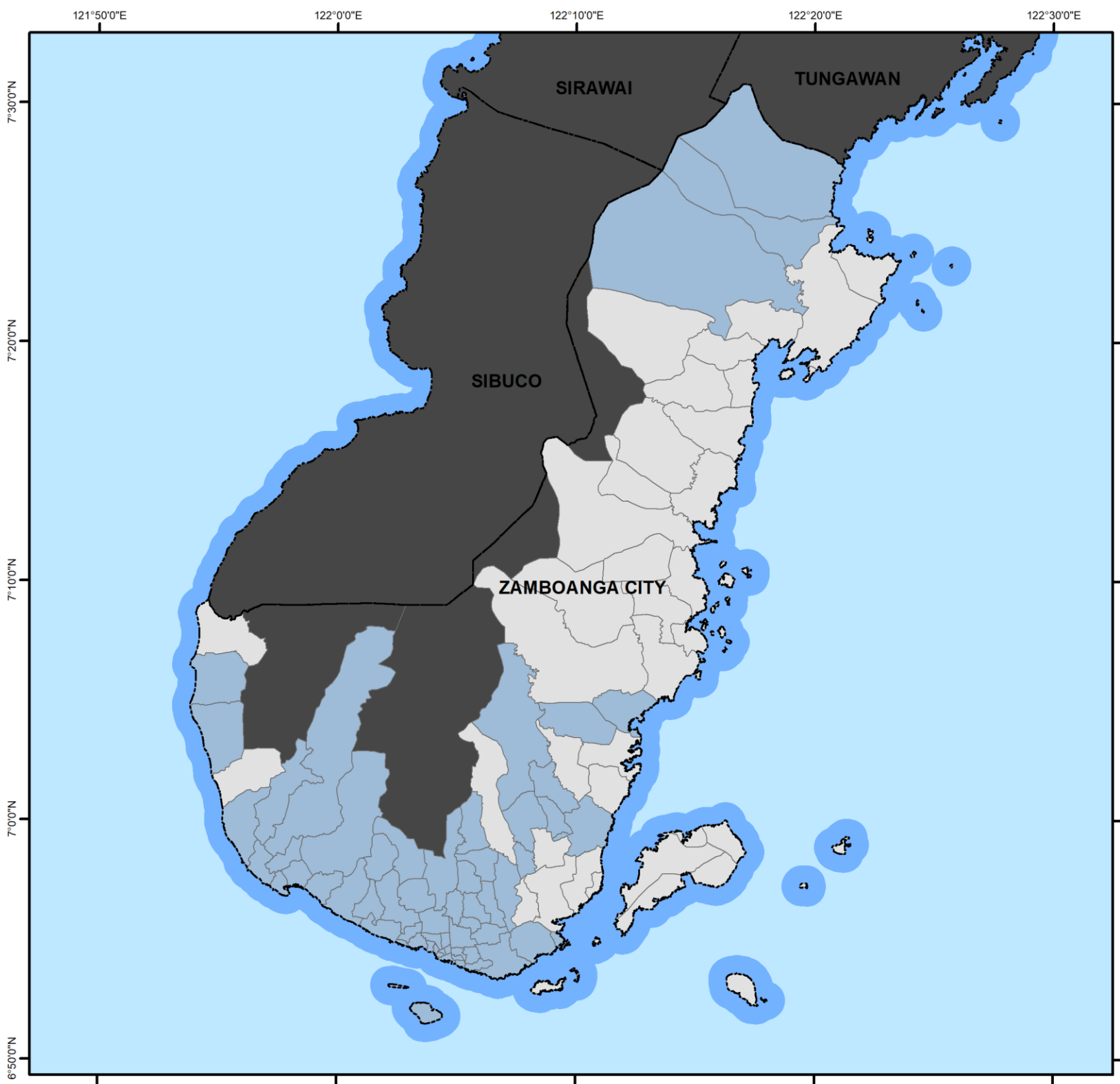
Barangay	Number of Service Connections (2020)		
	Residential	Commercial	Institutional
Zamboanga City	59,483	6,412	567
Arena Blanco*	0	0	0
Ayala	1,761	169	15
Baliwasan	1,956	228	17
Baluno	117	0	3
Boalan	558	32	4
Cabaluay	550	30	4
Cabatangan	1,345	26	20
Cacao	105	2	2
Calarian	2,648	158	31
Camino Nuevo	585	283	3
Campo Islam	279	6	1
Canelar	1,481	383	5
Capisan	121	0	6
Cawit	240	3	1
Divisoria	1,336	98	6
Dulian (Upper Pasonanca)	50	2	3
Guisao	34	1	2
Guiwan	2,806	306	4
Kasanyangan	507	39	2
La Paz	28	0	0
Labuan	188	12	6
Lamisahan	190	10	1
Lanzones	90	1	2
Licombo	8	0	0
Lumayang	101	0	4
Lumbangan	231	4	3
Lunzuran	737	25	2
Maasin	214	21	0
Malagutay	1,092	27	29
Mampang	581	34	4
Mariki*	0	0	0
Pamucutan	125	4	3
Pasobolong	509	17	8
Pasonanca	4,758	161	36

Barangay	Number of Service Connections (2020)		
	Residential	Commercial	Institutional
Zamboanga City	59,483	6,412	567
Patalon	128	1	4
Putik	2,725	213	9
Recodo	529	60	3
Rio Hondo	82	4	21
San Jose Cawa-cawa	638	275	29
San Jose Gusu	1,713	128	4
San Roque	3,734	183	22
Sangali	523	26	2
Sinunoc	1,994	76	10
Santa Barbara	67	9	0
Santa Catalina	1,021	94	2
Santa Maria	4,264	473	50
Santo Niño	528	153	2
Talisayan	73	14	0
Talon-Talon	3,135	226	8
Tetuan	4,493	703	13
Tictapul	111	1	4
Tolosa	138	0	6
Tugbungan	1,681	177	4
Tulungatung	607	28	6
Tumaga	4,165	317	17
Vitali	190	15	6
Zambowood	611	29	1
Barangay Zone I (Pob.)	221	286	24
Barangay Zone II (Pob.)	233	263	5
Barangay Zone III (Pob.)	262	209	3
Barangay Zone IV (Pob.)	286	367	85

Notes. Data was adapted from ZCWD Billed Volume Data for 2020. At present, Barangays Arena Blanco and Mariki have no registered and billed connections but are still captured in the ZCWD service area.

4.4.2 Projected Number of ZCWD Water Supply Service Connections

Service connections for ZCWD were projected based on the 2020-2029 service connection projections obtained from ZCWD (Local Water Utilities Administration, 2019) which used an arithmetic increase of 2,000 service connections per annum. These projections were projected up to 2040 and disaggregated in proportion to existing number of connections with residential connections comprising 89.50 percent of the service connections and non-residential connections comprising the remaining 10.50 percent. The resulting projections for residential and non-residential connections are presented in **Table 46** and **Table 47**, respectively.



LOCATION MAP
ZAMBOANGA CITY

- LEGEND:
- City/Municipal Boundary
 - BARANGAY BOUNDARIES**
 - ZCWD Served Barangays
 - ZCWD Unserved Barangays
 - Protected/Unclaimed Area

1:400,000

Datum: Philippine Reference System 1992
 Projection: Traverse Mercator
 Coordinate System: PRS 1992 Philippines Zone IV
 Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
 Service Area Coverage (ZCWD, 2021)

Table 46: ZCWD Projected Number of Residential Connections

City/Barangay	Projected Number of Residential Connections					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Zamboanga City	59,483	68,439	73,803	80,963	88,121	95,283
Arena Blanco	0	10	11	12	13	14
Ayala	1,761	2,025	2,184	2,406	2,657	2,906
Baliwasan	1,956	2,250	2,426	2,673	2,952	3,227
Baluno	117	135	145	160	176	193
Boalan	558	642	692	762	842	921
Cabaluay	550	633	682	751	830	908
Cabatangan	1,345	1,547	1,668	1,837	2,030	2,220
Cacao	105	121	130	144	159	173
Calarian	2,648	3,046	3,284	3,618	3,996	4,369
Camino Nuevo	585	673	726	799	882	966
Campo Islam	279	321	346	382	421	461
Canelar	1,481	1,703	1,837	2,023	2,234	2,444
Capisan	121	139	150	166	182	200
Cawit	240	276	298	328	362	396
Divisoria	1,336	1,537	1,657	1,825	2,016	2,204
Dulian (Upper Pasonanca)	50	58	62	68	75	82
Guisao	34	39	42	46	51	56
Guiwan	2,806	3,228	3,480	3,799	4,063	4,320
Kasanyangan	507	583	629	693	765	837
La Paz	28	32	35	38	42	46
Labuan	188	216	233	257	283	310
Lamisahan	190	219	236	260	286	313
Lanzones	90	104	112	122	136	148
Licombo	8	9	10	11	12	13
Lumayang	101	116	125	138	153	167
Lumbangan	231	266	287	315	348	381
Lunzuran	737	848	914	1,007	1,113	1,216
Maasin	214	246	265	292	323	353
Malagutay	1,092	1,256	1,354	1,492	1,648	1,802
Mampang	581	668	721	794	876	958
Mariki	0	10	11	12	13	14
Pamucutan	125	144	155	171	188	206
Pasobolong	509	585	631	696	768	840
Pasonanca	4,758	5,473	5,902	6,292	6,377	6,505
Patalon	128	147	159	175	194	211
Putik	2,725	3,134	3,380	3,723	4,112	4,497
Recodo	529	608	656	723	798	873
Rio Hondo	82	94	102	112	123	135

City/Barangay	Projected Number of Residential Connections					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
San Jose Cawa-cawa	638	734	791	872	888	906
San Jose Gusu	1,713	1,970	2,125	2,340	2,585	2,827
San Roque	3,734	4,296	4,632	5,102	5,635	6,162
Sangali	523	602	649	715	790	864
Sinunoc	1,994	2,293	2,473	2,724	3,009	3,291
Santa Barbara	67	77	83	91	101	110
Santa Catalina	1,021	1,174	1,266	1,395	1,541	1,685
Santa Maria	4,264	4,905	5,289	5,741	5,820	5,937
Santo Niño	528	607	655	721	797	872
Talisayan	73	84	91	99	110	121
Talon-Talon	3,135	3,606	3,889	4,283	4,732	5,174
Tetuan	4,493	5,167	5,573	6,139	6,782	7,416
Tictapul	111	128	138	152	167	183
Tolosa	138	159	171	189	208	228
Tugbungan	1,681	1,933	2,085	2,296	2,537	2,775
Tulungatung	607	698	753	829	916	1,002
Tumaga	4,165	4,791	5,166	5,690	6,286	6,874
Vitali	190	219	236	260	286	313
Zambowood	611	703	758	834	922	1,008
Barangay Zone I (Pob.)	221	254	274	302	333	365
Barangay Zone II (Pob.)	254	292	315	347	383	419
Barangay Zone III (Pob.)	262	301	325	358	395	429
Barangay Zone IV (Pob.)	265	305	329	362	399	437

Note. ZCWD served barangays with no record of billed residential connections were assumed to have a minimum of 10 residential service connections by 2025.

Table 47: ZCWD Projected Number of Non-Residential Connections

City/Barangay	Projected Number of Non-Residential Connections					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Zamboanga City	6,979	8,029	8,659	9,499	10,339	11,179
Arena Blanco	0	1	1	1	1	2
Ayala	184	212	228	250	272	295
Baliwasan	245	282	304	333	363	392
Baluno	3	3	4	4	4	5
Boalan	36	41	45	49	53	58
Cabaluay	34	39	42	46	50	54
Cabatangan	46	53	57	63	68	74
Cacao	4	5	5	5	6	6

City/Barangay	Projected Number of Non-Residential Connections					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Calarian	189	217	234	257	280	303
Camino Nuevo	286	329	355	389	423	458
Campo Islam	7	8	9	10	10	11
Canelar	388	446	482	528	576	621
Capisan	6	7	7	8	9	10
Cawit	4	5	5	5	6	6
Divisoria	104	120	129	141	154	166
Dulian (Upper Pasonanca)	5	6	6	7	7	8
Guisao	3	3	4	4	4	5
Guiwan	310	356	385	422	460	496
Kasanyangan	41	47	51	56	61	66
La Paz	0	1	1	1	1	2
Labuan	18	21	22	24	27	29
Lamisahan	11	13	14	15	16	18
Lanzones	3	3	4	4	4	5
Licombo	0	1	1	1	1	2
Lumayang	4	5	5	5	6	6
Lumbangan	7	8	9	10	10	11
Lunzuran	27	31	33	37	40	43
Maasin	21	24	26	29	31	34
Malagutay	56	64	69	76	83	90
Mampang	38	44	47	52	56	61
Mariki	0	1	1	1	1	2
Pamucutan	7	8	9	10	10	11
Pasobolong	25	29	31	34	37	40
Pasonanca	197	227	244	268	292	315
Patalon	5	6	6	7	7	8
Putik	222	255	275	302	329	355
Recodo	63	72	78	86	93	101
Rio Hondo	25	29	31	34	37	40
San Jose Cawa-cawa	304	350	377	414	450	487
San Jose Gusu	132	152	164	180	195	211
San Roque	205	236	254	279	304	328
Sangali	28	32	35	38	41	45
Sinunoc	86	99	107	117	127	138
Santa Barbara	9	10	11	12	13	14
Santa Catalina	96	110	119	131	142	154
Santa Maria	523	601	650	711	776	837
Santo Niño	155	178	192	211	229	248
Talisayan	14	16	17	19	21	22

City/Barangay	Projected Number of Non-Residential Connections					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	Dec 20	Dec 25	Dec 28	Dec 32	Dec 36	Dec 40
Talon-Talon	234	269	290	318	346	375
Tetuan	716	824	889	974	1,062	1,145
Tictapul	5	6	6	7	7	8
Tolosa	6	7	7	8	9	10
Tugbungan	181	208	224	246	268	290
Tulungatung	34	39	42	46	50	54
Tumaga	334	384	414	454	497	534
Vitali	21	24	26	29	31	34
Zambowood	30	34	37	41	44	48
Barangay Zone I (Pob.)	310	356	384	422	459	496
Barangay Zone II (Pob.)	268	308	332	365	397	429
Barangay Zone III (Pob.)	212	244	263	288	314	339
Barangay Zone IV (Pob.)	452	520	560	615	669	724

Note. ZCWD served barangays with no record of billed residential connections were assumed to have a minimum of 1 non-residential service connections by 2025.

4.5 Sanitation Service Coverage

4.5.1 Existing Septic Tank Systems

As mentioned in **Subsection 2.6.2** of this report, 90.3 percent of households in Zamboanga City have access to sanitary toilet facilities, according to the CBMS network in 2019. Based on the results of the household and commercial surveys conducted by the Study Team (see **Annex 1**), this septic tank coverage has increased to about 87 percent by 2021.

According to the Zamboanga City Comprehensive Land Use Plan (CLUP) 2016-2025, the majority of septic tanks for households and establishments are not properly designed or maintained and discharge residuals without treatment. This could potentially lead to contamination of surface and groundwater sources.

Considering this situation, improvement of septic tank systems, as well as the regular and proper maintenance and desludging of septic tanks is necessary.

4.5.2 Existing Septage Collection

As discussed in **Subsection 2.6.3**, desludging services in Zamboanga City are provided by two private desludging companies. The details of their operations are summarized in **Table 48**.

Table 48: Summary of Desludging Services in Zamboanga City

Company	Christine Haresco Wastewater Treatment Services (CHWTS)	Veterans Builder Enterprises
Frequency of Desludging	3-4 trips per day (sometimes no trips for 2-3 days)	3 trips per day (depending on days)

Cost of Desludging	PhP3,500 within 10 km radius (additional PhP 500 for every km)	PhP4,000-4,500 @ 4,500 L (depending on distance)	
Number of Septic Tanks Desludged	600-700/year	minimum of 3 HH/day (~700/year)	
Coverage of Services	from Barangay Labuan to Barangay Manicahan	Whole Zamboanga city	
Volume of septage collected per year	~2000 metric tons	no data available	
VTU Trucks capacity	3,700 L to 4,500 L	4 units @ 4,500 L 1 unit @ 19,000 L 1 unit @ 17,000 L	
Capacity of Treatment	no data available	330,000 L	1M L
Location of Treatment Plants	no data available	Cabaluay (East Coast)	Pamucutan (West Coast)

Considering the number of septic tanks desludged by both desludging companies at 1,400 per year and a four-year cycle as required by the DOH Administrative Order No. 2019-0047, each cycle can cover up to 5,600 households or establishments. Comparing this to the total number of households in Zamboanga City at 186,242 in 2020 shows the significant gap in existing septage collection in the area.

4.5.3 Existing Sewerage System Coverage and Capacity

Sanitation systems in Zamboanga City include a mix of septage management and sewer systems. At present, septage management services are provided by private desludgers while the existing sewerage system is operated by the ZCWD.

The existing sewer system consists of approximately 11,400 linear meters of vitrified clay pipes, covering an area of about 80 hectares within the urban center of Zamboanga City. As of the writing of this report, commissioning is ongoing for the 4,000 m³/day Sewage and Septage Treatment Plant in Magay Street, Barangay Zone I, which will provide treatment for the existing sewer system and potential expansion areas.

Under the Z3R Projects, the Local Water Utilities Administration (LWUA) will also be implementing the development of the Rio Hondo Sewage Treatment Plant (STP) and Vale Vista STP in Kasanyangan.

The proposed systems and their respective capacities are summarized in **Table 49**. These systems cover a total of 13 barangays, in total. The coverage of these systems is also shown in **Figure 23**.

Table 49: ZCWD Existing and Proposed Sewage and Septage Treatment Plants

Treatment Plant	Barangays Covered	STP Capacity (m³/day)	SpTP Capacity (m³/day)
Central Zamboanga STP & SpTP	Barangay Zone I (Pob.) Barangay Zone II (Pob.) Barangay Zone III (Pob.) Barangay Zone IV (Pob.) Santa Catalina Camino Nuevo Canelar Santo Niño	4,000 (Expandable to 6,000)	15

Treatment Plant	Barangays Covered	STP Capacity (m ³ /day)	SpTP Capacity (m ³ /day)
	San Jose Cawa-Cawa Santa Barbara*		
Rio Hondo STP	Rio Hondo Mariki	1,500	-
Vale Vista STP & SpTP	Kasanyangan	2,000	15

Notes. Adapted from ZCWD Plans and Programs

*Santa Barbara was assumed to be included as coverage for septage collection.

Based on consultations with ZCWD, there are no current reuse practices for wastewater residuals. Effluent and biosolids from treatment plants are planned to be discharged and disposed of.

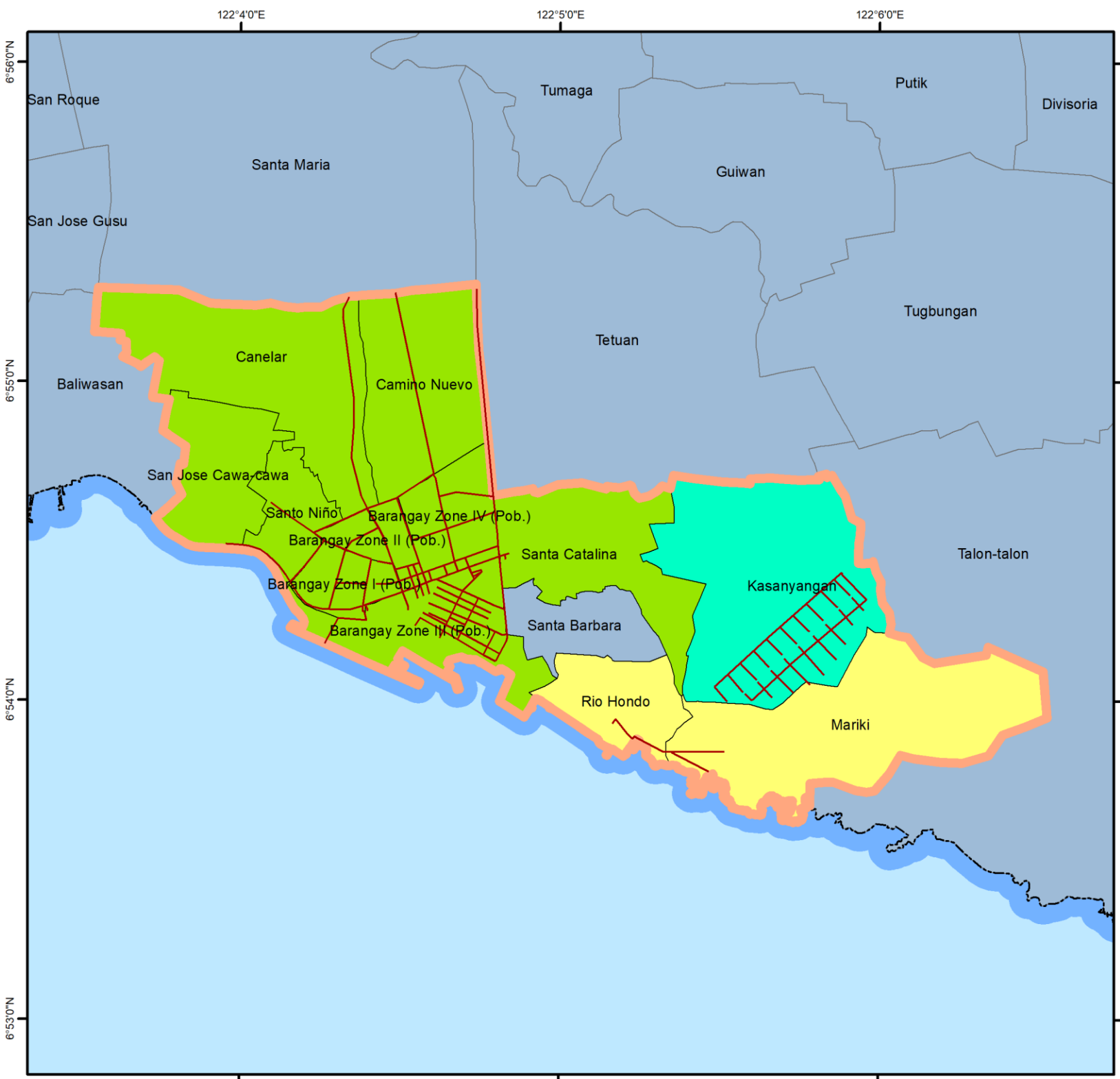
4.6 Septage Volume Projections

4.6.1 Service Coverage Area

To facilitate the proper planning and design of the proposed SMP, Zamboanga City is delineated into three service areas. Service Area 1 refers to a total of 77 barangays which are not covered by existing and proposed sewerage and septage systems; Service Area 2 refers to the 13 barangays covered by these existing and proposed systems mentioned in **Subsection 4.5.3**; and Service Area 3 refers to the island barangays of Zamboanga City. The distribution of these barangays is presented in **Table 50** and **Figure 24**.

Table 50: Zamboanga City Service Areas

Service Area	Covered Barangays
Service Area 1 (Non-Sewered Area)	Arena Blanco, Ayala, Baliwasan, Baluno, Boalan, Cabaluay, Cabatangan, Cacao, Calarian, Campo Islam, Capisan, Cawit, Divisoria, Dulian (Upper Pasonanca), Guisao, Guiwan, La Paz, Labuan, Lamisahan, Lanzones, Licom, Lumayang, Lumbangan, Lunzuran, Maasin, Malagutay, Mampang, Pamucutan, Pasobolong, Pasonanca, Patalon, Putik, Recodo, San Jose Gusu, San Roque, Sangali, Sinunoc, Santa Maria, Talisayan, Talon-Talon, Tetuan, Tictapul, Tolosa, Tugbungan, Tulungatung, Tumaga, Vitali, Zambowood, Bolong, Buenavista, Bunguiao, Calabasa, Culianan, Curuan, Dita, Dulian (Upper Bunguiao), Lapakan, Latuan (Curuan), Limaong, Limpapa, Lubigan, Mangusu, Manicahan, Mercedes, Muti, Panubigan, Quiniput, Salaan, Sibulao (Caruan), Sinubung, Tagasilay, Taguiti, Talabaan, Taluksangay, Tigbalabag, Tumitus, Victoria
Service Area 2 (Sewered Area)	Barangay Zone I (Pob.), Barangay Zone II (Pob.), Barangay Zone III (Pob.), Barangay Zone IV (Pob.), Camino Nuevo, Canelar, San Jose Cawa-Cawa, Santa Catalina, Santo Niño, Kasanyangan, Mariki, Rio Hondo, Santa Barbara
Service Area 3 (Island Barangays)	Tumalutab, Tigtabon, Pasilmanta (Sacol Island), Pangapuyan, Manalipa, Landang Laum, Landang Gua, Busay (Sacol Island)



LOCATION MAP
ZAMBOANGA CITY

- LEGEND:**
- Sewer Networks
 - Central Zamboanga Septage Coverage Area
 - Central Zamboanga Sewerage System
 - Rio Hondo Sewerage System
 - Vale Vista Sewerage System
 - City Boundary
 - Barangay Boundaries



1:30,000

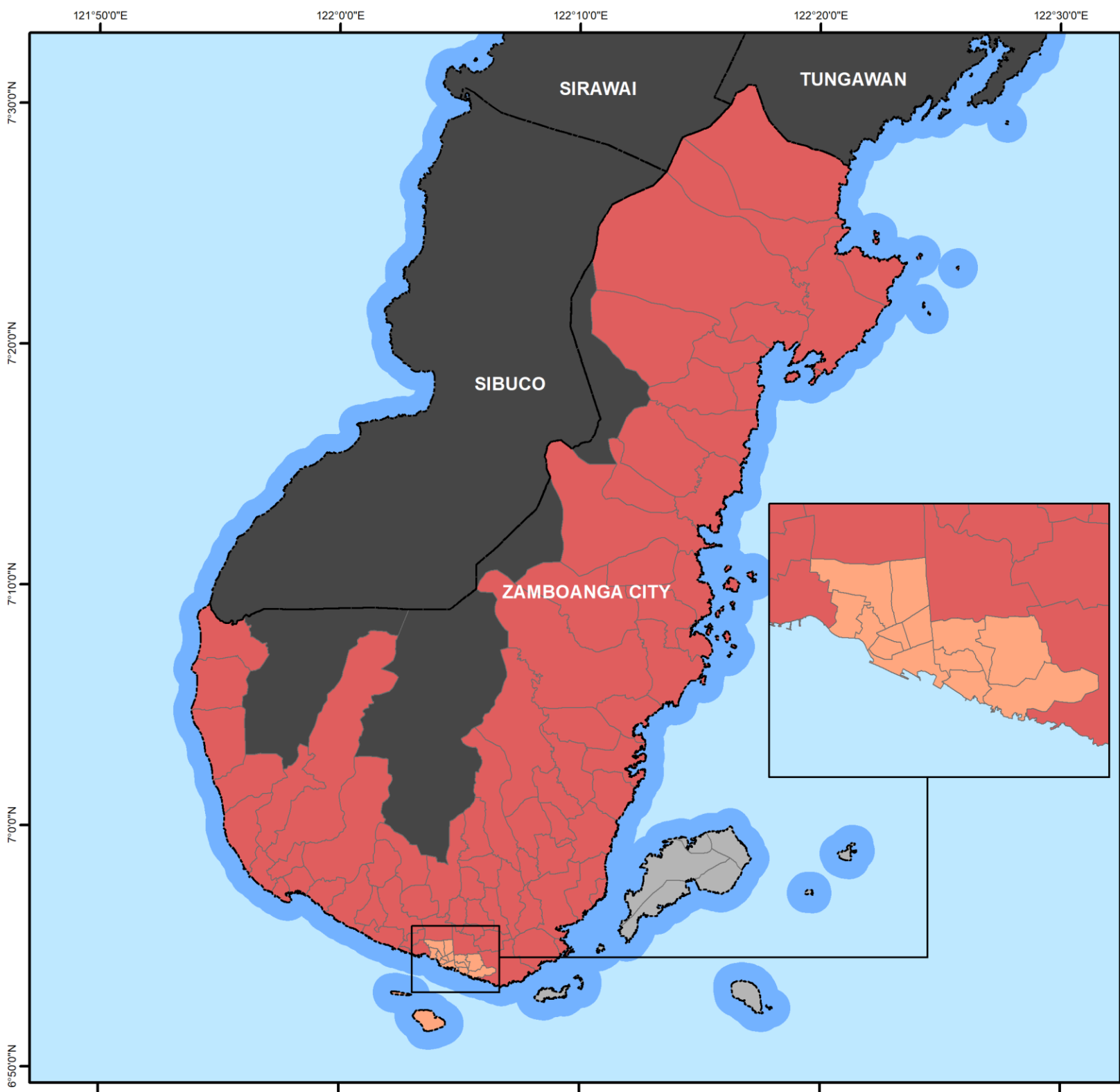
Datum: Philippine Reference System 1992
 Projection: Traverse Mercator
 Coordinate System: PRS 1992 Philippines Zone IV
 Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
 Sewerage Systems (ZCWD, 2021)

FIGURE 23

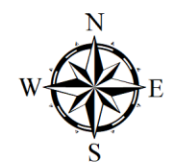
ZCWD Existing and Proposed
 Sewage and Septage Treatment Plants



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

- City/Municipal Boundary
- BARANGAY BOUNDARIES**
- Protected/Unclaimed Areas
- Service Areas**
- Service Area 1
- Service Area 2
- Service Area 3



1:400,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
Proposed SpTP Sites (ZCWD, 2021)

FIGURE 24

Zamboanga City
Service Areas

Septage volumes discussed in the following subsections were projected for all three service areas. **Table 51** and **Table 52** show the number of residential and non-residential structures, respectively.

Residential structures were computed from the projected number of households and for WD customers, based on projected number of residential service connections.

Table 51: Projected No. of Residential Structures (Household No.)

Service Area	Desludging Cycle / Yearend					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	2020	2025	2028	2032	2036	2040
A. No. of Residential Structures						
A.1 Total Zamboanga City	219,287	239,177	250,850	266,766	282,734	298,734
A.2 Service Area 1	193,901	210,666	220,423	233,663	246,913	260,223
A.2.1 WD Served Barangays						
a. WD Customers	53,572	61,632	66,460	72,876	79,267	85,664
b. WD Non-Customers	104,256	109,517	112,451	116,577	120,761	125,009
A.2.2 WD Unserved Barangays						
a. WD Non-Customers	36,073	39,517	41,512	44,210	46,885	49,550
A.3 Service Area 2	20,096	22,829	24,513	26,872	29,268	31,629
A.3.1 WD Customers	5,911	6,807	7,343	8,087	8,854	9,619
A.3.2 WD Non-Customers	14,185	16,022	17,170	18,785	20,414	22,010
A.3 Service Area 3	5,290	5,682	5,914	6,231	6,553	6,882
A.4.1 WD Non-Customers	5,290	5,682	5,914	6,231	6,553	6,882

Similar to residential structures, non-residential structures for WD customers were derived from the projected number of commercial and institutional service connections. For non-customers, the number of non-residential structures assumes one non-residential structure per 2,000 population.

Table 52: Projected No. of Non-Residential Structures (Com. & Inst.)

Service Area	Desludging Cycle / Yearend					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	2020	2025	2028	2032	2036	2040
A. No. of Non-Residential Structures						
A.1 Total Zamboanga City	7,312	8,376	9,023	9,879	10,736	11,594
A.2 Service Area 1	4,723	5,402	5,816	6,361	6,909	7,453
A.2.1 WD Served Barangays						
a. WD Customers	4,433	5,101	5,501	6,033	6,568	7,101
b. WD Non-Customers	216	222	230	239	246	254

Service Area	Desludging Cycle / Yearend					
	Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
	2020	2025	2028	2032	2036	2040
A.2.2 WD Unserved Barangays						
a. WD Non-Customers	74	79	85	89	95	98
A.3 Service Area 2	2,578	2,963	3,196	3,507	3,814	4,127
A.3.1 WD Customers	2,546	2,928	3,158	3,466	3,771	4,078
A.3.2 WD Non-Customers	32	35	38	41	43	49
A.3 Service Area 3	11	11	11	11	13	14
A.4.1 WD Non-Customers	11	11	11	11	13	14

Note. for WD Non-Customers Non-Residential Customers, barangay allocation assumes one (1) Non-Residential Structure per 2000 population

4.6.2 Estimation Approach and Basic Assumptions

There are several approaches in estimating septage generation. The most accurate is through collection of data from actual records reported by local septage haulers and treatment plants operating in the area. In the absence of such data, septage volume can be estimated using the “typical tank volume and pump-out frequency” method (US EPA, 1994). This method calculates septage volume by estimating the number of septic tanks and also assumes an average septic tank volume and desludging frequency. This is given by the formula:

$$\text{Potential Septage Volume (m}^3\text{/day)} = \frac{\text{No. of Desludgable Septic Tanks} * \text{Septage Volume per Septic Tank (m}^3\text{)}}{\text{Desludging Frequency (year)} * \text{Operational Days per Year (days/year)}} \quad (\text{Eq. 1})$$

The basic assumptions for the parameters given in the above formula are discussed in the following paragraphs.

Number of Accessible Septic Tanks

The number of accessible septic tanks relies on two factors: septic tank coverage and septic tank accessibility. Septic tank coverage refers to the availability of septic tanks for each structure. This is dependent on the type of toilet available to the structure while septic tank accessibility takes into account the location of the available septic tanks: this refers to the exclusion of septic tanks underneath structures or other locations that make desludging improbable.

Assumptions at base year for these factors were derived from the household and commercial surveys. Septic tank coverage for residential connections were calculated separately based on the classification of the structure (as WD customer, part of WD served barangay, and if residential or non-residential). In general, septic tank coverages for served barangays were found at 93 to 100 percent, and was assumed to increase up to ranges of 98 to 100 percent. Septic tank coverage for households within WD unserved barangays, however, were relatively low at 62 percent on the base year, and was assumed to increase by 15 percent or up to a coverage of 87 percent by 2040.

Septic tank accessibility figures also followed similar trends with residential connections in ZCWD served barangays showing accessibility at 93 and 90 percent for customers and non-customers, respectively. Non-residential connections were also found to range from 85 to 100 percent while residential connections within WD unserved barangays also showed low accessibility rates at 62 percent on the base year. Accessibility rates are also expected to gradually increase per annum considering an increase in awareness among the population and the implementation of sanitation ordinances.

The projected number of available septic tanks is then computed using the following formulas:

$$\text{No. of Residential Septic Tanks} = \text{No. of HH} * \text{ST Coverage (\%)} \quad (\text{Eq. 2})$$

$$\text{No. of Non-Residential Septic Tanks} = \text{No. of Non-Residential WD Customers} * \text{ST Coverage (\%)} \quad (\text{Eq. 3})$$

$$\text{No. of Accessible Septic Tanks} = \text{No. of Septic Tanks} * \text{ST Accessibility (\%)} \quad (\text{Eq. 4})$$

For non-residential establishments, it is expected that most, if not all, have septic tanks or other types of depository systems that can be desludged. Thus, septic tank coverage and accessibility for non-residential establishments unserved by the WD are set at 100 percent.

The resulting number of accessible septic tanks is shown in the following tables.

Table 53: Projected No. of Accessible Residential Septic Tanks

Service Area		Desludging Cycle / Yearend					
		Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
		2020	2025	2028	2032	2036	2040
A.	No. of Accessible Residential Septic Tanks						
A.1	Total Zamboanga City	167,335	189,104	203,447	222,914	243,190	265,441
A.2	Service Area 1	149,459	168,157	180,394	197,025	214,256	233,261
	A.2.1 WD Served Barangays						
	a. WD Customers	48,327	56,199	60,596	67,852	73,797	80,595
	b. WD Non-Customers	87,265	93,684	98,278	102,960	108,935	115,162
	A.2.2 WD Unserved Barangays						
	a. WD Non-Customers	13,867	18,274	21,520	26,213	31,524	37,504
A.3	Service Area 2	15,843	18,321	19,987	22,194	24,528	26,972
	A.3.1 WD Customers	3,970	4,617	4,980	5,601	6,114	6,696
	A.3.2 WD Non-Customers	11,873	13,704	15,007	16,593	18,414	20,276
A.3	Service Area 3	2,033	2,626	3,066	3,695	4,406	5,208
	A.4.1 WD Non-Customers	2,033	2,626	3,066	3,695	4,406	5,208

Table 54: Projected No. of Accessible Non-Residential Septic Tanks

Service Area		Desludging Cycle / Yearend					
		Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
		2020	2025	2028	2032	2036	2040
A.	No. of Accessible Non-Residential Septic Tanks						
A.1	Total Zamboanga City	5,171	6,174	6,787	7,664	8,580	9,550
A.2	Service Area 1	3,799	4,527	4,972	5,604	6,271	6,970
	A.2.1 WD Served Barangays						
	a. WD Customers	3,509	4,226	4,657	5,276	5,930	6,618
	b. WD Non-Customers	216	222	230	239	246	254
	A.2.2 WD Unserved Barangays						
	a. WD Non-Customers	74	79	85	89	95	98
A.3	Service Area 2	1,363	1,638	1,806	2,049	2,296	2,566
	A.3.1 WD Customers	1,333	1,606	1,770	2,010	2,255	2,518
	A.3.2 WD Non-Customers	30	32	36	39	41	48
A.3	Service Area 3	9	9	9	11	13	14
	A.4.1 WD Non-Customers	9	9	9	11	13	14

Desludging Participation Rate

Desludging participation rates account for the willingness of the establishments to avail of the proposed desludging services. These rates were also obtained from survey results considering the classifications of the establishments. Willingness within WD served barangays were computed at 87 percent and 51 percent for residential customers and non-customers, respectively.

Consistent with the provision/updating of the local sanitation ordinances requiring septage management, enforcement of the recently released DOH directive on proper septic tank maintenance, and an effective Promotional Campaign, desludging participation rates are expected to gradually increase.

Considering the participation rates, the number of desludgable septic tanks is computed using **Eq. 5** shown below. The results are shown in **Table 55** and **Table 56**.

$$\text{No. of Desludgable Septic Tanks} = \text{No. Accessible of Septic Tanks} * \text{Desludging Participation Rate (\%)} \quad (\text{Eq. 5})$$

Table 55: Projected No. of Desludgeable Residential Septic Tanks

Service Area		Desludging Cycle / Yearend					
		Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
		2020	2025	2028	2032	2036	2040
A.	No. of Desludgeable Residential Septic Tanks						
A.1	Total Zamboanga City	102,577	125,802	141,620	163,201	186,759	213,119
A.2	Service Area 1	92,232	112,594	126,314	145,063	165,324	187,992
	A.2.1 WD Served Barangays						
	a. WD Customers	42,044	50,580	55,146	63,779	70,845	78,984
	b. WD Non-Customers	44,505	54,339	61,914	70,011	80,611	92,132
	A.2.2 WD Unserved Barangays						
	a. WD Non-Customers	5,683	7,675	9,254	11,273	13,868	16,876
A.3	Service Area 2	9,511	12,104	13,987	16,549	19,496	22,783
	A.3.1 WD Customers	3,455	4,155	4,533	5,265	5,868	6,562
	A.3.2 WD Non-Customers	6,056	7,949	9,454	11,284	13,628	16,221
A.3	Service Area 3	834	1,104	1,319	1,589	1,939	2,344
	A.4.1 WD Non-Customers	834	1,104	1,319	1,589	1,939	2,344

Table 56: Projected No. of Desludgeable Non-Residential Septic Tanks

Service Area		Desludging Cycle / Yearend					
		Base Year	Cycle 1 ('25-'28)		Cycle 2 ('29-'32)	Cycle 3 ('33-'36)	Cycle 4 ('37-'40)
		2020	2025	2028	2032	2036	2040
A.	No. of Desludgeable Non-Residential Septic Tanks						
A.1	Total Zamboanga City	3,218	4,117	4,715	5,608	6,599	7,712
A.2	Service Area 1	2,395	3,050	3,483	4,130	4,847	5,650
	A.2.1 WD Served Barangays						
	a. WD Customers	2,105	2,749	3,168	3,802	4,506	5,298
	b. WD Non-Customers	216	222	230	239	246	254
	A.2.2 WD Unserved Barangays						
	a. WD Non-Customers	74	79	85	89	95	98
A.3	Service Area 2	820	1,064	1,229	1,473	1,745	2,055
	A.3.1 WD Customers	801	1,043	1,204	1,446	1,715	2,015
	A.3.2 WD Non-Customers	19	21	25	27	30	40
A.3	Service Area 3	3	3	3	5	7	7
	A.4.1 WD Non-Customers	3	3	3	5	7	7

Septage Volume per Septic Tank

Surveys conducted by similar studies under the MTSP and the USAID PWRP-SP exhibit that septic tank and cesspools' nominal capacities range from 1.0 to 6.0 m³. Moreover, under typical circumstances, the septage volume produced in a single pump-out is equal to the nominal capacity of the septic tank. The assumptions used in the feasibility studies under the above-mentioned project range from 2.0 to 3.0 m³ of septage from residential septic tanks.

At present, based from the data provided by on-going septage management programs in the country, a single pump-out can range from 1.5 to 4.0 m³ of septage per residential septic tank. Based on records, average annual size for HUCs, particularly those in Manila, have septage volumes ranging from 1.0 to 2.0 m³. Comparing these with the results of the survey wherein the majority identified dimensions of 2 meters below and 2.1 to 5 meters as the most common answers, 2.0 m³ was assumed as an appropriate estimation for the septage collected in a single pump-out from residential septic tanks.

To account for the high variability of septic tanks sizes for non-residential establishments, it was assumed that the figure is at least twice that of the residential – that is, the assumption used for commercial and government establishments is 5.0 m³.

Desludging Frequency

The recently approved DOH Administrative Order 2019-0047 specifies desludging frequency of once in every three to five years (Section VI.A) or four years (Section VI.C). The recommended frequency of desludging used for this Study is once every four years to maintain the designed treatment efficiency of septic tanks.

Operational Days

The number of operational days was set at 230 days per year. This assumes 20 working days per month, less holidays, allowance to account for truck maintenance and downtime, and inclement weather conditions.

4.6.3 Projected Septage Volume

Using **Eq. 1** and the assumptions discussed, potential septage volumes in Zamboanga City were calculated and presented in **Table 57**.

Table 57: Projected Potential Septage Volume

Service Area		Desludging Cycle / Yearend																					
		BY	Pre-Construction				Con	Cycle 1				Cycle 2				Cycle 3				Cycle 4			
		'20	'21	'22	'23	'24	'25	'26	'27	'28	'29	'30	'31	'32	'33	'34	'35	'36	'37	'38	'39	'40	
A	Potential Projected Septage Volume (m³/day)																						
	A.1 Total Zamboanga City	240	250	262	273	285	296	309	320	333	345	364	374	385	401	416	430	442	458	477	492	505	
	A.1.1 Residential	223	231	242	253	264	273	286	295	308	318	336	344	355	369	383	395	406	420	438	451	463	
	A.1.2 Non-Residential	17.5	18.4	19.4	20.5	21.3	22.4	23.5	24.7	25.6	26.9	28.2	29.5	30.5	31.9	33.3	34.8	35.9	37.4	39.0	40.7	41.9	
	A.2 Service Area 1	214	221	232	242	252	261	273	282	294	303	320	328	338	351	364	375	386	399	416	428	439	
	A.2.1 WD Served Barangays																						
	a. WD Customers	103	107	111	116	120	125	129	134	137	142	150	154	159	163	169	173	179	184	190	195	200	
	i. Residential	91	95	98	102	106	110	113	117	120	124	131	134	139	142	146	149	154	159	164	167	172	
	ii. Non-Residential	11.4	12.1	12.8	13.6	14.1	14.9	15.7	16.5	17.2	18.1	19.0	19.9	20.7	21.6	22.7	23.7	24.5	25.6	26.8	27.9	28.8	
	b. WD Non-Customers	98	101	107	111	116	119	126	129	136	139	147	150	153	161	167	173	177	183	191	197	202	
	i. Residential	97	100	105	110	115	118	125	128	135	138	145	149	152	160	165	171	175	181	189	196	200	
	ii. Non-Residential	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	
	A.2.2 WD Unserved Barangays																						
	a. WD Non-Customers	13	13	14	16	16	17	18	19	21	21	23	24	25	27	28	30	31	32	35	36	37	
	i. Residential	12	13	14	15	16	17	18	19	20	21	23	24	25	26	28	29	30	31	34	35	37	
	ii. Non-Residential	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
A.3 Service Area 2	25	26	28	29	31	32	34	35	37	39	41	42	44	46	48	50	52	54	57	59	61		
A.3.1 WD Customers	12	12	13	14	14	15	15	16	16	17	18	19	19	20	21	21	22	23	24	24	25		
i. Residential	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	14	14	14		
ii. Non-Residential	4.4	4.6	4.9	5.2	5.4	5.7	6.0	6.3	6.5	6.9	7.2	7.6	7.9	8.3	8.6	9.0	9.3	9.7	10.2	10.6	11.0		
A.3.2 WD Non-Customers	13	14	15	16	17	17	19	19	21	22	23	24	25	26	27	29	30	31	33	34	35		
i. Residential	13	14	15	16	17	17	18	19	21	21	23	24	25	26	27	29	30	31	33	34	35		
ii. Non-Residential	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
A.3 Service Area 3	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	5	5	5		
A.4.1 WD Non-Customers	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	5	5	5		
i. Residential	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	5	5	5		
ii. Non-Residential	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04		

5 Development Options for Septage Management

This section discusses the alternatives considered for septage management. This includes an in-depth discussion of the development of the SMP, including the treatment options, project phasing, and corresponding costs.

5.1 Elements of a Septage Management Program

The proposed SMP for the City of Zamboanga is a comprehensive approach that regulates septic tank desludging, as well septage transport, treatment, and disposal/reuse. It involves the full cooperation of the community, through septic tank construction and maintenance, service providers, for the operations of the septage management system, and the LGU, in the updating of city ordinances as well as possible counterpart funding and program enforcement and monitoring.

In preparing the conceptual septage management system for the city, the following were taken into consideration:

- Planning horizon and project phasing;
- Service coverage area;
- Target septage volume;
- Alternative septage treatment plant sites;
- SpTP equipment sizing and design capacities;
- Septage hauling and disposal; and
- Costs.

5.2 Planning Horizon and Project Phasing

The planning horizon was set for 20 years, from 2021 to 2040. Considering the COVID-19 pandemic that will impact the implementation of infrastructure projects in the country, as well as the required lead time to prepare local ordinance/s, memorandum of agreement (MOA), securing project financing, permitting, engineering and construction, and public consultations, the septage management system was conservatively assumed to start operations by year 2025.

The SpTP and vacuum truck capacities will be established to meet year 2040 demand. Phasing of project implementation may be more economical by reducing the risk of overdesign and overinvesting – as the system design at this time can only be based on a limited set of primary and secondary data.

For a septage management system, Phase 1 can cover the first to second cycle of desludging operations, corresponding to eight years. At the fourth year, it is expected that the system operator will have enough information, particularly on septage volumes, needed to plan for Phase 2 program implementation.

In reference to existing systems, treatment facilities are usually designed to meet the projected demand from 10 to 20 years – generally based on the life of the equipment and facilities. In consideration of the acceptance level of the proposed desludging program – pertaining to the willingness of households/establishments to avail of the services, it is more practical to design these facilities based on a conservative level. Since treatment facilities can be modular in design, future upgrading/expansion can be carried out with minimal difficulty.

Vacuum truck procurement, on the other hand, can be done in a very short period (i.e., within a year). Therefore, this can be undertaken in several tranches during the planning horizon, corresponding to the septage collection targets.

5.3 Service Area Coverage

As discussed in **Section 4**, the service area for the SMP will cover Service Area 1 of Zamboanga City composed of the 77 unsewered barangays and accessible via land transportation. This is composed of 48 ZCWD served barangays and 29 ZCWD unserved barangays.

5.4 Target Septage Volume for Collection and Treatment

From the septage volume projections presented in **Section 4**, which considers the potential volume for Zamboanga City, “collection targets” were further applied to conservatively account for the volumes that may be collected within the service areas. Ideally, the main target for collection is the coverage of ZCWD, thus, it was assumed that 100 percent of septage from ZCWD customers will be desludged. These structures are expected to pay on a monthly basis, as additional charges to their monthly water bill. Additionally, ZCWD non-customers may also be desludged on a pay per service basis. Collection targets for the residential non-customers were assumed at a minimal 10 percent for the first year and gradually increasing to a 25 percent collection rate at Year 2040. For ZCWD non-residential non-customers, 100 percent collection was considered following strict implementation of the requirement for desludging on commercial and institutional establishments. These collection targets are summarized in **Table 58**.

Following these collection targets, the total target septage volume was computed at 191 m³/day by end of the 1st desludging cycle at Year 2032 and 262 m³/day by the end of the 2nd desludging cycle and planning horizon at Year 2040. The majority of this volume is attributed to the ZCWD customers as shown in the breakdown presented in **Table 58**.

These target volumes will serve as the bases for the design capacity of the proposed SpTP and vacuum truck procurement. With this, the ultimate capacity of the proposed SpTP is identified as 262 m³/day.

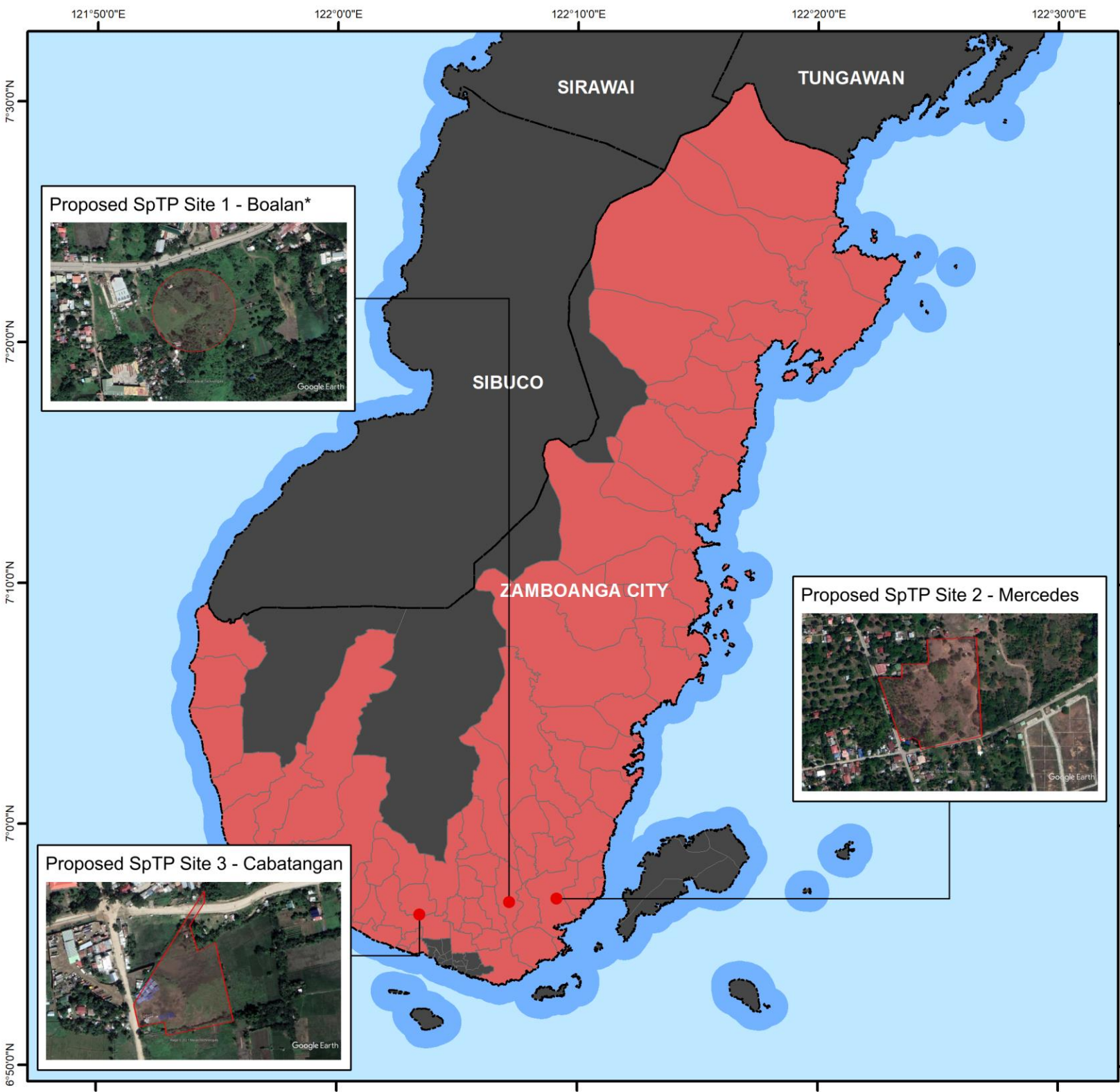
5.5 Candidate Septage Treatment Plant Sites

For the identification of the SpTP sites, the Study considered three candidate locations identified by the ZCWD. The proposed site locations are presented in **Figure 25**. Comparison of the alternative sites is summarized in **Table 59**.

Field visits were also conducted in each of the candidate septage treatment plant sites. The report of the findings is presented in **Annex 2**.

Table 58: Target Septage Volume for Service Area 1

Service Area	Desludging Cycle / Yearend															
	Cycle 1 (‘29-‘32)				Cycle 2 (‘29-‘32)				Cycle 3 (‘33-‘36)				Cycle 4 (‘37-‘40)			
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
A. Percent Collection Target																
A.1 ZCWD Customers																
A.1.1 Residential	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
A.1.2 Non-Residential	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
A.2 ZCWD Non-Customers																
A.2.1 Residential	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%
A.2.2 Non-Residential	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
B. No. of Septic Tanks Desludged per Year																
B.1 ZCWD Customers																
B.1.1 Residential	12,645	12,975	13,452	13,787	14,276	15,083	15,429	15,945	16,294	16,821	17,170	17,711	18,262	18,815	19,180	19,746
B.1.2 Non-Residential	687	723	761	792	833	875	917	951	995	1,043	1,091	1,127	1,176	1,231	1,284	1,325
B.2 ZCWD Non-Customers																
B.2.1 Residential	1,552	1,803	2,021	2,313	2,562	2,896	3,168	3,455	3,847	4,221	4,612	4,961	5,384	5,910	6,385	6,817
B.2.2 Non-Residential	75	76	77	79	80	80	81	82	83	83	84	85	86	86	87	88
Total Residential	14,197	14,778	15,473	16,100	16,838	17,979	18,597	19,400	20,141	21,042	21,782	22,672	23,646	24,725	25,565	26,563
Total Non-Residential	762	799	838	871	913	955	998	1,033	1,078	1,126	1,175	1,212	1,262	1,317	1,371	1,413
Total Septic Tanks to be Desludged	14,959	15,577	16,311	16,971	17,751	18,934	19,595	20,433	21,219	22,168	22,957	23,884	24,908	26,042	26,936	27,976
C. Target Septage Volume (m³/day)																
C.1 ZCWD Customers	125	129	134	137	142	150	154	159	163	169	173	179	184	190	195	201
C.1.1 Residential	110	113	117	120	124	131	134	139	142	146	149	154	159	164	167	172
C.1.2 Non-Residential	14.9	15.7	16.5	17.2	18.1	19.0	19.9	20.7	21.6	22.7	23.7	24.5	25.6	26.8	27.9	28.8
C.2 ZCWD Non-Customers	15	17	19	22	24	27	29	32	35	39	42	45	49	53	57	61
C.2.1 Residential	13	16	18	20	22	25	28	30	33	37	40	43	47	51	56	59
C.2.2 Non-Residential	1.6	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.9	1.9
Total Residential	123	129	135	140	146	156	162	169	175	183	189	197	206	215	222	231
Total Non-Residential	16.6	17.4	18.2	18.9	19.8	20.8	21.7	22.5	23.4	24.5	25.5	26.3	27.4	28.6	29.8	30.7
Total Septage Volume	140	146	153	159	166	177	183	191	199	207	215	223	233	244	252	262



LOCATION MAP
ZAMBOANGA CITY

- LEGEND:
- City/Municipal Boundary
 - Candidate SpTP Site Locations
 - Service Area 1
 - Barangay Boundaries

1:400,000

Datum: Philippine Reference System 1992
 Projection: Traverse Mercator
 Coordinate System: PRS 1992 Philippines Zone IV
 Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
 Candidate SpTP Site Locations (ZCWD, 2021)

FIGURE 25

Zamboanga City
 Candidate SpTP Site Locations

Table 59: Comparison of Candidate SpTP Sites

Parameter	Candidate SpTP Site		
	Site 1 Boalan	Site 2 Mercedes	Site 3 Cabatangan
I. Location			
1. Address	Barangay Boalan	Barangay Mercedes	Barangay Cabatangan
2. Owner	Private Property/under negotiation with ZCWD	ZCWD	ZCWD
3. Approximate Cost of Land	Approximately 3,000 PhP/m ²	Approximately 2,500 PhP/m ²	Approximately 2,800 PhP/m ²
II. Area capacity and space availability			
1. Available Land Area	data not available	4.05 ha	1.61 ha
2. Surrounding area available for expansion?	Yes	Yes	Yes
III. Local Zoning			
1. Current Land Use/ Zoning	Commercial/Residential	Industrial/Commercial	Agricultural
2. Nearby Establishments	None	Concrete batching plant	None
IV. Availability of Utilities			
1. Power	Available	Available	Available
2. Water	Available	Available	Available
V. Topography			
1. Topography	Flat	Flat	Flat
VI. Proximity to Water Sources			
1. Groundwater Sources	ZCWD Production Well within lot	None	Non-operational production well (due to copper concentration)
2. Surface Water Sources	None	1.5 km from Mercedes River	None
VII. Receiving Water Body/Drainage (for treated effluent)	Drainage Canal	Mercedes River	NIA Canal
VIII. Natural Hazards			
1. Landslide	None	None	None
2. Flood	High	Low to Moderate	Moderate to High
IX. Accessibility			
1. Access road/ Right of way	Available	Available	Available
2. Main access road width (range of most narrow to widest)	~15 m (four-lane)	6 m	~ 9 m
3. Main access road condition	National road, concrete & good condition	Municipal/barangay road, concrete & good condition	Municipal/barangay road, concrete & good condition
4. Traffic situation of main access road	Light to Moderate	Light	Moderate

Notes. Cost of land was approximated based on online listings.

In addition to the above details, candidate SpTP sites were evaluated by the Study Team based on their corresponding costs. Capital expenditures (CAPEX) are dependent on site location due to varying land acquisition costs while operations and maintenance (O&M) costs are also impacted based on the relative distance to the service areas and their corresponding vacuum truck requirements. This comparison was conducted during the preliminary assessment portion of the Study and the results are summarized in **Annex 2: Site Evaluation Report**. The candidate sites were ranked according to computed PV costs and Site 3 in Cabatangan was found to be the least cost option.

The results of this analysis were verified with the ZCWD and they also provided their own assessment through pros and cons. The results of their analysis are also presented in **Annex 2**. Overall, the ZCWD also recommends the use of Site 3 primarily also due to its location in proximity to the service area, the minimal residential houses in the vicinity, access to other barangays and potential sanitation by-product users, and the ownership of the property by the ZCWD.

After confirmation of the proposed site with the ZCWD, consultation was conducted with the office of the Association of Barangay Captains (ABC) and Cabatangan barangay captain for their comments on the use of the Cabatangan site. No significant issues were raised and the use of the Cabatangan site was ultimately approved during the meeting.

5.6 Septage Collection and Transport

5.6.1 Vacuum Truck Requirement

Before septage can be treated in the proposed SpTP, these must first be collected/desludged from individual septic tanks. This Study considers the transport of the septage through conventional vacuum truck units (VTUs).

A VTU refers to a tank-mounted truck with a heavy-duty vacuum and hose to load the sludge onto the tank. Hoses often have diameters ranging from 50 to 100 mm and lengths of 200 to 350 m.



Figure 26: Photograph of Vacuum Truck Unit (Baliwag Water District)

All vehicles and tanks used to transport septage should be in accordance with the requirements identified in the “Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage” (2008) by the DOH. This includes compliance with safety and roadworthiness standards of the Local Transportation Office (LTO).

Common available VTUs used by local desludging service providers in the Philippines have capacities of 3-, 5-, and 10-m³. The selection of truck capacities should be dependent on the septage volume to be transported, as well as the accessibility of roads in the Study Area.

For this Study, the mix of truck capacities and number of units needed was optimized to collect the target septage volume with the least cost. An optimization model was used to determine this optimal truck mix and the corresponding procurement schedule. Inputs to the optimization model include the vacuum truck capacities (3-, 5-, and 10-m³ VTUs were considered), target septage volume for each year of operation, average hauling distances, road accessibility, and corresponding costs.

Initially, this optimization resulted in a recommendation of the use of five 10-m³ VTUs for the initial operation. However, upon consultation with the ZCWD, it was suggested to substitute one of the 10-m³ VTUs with two 5-m³ VTUs, to accommodate road accessibility. The resulting procurement schedule is presented in **Table 62** and the average hauling distances used for the computation of the procurement schedule is presented in **Table 60** and illustrated in **Figure 27**.

Table 60: Estimated Average Hauling Distances and Road Widths

Barangay	One-way Distance (km)	Average Hauling Distance (km)	Road Width (m)	Surface
Arena Blanco	13.69	0.08	6-10	paved
Ayala	20.30	0.74	8-12	paved
Baliwasan	6.89	0.23	6-8	paved
Baluno	20.41	0.07	4-12	paved
Boalan	10.20	0.13	5-15	paved
Cabaluay	18.09	0.20	6-11	paved
Cabatangan	4.10	0.10	4-12	paved
Cacao	22.10	0.04	3-11	paved
Calarian	8.68	0.42	6-10	paved
Campo Islam	7.12	0.06	6-8	paved
Capisan	9.12	0.02	4-12	paved/unpaved
Cawit	17.01	0.11	5-10	paved
Divisoria	8.12	0.18	6-11	paved
Dulian (Upper Pasonanca)	8.36	0.01	4-10	paved
Guisao	17.19	0.03	4-11	paved
Guiwan	6.36	0.26	4-11	paved
La Paz	21.61	0.10	5-10	paved
Labuan	35.71	0.37	6-10	paved
Lamisahan	29.00	0.10	4-10	paved
Lanzones	18.07	0.05	3-11	paved
Licombo	86.80	0.26	4-11	paved
Lumayang	14.00	0.03	4-11	paved/unclassified
Lumbangan	9.82	0.05	6-11	paved
Lunzuran	7.74	0.12	6-11	paved
Maasin	15.41	0.11	4-10	paved
Malagutay	11.91	0.20	5-10	paved
Mampang	12.22	0.28	6-8	paved
Pamucutan	24.41	0.09	5-10	paved

Barangay	One-way Distance (km)	Average Hauling Distance (km)	Road Width (m)	Surface
Pasobolong	12.68	0.11	6-11	paved
Pasonanca	2.35	0.13	6-10	paved
Patalon	31.71	0.22	6-10	paved
Putik	6.57	0.28	4-11	paved
Recodo	18.01	0.29	6-10	paved
San Jose Gusu	6.21	0.17	6-10	paved
San Roque	5.51	0.31	6-10	paved
Sangali	29.00	0.56	6-11	paved
Sinunoc	12.68	0.43	5-10	paved
Santa Maria	2.75	0.16	6-10	paved
Talisayan	23.11	0.13	6-10	paved
Talon-Talon	9.75	0.54	6-8	paved
Tetuan	5.46	0.43	6-11	paved
Tictapul	80.80	0.23	4-11	paved/unclassified
Tolosa	26.80	0.08	3-11	paved
Tugbungan	8.33	0.28	6-8	paved
Tulungatung	18.71	0.25	5-10	paved
Tumaga	4.36	0.28	6-11	paved
Vitali	74.10	0.52	6-11	paved
Zambowood	10.68	0.15	6-11	paved
Bolong	33.10	0.07	6-11	paved
Buenavista	67.50	0.13	6-11	paved
Bunguiao	34.40	0.07	4-11	paved
Calabasa	52.30	0.03	4-11	paved
Culianan	14.01	0.04	6-11	paved
Curuan	47.40	0.15	6-11	paved
Dita	41.20	0.02	6-11	paved
Dulian (Upper Bunguiao)	40.90	0.03	4-11	paved
Lapakan	26.40	0.01	4-11	paved/unpaved
Latuan (Curuan)	52.80	0.04	6-11	paved
Limaong	86.30	0.10	4-11	paved
Limpapa	42.91	0.06	6-10	paved
Lubigan	39.00	0.03	6-11	paved
Mangusu	71.40	0.09	6-11	paved
Manicahan	22.60	0.06	6-11	paved
Mercedes	13.90	0.08	4-11	paved
Muti	56.40	0.04	6-11	paved
Panubigan	38.80	0.01	6-11	paved
Quiniput	45.80	0.05	6-11	paved
Salaan	15.41	0.01	4-11	paved
Sibulao (Caruan)	66.80	0.05	4-11	paved/unclassified

Barangay	One-way Distance (km)	Average Hauling Distance (km)	Road Width (m)	Surface
Sinubung	28.11	0.01	4-10	paved
Tagasilay	61.70	0.06	6-11	paved
Taguiti	67.70	0.02	4-11	paved/unpaved
Talabaan	16.00	0.02	4-11	paved
Taluksangay	17.30	0.02	4-11	paved
Tigbalabag	65.40	0.04	6-11	paved
Tumitus	88.20	0.06	4-11	paved
Victoria	25.20	0.02	6-11	paved

Note. Road widths were measured using Google Earth imagery.

5.6.2 Septage Collection Zones

The service area for the SMP was divided into septage collection areas (SCAs) to facilitate more efficient septage collection operations. These were determined based on the proximity of the barangays to each other and the total septage that may be collected. The recommended operation of septage collection is collection within one SCA per year, potentially focusing the VTU's trips for more efficient collection. The proposed SCAs are **Table 61** and illustrated in **Figure 28**.

Table 61: Proposed Septage Collection Areas

Zone	Scheduled Barangays
Zone 1	Limpapa, Labuan, Patalon, Sinubung, Talisayan, Pamucutan, Ayala, La Paz, Recodo, Cawit, Tulungatung, Baluno, Maasin, Sinunoc, Malagutay, Calarian, Campo Islam, Baliwasan, San Jose Gusu*
Zone 2	San Jose Gusu*, San Roque, Capisan, Santa Maria, Cabatangan, Dulian (Upper Pasonanca), Pasonanca, Tumaga*
Zone 3	Tumaga*, Tetuan, Talon-talon, Mampang, Arena Blanco, Tugbungan, Guiwan
Zone 4	Putik, Lunzuran, Divisoria, Lumbangan, Lumayang, Boalan, Zambowood, Mercedes, Talabaan, Taluksangay, Pasobolong, Culianan, Salaan, Lanzones, Tolosa, Guisao, Cacao, Cabaluay, Lapakan, Manicahan, Victoria, Lamisahan, Sangali, Bolong, Panubigan, Lubigan, Dita, Bunguiao, Dulian (Upper Bunguiao), Quiniput, Curuan, Buenavista, Latuan (Curuan), Calabasa, Muti, Tagasilay, Taguiti, Tigbalabag, Mangusu, Sibulao (Caruan), Vitali, Limaong, Tumitus, Tictapul, Licombo

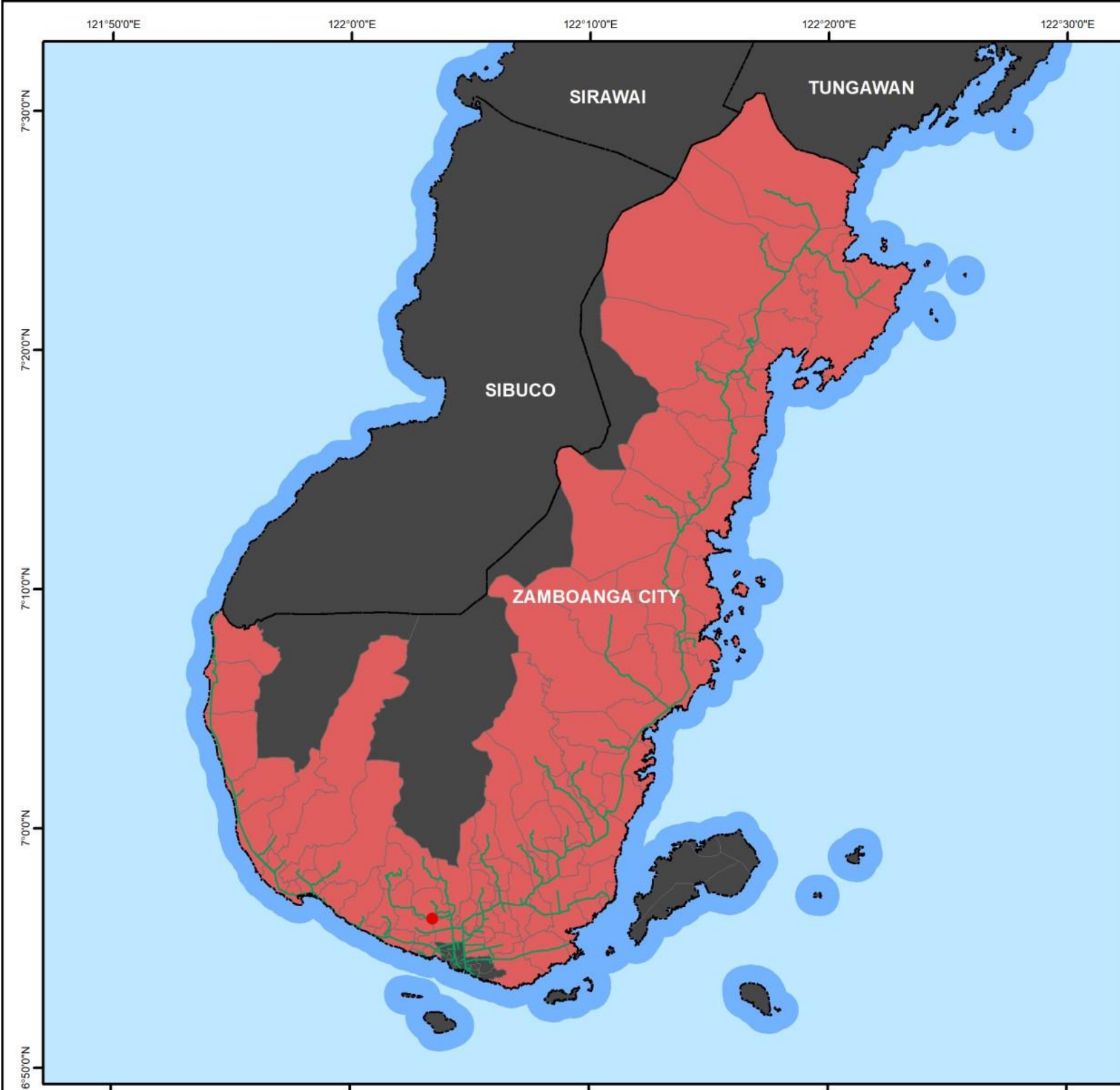
Note. *Barangays served within two zones.

Table 62: Proposed Truck Procurement Schedule

Year		Target Septage Vol. (m ³ /yr)	Truck Procurement			Total Current Fleet			Total Round-Trips per year			Total Volume Allocation per Year (m ³ /year)			
			10 m ³ VTU	5 m ³ VTU	3 m ³ VTU	10 m ³ VTU	5 m ³ VTU	3 m ³ VTU	10 m ³ VTU	5 m ³ VTU	3 m ³ VTU	10 m ³ VTU	5 m ³ VTU	3 m ³ VTU	Total
1	2025	32,204	4	2		4	2		3,055	474	0	29,933	2,271	0	32,204
2	2026	33,551				4	2		3,055	754	0	29,933	3,618	0	33,551
3	2027	35,136				4	2		3,055	1,084	0	29,933	5,203	0	35,136
4	2028	36,555				4	2		3,055	1,380	0	29,933	6,622	0	36,555
5	2029	38,241	1			5	2		3,818	172	0	37,416	825	0	38,241
6	2030	40,733				5	2		3,818	691	0	37,416	3,317	0	40,733
7	2031	42,184				5	2		3,818	994	0	37,416	4,768	0	42,184
8	2032	43,965				5	2		3,818	1,365	0	37,416	6,549	0	43,965
9	2033	45,672				5	2		3,818	1,720	0	37,416	8,256	0	45,672
10	2034	47,714	1			6	2		4,582	587	0	44,900	2,814	0	47,714
11	2035	49,439	4	2		6	2		4,582	946	0	44,900	4,539	0	49,439
12	2036	51,404				6	2		4,582	1,356	0	44,900	6,504	0	51,404
13	2037	53,602			1	6	2	1	4,582	1,813	0	44,900	8,702	0	53,602
14	2038	56,035				6	2	1	4,582	1,960	597	44,900	9,406	1,729	56,035
15	2039	56,035	1			6	2	1	4,582	1,960	597	44,900	9,406	1,729	56,035
16	2040	60,191				7	2	1	5,346	1,627	0	52,383	7,808	0	60,191

Notes.

1. Truck procurement based on results of VTU Optimization Model (see **Appendix B**)
2. Truck replacement every 10 Years
3. Avg. number of trips per day based on results of VTU Optimization Model (see **Appendix B**)
4. Total volume allocation per year = Truck Capacity x Trips per Year



LOCATION MAP
ZAMBOANGA CITY

- LEGEND:
- Proposed SpTP Site Location
 - Hauling Distances
 - Barangay Boundaries
 - City/Municipal Boundary
 - SMP Served Barangays

1:400,000

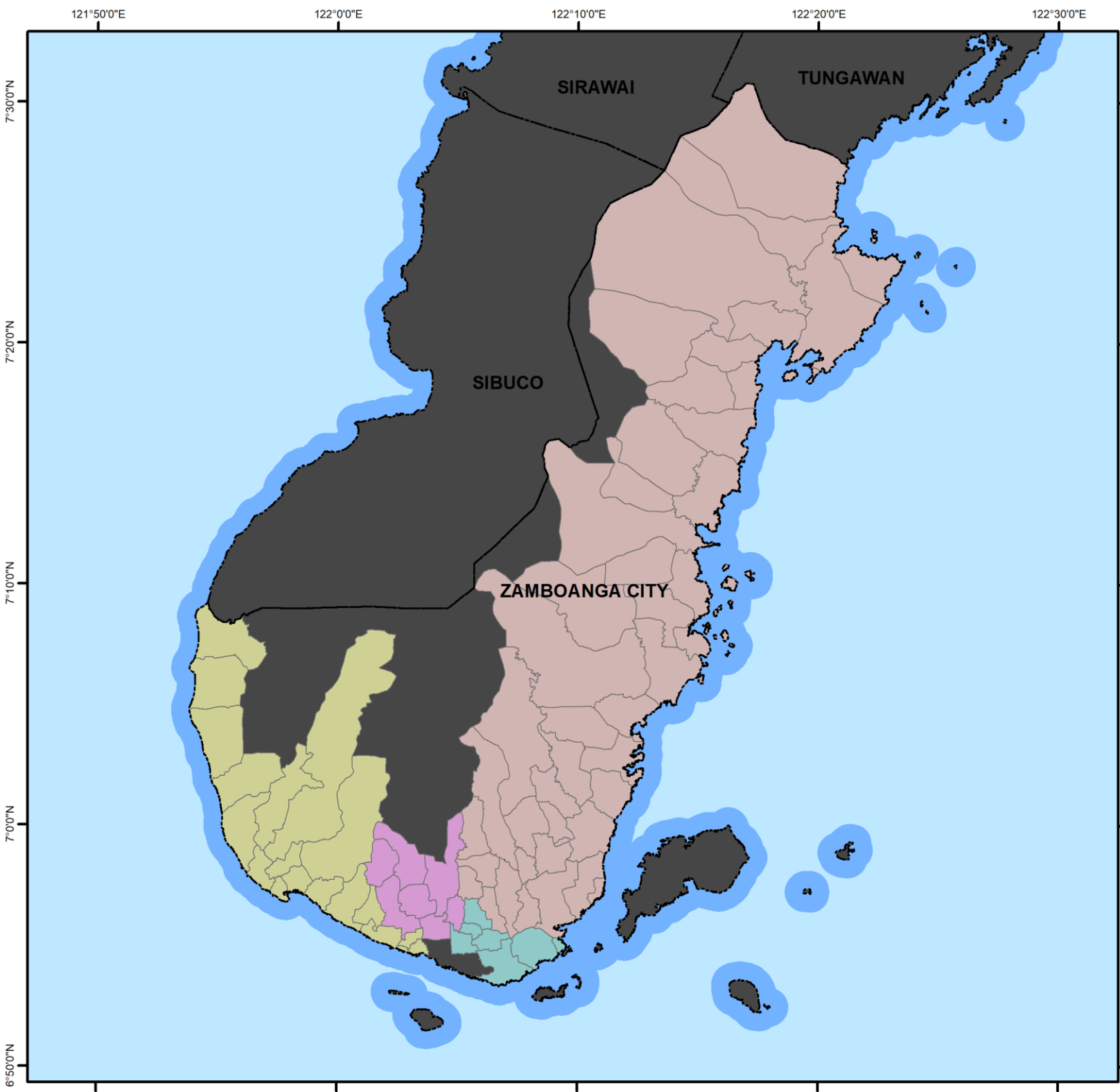
Datum: Philippine Reference System 1992
 Projection: Traverse Mercator
 Coordinate System: PRS 1992 Philippines Zone IV
 Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
 Proposed SpTP Site Location (ZCWD, 2021)

FIGURE 27

Zamboanga City
One-way Hauling Distances



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

- City/Municipal Boundary
- SMP SERVED BARANGAYS**
 - Zone 1
 - Zone 2
 - Zone 3
 - Zone 4



1:400,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)

FIGURE 28

Zamboanga City
Proposed Septage Collection Areas

5.7 Septage Treatment Process

Effluent Targets

The primary goal of the septage treatment plant is to ensure safe disposal or reuse of the treated wastewater. To ensure the safety of the environment and the population, numerous standards have been set to standardize effluent quality. As prescribed by the Philippine CWA, facilities discharging effluent must ensure that effluent water quality will not affect the usability of land nor impair the quality of groundwater sources (2008). Discharges to water bodies should meet the General Effluent Standards (GES) set by the DENR Administrative Order (DAO) No. 2016-08 and 2019-11. Monitoring of this effluent quality is primarily undertaken by the EMB and the DENR, to ensure compliance of commercial and industrial establishments with the GES.

For the proposed SMP, the SpTP was designed to conform with GES. Additional treatment for reuse purposes is further discussed in **Section 6** of this report. Based on EMB inventory of water bodies in Zamboanga City, the downstream portion of Tumaga River was identified to be the closest major water body to the proposed site in Cabatangan and is classified as Class C waters. The current water quality conditions for the Tumaga River are monitored by the EMB and were discussed in **Subsection 2.3.5**. The SpTP was thus designed to treat water up to conform to the effluent quality allowed for Class C water bodies. The design parameters are summarized in **Table 63**.

Table 63: Design Parameters

Parameters	Unit	Influent ¹	Effluent Target	Water Body Classification
BOD	mg/L	6,000	50.00	Class C
Ammonia-N	mg/L	700	4.00	Class C
Nitrate	mg/L	800	14.00	Class C
Phosphate-P	mg/L	250	4.00	Class C
Total Suspended Solids	mg/L	139	100.00	Class C

Note. Based on DAO 16-08 GES and DAO 21-19 Updated GES

(Water Quality Guidelines and General Effluent Standards of 2016)

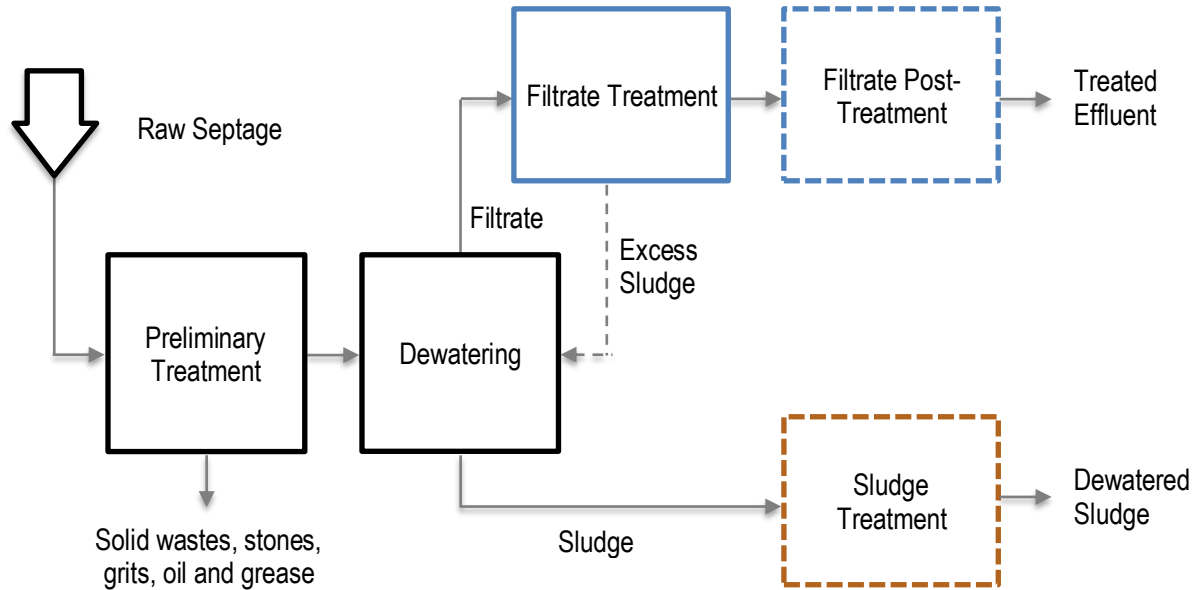
(Updated Water Quality Guidelines (WQG) and General Effluent Standards (GES) for Selected Parameters , 2021)

¹ Design values for influent parameters are adapted from the Metro Cebu Septage Management Feasibility Study (USAID-PWRF SP, 2008)

Treatment Process

Septage treatment typically follows a general process flow as shown in **Figure 29**. As shown in the figure, septage collected by the VTUs enter the treatment plant as raw septage and undergoes a number of treatment stages to remove contaminants before ultimately resulting to two sanitation by-products: treated effluent (referring to the liquid component) and biosolids.

Figure 29: General Process Flow Diagram



The septage treatment technology alternatives for each of the treatment stages are summarized in **Table 64**.

Table 64: Septage Treatment Technology Alternatives

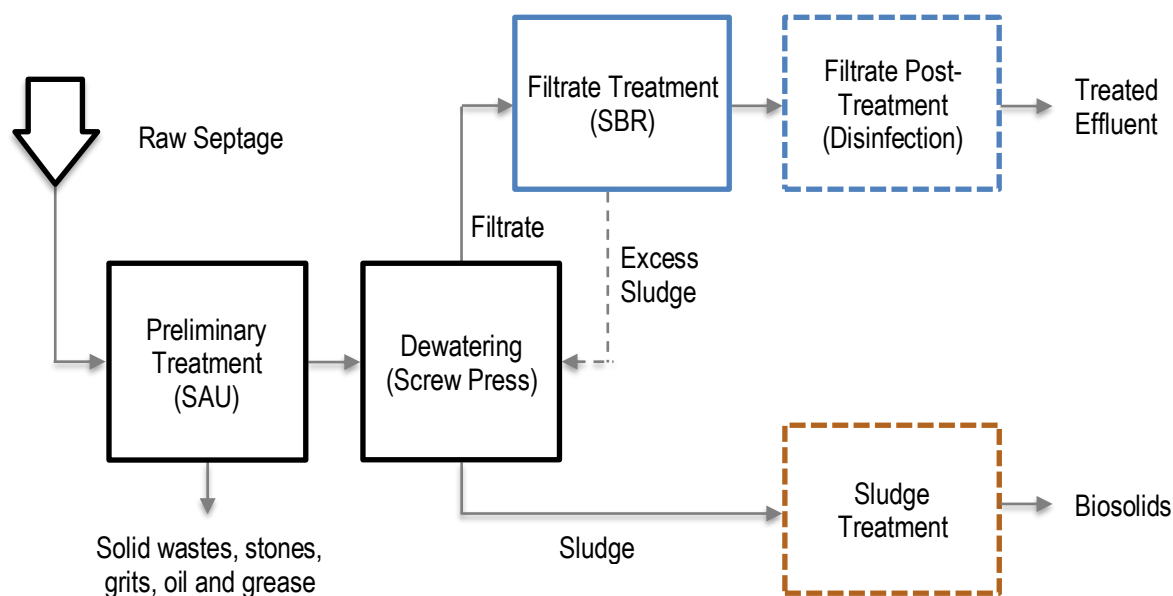
Treatment Stage	Description	Process Alternatives
Preliminary Treatment	Physical treatment to remove coarse materials that may damage or clog downstream processes (sand, grit, debris, etc.)	<ul style="list-style-type: none"> • Septage Acceptance Unit • Screening and Grit Removal • Grease trap or Skimming Tank
Dewatering	Separation of the septage into its liquid (filtrate) and solid (sludge) portions	<ul style="list-style-type: none"> • Belt Filter Press • Screw Press • Decanter Centrifuge • Filter Press
Filtrate Treatment	Chemical or biological treatment for the removal of dissolved and suspended organic contaminants. Bionutrients (nitrogen and phosphorus) may also be removed at this stage.	<ul style="list-style-type: none"> • Conventional Activated Sludge • Sequencing Batch Reactor • Moving Bed Bioreactor • Membrane Bio-reactors • Waste Stabilization Ponds
Filtrate Post-Treatment	Removal of other contaminants such as pathogens and dissolved inorganic matter	<ul style="list-style-type: none"> • UV Disinfection • Chlorination • Multi-media Filter • Constructed Wetlands
Sludge Treatment	Stabilization, thickening, and dewatering of sludge prior to disposal or reuse	<ul style="list-style-type: none"> • Thickening • Digestion • Conditioning
Biosolids Disposal	Disposal or reuse of sludge	<ul style="list-style-type: none"> • Landfill Cover • Soil Amendment

From **Table 64**, recommended treatment processes were chosen considering the needs and conditions of the Study Area. For Zamboanga City, as an HUC, land area is limited and may be expensive. Thus, processes with smaller footprints may be recommended. Overall, the use of a fully-mechanized system was identified as the recommended scheme. The summary of the treatment processes involved in this scheme is presented in **Table 65** and **Figure 30**. At each stage of treatment, the values for the design parameters converge to Class C GES.

Table 65: Recommended Septage Treatment Scheme

Treatment Level	Treatment Units and Processes
Preliminary Treatment	Septage Acceptance Unit (SAU)
Dewatering	Screw Press with Polymer Dosing
Filtrate Treatment	Sequencing Batch Reactor (SBR)
Filtrate Post-Treatment	Chlorination
Sludge Disposal	Landfill Cover or Soil Amendment

Figure 30: Fully-Mechanized System Process Flow Diagram



The components of the proposed scheme are further discussed below.

Septage Acceptance Unit

Preliminary treatment will utilize a Septage Acceptance Unit (SAU). This is a fully automated equipment designed to easily connect to the siphoning hose of VTUs to accept septage. SAUs are compact systems that combine mechanical operations such as screening, grit removal, and sometimes, fat, oil, and grease (FOG) removal into a single unit.

Septage Holding Tank

Prior to dewatering, septage from the SAU is first transferred to a septage holding tank to control the flow going into the dewatering unit. The tank is designed to have capacity capable of holding the load of at least one day of operation.

Screw Press

The screw press serves as the dewatering unit for the proposed scheme. This equipment extracts sludge through an inclined screw rotating inside a body made of steel. The sludge is mixed with flocculants as it enters the screw press.

Polymer may be added to the sludge during dewatering to increase the efficiency of solid and liquid separation. Polymer powder is mixed into water and pumped in specified doses into the screw press.

Thickener

To ensure that the filtrate is free from suspended solids, a thickener is considered. The thickening tank simply uses gravity to allow settling of excess solids to the bottom of the tank.

Equalization Tank

Equalization tanks are also added to the system to serve as temporary storage of the filtrate prior to entering the SBR. What is the tank capacity?

Sequencing Batch Reactor

The sequencing batch reactor (SBR) utilizes biological treatment to reduce the amount of organic matter in the filtrate. The SBR also has potential to remove nutrients such as phosphorus and nitrate. SBRs require little space and operates in a type of activated sludge system, treating the filtrate in batches undergoing five stages of treatment.

Flocculator

Filtrates from the SBR are transferred to the flocculator wherein the filtrate is mixed with flocculants and using rotating paddles allowing large masses of solids to form. The contents of the flocculator tank are then pumped for post-treatment.

Chlorination

Filtrate post-treatment considers chlorination to disinfect the treated effluent and kill pathogenic microorganisms. This is done in a disinfection tank where the effluent is stored for contact with the chlorine for a given time.

Disposal/Reuse

The treated effluent may be discharged into the nearest Class C water body (Tumaga River) or may be considered for reuse. More detailed discussions of potential reuse of effluent are

discussed in **Section 6**. Likewise, dewatered sludge from the screw press may also undergo additional treatment prior to its reuse or disposal as landfill cover or soil amendment.

The detailed process flow for this recommended scheme is presented in **Figure 31**.

5.8 Preliminary Designs

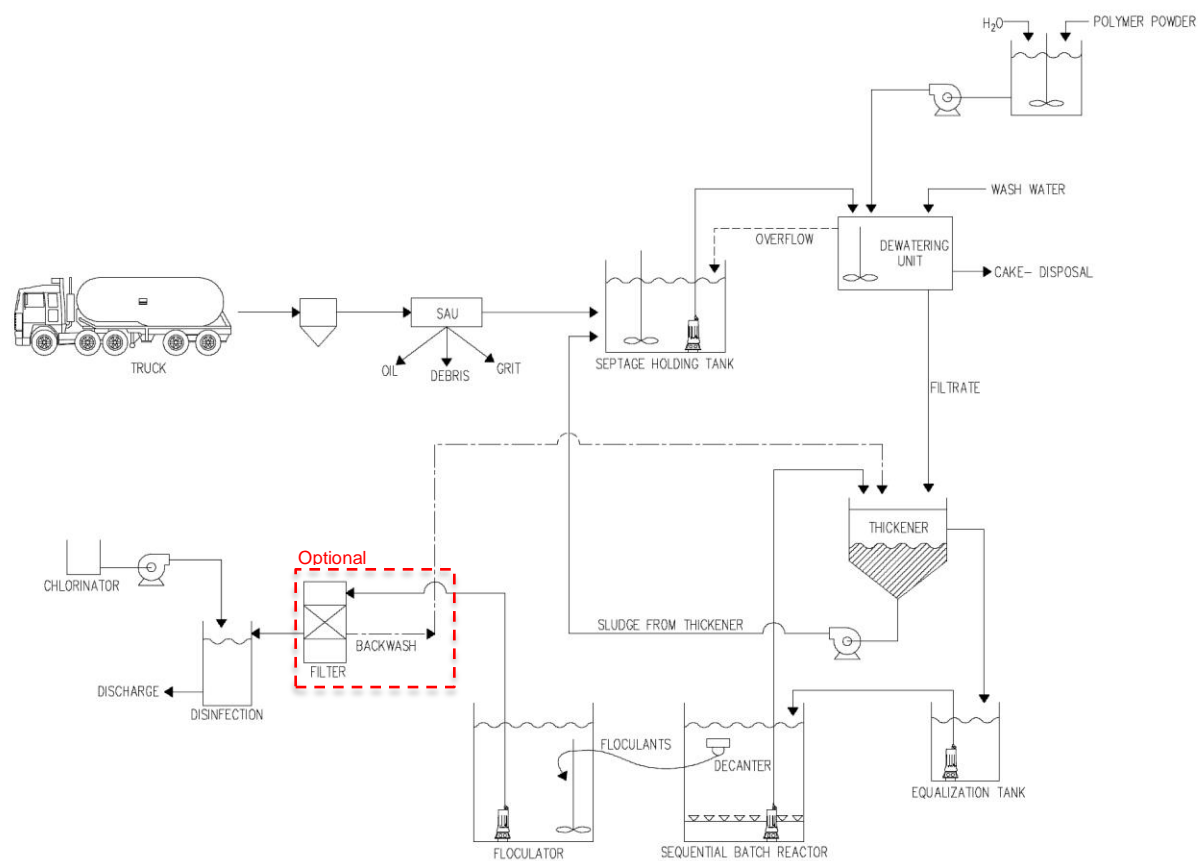
Based on the projected septage volumes for Service Area 1, phasing of the SpTP construction was considered. Phase 1, with a capacity of 190 m³/day, will be constructed in Year 2024 and will cover the 1st and 2nd desludging cycles covering Years 2025 to 2032. By Year 2032, Phase 1 is expected to reach max capacity and Phase 2 will begin construction and start operations by 2033. Phase 2 will cover the 3rd and 4th desludging cycles covering Years 2033 to 2040.

Following this and adapting the recommended scheme, the preliminary design was formulated and summarized in **Table 66**.

Table 66: Preliminary Design for Fully-Mechanized Septage Treatment Plant

SpTP Components	Unit	Qty.	
		Phase 1	Phase 2 (Additional)
A. Design Capacity	m ³ /day	190.00	70.00
B. Septage Acceptance Unit			
B.1 Capacity per Unit		40.00	-
B.2 No. of Units		2.00	-
B.3 Total Capacity	m ³ /hr	80.00	-
B.4 Average Operating Hours per Unit	hr	6.02	-
B.5 Septage Holding Tank			
B.5.1 No. of Tanks		2	1
B.5.2 Length	m	6.00	5.50
B.5.3 Width	m	4.60	3.70
B.5.4 Water Depth	m	3.50	3.50
B.5.5 Volumetric Capacity	m ³	193.20	71.20
C. Back-up Manually cleaned Bar Rack		1	-
D. Dewatering Unit (Screw Press)			
D.1 Total Design Inflow	m ³ /day	217.40	80.10
D.2 Plant Operating Hours	hr	8.10	6.30
D.3 Unit Capacity	m ³ /hr	30.80	15.40
D.4 No. of Dewatering Units		2	1
D.5 Average Operating Hours per Unit	hr	7.10	5.30
D.6 Dewatered Sludge Production at 20% DS	m ³ /day	4.40	1.70
E. Filtrate Treatment (Sequencing Batch Reactor)			
E.1 Total Design Inflow: septage, polymers and washwater	m ³ /day	196.90	73.20
E.2 Design Parameters (Basic)			
E.2.1 BOD	mg/L	1,000.00	1,000.00
E.2.2 Ammonia-N	mg/L	100.00	100.00

SpTP Components	Unit	Qty.	
		Phase 1	Phase 2 (Additional)
E.2.3 Nitrate	mg/L	40.00	40.00
E.2.4 Phosphate-P	mg/L	15.00	15.00
E.2.5 Total Suspended Solids	mg/L	139.00	139.00
E.3 Thickener			
E.3.1 No. of Tanks		1	1
E.3.2 Length	m	8.00	6.00
E.3.3 Width	m	4.80	3.10
E.3.4 Water Depth	m	3.50	4.50
E.3.5 Peak Overflow Rate	m ³ /m ² -hr	1.00	1.00
E.4 Equalization Tank			
E.4.1 No. of Tanks		1	1
E.4.2 Length	m	6.90	3.00
E.4.3 Width	m	4.80	3.10
E.4.4 Water Depth	m	3.00	4.00
E.4.5 Volumetric Capacity	m ³	99.40	37.20
E.5 Sequencing Batch Reactor			
E.5.1 No. of Tanks		1	1
E.5.2 Length	m	15.20	9.30
E.5.3 Width	m	8.70	4.70
E.5.4 Water Depth	m	4.00	4.50
E.5.5 Hydraulic Retention Time, hr	hr	64.00	65.00
E.5.6 F/M Ratio	kg-BOD/kg-MLVSS-day	0.15	0.15
E.6 Treated Water Holding Tank			
E.6.1 No. of Tanks		1	1
E.6.2 Length	m	5.00	2.00
E.6.3 Width	m	4.00	3.00
E.6.4 Water Depth	m	2.00	2.50
E.6.5 Hydraulic Retention Time	hr	0.41	0.41
E.7 Disinfection Tank			
E.7.1 No. of Tanks		1	1
E.7.2 Length	m	9.90	7.00
E.7.3 Width	m	4.00	3.00
E.7.4 Water Depth	m	1.30	0.90
E.7.5 Hydraulic Retention Time	hr	0.52	0.52




MECHANIZED SYSTEM PROCESS FLOW DIAGRAM
 SCALE NTS

FIGURE 31

Mechanized System Process Flow Diagram

Electricity Requirement

Considering this configuration, the electricity requirement for the operation of treatment equipment is computed and tabulated in **Table 67**. This electricity requirement served as basis for the power costs for the operations and maintenance of the SpTP.

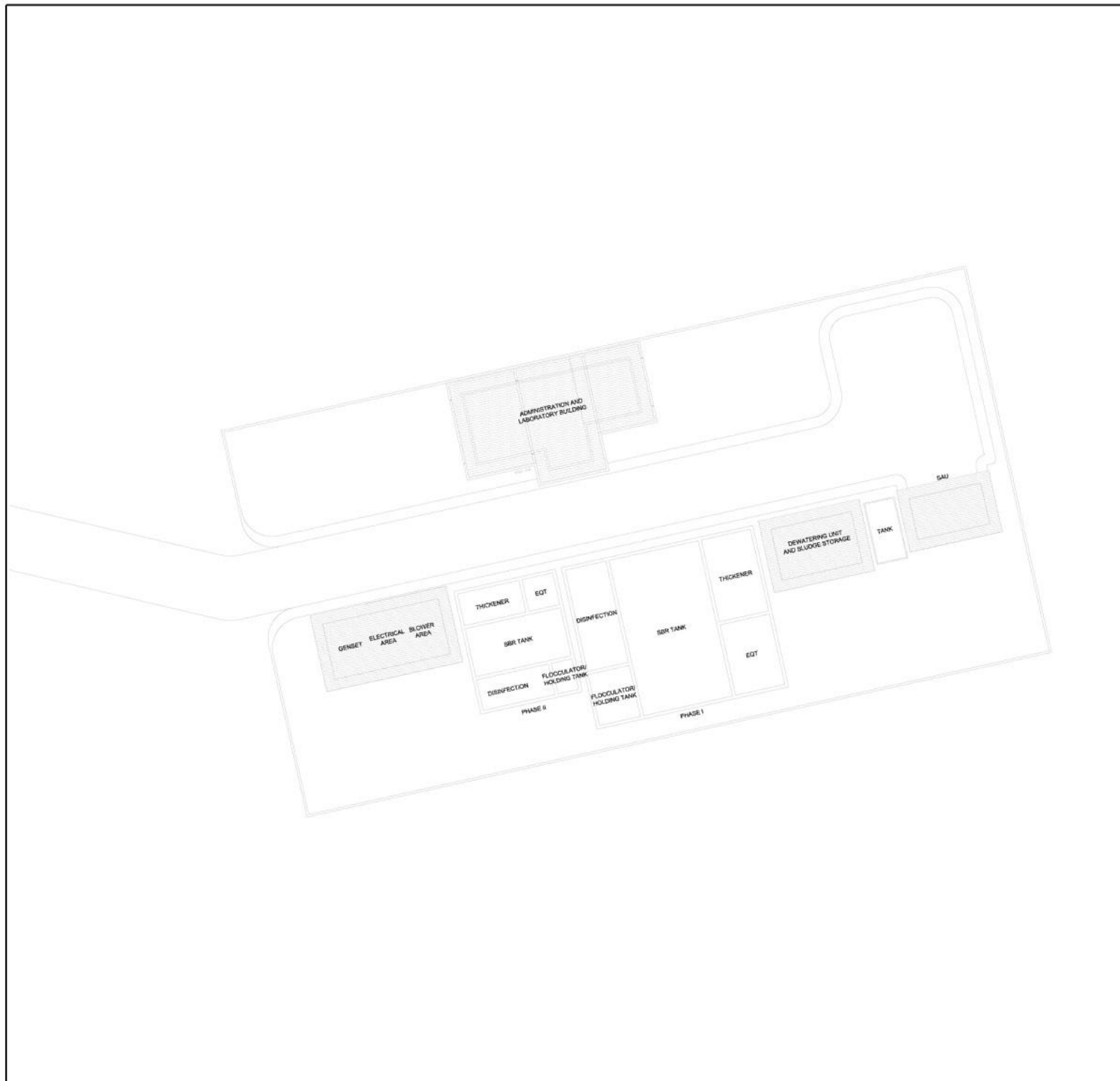
Table 67: Electricity Requirement

Item No.	Equipment	Duty	Motor Power (kW)	Load Factor	Operating Hours per day	Electricity Requirement (kWh)
1	Septage Acceptance Unit	2	3.05	0.70	6.02	25.72
2	Sludge Mixer	2	1.50	0.50	7.56	11.34
3	Sludge Feed Pump	2	2.20	0.80	7.06	24.86
4	Dewatering Unit	2	6.00	0.80	8.06	77.40
5	Polymer Tank, with Mixer	1	0.75	0.50	7.23	2.71
6	Polymer Dosing Pump	1	1.50	0.50	7.06	5.30
7	Sludge Conveyor (Option)	1	1.50	0.50	7.06	5.30
8	Sludge Transfer Pump	1	0.40	0.80	4.00	1.28
9	SBR Feed Pump	1	2.20	0.80	6.00	10.56
10	SBR Blower	1	11.00	0.80	9.00	79.20
11	Decanter	1	2.20	0.60	2.00	2.64
12	WAS Pump	1	0.75	0.80	0.75	0.45
13	Chemical Pumps	4	0.10	1.00	2.00	0.80
14	Reuse Water Facility	1	0.55	1.00	2.00	1.10
Total Electricity Requirement per day						248.66

Electricity requirements are expected to be sourced from ZAMCELCO with a substation located within Barangay Cabatangan and serving the area of the proposed site. A generator set is also included in the bill of quantities (BOQ) as a back-up source in case of outages.

Site Plan and Facility layout

The proposed site plan is shown in **Figure 32**. This covers a land area of 1,500 m² and shows two proposed phasing of construction for the filtrate treatment tanks.



VICINITY MAP
BRGY. CABATANGAN,
ZAMBOANGA CITY



Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

DATA SOURCES
Proposed SpTP Site Area (ZCWD, 2021)

FIGURE 32
Zamboanga City
Proposed SpTP Site Plan

5.9 Cost Estimates

The capital and operating costs presented in this subsection are all expressed in year 2021 constant prices, based on the following general assumptions:

- Unit costs were derived for general works and installations.
- Material and in-place costs, where applicable, were based on the Construction Materials Price Data CY 2021 of the Department of Public Works and Highways.
- Vacuum truck units (VTUs) are replaced every 10 years and corresponding truck replacement costs are adopted.
- The SpTP's major electro-mechanical equipment are replaced on the 15th year to warrant that the plant will be functional up to the economic lifespan of the facility (i.e., 30 to 35 years to account for the civil work structures); amounting to about Php 43,190,025.
- The cost of the land, priced at Php4.2 million according to the ZCWD, was included to present the total cost of the SpTP; the proposed land is owned by the ZCWD, no additional tariff impact can be realized should ZCWD decides to remove cost recovery of the land through the project (as long as ownership is retained by ZCWD).

The adjusted costs (escalated) are presented in **Section 9: Financial Analysis** of this report.

5.9.1 Capital Cost

The total capital cost for the construction of the SpTP for Phase 1, with a capacity of 190 m³/day is estimated to be at Php107.5 million. For Phase 2, additional tanks will be constructed with their accompanying pumps to increase the capacity of the treatment plant to 260 m³/day. Estimated additional capital cost for Phase 2 is about Php29.8 million. The BOQs for both phases are shown in **Table 69**. These costs also include the safety and environmental impact mitigating measures (See **Section 8.6.2**) in the process of construction.

In addition to the construction of the SpTP, procurement of VTUs is also included as a capital cost of the project and is scheduled in accordance with the optimal schedule shown in **Table 62**. The schedule of all these capital costs for the SMP is summarized in **Table 68**.

Table 68: Annual Capital Cost for the Septage Management Program (in Php)

Year			Septage Treatment Plant	Vacuum Truck Units	Total
Construction	Yr. 0	2024	111,662,669*		111,662,669
1 st Desludging Cycle	Yr. 1	2025		44,544,620	44,544,620
	Yr. 2	2026			
	Yr. 3	2027			
	Yr. 4	2028			
2nd Desludging Cycle	Yr. 5	2029		8,030,880	8,030,880
	Yr. 6	2030			
	Yr. 7	2031			
	Yr. 8	2032	29,770,478		29,770,478

Year			Septage Treatment Plant	Vacuum Truck Units	Total
3rd Desludging Cycle	Yr. 9	2033			
	Yr. 10	2034		8,030,880	8,030,880
	Yr. 11	2035		44,544,620	44,544,620
	Yr. 12	2036			
4th Desludging Cycle	Yr. 13	2037		5,657,310	5,657,310
	Yr. 14	2038			
	Yr. 15	2039		8,030,880	8,030,880
	Yr. 16	2040			

Note: * Cost of land is included as part of total project cost and will be subtracted from the equity required by the creditor

5.9.2 Operating Costs

The operating cost of the reuse facility includes the manpower, chemical cost for disinfection, packing of the compost and the delivery of the compost product to the intended users, as shown in **Table 70** and **Table 71**.

Table 69: Estimated Capital Cost for the Septage Treatment Plant (in PhP)

Item	Unit	Unit Price	Phase 1		Phase 2	
			Qty.	Total Cost	Qty.	Total Cost
A Engineering Cost Items						
1 Site Development Works						
1.1 Site Development	m ²	1,540	1,500	2,310,000		
1.2 Fence and Perimeter Fencing	lm	7,980	320	2,553,600		
1.3 Internal Road	lm	2,880	150	432,000		
Sub-Total for Item 1				5,295,600		
2 Septage Treatment Plant						
2.1 Septage Acceptance						
2.1.1 Septage Acceptance Unit (1.65 kW, 40 m3/hr)	unit	7,436,000	2	14,872,000		
2.1.2 Rock Trap (40 m3/hr)	set	577,200	2	1,154,400		
2.1.3 Garbage Bins (100 to 200L)	unit	7,500	3	22,500		
2.1.4 Manually cleaned basket screen (Back-up)	set	10,200	1	10,200		
2.2 Septage Holding Tank						
2.2.1 Excavation	m ³	100	226	22,632	83	8,344
2.2.2 Compaction and Backfill	m ³	510	45	23,085	17	8,510
2.2.3 Sludge Holding Tank (concrete)	m ³	10,000	107	1,073,520	43	429,820
2.2.4 Sludge Mixer	unit	665,990	2	1,331,980	1	665,990
2.2.5 Sludge Feed Pump Submersible (non-clog impeller)	set	304,860	2	609,720	2	609,720
2.3 Dewatering						
2.3.1 Dewatering Unit - Screw Multi-disk Press	unit	9,950,450	2	19,900,900	1	9,950,450
2.3.2 Polymer Tank	unit	177,510	1	177,510	1	177,510
2.3.3 Polymer Dosing Pump (positive displacement)	set	126,875	1	126,875	1	50,750
2.4 Thickener						
2.4.1 Excavation	m ³	100	136	13,579	47	4,743
2.4.1 Backfill and Compaction	m ³	510	27	13,851	9	4,838
2.4.3 Thickener Tank (concrete)	m ³	10,000	62	619,020	28	279,660

Item	Unit	Unit Price	Phase 1		Phase 2	
			Qty.	Total Cost	Qty.	Total Cost
2.4.4 Sludge Transfer Pump Submersible (Non-clog impeller)	set	81,030	1	81,030	1	81,030
2.5. Equalization						
2.5.1 Excavation	m ³	100	119	11,923	43	4,278
2.5.2 Backfill and Compaction	m ³	510	24	12,162	9	4,364
2.5.2 Thickener Tank (concrete)	m ³	10,000	58	583,920	26	261,360
2.5.3 SBR Feed Pump Submersible (Non-clog impeller)	set	304,860	1	304,860	1	304,860
2.6 Sequencing Batch Reactor (SBR)						
2.6.1 Excavation	m ³	100	608	60,830	223	22,292
2.6.1 Backfill and Compaction	m ³	510	122	62,047	45	22,738
2.6.2 SBR Tank (concrete)	m ³	10,000	198	1,982,040	87	865,500
2.7.2 SBR Blower Roots Type	set	49,440	1	49,440	1	49,440
2.7.3 Fine Bubble Diffusers	unit	5,660	420	2,377,200	139	786,740
2.7.4 Decanter	unit	438,240	1	438,240	1	438,240
2.7.5 WAS Pump	set	44,820	1	44,820	1	44,820
2.7.6 Static Mixer	unit	16,220	1	16,220	1	16,220
2.7 Flocculator						
2.7.1 Excavation	m ³	100	52	5,200	19	1,860
2.7.1 Backfill and Compaction	m ³	510	10	5,304	4	1,897
2.7.3 Treated Water Holding Tank (concrete)	m ³	10,000	34	340,400	15	153,000
2.7.4 Paddle Type Flocculator (paddle type, top mounted motor)	set	329,030	1	329,030	1	329,030
2.8 Disinfection Tank						
2.8.1 Excavation	m ³	100	75	7,524	32	3,150
2.8.2 Backfill and Compaction	m ³	510	15	7,674	6	3,213
2.8.3 Disinfection Tank (concrete)	m ³	10,000	55	554,460	30	300,000
2.9 Chemical Tanks Area						
2.9.1 Chemical Pumps & Tanks (diaphragm type, 100L PE tanks, 100 mL/min pumps)	set	29,200	4	116,800	2	58,400
2.10 Temporary Sludge Cake Storage Tank	m ³	10,000	9	85,000	9	85,000

Item	Unit	Unit Price	Phase 1		Phase 2	
			Qty.	Total Cost	Qty.	Total Cost
2.11 Generator Set	set	1,226,300	1	1,226,300	0	0
2.12 Process Piping and Accessories (20% EM)	LS	3,455,000	1	3,455,000	1	1,085,000
2.13 Electro-mechanical works (40% EM equipment)	LS	17,276,000	1	17,276,000	1	5,425,000
2.14 Instrumentation works (20% EM)	LS	3,455,000	1	3,455,000	1	1,085,000
Sub-Total for Item 2				72,860,196		23,622,767
3 Buildings and Others						
3.1 Administration and Laboratory Building	m ²	35,000	120	4,200,000	0	0
3.2 Building for Septage Acceptance	m ²	30,000	40	1,200,000	0	0
3.3 Building for Dewatering	m ²	30,000	100	3,000,000	0	0
3.4 Building for Filter Area, Blower Area, Electrical Room, Genset	m ²	30,000	70	2,100,000	0	0
3.5 Reuse Water Tank w/ Chlorinator	Unit	30,000	1	30,000	0	0
3.6 Office and Laboratory Equipment	LS	500,000	1	500,000	0	0
3.7 Utility Vehicle	Unit	1,500,000	1	1,500,000	1	1,500,000
Sub-Total for Item 3				12,530,000		1,500,000
A Sub-Total Project Cost				90,685,796		25,122,767
						0
B Contingencies (5% of A)				4,534,290		1,256,138
C Engineering Charges (6% of A+B)				5,713,205		1,582,734
D Construction Supervision (4% of A+B)				3,808,803		1,055,156
E Permits and Licenses (3% of A)				2,720,574		753,683
TOTAL SEPTAGE TREATMENT PLANT (Mechanized)				107,462,669		29,770,478

Table 70: Estimated Operating Cost of the Septage Management Program (1st and 2nd Cycle, in PhP)

Item	1 st Desludging Cycle				2 nd Desludging Cycle			
	Yr. 1 2025	Yr. 2 2026	Yr. 3 2027	Yr. 4 2028	Yr. 5 2029	Yr. 6 2030	Yr. 7 2031	Yr. 8 2032
B Operations and Maintenance Cost (O&M)								
B.1 Septage Treatment, Disposal, and Administration								
B.1.1 Personnel								
<u>Wastewater Management</u>								
i. Wastewater Management Officer	627,435	627,435	627,435	627,435	627,435	627,435	627,435	627,435
ii. Accounting Processor	354,163	354,163	354,163	354,163	354,163	354,163	354,163	354,163
<u>Operations</u>								
i. Wastewater Supervising Engineer	428,537	428,537	428,537	428,537	428,537	428,537	428,537	428,537
ii. Treatment Plant Operator	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
iii. Treatment Plant Operator	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
iv. Treatment Plant Operator	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
v. Senior Maintenance Technician	296,958	296,958	296,958	296,958	296,958	296,958	296,958	296,958
vi. Maintenance Technician	229,238	229,238	229,238	229,238	229,238	229,238	229,238	229,238
Sub-Total Personnel Cost	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403
B.1.2 Office Operations								
<u>Office Supplies</u>	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
<u>Utilities (Electricity, Water, Comm.)</u>	225,600	225,600	225,600	225,600	225,600	225,600	225,600	225,600
<u>Vehicle (Reg, Insrnc., Mntnce., & Fuel)</u>	336,000	336,000	336,000	336,000	336,000	336,000	336,000	336,000
<u>Admin and Security</u>								
i. Janitor / Utility	181,590	181,590	181,590	181,590	181,590	181,590	181,590	181,590
ii. Security Guard	192,475	192,475	192,475	192,475	192,475	192,475	192,475	192,475
iii. Security Guard	192,475	192,475	192,475	192,475	192,475	192,475	192,475	192,475
Sub-Total Office Operations	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140
B.1.3 SpTP Operations								
<u>Operational Parameters</u>								
i. Septage Volume	32,204	33,551	35,136	36,555	38,241	40,733	42,184	43,965
ii. Bio-solids for Disposal	3,080	3,209	3,361	3,497	3,658	3,896	4,035	4,205

Item	1 st Desludging Cycle				2nd Desludging Cycle			
	Yr. 1 2025	Yr. 2 2026	Yr. 3 2027	Yr. 4 2028	Yr. 5 2029	Yr. 6 2030	Yr. 7 2031	Yr. 8 2032
<u>Power Costs</u>								
i. SAU	51,526	53,682	56,218	58,488	61,186	65,173	67,494	70,344
ii. Septage Holding Tank	74,069	77,167	80,813	84,077	87,954	93,686	97,023	101,120
iii. Dewatering (Screw Press)	157,800	164,400	172,166	179,120	187,381	199,592	206,702	215,429
iv. Polymer Tank	16,102	16,776	17,568	18,278	19,121	20,367	21,092	21,983
v. SBR	186,783	194,596	203,789	212,019	221,798	236,251	244,667	254,997
vi. Utilities and Misc. Equipment	19,322	20,131	21,082	21,933	22,945	24,440	25,310	26,379
<u>Chemical Costs</u>								
i. Polymer Dosing	1,172,226	1,221,256	1,278,950	1,330,602	1,391,972	1,482,681	1,535,498	1,600,326
ii. Chlorine	80,510	83,878	87,840	91,388	95,603	101,833	105,460	109,913
<u>Others</u>								
i. Maintenance and Spare Parts	674,000	674,000	674,000	674,000	674,000	674,000	674,000	674,000
ii. Water Quality Tests	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000
iii. Bio-Solids Disposal	1,540,191	1,604,613	1,680,417	1,748,283	1,828,917	1,948,100	2,017,496	2,102,674
iv. Discharge Permit Application	5,612	5,734	5,878	6,606	6,758	6,984	7,115	7,276
Sub-Total SpTP Operations	4,338,142	4,476,233	4,638,721	4,784,793	4,957,636	5,213,107	5,361,857	5,544,441
SUB-TOTAL SEPTAGE TREATMENT, DISPOSAL, & ADMIN. O&M	8,068,684	8,206,776	8,369,264	8,515,336	8,688,179	8,943,649	9,092,399	9,274,984
B.2 Desludging Operations								
<u>Number of Operational VTUs</u>								
10 m3 Capacity VTU	4	4	4	4	5	5	5	5
5 m3 Capacity VTU	2	2	2	2	2	2	2	2
3.0 m3 Capacity VTU	-	-	-	-	-	-	-	-
B.2.1 Personnel								
<u>Desludging Services Unit</u>								
i. Desludging Coordinator	296,958	296,958	296,958	296,958	296,958	296,958	296,958	296,958
ii. Desludging Coordinator	296,958	296,958	296,958	296,958	296,958	296,958	296,958	296,958
iii. Survey Aide	229,238	229,238	229,238	229,238	229,238	229,238	229,238	229,238
iv. Survey Aide	229,238	229,238	229,238	229,238	229,238	229,238	229,238	229,238
<u>Logistics Unit</u>	6	6	6	6	7	7	7	7
i. VTU Driver	1,224,145	1,224,145	1,224,145	1,224,145	1,428,169	1,428,169	1,428,169	1,428,169
ii. VTU Helper	1,025,340	1,025,340	1,025,340	1,025,340	1,196,229	1,196,229	1,196,229	1,196,229

Item	1 st Desludging Cycle				2nd Desludging Cycle			
	Yr. 1 2025	Yr. 2 2026	Yr. 3 2027	Yr. 4 2028	Yr. 5 2029	Yr. 6 2030	Yr. 7 2031	Yr. 8 2032
Sub-Total Personnel Cost	3,301,875	3,301,875	3,301,875	3,301,875	3,676,789	3,676,789	3,676,789	3,676,789
B.2.2 VTU Fuel								
<u>10 m³ Capacity VTU</u>								
i. Dist. Travelled	69,818	69,818	69,818	69,818	87,255	87,255	87,255	87,255
ii. Fuel Consumed (liters)	69,818	69,818	69,818	69,818	87,255	87,255	87,255	87,255
iii. Total Fuel Cost	3,770,172	3,770,172	3,770,172	3,770,172	4,711,770	4,711,770	4,711,770	4,711,770
<u>5 m³ Capacity VTU</u>								
i. Dist. Travelled	10,833	17,232	24,773	31,538	3,931	15,792	22,717	31,195
ii. Fuel Consumed (liters)	8,333	13,255	19,056	24,260	3,024	12,148	17,474	23,996
iii. Total Fuel Cost	449,982	715,770	1,029,024	1,310,040	163,296	655,992	943,596	1,295,784
<u>3.0 m³ Capacity VTU</u>								
i. Dist. Travelled	-	-	-	-	-	-	-	-
ii. Fuel Consumed (liters)	-	-	-	-	-	-	-	-
iii. Total Fuel Cost	-	-	-	-	-	-	-	-
Sub-Total VTU Fuel Cost	4,220,154	4,485,942	4,799,196	5,080,212	4,875,066	5,367,762	5,655,366	6,007,554
B.2.3 Insurance and Registration								
<u>10 m³ Capacity VTU</u>	716,000	624,000	624,000	716,000	895,000	895,000	895,000	895,000
<u>5 m³ Capacity VTU</u>	322,200	280,800	280,800	322,200	322,200	322,200	322,200	322,200
<u>3.0 m³ Capacity VTU</u>	-	-	-	-	-	-	-	-
Sub-Total Insurance and Reg.	1,038,200	904,800	904,800	1,038,200	1,217,200	1,217,200	1,217,200	1,217,200
B.2.5 VTU Maintenance								
<u>10 m³ Capacity VTU</u>								
i. Tires	160,000	160,000	160,000	160,000	200,000	200,000	200,000	200,000
ii. Spare Parts (hose & misc. parts)	1,872,000	1,872,000	1,872,000	1,872,000	2,340,000	2,340,000	2,340,000	2,340,000
iii. Preventive Maintenance	140,800	140,800	140,800	140,800	176,000	176,000	176,000	176,000
iv. Painting	256,000	256,000	256,000	256,000	320,000	320,000	320,000	320,000
Sub-Total 10 m³ VTU Mntnc. Cost	2,428,800	2,428,800	2,428,800	2,428,800	3,036,000	3,036,000	3,036,000	3,036,000
<u>5 m³ Capacity VTU</u>								
i. Tires	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000
ii. Spare Parts (hose & misc. parts)	696,000	696,000	696,000	696,000	696,000	696,000	696,000	696,000
iii. Preventive Maintenance	70,400	70,400	70,400	70,400	70,400	70,400	70,400	70,400

Item	1 st Desludging Cycle				2nd Desludging Cycle			
	Yr. 1 2025	Yr. 2 2026	Yr. 3 2027	Yr. 4 2028	Yr. 5 2029	Yr. 6 2030	Yr. 7 2031	Yr. 8 2032
iv. Painting	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200
Sub-Total 5 m³ VTU Mntnc. Cost	929,600	929,600	929,600	929,600	929,600	929,600	929,600	929,600
<u>3.0 m³ Capacity VTU</u>								
i. Tires	-	-	-	-	-	-	-	-
ii. Spare Parts (hose & misc. parts)	-	-	-	-	-	-	-	-
iii. Preventive Maintenance	-	-	-	-	-	-	-	-
iv. Painting	-	-	-	-	-	-	-	-
Sub-Total 3.0 m³ VTU Mntnc. Cost	-	-	-	-	-	-	-	-
Sub-Total VTU Maintenance Cost	3,358,400	3,358,400	3,358,400	3,358,400	3,965,600	3,965,600	3,965,600	3,965,600
SUB-TOTAL DESLUDGING OPERATIONS O&M	11,918,629	12,051,017	12,364,271	12,778,687	13,734,655	14,227,351	14,514,955	14,867,143
TOTAL O&M	19,987,313	20,257,793	20,733,535	21,294,023	22,422,833	23,171,000	23,607,354	24,142,127

Table 71: Estimated Operating Cost of the Septage Management Program (3rd and 4th Cycle, in PhP)

Item	3rd Desludging Cycle				4th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
B Operations and Maintenance Cost (O&M)								
B.1 Septage Treatment, Disposal, and Administration								
B.1.1 Personnel								
<u>Wastewater Management</u>								
i. Wastewater Management Officer	627,435	627,435	627,435	627,435	627,435	627,435	627,435	627,435
ii. Accounting Processor	354,163	354,163	354,163	354,163	354,163	354,163	354,163	354,163
<u>Operations</u>								
i. Wastewater Supervising Engineer	428,537	428,537	428,537	428,537	428,537	428,537	428,537	428,537
ii. Treatment Plant Operator	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024

Item	3rd Desludging Cycle				4th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
iii. Treatment Plant Operator	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
iv. Treatment Plant Operator	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
v. Senior Maintenance Technician	296,958	296,958	296,958	296,958	296,958	296,958	296,958	296,958
vi. Maintenance Technician	229,238	229,238	229,238	229,238	229,238	229,238	229,238	229,238
Sub-Total Personnel Cost	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403	2,548,403
B.1.2 Office Operations								
Office Supplies	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
Utilities (Electricity, Water, Comm.)	225,600	225,600	225,600	225,600	225,600	225,600	225,600	225,600
Vehicle (Reg. Insmc., Mntnce., & Fuel)	336,000	336,000	336,000	336,000	336,000	336,000	336,000	336,000
Admin and Security								
i. Janitor / Utility	181,590	181,590	181,590	181,590	181,590	181,590	181,590	181,590
ii. Security Guard	192,475	192,475	192,475	192,475	192,475	192,475	192,475	192,475
iii. Security Guard	192,475	192,475	192,475	192,475	192,475	192,475	192,475	192,475
Sub-Total Office Operations	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140	1,182,140
B.1.3 SpTP Operations								
Operational Parameters								
i. Septage Volume	45,672	47,714	49,439	51,404	53,602	56,035	56,035	60,191
ii. Bio-solids for Disposal	4,369	4,564	4,729	4,917	5,127	5,360	5,546	5,757
Power Costs								
i. SAU	73,075	76,342	79,102	82,246	85,763	89,656	89,656	96,306
ii. Septage Holding Tank	105,046	109,742	113,710	118,229	123,285	128,881	128,881	138,439
iii. Dewatering (Screw Press)	223,793	233,799	242,251	251,880	262,650	274,572	274,572	294,936
iv. Polymer Tank	22,836	23,857	24,720	25,702	26,801	28,018	28,018	30,096
v. SBR	264,898	276,741	286,746	298,143	310,892	325,003	325,003	349,108
vi. Utilities and Misc. Equipment	27,403	28,628	29,663	30,842	32,161	33,621	33,621	36,115
Chemical Costs								
i. Polymer Dosing	1,662,461	1,736,790	1,799,580	1,871,106	1,951,113	2,039,674	2,039,674	2,190,952
ii. Chlorine	114,180	119,285	123,598	128,510	134,005	140,088	140,088	150,478
Others								
i. Maintenance and Spare Parts	674,000	674,000	674,000	674,000	674,000	674,000	674,000	674,000

Item	3rd Desludging Cycle				4th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
ii. Water Quality Tests	360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000
iii. Bio-Solids Disposal	2,184,313	2,281,974	2,364,474	2,458,452	2,563,574	2,679,935	2,773,196	2,878,700
iv. Discharge Permit Application	7,430	7,615	7,771	7,949	8,147	8,368	8,349	5,443
Sub-Total SpTP Operations	5,719,435	5,928,773	6,105,615	6,307,059	6,532,391	6,781,815	6,875,058	7,204,573
SUB-TOTAL SEPTAGE TREATMENT, DISPOSAL, & ADMIN. O&M	9,449,978	9,659,316	9,836,158	10,037,602	10,262,934	10,512,358	10,605,600	10,935,116
B.2 Desludging Operations								
<u>Number of Operational VTUs</u>								
10 m3 Capacity VTU	5	6	6	6	6	6	6	7
5 m3 Capacity VTU	2	2	2	2	2	2	2	2
3.0 m3 Capacity VTU	-	-	-	-	1	1	1	1
B.2.1 Personnel								
<u>Desludging Services Unit</u>								
i. Desludging Coordinator	296,958	296,958	296,958	296,958	296,958	296,958	296,958	296,958
ii. Desludging Coordinator	296,958	296,958	296,958	296,958	296,958	296,958	296,958	296,958
iii. Survey Aide	229,238	229,238	229,238	229,238	229,238	229,238	229,238	229,238
iv. Survey Aide	229,238	229,238	229,238	229,238	229,238	229,238	229,238	229,238
<u>Logistics Unit</u>	7	8	8	8	9	9	9	10
i. VTU Driver	1,428,169	1,632,193	1,632,193	1,632,193	1,836,217	1,836,217	1,836,217	2,040,242
ii. VTU Helper	1,196,229	1,367,119	1,367,119	1,367,119	1,538,009	1,538,009	1,538,009	1,708,899
Sub-Total Personnel Cost	3,676,789	4,051,703	4,051,703	4,051,703	4,426,617	4,426,617	4,426,617	4,801,531
B.2.2 VTU Fuel								
<u>10 m³ Capacity VTU</u>								
i. Dist. Travelled	87,255	104,716	104,716	104,716	104,716	104,716	104,716	122,176
ii. Fuel Consumed (liters)	87,255	104,716	104,716	104,716	104,716	104,716	104,716	122,176
iii. Total Fuel Cost	4,711,770	5,654,664	5,654,664	5,654,664	5,654,664	5,654,664	5,654,664	6,597,504
<u>5 m³ Capacity VTU</u>								
i. Dist. Travelled	39,308	13,415	21,620	30,990	41,434	44,793	44,793	37,183
ii. Fuel Consumed (liters)	30,237	10,319	16,630	23,838	31,872	34,456	34,456	28,602
iii. Total Fuel Cost	1,632,798	557,226	898,020	1,287,252	1,721,088	1,860,624	1,860,624	1,544,508
<u>3.0 m³ Capacity VTU</u>								

Item	3rd Desludging Cycle				4th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
i. Dist. Travelled	-	-	-	-	-	13,644	13,644	-
ii. Fuel Consumed (liters)	-	-	-	-	-	9,096	9,096	-
iii. Total Fuel Cost	-	-	-	-	-	491,184	491,184	-
Sub-Total VTU Fuel Cost	6,344,568	6,211,890	6,552,684	6,941,916	7,375,752	8,006,472	8,006,472	8,142,012
B.2.3 Insurance and Registration								
<u>10 m³ Capacity VTU</u>	895,000	1,074,000	1,074,000	1,074,000	1,074,000	1,074,000	1,074,000	1,253,000
<u>5 m³ Capacity VTU</u>	322,200	322,200	322,200	322,200	322,200	322,200	322,200	322,200
<u>3.0 m³ Capacity VTU</u>	-	-	-	-	161,000	161,000	161,000	161,000
Sub-Total Insurance and Reg.	1,217,200	1,396,200	1,396,200	1,396,200	1,557,200	1,557,200	1,557,200	1,736,200
B.2.5 VTU Maintenance								
<u>10 m³ Capacity VTU</u>								
i. Tires	200,000	240,000	240,000	240,000	240,000	240,000	240,000	280,000
ii. Spare Parts (hose & misc. parts)	2,340,000	2,808,000	2,808,000	2,808,000	2,808,000	2,808,000	2,808,000	3,276,000
iii. Preventive Maintenance	176,000	211,200	211,200	211,200	211,200	211,200	211,200	246,400
iv. Painting	320,000	384,000	384,000	384,000	384,000	384,000	384,000	448,000
Sub-Total 10 m³ VTU Mntnc. Cost	3,036,000	3,643,200	3,643,200	3,643,200	3,643,200	3,643,200	3,643,200	4,250,400
<u>5 m³ Capacity VTU</u>								
i. Tires	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000
ii. Spare Parts (hose & misc. parts)	696,000	696,000	696,000	696,000	696,000	696,000	696,000	696,000
iii. Preventive Maintenance	70,400	70,400	70,400	70,400	70,400	70,400	70,400	70,400
iv. Painting	115,200	115,200	115,200	115,200	115,200	115,200	115,200	115,200
Sub-Total 5 m³ VTU Mntnc. Cost	929,600	929,600	929,600	929,600	929,600	929,600	929,600	929,600
<u>3.0 m³ Capacity VTU</u>								
i. Tires	-	-	-	-	16,000	16,000	16,000	16,000
ii. Spare Parts (hose & misc. parts)	-	-	-	-	348,000	348,000	348,000	348,000
iii. Preventive Maintenance	-	-	-	-	35,200	35,200	35,200	35,200
iv. Painting	-	-	-	-	57,600	57,600	57,600	57,600

Item	3rd Desludging Cycle				4th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
Sub-Total 3.0 m³ VTU Mntnc. Cost	-	-	-	-	456,800	456,800	456,800	456,800
Sub-Total VTU Maintenance Cost	3,965,600	4,572,800	4,572,800	4,572,800	5,029,600	5,029,600	5,029,600	5,636,800
SUB-TOTAL DESLUDGING OPERATIONS O&M	15,204,157	16,232,593	16,573,387	16,962,619	18,389,169	19,019,889	19,019,889	20,316,543
TOTAL O&M	24,654,135	25,891,909	26,409,545	27,000,221	28,652,103	29,532,247	29,625,489	31,251,659

5.10 Implementation Schedule

The proposed implementation schedule of the proposed SMP is shown in **Table 72**. This considers the need for further planning and design for the first two years of implementation, followed by construction of Phase 1 of the SpTP by Year 2024 and the subsequent turn-over of facilities as operations start in 2025. Phase 1 facilities are expected to reach max capacity by 2032, as Phase 2 is constructed. Phase 2 is expected to begin operations by Year 2033. Electro-mechanical components of the SpTP have life cycles of about 15 years. Therefore by 2039, these components should be replaced.

Table 72: Proposed Implementation Schedule

Activities	Pre-Implementation			1st Cycle				2nd Cycle				3rd Cycle				4th Cycle			
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Planning and Pre-Construction Phase																			
Feasibility Study																			
Detailed Engineering Design																			
Bidding Process																			
Construction and Delivery Phase																			
Construction of Phase 1 Facilities																			
Turn-Over and Process Proving																			
Construction of Phase 2 Facilities																			
Replacement of Electro-Mechanical Components																			
Operation and Maintenance Phase																			
Septage Collection, Treatment, and Disposal/Reuse Operations																			
Billing & Collection and Reporting																			

6 Development Options for Resource Recovery

Reuse of sanitation residuals should consider several factors such as generation rates, potential users, and the health and safety requirements. Once the supply is matched to potential demand, further handling, processing, and storage requirements may be identified.

Reuse potentials of the treated effluent may include agriculture (and aquaculture), recreational impoundments, industries and other non-potable uses. For biosolids, the primary reuse is for agriculture (such as soil conditioning), and soil cover or landfilling.

The reuse of treated sanitation residuals, if not properly managed, may pose environmental and health risks. The potential environmental impacts of reusing the treated effluent are similar to the impacts of direct disposal of the effluent to receiving water bodies. Thus, the primary requirement for the reuse of the SpTP effluent is to meet the GES before other reuse potentials will be considered. The need for further treatment or processing will be determined by the required water quality of the user.

On the other hand, the reuse of biosolids for agriculture may also contaminate groundwater and surface water by infiltration and surface run-off. With this, further processing will be required to use the biosolids as soil conditioner or fertilizer.

Risks on public health associated in the reuse of treated sanitation residuals includes the potential exposure of the public (e.g., workers, consumers of products, community) to the pathogens. The main potential routes of transmission of the pathogens, in the context of reuse, include ingestion or consumption of contaminated water or foods from vectors via hand-to-mouth contact, or by inhalation from breathing in a mist or aerosolized water containing suspended pathogens.

With this, the reuse of the treated sanitation residuals must conform to the health-based standards. These standards are primarily directed in reducing or eliminating the concentrations of the pathogenic microorganisms. Health protection measures must also be implemented to limit the public exposure to these residuals.

This section discusses the potential reuse of the treated effluent and dewatered sludge of the septage treatment plant. The handling, processing and storage requirements of the sanitation residuals for reuse were identified based on the generation rates, potential users identified, and the health and safety requirements. The quality of the sanitation residuals for reuse depends on the requirement of the proposed user.

6.1 Characteristics and Generation Rates of Sanitation Residuals

6.1.1 Generation Rates of Sanitation Residuals

From the screw press, the filtrate and biosolids of the collected raw septage are separated. The raw septage typically contains two percent of solids while the dewatered sludge from the screw press may contain 20 to 25 percent solids. Based on the mass balance equation for dry solids, it is estimated that the daily volume of biosolids generated from the SpTP is about ten percent of the raw septage volume while the remaining 90 percent is the treated effluent.

The estimated volume of treated effluent and sludge that can be reused is shown in **Table 73**.

Table 73: Generation Rates of Sanitation Residuals

Year	Septage Volume (m ³ /day)	Potential volume of effluent for reuse (m ³ /day)	Dewatered sludge from screw press (m ³ /day)
2025	140	126	14
2026	146	131	14
2027	153	137	15
2028	159	143	16
2029	166	150	16
2030	177	159	17
2031	183	165	18
2032	191	172	19
2033	199	179	19
2034	207	187	20
2035	215	193	21
2036	223	201	22
2037	233	210	23
2038	244	219	24
2039	252	227	25
2040	262	236	26

6.1.2 Quality of Sanitation Residuals

Treated Effluent

The treated effluent from the SpTP is expected to comply to DENR GES for Class C, as shown in **Table 74**. This will be used as the design criteria for the effluent reuse facility.

Table 74: Expected Quality of Treated Effluent from SpTP

Parameter	Unit	GES, Class C
BOD	mg/L	50
Fecal Coliform	MPN/100 mL	400
Ammonia	mg/L	4
Nitrate	mg/L	14
Phosphate	mg/L	4
Oil and Grease	mg/L	5
Surfactants	mg/L	15

Source: DENR AO 2016-09, DENR AO No. 2021-19

Dewatered Sludge

The quality of the dewatered sludge from screw press was based on available data from the Baliwag Water District's SpTP shown on **Table 17**.

Table 75: Assumed Quality of Dewatered Sludge from SpTP

Properties	Unit	Dewatered Sludge from Screw Press
Total N-P ₂ O ₅ -K ₂ O	%	31.93
C:N	-	84:1
Organic Matter	%	83.5
Actual Moisture Content	%	72.28
Color	-	Black
Consistency	-	Slimy
Odor	-	Foul odor
Arsenic (As)	mg/L	0.002
Lead (Pb)	mg/L	0.21
Chromium (Cr)	mg/L	0.006
Mercury (Hg)	mg/L	0.0001
Cadmium (Cd)	mg/L	<0.002
Total coliforms*	CFU/g	<10
Helminths**	ova/gram	5

Source: Baliwag Water District (2017)

6.2 Potential Use of Sanitation Residuals

6.2.1 Potential Use of Treated Effluent

The survey and consultations conducted (see **Annex 3**) with the potential users of the treated effluent revealed that the treated effluent of the SpTP can be reused for irrigation, landscaping, cleaning of equipment/markets/roads and for firefighting in the city. However, only the **reuse of the treated effluent for irrigation** was considered in this study.

During the consultation meeting (see **Annex 4**) with the ABC and the barangay officials of Barangay Cabatangan, it was suggested that the treated effluent from the SpTP be discharged to the nearby National Irrigation Administration (NIA) canal for the farmers to reuse in irrigating their agricultural land.

6.2.2 Potential Reuse of Sludge

Based on the online survey conducted with the officials of Zamboanga City and other stakeholders, the sludge from the SpTP may be used as: (a) earth fill for daily covering of the sanitary landfill or for (b) land application as organic soil amendment for agricultural purposes. Moreover, survey results show that the OCENR, NIA, and Zamboanga State College of Marine Sciences & Technology (ZSCMST) are willing to use the biosolids for agricultural purposes. Out of those willing to use the biosolids for agricultural purposes, only the OCENR and ZSCMST are willing to pay for the product. The raw survey results are presented in **Annex 3**.

Both options are widely practiced in other countries. In the United States, statistics show that 60 percent of biosolids produced are applied on land while the remaining 40 percent are either

disposed in landfills or incinerated. In the European Union, approximately 45 percent of biosolids are applied on land and 18 percent is disposed in landfill.

Sludge as Earth Fill

Using the biosolids as earth fill is a feasible option for Zamboanga City given that they are operating a sanitary landfill that requires daily covering. After final treatment at the SpTP, the biosolids may be dried for easier handling. After drying, the biosolids may be brought to the sanitary landfill in Barangay Salaan to be used as landfill cover. This manner of using the treated biosolids is beneficial to the environment since less soil will be used as cover. According to the OCENR, the estimated soil requirement for daily covering of the sanitary landfill is about 20 m³. The sanitary landfill can accommodate the biosolids from the SpTP given that the projected output is 5.6 m³/day in 2025 and may reach up to 10.5 m³/day in 2040 (assuming 50 percent moisture content of the sludge).

As stipulated in Rule XIV, Section 1 of RA 9003 or the Ecological Solid Waste Management Act of 2000, "Cover shall consist of a daily soil cover at least 6 inches in thickness applied at the end of each workday. Alternative Daily Cover (ADC) may be used provided that the owner/operator can demonstrate to the Department in writing the equivalency of the proposed ADC in controlling infiltration, vector, odor, and litter based on technical research or studies." According to the EPA, biosolids can be used as landfill cover as long as it is dewatered.

Biosolids as Compost / Organic Soil Amendment

Operators of the proposed SpTP may also coordinate with the City LGU in case they opt to process the biosolids to produce organic soil amendments. According to their solid waste management plan, Zamboanga City recognizes the value of composting biodegradable waste. Because of this, they have already established a number of composting facilities in the city. In fact, all MRFs in the city have 2-tonner rotary stainless-steel composter drums with accessories including bioreactors. The MRFs produce sun-dried compost that are packaged for marketing. For the purpose of this study, composting methods will be discussed in case ZCWD would like to explore the possibility of producing their own organic soil amendment.

The benefits of using compost are soil enhancement, plant growth, and pollution prevention. Compost can enhance soil because it aerates the soil and improves the water-holding capacity, which is beneficial especially in tropical countries that experience warm weather in some periods.

Another benefit of using compost is plant growth since this soil amendment can serve as a nutrient source that can promote faster root development and can reduce plant disease by promoting beneficial microorganisms that reduce plant parasites. Nutrients from compost are slowly released, thus making the nutrients available to the plant for a longer period.

Use of compost can also prevent pollution. Slow release of nutrients from the compost also reduces leaching of nitrogen into the water table, which is a common problem with traditional fertilizers. Given the benefits of the compost on soil quality and plant growth, use of fertilizers and pesticides can be lessened. Compost can also help prevent soil erosion due to increased water infiltration.

6.3 Residuals Processing and Recovery Alternatives

6.3.1 Removal of Pathogens in the Treated Effluent

The minimum requirement for the reuse of the treated effluent is the compliance to the general effluent standards of DENR EMB. However, based on DENR GES for Class C, the treated effluent still contains about 400 MPN/100 mL of fecal coliform. To ensure the protection of the public health, the concentration of the fecal coliform must be eliminated or reduced.

As required in the DA AO No. 2019-11, the fecal coliform of the effluent must be less than 200 MPN/100 mL if the effluent will be applied to food crops that are commercially processed however, if the food crop will be eaten raw and not commercially processed, the fecal coliform must be “not detectable”, meaning the total number of fecal coliform organisms shall not exceed 14 MPN/mL in any sample. Since the treated effluent will be discharged in the NIA canal, ZCWD cannot control or restrict the type of food crop where it will be applied to. With this, the treated effluent will undergo further disinfection via chlorination to reduce the fecal coliform concentration to not detectable.

To reduce the concentration of the fecal coliform in the wastewater to not detectable, the CT of the chlorination must be 120 mg-min/L. CT is the product of free chlorine residual and the contact time. Based on the DA standards, the free chlorine residual of the effluent reuse should be less than 1 mg/L. With this, the contact time for the chlorination of the treated effluent must not be more than 120 minutes. Since the proposed SpTP will already provide disinfection with 30 minutes contact time, the reuse facility shall provide additional 90 minutes of disinfection to the effluent.

6.3.2 Drying of Sludge as Earth Fill for Sanitary Landfill

The sludge must be further dried after the dewatering from the screw press to achieve a more soil-like characteristics and for easier handling. The proposed design of the SpTP provided a facility to further dry the dewatered sludge for up to seven days.

6.3.3 Composting of Sludge as Organic Soil Amendment

Based on the raw quality of the dewatered sludge, further processing is required to stabilize the sludge, reduce the water content and reduce the pathogens content prior to reuse as soil amendment.

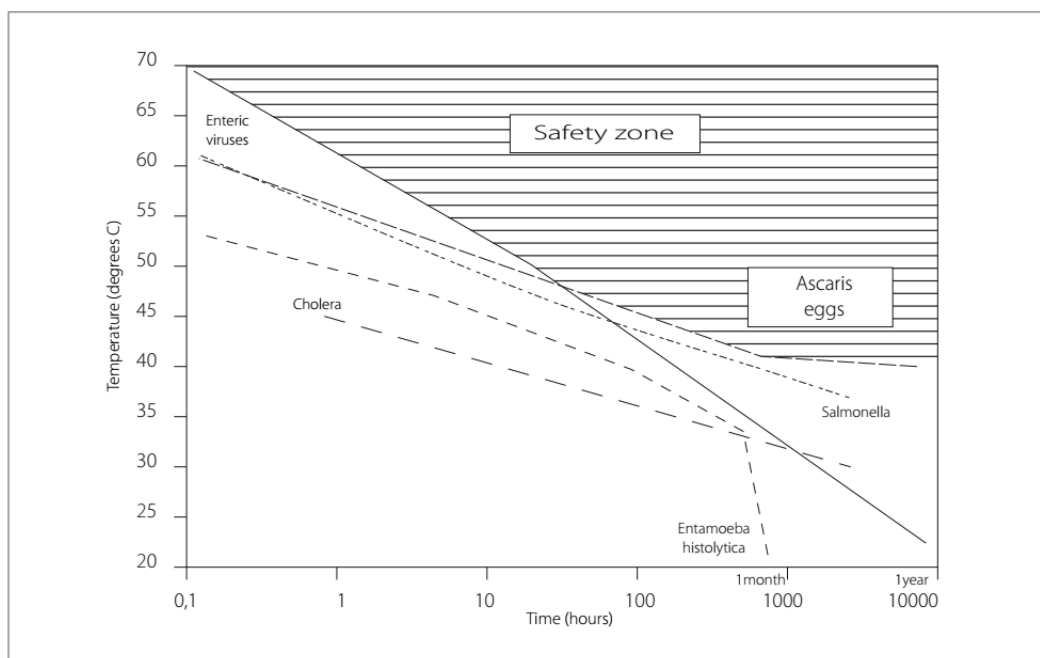
Composting is a natural process of recycling organic material into a nutrient rich soil material. It involves biological and chemical processes that accelerate the rate of decomposition and transform organic materials into a more stable humus form for application to the soil. The processes in composting are important parts of cycles of essential bio-elements C, H, O, N and P in nature.

Aside from stabilizing the biosolids to make nutrients available for plant uptake, it is also important to reduce or remove pathogens in biosolids prior to agricultural application. Conditions that are lethal to most pathogens include high pH (>9), high temperature (>55°C) for more than ten hours, long retention time (>6 months), and low moisture content (<25 percent). Studies show that not all the options can render the biosolids safe for agricultural use. While allowing the biosolids to achieve a moisture content of <25 percent is viable, regrowth of pathogens may occur if moisture

is added to the biosolids. Other options may add to the cost of composting. Mixing lime into the compost mixture may not be viable since it will add cost to the composting process. Long retention time may require large areas to house the biosolids for more than six months, thus requiring additional funding.

The most effective way to achieve pathogen removal from biosolids is to apply a treatment process with time-temperature effects, which can be achieved through composting. **Figure 33** shows the impact of time and temperature on some pathogens in sludge. The composting process must reach the “safety zone” to achieve pathogen removal. According to the figure, the time-temperature requirements are at least 1 hour at $>62^{\circ}\text{C}$, 1 day at $>50^{\circ}\text{C}$, and 1 week at $>46^{\circ}\text{C}$.

Figure 33: Effects of temperature and time on pathogen removal



Source: Feachem et al. Sanitation and Disease. 1983. The World Bank.

Composting System

The composting system that can be applied is windrow composting. This requires forming the biosolids and the bulking agent into piles, which are turned periodically to introduce oxygen into the compost. This also ensures that the pile has enough moisture and that all parts are subject to temperatures of 55°C to destroy pathogens.

Bulking Agent

Composting requires mixing the biosolids with a bulking agent such as yard trimmings, rice hull, and wood chips. This allows for aerobic decomposition of the compost. The bulking agent also lowers the moisture content of the biosolids, increases porosity, and adds carbon to the compost product.

It is suggested that the bulking agent to be used for composting the biosolids is organic municipal waste (OMW) since these are readily available from the city's numerous MRFs.

Moisture Content

Moisture must be kept at 50-60 percent to sustain sufficient microbial activity during composting. The initial moisture content of the biosolids may be as high as 85 percent prior to mixing with the bulking agent.

Temperature

Co-composting using organic municipal waste may yield temperatures that may exceed 55°C and as high as 65 to 70°C.

pH

Using organic municipal waste as bulking agent, a pH of 6.8 can be achieved in the first 20 days, and may reach up to pH 8.5 by day 80.

Maturity

Composting may last from 90 to 120 days. Co-composting methods have two phases. The first phase is the active phase, which is characterized by the availability of readily decomposable carbon, intense microbial activity, rapid wastes of organic matter decomposition, and high temperatures. The active phase lasts for 60 to 80 days. The second phase is the stabilization, which is characterized by a slow process of mineralization and humification.

Composting Method

The following outlines the proposed composting method that can be applied by ZCWD to meet the required organic soil amendment quality of PNS/VAFS 183:2020.

1. Acquire dewatered biosolids (up to 85 percent moisture content).
2. Sieve the biosolids using 3mm wire screens to assist with air infiltration into the compost.
3. Acquire shredded OMW from City MRFs.
4. Prepare and mix piles on impermeable lining using 2:1 OMW to biosolids ratio (v/v).
5. Monitor temperature and moisture of the piles daily at 60 cm depth. Maintain moisture of the piles at 50-60 percent. Water the piles, if necessary.
6. Turn the piles on day 2, 6 and 10, then every 10 days until day 60. Scoop the heap from one heap into a new heap, from top to bottom.
7. Leave the compost heap for stabilization for 1 to 2 weeks. To test for microbial activity, put the compost inside a sealed bag and observe if no gas is produced.
8. The following are the characteristics of matured compost:
 - No foul odor
 - Low moisture (<35 percent)
 - Neutral pH
 - Even particle sizes (friable)
 - No signs of microbial activity
9. Store the compost in properly labeled sacks.

6.4 Reuse Facility Components

6.4.1 Disinfection Facility

The disinfection facility consisting of the chlorine contact chamber tank will be constructed within the proposed SpTP site. The design capacity of the disinfection facility will be 240 m³/day to accommodate the projected treated effluent volume until 2040.

Table 76: Proposed Design of the Disinfection Facility

	Unit	Qty
Design capacity	m ³ /day	240
Contact time,	minutes	90
Volume of tank	m ³	15
Dimensions of tank		
]]L x W x D	m	3 x 3 x 2
Area requirement	m ²	9

6.4.2 Composting Facility

To process the sludge as organic soil amendment, a composting facility shall be constructed. It will consist of the composting area, bulking agent storage area and the composted product warehouse. The construction of the composting facility will be done in two phases. The composting facility will have an initial capacity to process the projected dewatered sludge until 2032 and will be expanded to meet the projected dewatered sludge for 2040.

The proposed composting facility will be constructed within the proposed SpTP site and will require land area of about 4,200 m² for Phase 1 and additional 1,550 m² for Phase 2.

Table 77: Proposed Design of the Composting Facility

Item		Phase 1	Phase 2
A. Composting Area			
Composting time	days	80	80
Total Volume for Composting (sludge +MSW)	m ³	42.3	15.6
Area required for composting with heaping	m ²	3,721	1,373
B. Compost Product Warehouse			
Weight of composted product	kg/day	13,528	4,993
Number of sacks	sacks/day	541	200
Holding time	days	7	7
Area for product warehouse	m ²	379	140
C. Bulking Agent Storage Area			
Bulking agent required	kg/day	7,646	2,822
Holding time	days	2	2
Area required for bulking agent	m ²	49	18

Site Plan and Layout

The reuse facility is proposed to be located within the same lot and adjacent to the proposed SpTP. **Figure 34** shows the proposed layout considering the disinfection and composting facilities.

6.5 Cost Requirement

Similar with **Section 5.9**, the capital and operating costs presented in this subsection are all expressed in year 2021 constant prices. The corresponding adjusted costs (escalated) are presented in **Section 9.2** of this report.

6.5.1 Capital Cost

The total capital cost for the construction of the reuse facilities for Phase 1 is estimated to be PhP3.7 million. For Phase 2, only the composting facility will be constructed with estimated cost of PhP1.25 million. The details of the capital cost for the reuse facilities are shown in **Table 78**. These costs also include the safety and environmental impact mitigating measures (See **Section 8.6.2**) in the process of construction.

6.5.2 Operating Costs

The operating cost of the reuse facility includes the manpower, chemical cost for disinfection, packing of the compost and the delivery of the compost product to the intended users, as shown in **Table 79** and **Table 80**.

Table 78: Estimated Capital Cost for the Reuse Facilities (in PhP)

Item	Unit	Unit Price	Phase 1		Phase 2	
			Qty.	Total Cost Phase 1	Qty.	Total Cost Phase 2
A. Engineering Cost Items						
1 Effluent Reuse						
1.1 Disinfection Tank						
1.1.1 Excavation	m ³	100	24	2,400		
1.1.2 Backfill and Compaction	m ³	510	5	2,448		
1.1.3 Disinfection Tank (concrete)	m ³	10,000	23	226,800		
1.1.4 Chlorinator with Accessories	set	30,000	1	30,000		
Sub-Total for Item 1				261,648		
2 Biosolids Reuse						
2.1 Composting Area						
2.1.1 Building for Composting Area	m ²	500	3721	1,860,548	1373	686,666
2.1.2 Liner	m ²	200	3721	744,219	1373	274,666
2.1.3 Materials	set	20,000	1	20,000	1	20,000
2.2 Product Warehouse	m ²	500	379	189,388	140	69,897
2.3 Bulking Agent Storage Area	m ²	500	49	24,273	18	8,958
Sub-Total for Item 2				2,838,428		1,060,187
A Sub-Total Project Cost				3,100,076		1,060,187
B Contingencies (5% of A)				155,004		53,009
C Engineering Charges (6% of A+B)				195,305		66,792
D Construction Supervision (4% of A+B)				130,203		44,528
E Permits and Licenses (3% of A)				93,002		31,806
TOTAL REUSE FACILITIES				3,673,590		1,256,321

Table 79: Estimated Operating Cost of the Reuse Facility (1st and 2nd Cycle, in PhP)

Item	1 st Desludging Cycle				2 nd Desludging Cycle			
	Yr. 1 2025	Yr. 2 2026	Yr. 3 2027	Yr. 4 2028	Yr. 5 2029	Yr. 6 2030	Yr. 7 2031	Yr. 8 2032
B.1 Additional Treatment of Sanitation Residuals								
B.1.1 Personnel								
<u>Operations</u>								
i. Utility / Helper	170,890	170,890	170,890	170,890	170,890	170,890	170,890	170,890
B.1.2 Reuse Facilities Operations								
<u>Operational Parameters</u>								
i. Potential volume of effluent for reuse (m ³)	27,723	28,883	30,248	31,469	32,921	35,066	36,315	37,848
ii. Composted biosolid product	87,199	90,846	95,137	98,980	103,545	110,292	114,221	119,044
<u>Chemical Costs (PhP)</u>								
i. Chlorine	69,309	72,208	75,619	78,673	82,301	87,665	90,787	94,620
<u>Utility Costs (PhP)</u>								
i. Utilities	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
<u>Packaging Costs (PhP)</u>								
i. Packaging	1,307,978	1,362,687	1,427,062	1,484,695	1,553,173	1,654,386	1,713,319	1,785,655
SUB-TOTAL REUSE FACILITY O&M	1,572,176	1,629,784	1,697,571	1,758,258	1,830,364	1,936,941	1,998,997	2,075,166
B.3 Biosolids Handling and Delivery								
<u>Number of Cargo Trucks</u>								
4-ton Capacity (units)	1	1	1	1	1	1	1	1
B.3.1 Personnel Cost (PhP)								
i. Cargo Truck Driver	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
ii. Cargo Helper	170,890	170,890	170,890	170,890	170,890	170,890	170,890	170,890
Sub-Total Personnel Cost	374,914	374,914	374,914	374,914	374,914	374,914	374,914	374,914
B.3.2 CT Fuel								
<u>4-ton Capacity CT</u>								
i. Dist. Travelled (km)	728	728	728	728	728	728	728	728
ii. Fuel Consumed (liters)	121	121	121	121	121	121	121	121
iii. Total Fuel Cost (PhP)	6,552	6,552	6,552	6,552	6,552	6,552	6,552	6,552
Sub-Total CT Fuel Cost	6,552	6,552	6,552	6,552	6,552	6,552	6,552	6,552
B.3.3 Insurance and Registration								
<u>4-ton Capacity CT (PhP)</u>	161,100	161,100	161,100	161,100	161,100	161,100	161,100	161,100
Sub-Total Insurance and Reg.	161,100	161,100	161,100	161,100	161,100	161,100	161,100	161,100
B.3.4 WT Maintenance								
<u>4-ton Capacity CT</u>								
i. Tires	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
ii. Spare Parts	188,000	188,000	188,000	188,000	188,000	188,000	188,000	188,000
iii. Preventive Maintenance	35,200	35,200	35,200	35,200	35,200	35,200	35,200	35,200

Item	1 st Desludging Cycle				2 nd Desludging Cycle			
	Yr. 1 2025	Yr. 2 2026	Yr. 3 2027	Yr. 4 2028	Yr. 5 2029	Yr. 6 2030	Yr. 7 2031	Yr. 8 2032
iv Painting	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600
Sub-Total 4-ton CT Mntnc. Cost (PhP)	288,800	288,800	288,800	288,800	288,800	288,800	288,800	288,800
Sub-Total CT Maintenance Cost	288,800	288,800	288,800	288,800	288,800	288,800	288,800	288,800
SUB-TOTAL BIOSOLIDS HANDLING AND DELIVERY OPERATIONS O&M	831,366	831,366	831,366	831,366	831,366	831,366	831,366	831,366
TOTAL O&M (PhP)	2,403,542	2,461,150	2,528,937	2,589,624	2,661,730	2,768,307	2,830,363	2,906,532

Table 80: Estimated Operating Cost of the Reuse Facility (3rd and 4th Cycle, in PhP)

Item	3 rd Desludging Cycle				4 th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
B.1 Additional Treatment of Sanitation Residuals								
B.1.1 Personnel								
Operations								
i. Utility / Helper	170,890	170,890	170,890	170,890	170,890	170,890	170,890	170,890
B.1.2 Reuse Facilities Operations								
Operational Parameters								
i. Potential volume of effluent for reuse	39,318	41,076	42,561	44,252	46,144	48,239	49,918	51,817
ii. Composted biosolid product	123,666	129,195	133,866	139,186	145,138	151,726	157,006	162,979
Chemical Costs								
i. Chlorine	98,294	102,689	106,401	110,630	115,361	120,597	124,794	129,542
Utility Costs								
i. Utilities	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Packaging Costs								
i. Packaging	1,854,986	1,937,922	2,007,984	2,087,793	2,177,066	2,275,883	2,355,083	2,444,681
SUB-TOTAL REUSE FACILITY O&M	2,148,170	2,235,501	2,309,275	2,393,313	2,487,317	2,591,370	2,674,767	2,769,112
B.3 Biosolids Handling and Delivery								
Number of Cargo Trucks								
4-ton Capacity	1	1	1	1	1	1	1	1
B.3.1 Personnel								
i. Cargo Truck Driver	204,024	204,024	204,024	204,024	204,024	204,024	204,024	204,024
ii. Cargo Helper	170,890	170,890	170,890	170,890	170,890	170,890	170,890	170,890
Sub-Total Personnel Cost	374,914	374,914	374,914	374,914	374,914	374,914	374,914	374,914
B.3.2 CT Fuel								
4-ton Capacity CT								
i. Dist. Travelled	728	728	728	728	728	728	728	728

Item	3rd Desludging Cycle				4th Desludging Cycle			
	Yr. 9 2033	Yr. 10 2034	Yr. 11 2035	Yr. 12 2036	Yr. 13 2037	Yr. 14 2038	Yr. 15 2039	Yr. 16 2040
ii. Fuel Consumed (liters)	121	121	121	121	121	121	121	121
iii Total Fuel Cost	6,552	6,552	6,552	6,552	6,552	6,552	6,552	6,552
Sub-Total CT Fuel Cost	6,552	6,552	6,552	6,552	6,552	6,552	6,552	6,552
B.3.3 Insurance and Registration								
<u>4-ton Capacity CT</u>	161,100	161,100	161,100	161,100	161,100	161,100	161,100	161,100
Sub-Total Insurance and Reg.	161,100	161,100	161,100	161,100	161,100	161,100	161,100	161,100
B.3.4 WT Maintenance								
<u>4-ton Capacity CT</u>								
i. Tires	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
ii. Spare Parts	188,000	188,000	188,000	188,000	188,000	188,000	188,000	188,000
iii Preventive Maintenance	35,200	35,200	35,200	35,200	35,200	35,200	35,200	35,200
iv Painting	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600
Sub-Total 4-ton CT Mntnc. Cost	288,800	288,800	288,800	288,800	288,800	288,800	288,800	288,800
Sub-Total CT Maintenance Cost	288,800	288,800	288,800	288,800	288,800	288,800	288,800	288,800
SUB-TOTAL BIOSOLIDS HANDLING AND DELIVERY OPERATIONS O&M	831,366	831,366	831,366	831,366	831,366	831,366	831,366	831,366
TOTAL O&M (PhP)	2,979,536	3,066,867	3,140,641	3,224,680	3,318,683	3,422,736	3,506,133	3,600,478

6.6 Permitting Requirements

6.6.1 Treated effluent for irrigation

A certification for safe reuse must be secured from the regional office of NIA if the treated effluent will be reused for irrigation. The accomplished application form and the requirements listed in Section 6 of the DA Administrative Order No. 2019-11: “Revised Guidelines on the Procedures and Technical Requirements for the issuance of a Certification allowing the safe reuse of wastewater for purposes of irrigation and other agricultural uses” must be submitted to NIA. The initial certification is valid for one year. The renewal of the certification must be done 90 days before expiration. After the first renewal, the certification may be valid for three years or five years, depending on the compliance with the submission.

In addition to the certification, the wastewater generator must also secure a discharge permit to the EMB. The approved certificate must be submitted to EMB as part of its application for the discharge permit.

6.6.2 Composted Sludge

If the composted sludge will be sold to the farmers, the product must be registered to the Fertilizer and Pesticide Authority (FPA). There are two types of product registration under FPA: full registration and provisional registration.

Full registration for non-traditional fertilizers requires conduct of bio efficacy test in two distinct seasons or two agro-climatically different locations such as different provinces. The product shall yield significant results on a representative crop. The length of the bio-efficacy trial shall depend on the crop that will be used for the experiment. Considering that Zamboanga experiences Type III climate, some vegetable crops have three cropping seasons per year (e.g. corn), while some have two (e.g. amplaya).

ZCWD may dedicate its first year of compost production to conducting these bio-efficacy tests and for product registration. After the first successful bio-efficacy trial, ZCWD may already apply for a provisional registration. This shall be valid for one year from date of issuance. Renewal of provisional registration can be granted only up to a maximum of two renewals; this shall give ample time for the ZCWD to complete the bio efficacy test required for full registration.

Full registration is valid for three years from the date of issuance. Renewal of registration shall be filed three months prior to expiry.

The following are the requirements for product registration:

1. Administrative requirements
 - a. Product Information:
 - Brand/Trade Name – name the product to be sold and to be printed on the label. Superlative and supernatural names, such as Miracle, Super, Best, Demon, which imply superiority of the product compared with other products are not allowed. The company shall submit three sets of brand names for approval by FPA.

- Type of Product – inorganic fertilizer, bio stimulants, fortified organic fertilizers, GMOs, Decomposers, soil conditioner/soil amendment, plant growth regulator and raw materials, on FPA's definition.
 - Guaranteed Analysis - the minimum percentage content of the primary nutrients, secondary nutrients and micronutrients as confirmed by FPA recognized laboratories.
 - Size and Type of Packaging
 - Country of Origin (for imported fertilizers)
 - Name of Manufacturer (for imported fertilizers)
 - Name of Supplier (for imported fertilizers)
 - Trader (for imported fertilizers)
- b. Company Information
 - c. List of raw materials used in the production of the product
 - d. Target crops (refers to crops to which the fertilizers are to be applied)
 - e. FPA accredited researcher (the name of the FPA accredited researcher who conducts the efficacy test)
 - f. Cost components and Prices: In case of new importation, when registrant cannot provide details on the cost component and prices, a waiver should be made available stating that they are going to provide the cost component and prices on the succeeding importation.
2. Technical Requirements for soil conditioner
 - a. Actual Production Process – brief description with schematic diagram of the production process indicating the percentage of raw material used
 - b. Passed Confirmatory Analysis done by FPA recognized laboratory. Test reports are valid as confirmatory analysis within one year or less after the test report date. In case where no FPA recognized laboratory can perform the analysis, this can be done by other independent laboratories in the country or from abroad.
 - Sample of product; 250 g to 500 g of solid samples
 - Methods of analysis (if needed)
 - Test of guaranteed composition
 - Test of heavy metals
 - Test of total coliform
 - c. Certificate of Analysis (COA) from the manufacturer (for imported fertilizers)
 - d. Materials Safety Data Sheet or MSDS (for imported fertilizers)
 - e. Draft Label

6.7 Health and Safety Consideration Measures

The health risks associated in the reuse of the sanitation residuals are mostly associated with the potential exposure to the excreta-related pathogens in the treated effluent and sludge. There are three main exposed groups that are at risk from the reuse of the sanitation residuals namely, the ZCWD workers, farmers and the local community who are the product consumers. The exposure and transmission routes for excreta-related pathogens may be either primary (through direct contact exposure or short distance airborne transmissions) and/or secondary (exposure through an external route such as consumption of contaminated produce). With this, control measures must be implemented to reduce, prevent or eliminate the risks associated with the reuse of the sanitation residuals. It is also recommended for ZCWD to provide appropriate capacity building and conduct information, education, and communication (IEC) campaigns to the workers, farmers and consumers to ensure the safe reuse of the treated sanitation residuals.

Table 81 presents the risk activities and its corresponding exposure routes, groups at risk, and control measures.

Table 81: Identified risks and potential control measures for the reuse of sanitation residuals

Risk Activity	Exposure Routes	Groups at risk	Possible Control Measures
Composting of sludge	Contact Vectors	Workers Nearby Communities	<ul style="list-style-type: none"> • Ensure treatment efficiency of the composting • Proper personal protective equipment (PPE) must be worn when processing the compost. PPE must include safety glasses, coveralls, gloves, masks, and rubber boots. • Facility should be fenced and ensure no access from public specially for children • Consider and minimize vector propagation • According to Section 4, Rule XI of the IRR of RA 9003, the composting facility shall not be situated in areas subject to frequent flooding. The facility shall also be designed such that compost piles, will not come in contact with storm run-off. Provisions for vector, odor, litter, and dust control shall be included. • Observe proper handwashing and personal hygiene practices
Land Application of composted sludge	Contact Inhalation	Entrepreneurs Farmers Local Communities	<ul style="list-style-type: none"> • The use of biosolids-based compost may be restricted to use as soil amendment for rehabilitation/reforestation areas, or for landscaping. • Proper PPE shall also be worn when applying the compost product. • It is advisable for farmers to apply the compost close to the ground, to work the compost into the soil, and to cover the compost with soil after application. • Observe proper handwashing and personal hygiene practices
Reuse of treated effluent for irrigation	Contact Inhalation	Farmers Nearby communities	<ul style="list-style-type: none"> • Use appropriate irrigation method to limit contact. Based on the DA guidelines, types of irrigation system that can be used include furrow and drip for foods eaten raw and not commercially processed, and furrow and sprinkler for food crops commercially processed and non-food crops. • Consider set back distances from potable water supply wells • Limit access of public to irrigation site • Observe proper handwashing and personal hygiene practices
Crops harvest, processing, and sale	Consumption Handling	Consumers Workers Vendors	<ul style="list-style-type: none"> • Crops eaten raw pose the most risk; industrial crops, biofuels, or crops eaten only after cooking pose less risk • Use PPE when harvesting • Provide safe water in markets for washing and refreshing vegetables • Observe proper handwashing and personal hygiene practices
Consumption of produce where reuse was applied	Consumption	Consumers	<ul style="list-style-type: none"> • Practicing good personal, domestic, and food hygiene. Food handlers in markets, restaurants, and domestic settings should be advised on how they should properly wash the produce. • It is advisable to wash the produce vigorously in tap water as this may reduce bacteria by at least 1 log unit. For smooth-surfaced salad crops such as tomatoes and cucumbers, the reduction of bacteria is approximately 2 log units. Washing in disinfectant solution and rinsing in tap water can reduce pathogens by 1-2 log units. • Cooking food thoroughly.

7 Institutional, Legal, and Organizational Assessment

This section discusses the local and national laws/ordinances pertinent to the development of the SMP in Zamboanga City. The duties and responsibilities of the government offices and institutions involved are also discussed, together with the recommendation for the amendment of the current policies relevant to the project.

7.1 Institutional Assessment

7.1.1 Key Institutions in Sanitation Sector

While several government agencies and institutions are involved in the sanitation sector, there is currently no lead department assigned with the overall responsibility of execution of sector policies, coordination among relevant organizations, and provision of direction and administration. The PWSSMP, intends to streamline strategies, policy reforms, programs, and projects towards achieving global and national goals in water supply and sanitation and to achieve the goal of providing universal access to safe and sustainable water and sanitation to Filipinos by 2030. Among the key reform agenda of the PWSSMP is establishing effective Water Supply and Sanitation Sector institutions, wherein NEDA has been identified to take the lead in addressing the existing institutional fragmentation in the sector (NEDA, 2021). In the absence of an apex body NEDA and the National Water Resources Board (NWRB) serves as the executing and implementing agencies at the Interim with oversight from the Infrastructure Sub-Committee on Water Resources (INFRACOM-SCWR).

As there are overlapping mandates in the sanitation sector, there are various government agencies, institutions, and entities which are involved in policy creation and coordination and in oversight of the implementation of sectoral reforms. **Figure 35** presents the different institutions involved in the field of sanitation, while **Table 82** summarizes the background, roles, and responsibilities of each agency.

Figure 35: Institutions Involved in the Sanitation Sector

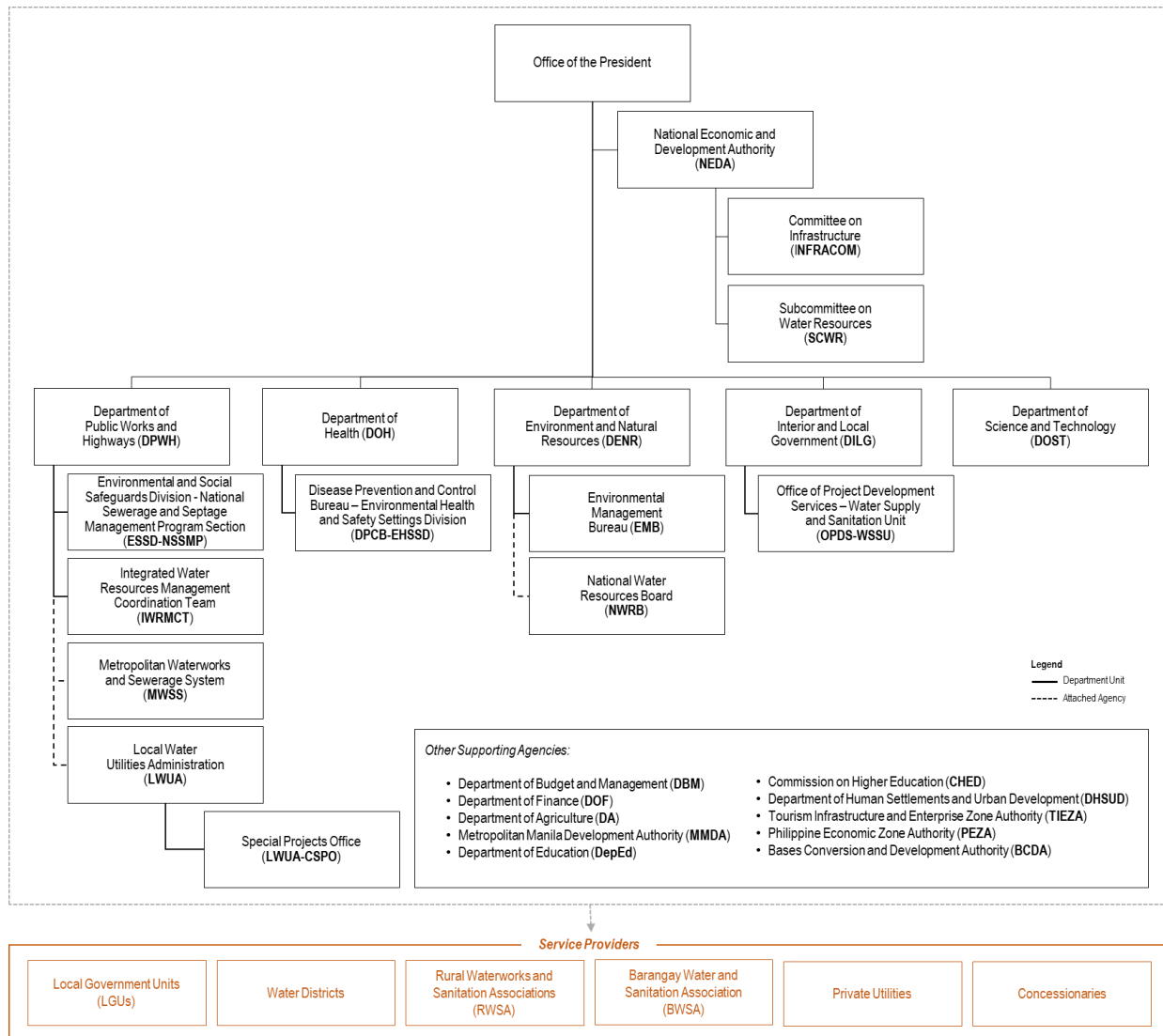


Table 82: Sanitation Sector Institutional Roles and Responsibilities

Institution	Background	Relevant Roles and Responsibilities
National Economic and Development Authority (NEDA)	<p>As mandated by EO 230 (1987), RA 7640 (1992), and AO 8 (2017):</p> <ul style="list-style-type: none"> Serves as the primary social and economic planning and policy coordinating body of the country Formulates continuing, coordinated and fully integrated social and economic policies, plans and programs to achieve the growth objectives of the State coupled with equity Provides technical support as required by the board, committees, regional offices, and implementing agencies 	<ul style="list-style-type: none"> Approves development plans and programs consistent with the policies set by the President of the Philippines through the NEDA Board Executive Committee Confirm projects approved and classified as extremely urgent by the Investment Coordination Committee (ICC), among which may include sanitation projects through the Subcommittee on Water Resources (SCWR) of the Committee on Infrastructure (INFRACOM) Conduct consultation with the concerned Cabinet-level Interagency Committees prior to project approval

Institution	Background	Relevant Roles and Responsibilities
		<ul style="list-style-type: none"> Serves as the interim executing agency of the PWSSMP in the absence of an WSS apex body
Department of Public Works and Highways (DPWH)	<ul style="list-style-type: none"> The CWA has specifically mandated the DPWH to lead the preparation of the NSSMP. The NSSMP Office is currently lodged under the Environmental and Social Safeguards Division (ESSD) of the Planning Service. DPWH also formed in July 2014 the Integrated Water Resources Coordination Team (IWRMCT) whose function includes planning, design, construction, and maintenance of infrastructure facilities related to flood control, sewerage and sanitation facilities and the efficient and safe collection, treatment and disposal of sewage. 	<p>Its functions mandated under CWA are to:</p> <ul style="list-style-type: none"> Plan NSSMP implementation; Promote LGU participation in NSSMP; Ensure that WDs or LGUs prepare their compliance plans and sanitation systems are designed accordingly; Review and prioritize proposed LGU infrastructure projects; Draw up a priority list which will be the basis for the allotment of funds on an annual basis by the national government for the construction and rehabilitation of required sanitation facilities; Enter MOA with LGU for NG cost share in sanitation projects funded under the NSSMP; and Monitor and evaluate progress to achieve NSSMP targets.
Metropolitan Waterworks and Sewerage System (MWSS)	<p>Mandated by the RA 6234 to</p> <ul style="list-style-type: none"> Oversee the proper operation and maintenance of waterworks system in Metro Manila and parts of Cavite and Rizal Ensure adequate supply and distribution of water for domestic and other purposes and the proper operation and maintenance of sewerage systems. 	<p>Through its Regulatory Office:</p> <ul style="list-style-type: none"> Approves, regulates, and supervises the establishment, operation and maintenance of waterworks and deep wells within its jurisdiction by its concessionaires Sets and fixes periodically water rates and sewerage service fees.
Local Water Utilities Administration (LWUA)	<p>A government-owned and controlled corporation (GOCC) with a specialized lending function with the following mandates:</p> <ul style="list-style-type: none"> Promote and oversee the development of water supply and sanitation systems in provincial cities and municipalities outside of Metropolitan Manila. Maintains the Central Sanitation/Sewerage Program Support Office (CPSO), originally created to exist for a period of about three to five years or until its functions have been fully devolved to the LGUs, to coordinate subsector activities at the national level and assist LGUs to plan and manage sanitation/sewerage programs at the community level. 	<ul style="list-style-type: none"> PD 198 and CWA mandates LWUA to oversee the implementation of sanitation activities by the WDs. It exercises over-all jurisdiction on the operations of the CPSO through the LWUA Board. Through the CPSO, it acts as the coordination body in the implementation and monitoring of urban sewerage and sanitation programs nationwide and policy related matters.
Department of Health (DOH)	<p>As provided by Executive Order (1999):</p> <ul style="list-style-type: none"> Serves as the national health policymaker and regulator of all health services and products. Mandated its mandate is to develop national plans, technical standards, and guidelines on health-related matters including sanitation 	<ul style="list-style-type: none"> Responsible for creating and enforcing standards for drinking water, septage and sludge disposal. Performs role in review and issuance of Environmental Compliance Certificates (ECC) for both stationary (treatment) and mobile (collection and transportation) septage services.

Institution	Background	Relevant Roles and Responsibilities
	<ul style="list-style-type: none"> Implements Environmental Health Programs under the Environmental Health and Safety Settings Division of its Disease Prevention and Control Bureau (DOH, 2021) 	<ul style="list-style-type: none"> Developed and published its Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage which spells out the requirements for a comprehensive septage management program that should be adopted by the LGUs and WDs.
Department of Environment and Natural Resources (DENR)	<ul style="list-style-type: none"> It is the lead agency for water and wastewater regulation, policy enforcement, and institutional coordination. It is also the lead department tasked to enforce the CWA. 	<p>Its functions mandated under CWA includes:</p> <ul style="list-style-type: none"> Establish a National Water Quality Management Fund which can be used to help finance sanitation programs of the LGUs or to serve as an incentive to LGUs as they move into implementation stage; and Establish a wastewater charge system applicable to all wastewater discharges in the country.
Environmental Management Bureau (EMB)	<p>As provided by Executive Order 192 (1987) and RA 8749 (1999):</p> <ul style="list-style-type: none"> Formulate plans and policies and set appropriate environmental quality standards (Water, Air and Noise) for the prevention, control of pollution and protection of the environment Reviews applications of undertakings that fall under the Philippine Environmental Impact Statement System 	<ul style="list-style-type: none"> Designate certain areas as water quality management areas (WQMA) using appropriate physiographic units such as watershed, river basins or water resources regions to address water quality issues and problems (Section 5, RA 9275) Monitor compliance and issues clearances and permits under RA 8749, RA 9003, RA 9275, RA 6969 and PD 1586
National Water Resources Board (NWRB)	<ul style="list-style-type: none"> An attached agency of the DENR. It is granted with policy-making, economic and resource regulatory and quasi-judicial functions related to water. It is mandated to regulate and monitor the water service providers (WSPs) specifically private utilities through tariff and service regulation coverage and management of the sector database. 	<ul style="list-style-type: none"> Role in sanitation falls as part of its resource regulation functions, however, how it will be integrated in its economic regulatory function (e.g., tariff, standard and performance setting) over WSPs has yet to be clearly defined Serves as the interim implementing agency of the PWSSMP in the absence of an WSS apex body
Department of the Interior of Local Government (DILG)	<ul style="list-style-type: none"> It is mandated to provide assistance towards local government legislation, law enforcement and public safety. It has included sanitation in the SALINTUBIG planning and programming guidelines issued to LGUs but the initiative has focused on advocacy. It establishes and prescribes guidelines for plans, policies, programs and standards and provides technical assistance to strengthen the administrative, fiscal and technical capabilities of LGUs It supervises the LGUs in aspects of formulating of local development plans and policies of local programs in accordance with national priorities. 	<ul style="list-style-type: none"> Ensures the integration of sanitation in LGU initiatives, Establish a system of incentives and grants to LGUs, e.g. SALINTUBIG carving a portion of the SALINTUBIG grant for sanitation investments, and prescribe policies, procedures and guidelines in project implementation; Monitor LGU compliance with sanitation laws and policies; Periodically evaluate the performance of LGUs using the LGPMS (which includes environmental governance criteria); and Support the strengthening LGUs Igus in the performance of their sanitation-related mandates.
Department of Science and Technology (DOST)	Spearheads the harnessing of science and technology for sustainable economic development and enhancement of the quality	Specific to sanitation, it is responsible for the evaluation, verification, and development of technologies for wastewater treatment.

Institution	Background	Relevant Roles and Responsibilities
	of life of the people and environment of the Philippines.	
Department of Agriculture (DA)	Serves as the primary agency promoting agriculture development in the country through the provision of policy frameworks, identifying public investments and support services toward strengthening the agricultural productivity, developing domestic and export-oriented enterprises, and promoting food security	<ul style="list-style-type: none"> • Designated to formulate guidelines and technical requirements for reuse of wastewater for irrigation and other agricultural uses by the Clean Water Act (RA 9275, Section 22) • Established the process for certification and designated the assigned agencies to regulate the reuse of wastewater in irrigation (through National Irrigation Authority), aquaculture (through Bureau of Fisheries and Aquatic Resources), and fertilization (through Fertilizer and Pesticide Authority). • Released Revised Guidelines on Safe Reuse of Wastewater for Agricultural Uses through the DA Administrative Order No. 2019-11
Service Providers	Institutions include the LGUs, WDs, private utilities and the MWSS concessionaires <ul style="list-style-type: none"> - Institutions include the LGUs, WDs, private operators, including subdivisions, and the MWSS concessionaires. - BWASA operate independently of LGUs. - RWSAs are legally under LWUA. 	Service providers construct, operate, and maintain sanitation and sewerage systems. These can also act as a collection and coordination agent to their current service connections and area.

Note. Adapted from the *Feasibility study for the proposed Malaybalay City Septage Management Program, 2019, and the National Sewerage and Septage Management Program, 2010*. Updated by the Study Team.

7.1.2 National Sewerage and Septage Management Program

Headed by the DPWH, in coordination with concerned government agencies as mandated under the CWA, the NSSMP was rolled-out to form part of the integrated framework for water quality management. The guiding principle behind the NSSMP is the implementation of sewerage and septage management infrastructure projects including required support activities such as advocacy and inter-agency and institutional arrangements/cooperation. Following the CWA mandate, the overall target of NSSMP is to improve water quality and public health in the Philippines by 2020. The specific targets for areas outside Metro Manila are shown in **Table 83**.

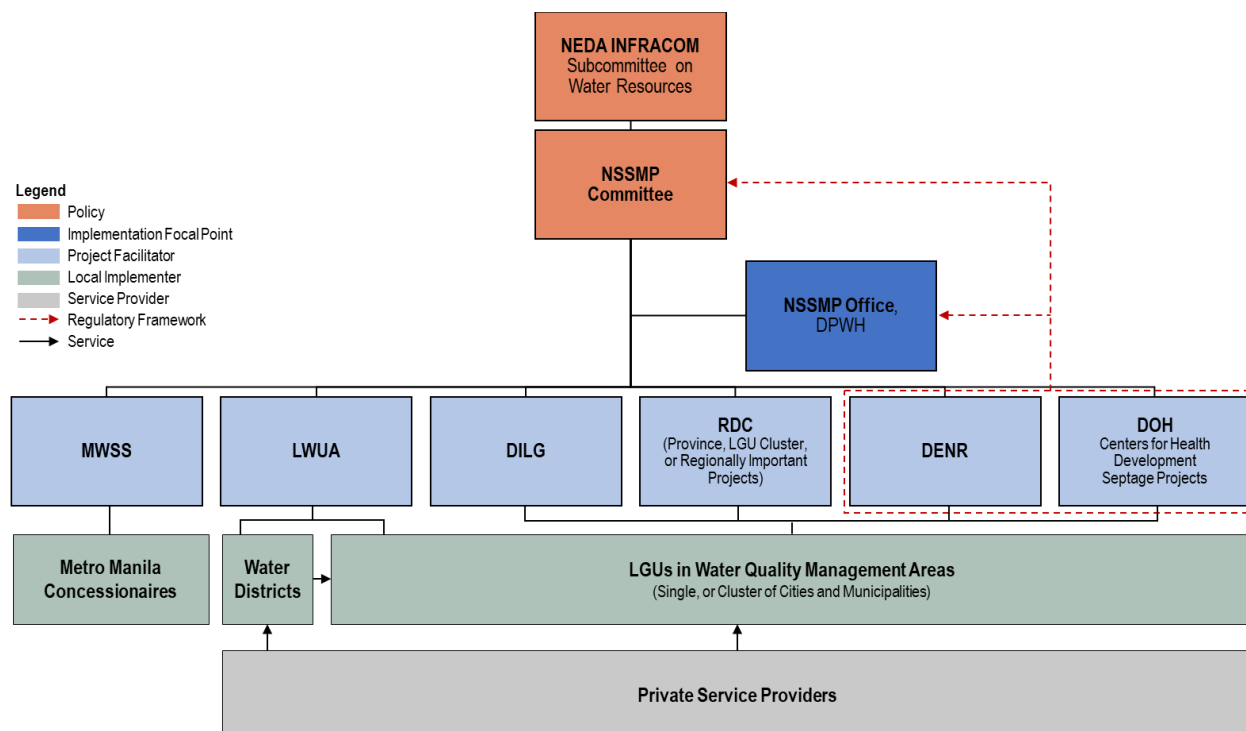
Table 83: NSSMP Targets for Areas outside Metro Manila

Target 1	By 2020, all LGUs have developed septage management systems and the 17 highly urbanized cities (HUCs) have developed sewerage systems
Target 2	By 2020, approximately 43.6 million people have access to septage treatment facilities and about 3.2 million will have access to sewage treatment facilities
Target 3	By 2020, P26.3 billion has been invested in sanitation improvement projects
Target 4	By 2020, about 346 million kilograms of BOD is diverted from the environment per year as a result of the sewerage and septage management projects

Note. Lifted from *NSSMP Program Operations Manual (DPWH, 2013)*.

Figure 36 illustrates the approved inter-agency arrangement in the implementation of the NSSMP. It is also presented that LGUs, WDs, including the Private WSPs are the lead local implementers of the program. The proposed SMP is consistent with the strategies adapted under the NSSMP. Moreover, it complements the initiatives defined in meeting the targets set by year 2020 which is expected to be updated and expanded considering the target year has been reached.

Figure 36: NSSMP Interagency Organizational Arrangement



Note. Figure lifted from NSSMP Program Operations Manual (DPWH, 2013).

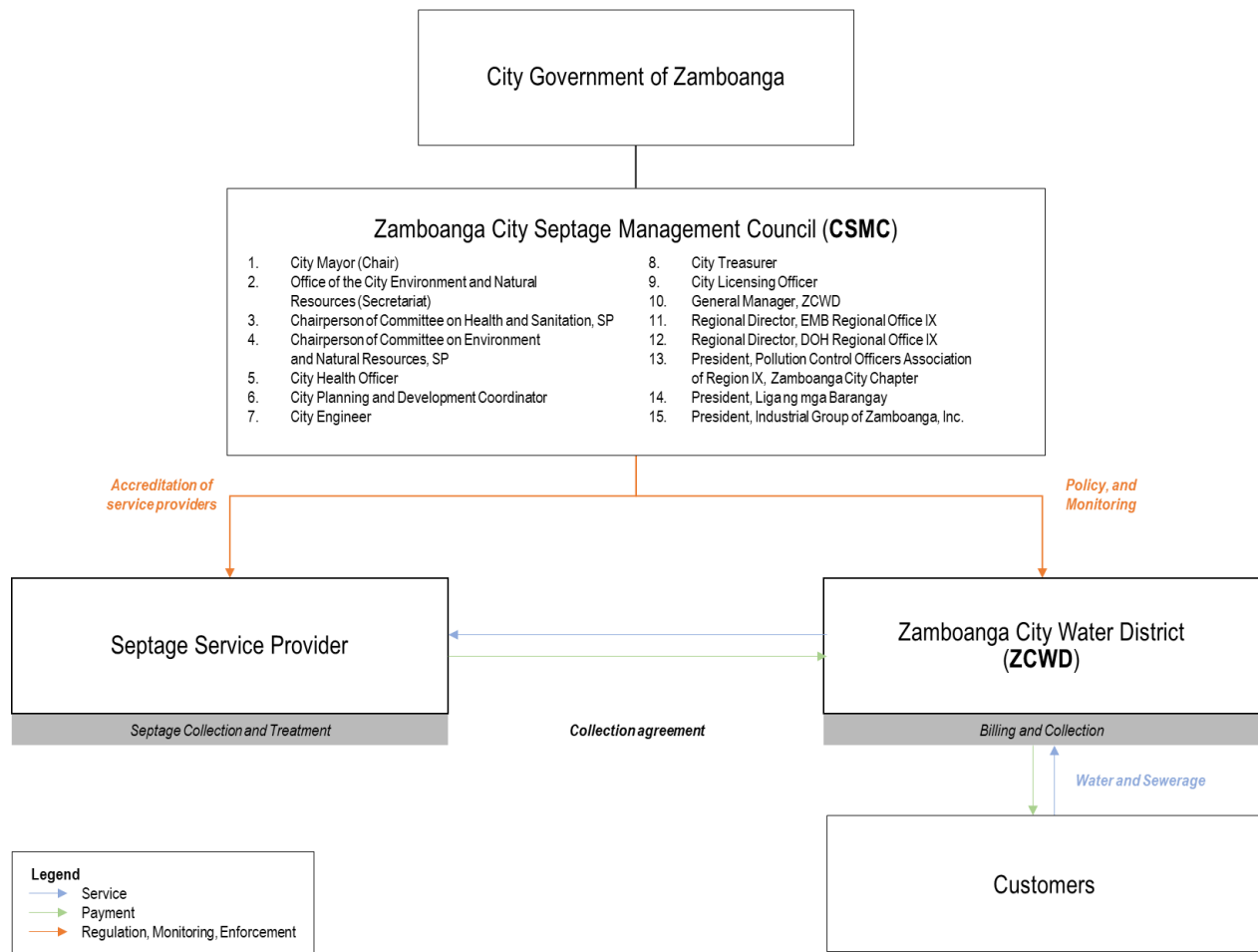
7.1.3 Zamboanga City Septage Management Council

In Zamboanga City through its local ordinance SP No. 2009-152 and Implementing Rules and Regulations, created the Zamboanga City Septage Management Council which have the following functions:

1. Regulation, monitoring and enforcement of Septage Laws;
2. Accreditation of private desludgers and septage treaters;
3. Review and approval of application for service providers, and;
4. Issuance of non-conformance.

The council consist of 15 members from various LGU offices, regional offices of NGAs along with representatives from the private sector, as illustrated in **Figure 37**. During the consultation meetings conducted by the Study Team, it was found that septage management services are, on paper, provided by private providers but currently to be serviced by ZCWD, who is the sole operator of existing treatment plants in the city. The LGU acts as an enforcer while the WD acts as a billing and collecting entity for the service.

Figure 37: Zamboanga City Septage Management Council



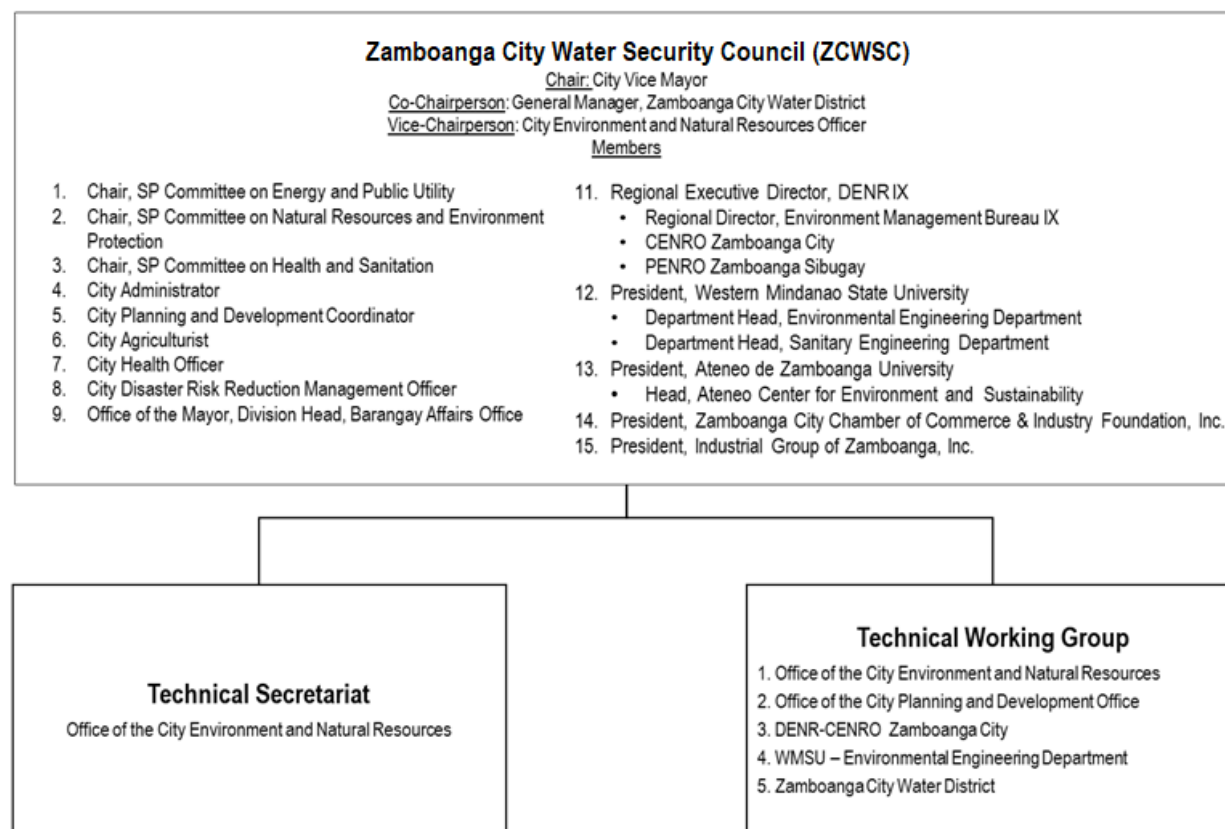
7.1.4 Zamboanga City Water Security Council

In June 2021, the Local Chief Executive of Zamboanga City enacted Executive Order No. BC-661-2021 which creates the Zamboanga City Water Security Council (ZCWSC). **Figure 38** illustrates the arrangement of the ZCWSC. The Council's objectives are the following:

1. Strengthen the enabling environment for sustainable management of water supply and water demand;
2. Strengthen the capacity of water supply and waste water treatment service providers to expand and improve services;
3. Strengthen the collection, analysis and sharing of water and climate data;
4. Reduce risk from climate, natural and other related disasters;
5. Engage multistakeholder participation in governance of water resource;
6. Improve capacity of service providers in ensuring long-term water security; and
7. Engage the expert services and adoption of water conservation-related technologies in ensuring water quality standards.

One of the functions of ZCWSC is to collaborate with both government and non-government stakeholders in crafting the Zamboanga City Water Security Masterplan and Zamboanga City Septage Management Plan. The ZCWSC also has its own Technical Secretariat and Technical Working Group to provide administrative and technical support to the Council.

Figure 38: Zamboanga City Water Security Council



7.2 Assessment of Zamboanga City Water District

The Zamboanga City Water District was established in 1970s through the City Council Resolution No. 446. ZCWD took over the operations of the defunct Zamboanga City Waterworks and Sewerage System. It has been operating for almost 50 years. ZCWD is classified by LWUA as Category A water district. Category A water districts are those who have at least 30,000 active service connections and have earned sufficient rating from LWUA Point-Rating Category based on gross revenues, total assets, net income, and staff productivity (DBM, 2011).

7.2.1 Management Direction and Strategic Intent

The management direction and strategic intent are entrenched in the stated mission, vision, core values and quality policy of the water district as indicated in **Table 84**.

Table 84: Strategic Intent of the Zamboanga City Water District

Mission	To be premier water utility that provides excellent services towards improving the quality of life of its customers in adherence to the belief that Agua es Vida (Water is Life).
Vision	Provide adequate, affordable and sustainable supply of potable water; Develop and protect the city's water resources; and Manage wastewater system in accordance with National and International Policies and Standards.
Core Values	Commitment, Reliability, Integrity, Solidarity, Professionalism, and Innovation.
Quality Policy	<p>Provision of quality water for all is our goal; Continual improvement in our processes is our 'way of life';</p> <p>Adherence and commitment to our core values affirms our dedication to service excellence that shall exceed customer and statutory requirements and, applicable local and international standards;</p> <p>Because we believe in the credo that 'Agua es Vida'.</p>

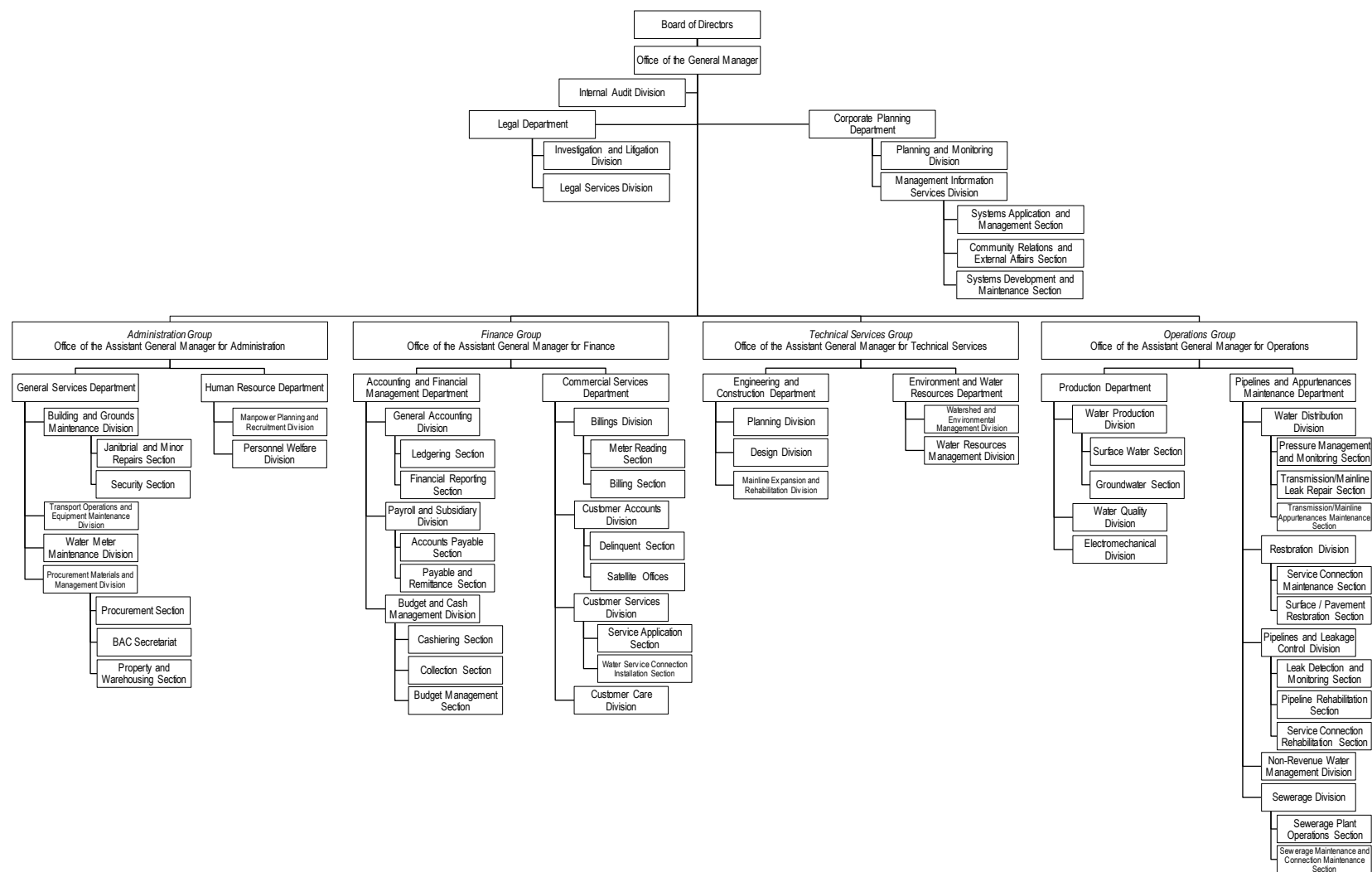
Source: Zamboanga City Water District

7.2.2 Functional Structure

The organizational structure of the Zamboanga City Water District consists of five primary offices, namely Office of the General Manager, Office of the Assistant General Manager for Finance, Office of the Assistant General Manager for Administration, Office of the Assistant General Manager for Technical Services, and Office of the Assistant General Manager for Operations

The functional structure of the ZCWD is illustrated in **Figure 39**.

Figure 39: Functional Structure of ZCWD



Source: Zamboanga City Water District

Office of the General Manager

This office directs the formulation of the corporate plans, development programs, and projects of ZCWD, and oversees the public and community relations activities. It also provides the necessary information in aid of sound decision-making. The Office of the General Manager consists of two departments:

1. ***Legal Department***: provides legal services such as drafting and reviewing contracts, memorandums, deeds, corporate policies, and providing legal opinions as needed by the water district.
2. ***Corporate Planning Department***: serves as coordinating body that develops and implements strategies that satisfies the objective of the individual departments as well as promoting overall goals of the water district. The planning and monitoring, and management information services divisions are under this department.

The Water District also has an Internal Audit Division which reports to the General Manager. The internal audit division determines the financial and operational soundness of ZCWD through audit of all financial transactions and operations. The division also reviews and recommends appropriate control measures in the discharge of funds and other assets.

Office of the Assistant General Manager for Administration

The department provides personnel welfare and development programs, directs the implementation of government rules and regulations pertaining to personnel matters, and oversees the procurement activities and administers the general services. There are two departments under the ZCWD Administration Group, namely:

1. ***Human Resources Department***: evaluates, regulates, and implements policies and programs on recruitment and selection of personnel. Aside from maintenance of records of employees, it also formulates, develops, and administers employee benefits, government-approved compensation packages, training programs and personnel development interventions
2. ***General Services Department***: maintains the general condition, cleanliness, and upkeep of the building, ground, and office facilities of the water district. Likewise, it operates, allocates, and maintains transportation and equipment facilities and services to ensure optimum availability and mobility. It is responsible for the administration of general office services such as those relative to communication and messengerial services. It is also part of its mandate to repair and maintain equipment, service vehicles and facilities.

Office of the Assistant General Manager for Finance

The Finance Group directs the financial activities of ZCWD such as, but not limited to, budget, and financial planning and control. The department oversees the optimum utilization of water district funds, assets and properties. It also ensures compliance with generally accepted government rules and regulations pertaining to accounting procedures.

1. ***Commercial Services Department***: directs the operations related to customer services and billing invoice. It also monitors, evaluates, and maintains customer accounts and records. Under the department includes the Billings Division who is responsible in conducting meter reading, timely preparation and delivery of customer billing, and

maintaining customer billing records and posts corresponding customer payments; Customer Accounts Division which evaluates both active and inactive accounts of the water district handle reconnection and disconnection of water service and is responsible for conducting site investigation and survey of accounts. Divisions concerning customer service and customer care are also under the department.

2. ***Accounting and Financial Management Department:*** prepares financial reports, disbursement vouchers, and budget disclosure. The division maintains and updates financial records, prepares financial analyses and evaluations and implements government rules and regulations pertaining to accounting procedures. It also implements established accounting principles of the water district in accordance with government procedures. Moreover, it takes charge of the water district's funds and establishes policies and procedures for cash control budgeting. They are also tasked to collect and disburse cash and cash equivalents for both internal and external use. It also recommends and implements investment plans for the water district.

Office of the Assistant General Manager for Technical Services

The Office of the Assistant General Manager for Technical Services includes two departments on environment and construction and environment and natural resources. The overall function of this office is to ensure smooth and reliable operations of distribution of clean water to the consumers through proper planning, maintenance and water production. The Technical Services Groups also has two departments:

1. ***Engineering and Construction Department:*** designs and implements of all pipelines, civil works, and electro-mechanical projects within its service area. The department is responsible for development of plans and designs including but not limited to as-built plans, drawings, and other computations, of all civil, pipeline expansion, improvement and rehabilitation programs and projects including new water source development, and construction supervision.
2. ***Environment and Water Resources Department:*** monitors and evaluates existing water resources and implements environmental and watershed development programs and projects. It also secures Right-of-Way (ROW), excavation permits and other licenses relative to the maintenance of pipelines and appurtenances. Moreover, formulates drilling designs and implements construction of wells and pumps and oversees the exploration of potential water sources and drilling of wells.

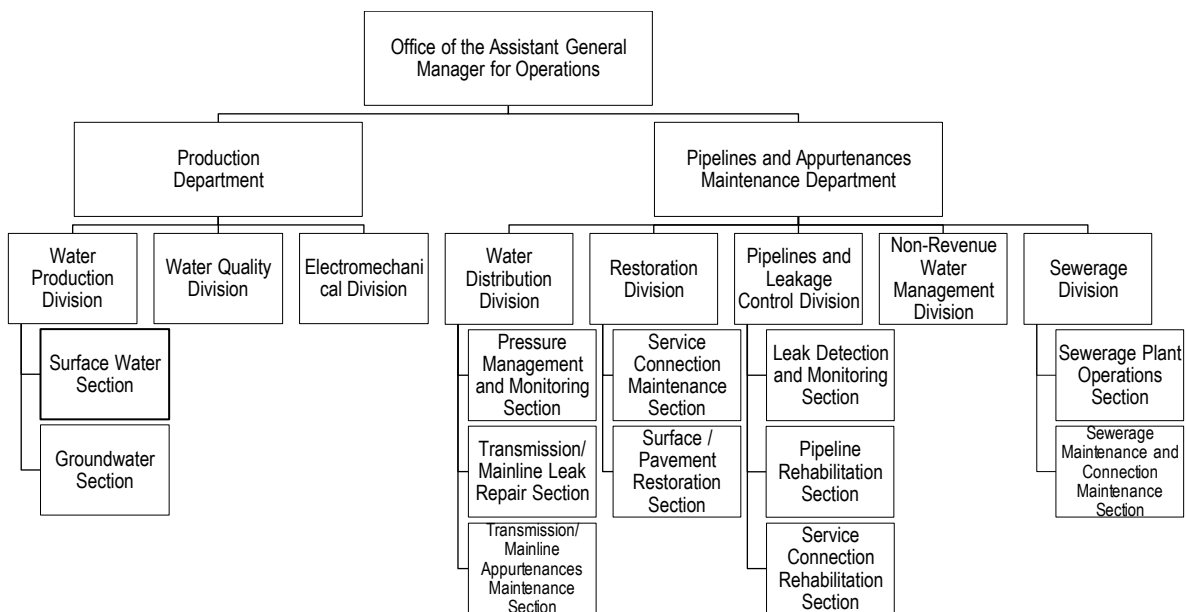
Office of the Assistant General Manager for Operations

The Office oversees the operation and maintenance of all production, storage, and treatment facilities to ensure equitable allocation of sale:

1. ***Production Department:*** operates water production facilities, including well pumping stations, water treatment facilities, chlorination systems, storage facilities, standby power equipment, and raw water mains. It also maintains the general condition and upkeep of all production and storage facilities. The division also ensures the supply is in accordance with the Philippine National Standards for Drinking Water and establishes procedures for monitoring water quality through continuous bacteriological and chemical tests.
3. ***Pipeline and Appurtenances Maintenance Department:*** manages of water losses for sustainability of water supply. It heads the Non-Revenue Water (NRW) Program and

monitors the progress of NRW strategy implementation towards reducing physical or real loss, commercial or apparent loss, and loss of water for operational purposes. Among its divisions include those specializing in Water Distribution, Restoration, Pipelines and Leakage Control, and NRW Management. Functions related to maintenance and operations of the sewerage plant and sewerage connections is included under the Sewerage Division of this department

Figure 40: Functional Structure of the ZCWD Operations Group



7.3 Proposed Institutional Arrangement

It is recommended that ZCWD takes the lead and operate the septage treatment facility and its reuse operations. This new wastewater treatment facility will add to the current capacity and capability of ZCWD in delivering sanitation services to the City of Zamboanga. It shall be responsible for the operations and maintenance of this facility to include undertaking of additional desludging services.

In managing a wastewater treatment facility and its reuse capabilities and operations, a new section named, Wastewater Management Section (WMS), shall be created under the Sewerage Division as highlighted in **Figure 41**. WMS has its own functions under the as presented in **Figure 42**.

Figure 41: Functional Structure of the Sewerage Division

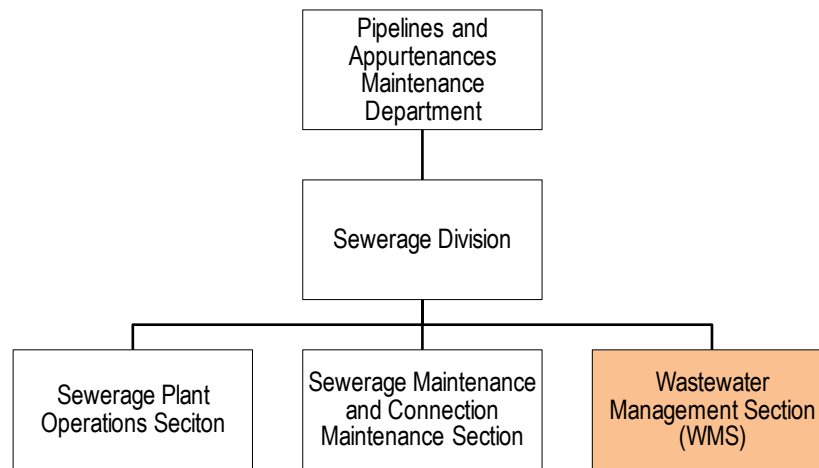
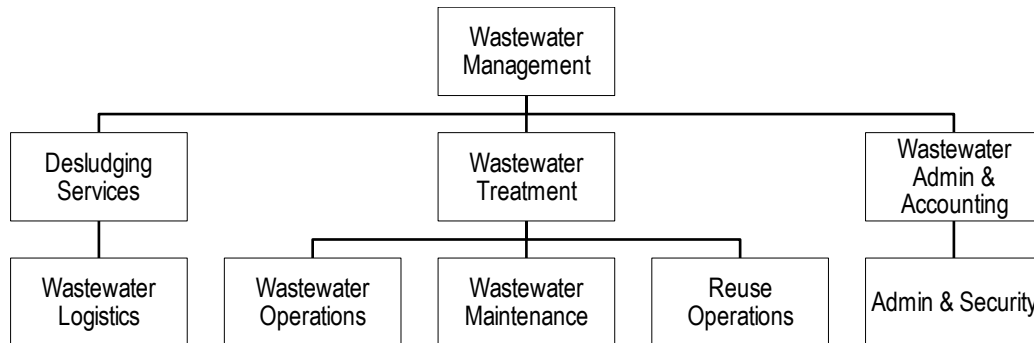


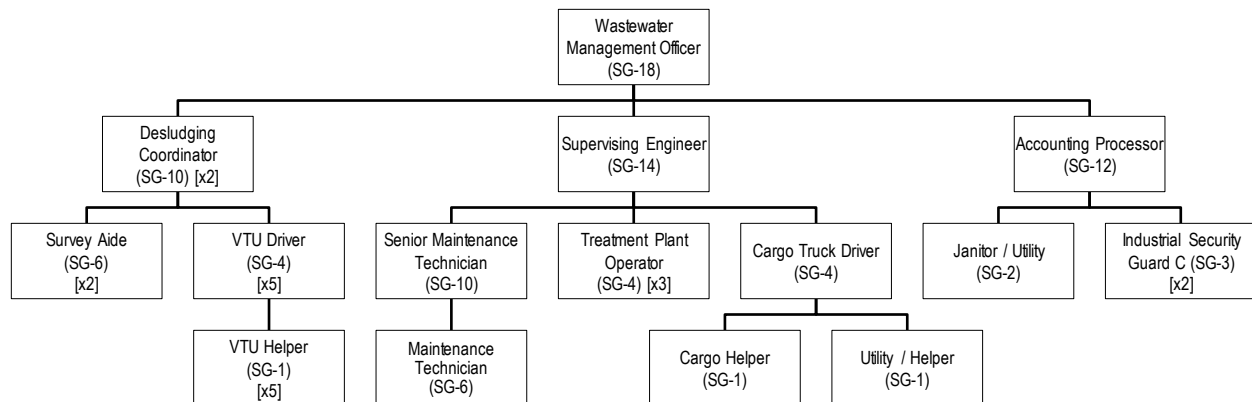
Figure 42: Functions of the Wastewater Management Section



7.4 Organizational Arrangement and Staffing Pattern

There are several positions that need to be created to ensure the smooth operations and functions of a SMP. These positions were conceptualized based on the concept of Lean Management and efficient operations taking into consideration 8 hours a day and 5 days a week operation. **Figure 43** illustrates the organizational structure considering the new positions and its reporting lines. The general guidelines on staffing patterns and positions created are benchmarked using the Revised Local Water District Manual on Categorization, Re-Categorization and Other Related Matters (DBM, 2011) and based on a Category A water district.

Figure 43: Proposed Organizational Structure



The Septage Treatment Plant entails labor cost to operate. The breakdown and estimated annual labor cost based on the new positions and their salary grade are presented in **Appendix D**.

7.5 Enabling Support Environment

There are various factors to designing an enabling environment for successful implementation of programs that may require behavioral and sustained change of its intended users. The program should also consider external aspects and local conditions that can impact and promote the desired change. The main drivers which can make or break the success of the initiative are local policies and ordinances, and the engagement of key stakeholders.

Policy Implementation

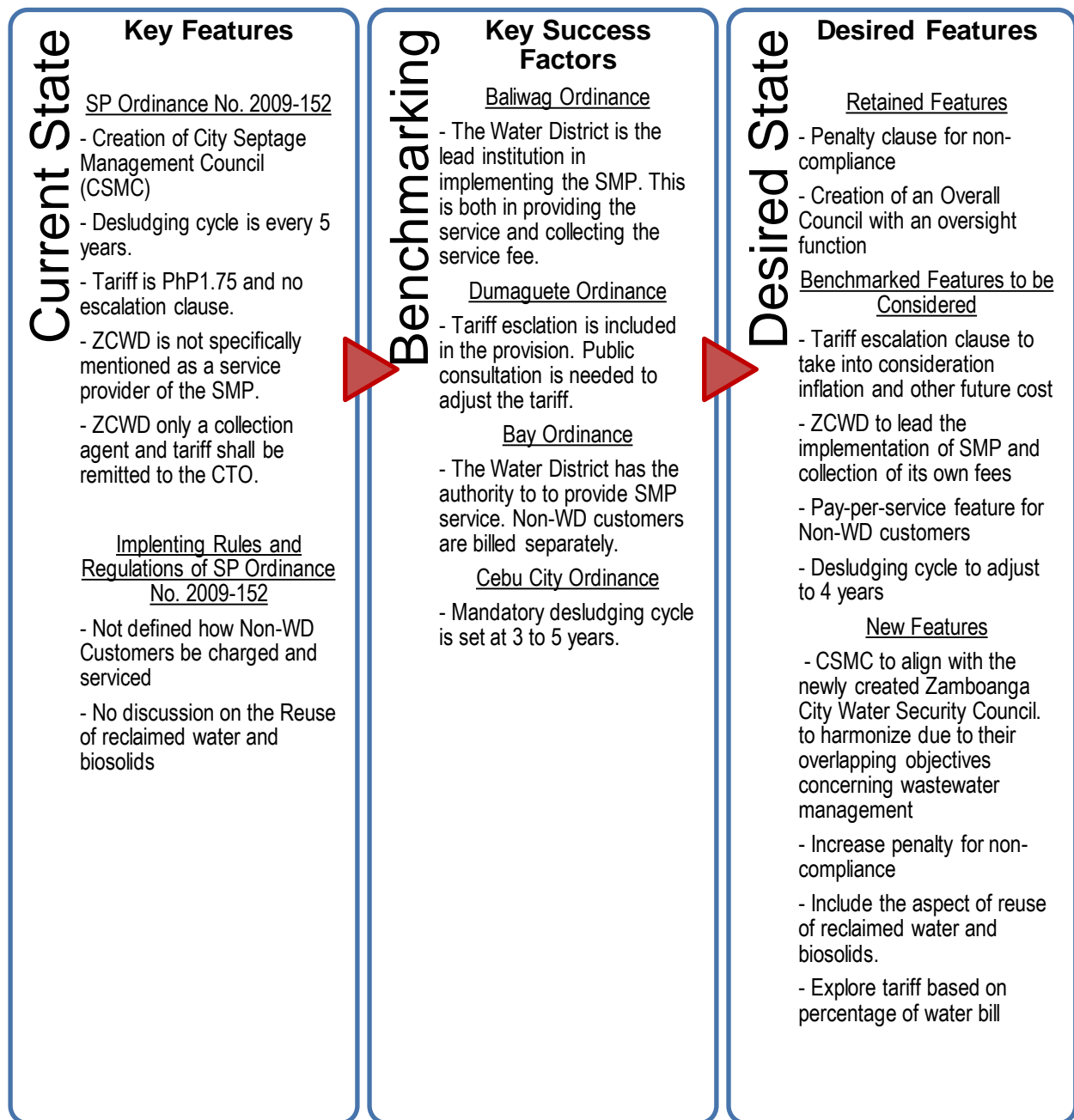
Currently, the City of Zamboanga has its Septage Management System Ordinance and its corresponding Implementing Rules and Regulations enacted by the City Council in 2009 and 2010, respectively. These local policies are still in effect and currently being enforced.

As these local policies were legislated more than a decade ago, there may be additional features that can be included to further improve and aid in monitoring and enforcement. Moreover, with the increased development of the SMP within the city along with the thrust of the stakeholders to tap into the reuse potential of the wastewater by-products, there is a need to revisit and enhance the scope of the local ordinance. Given that this practice is not widely observed in the city, the instruction of reuse features, together with stakeholder engagement, can facilitate acceptance and behavioral change among the public towards reuse of treated by-products.

The benchmark analysis framework considers the key success factors of existing SMP ordinances in the country. Due to the different background and context, some features of the benchmarked ordinances may not always be applicable. Thus, ordinances should be tailored to the current conditions and future requirements of the city.

Figure 44 illustrates the process of the ordinance review which analyzes the current state to its desired state considering current practices of other municipalities and cities. A more extensive benchmark analysis of other ordinances from other LGUs is further discussed in **Appendix D**.

Figure 44: Ordinance Review Process



Action Needed: *Proposal for a revision of the Septage Management System Ordinance to adapt to the current situation and to alignment of other national and local laws and policies. This is also to maintain the oversight Council of the Zamboanga City, CSMC, and constantly align with ZCWSC which tackles the full spectrum of Water Security.*

7.6 Promotional Plan

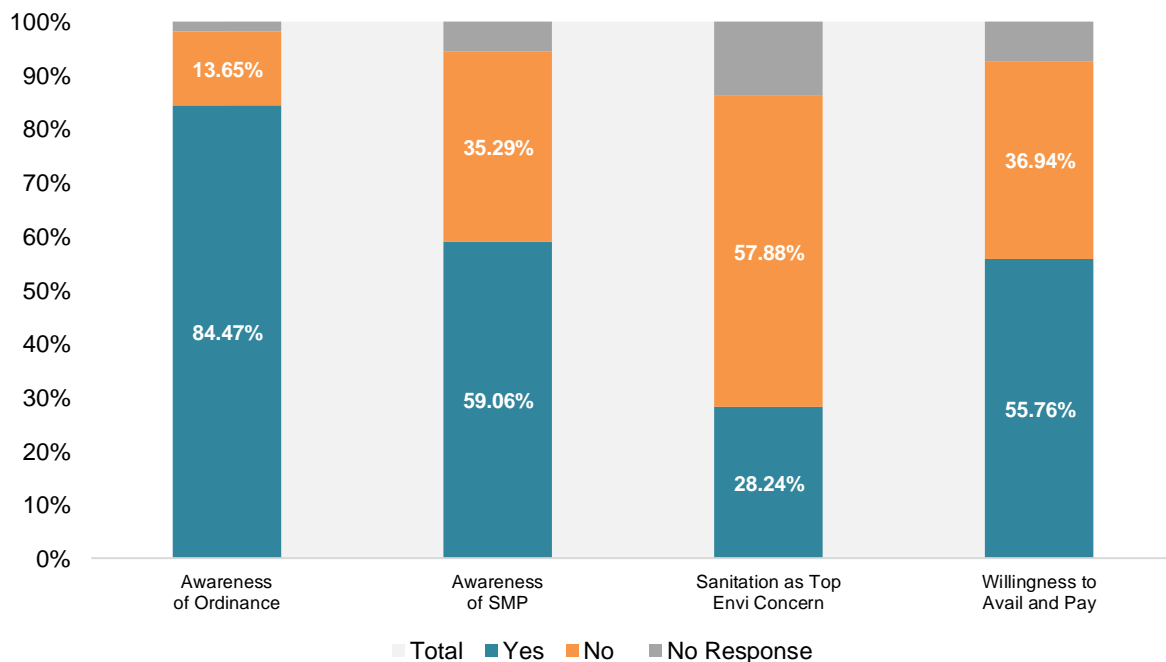
Aside from the establishment of the infrastructure and the enabling environment, an integral part for the success of the Septage Management Program is the promotion. As many sanitation initiatives have failed, promotion is meant to create awareness to the target audiences. It also influences and encourage the audience to change and conform to the ideal behavior.

The City of Zamboanga has a Septage Management Ordinance that is continuously engaging its constituents and households with respect to sanitation. The household and commercial survey conducted in the study assessed how the household may perceive the proposed project through the following questions:

- *Are you aware of any local ordinance on sanitation?*
- *Have you heard about the Septage Management Program of the LGU?*
- *Rank the following environmental concerns based on what should be prioritized: water supply, toilet facility/sanitation, and solid waste disposal.*
- *Are you willing to avail and pay for the regular desludging services of septic tanks that will be offered by the Water District?*

Based on the survey results shown in **Figure 45**, there is a high degree of awareness on local sanitation policy where majority (84.47 percent) of the respondents are aware that the city has a local sanitation ordinance. On the other hand, a significantly lower share of the respondents (59.06 percent) has heard that the city government is implementing the Septage Management Program. Among the environmental concerns the respondents were asked to rank, most of identified water supply as the concern that must be prioritized, and only one in four households (28.24 percent) thought that programs in sanitation or provision of toilet facility must be immediately addressed.

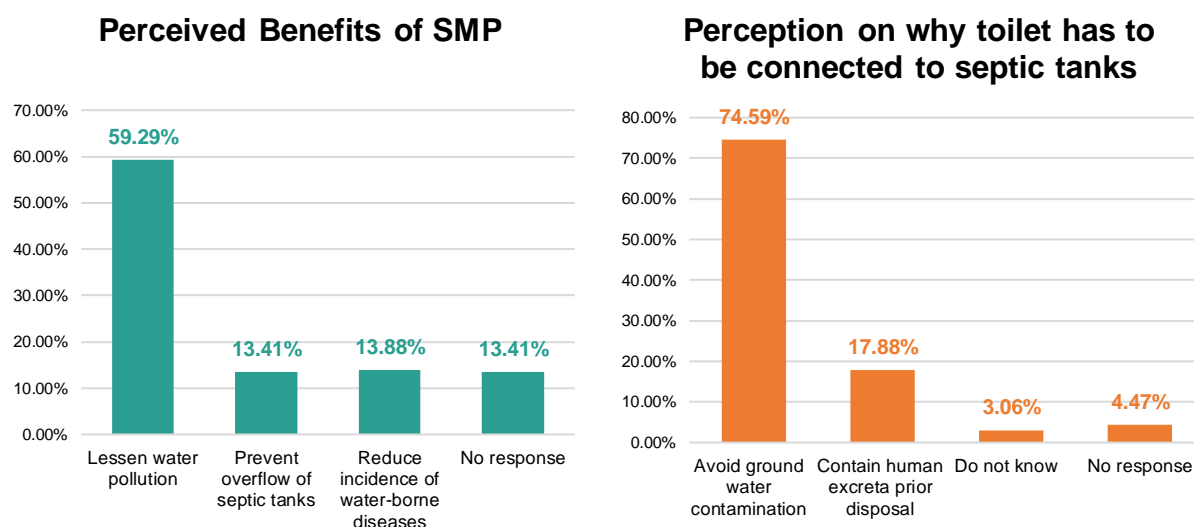
Figure 45: Project Perception of Surveyed Households



By linking these responses to their willingness to pay and avail of services, we can deduce the elements that can be considered barriers or facilitators to the desired change being introduced by the project, which is to maximize utilization of the treatment plant through the willingness of households to regularly desludge their septic tanks, when asked on their willingness to avail and pay for desludging services.

When asked about their thoughts on why toilet facilities **must** be connected to septic tanks, and the potential benefits that can be brought about by the implementation of the Septage Management Program, majority of their responses suggest that their awareness of the project benefits are mainly on environmental protection. This is demonstrated by the results showing that majority (59.29 percent) identified reduced water pollution as the potential benefit of the project and only a small share of the respondents is aware of its possible contribution to improvements in health. Similarly, about three in four (74.59 percent) respondents are aware that the use of septic tanks can avoid contamination of groundwater.

Figure 46: Perceived Project Benefits



The results of the survey provide evidence that the key proponents are encouraged to conduct IEC and promotional campaigns to inform households about the positive benefits of sanitation.

Another aspect of this study is the reuse application of reclaimed water and biosolids. This has a potential to create not only environmental but also economical benefits to the City of Zamboanga. However, there is a negative connotation in using byproducts of treated human waste to potential consumer. With this, it is also essential to explore, to educate, to inform and to market potential byproducts to be reused by individuals and/or businesses in the city.

Also included in this study is an IEC and Marketing Workshop that was conducted with the City LGU and ZCWD. **Annex 5** discusses background, approach and outputs of the promotional campaign workshop conducted on September 27 and 28, 2021.

8 Environmental and Social Assessment

This section presents the Environmental and Social Assessment (EA/SA) for the proposed SMP. This is necessary prior to the implementation of the program to ensure that the project is not compromising the environment in any way. The section also includes the discussion of the social impacts of the project and how to mitigate or lessen its negative effects.

8.1 Introduction

Development projects can bring about improvements in living conditions and economic benefits for its target beneficiaries, but these projects also bring about consequences to the environment and to people and communities. Environmental and social assessments are most successful if it forms an integral part of project development from the earliest stages so that issues are incorporated, not only on the design adopted, but also in the options considered and the ways in which the environmental components are approached. In this way, the key social and environmental aspects at every stage of the study and design are accounted for. By assessing and analyzing environmental and social impacts, improvements in the design and implementation of such projects can be carried out to make them more equitable and not undermine local needs over natural resources, ecosystem, and local communities.

8.1.1 Scope and Methodology

The development of the assessment utilized a combination of primary and secondary data sources. A desk review was conducted to collect relevant plans, reports and documents in relation to the proposed project and the project area, as well as to scope out the applicable national policies and international frameworks on environmental and social impact assessments to guide the preparation of the report. For primary data gathering, environmental and social components have been integrated in the conduct of the field activities to facilitate the data collection process especially with the limitations due to the ongoing community quarantine restrictions. The specific field activities that informed the development of the environmental assessment utilizes are outlined in **Table 85**. A more detailed discussion of the household and commercial survey is on **Annex 1**.

Table 85: Environmental and Social Components of Field Activities of the Study

Activity	Date	Environmental and Social Components
Sanitation Planning Workshop	July 8, 2021	<ul style="list-style-type: none">Identified key sanitation problems and their respective causesDetermined the desired changes and corresponding actions to address sanitation concerns
Household and Commercial Survey	August 19-26, 2021	<ul style="list-style-type: none">Determined socio-economic characteristics in the target barangays and their households;Assessed current sanitation conditions in the project area including available facilities and existing practicesDetermined perceptions, acceptability, and willingness-to-pay for improved sanitation services
Site Evaluation	August 24, 2021	<ul style="list-style-type: none">Conducted site visits to all candidate SpTP sitesAssessed all sites to determine its topography, zoning, vicinity, and accessibility
Stakeholder Consultation Meeting on Reuse	August 27 2021	<ul style="list-style-type: none">Gathered information on the concerns of the stakeholder about the social, environmental, and economical issuesDiscussed social acceptability concerns for the reuse component of the project

Activity	Date	Environmental and Social Components
Consultation with the Host Barangay of the SpTP	September 13, 2021	<ul style="list-style-type: none"> Discussed potential concerns of the stakeholders in the barangay regarding the proposed project
Promotional Campaign Workshop	September 27-28, 2021	<ul style="list-style-type: none"> Demonstrated strategies to market and promote sanitation residual byproducts Enabled stakeholders to develop their own promotional campaigns

During the conduct of the study, there were restrictions on face-to-face meetings, trainings, and seminars, thus stakeholder consultation activities, with exception to the household surveys, were conducted virtually, thus limiting the participation of some groups who may have internet connectivity issues.

8.2 Legal Framework

8.2.1 Philippine Environmental and Social Policy Framework

The policies governing the conduct of environmental and social impact assessments of infrastructure projects at the national level, including republic acts, presidential decrees, memorandum circulars and administrative orders, are enumerated in **Table 86** and further detailed in **Appendix C**.

Table 86: Environmental and Social Sector Policies in the Philippines

Topic	Related Policies
Project Categorization, and Environmental and Social Impact Assessments	<ul style="list-style-type: none"> Presidential Decree No. 1151: Philippine Environmental Policy (1977) Presidential Decree No. 1586: Establishing an Environmental Impact Statement System including other Environmental Management Related Measures (1978) DENR-EMB MC No. 005 - Revised Guidelines for Coverage Screening and Standardized Requirements under the PEISS (2004)
Environmental Management and Protection	<ul style="list-style-type: none"> Republic Act No. 7586: National Integrated Protected Areas System Act (1992) Republic Act No. 11038 Expanded NIPAS Act (2018) Republic Act No. 9147: Wildlife Resources Conservation and Protection Act Presidential Decree No. 1067 of 1976: The Water Code of the Philippines Republic Act No. 9275 – Philippine Clean Water Act (2004) DENR AO No. 2016-08 – Water Quality Guidelines and General Effluent Standards (2016) DENR AO No. 2021-19 – Updated WQG and GES for Selected Parameters (2021)
Disaster Risk Reduction and Management	<ul style="list-style-type: none"> Republic Act No. 9729: Climate Change Act (2009) Republic Act No. 10121: Philippine Disaster Risk Reduction and Management Act (2010) DENR-EMB Memorandum Circular 2011-005: Incorporating DRR-CCA Concerns in the PEISS (2011)
Cultural Heritage	<ul style="list-style-type: none"> Republic Act No. 10066 – National Cultural Heritage Act (2009) Republic Act No. 10086 – Strengthening People's Nationalism through Philippine History Act (2009) Republic Act No. 11333 – National Museum of the Philippines Act (2018)
Land and ROW Acquisition, and Involuntary Resettlement	<ul style="list-style-type: none"> The 1987 Philippine Constitution Republic Act No. 7160: Local Government Code (1991) Republic Act 7279: Urban Development Housing Act (1992) Republic Act 10752: The Right-of-Way Act (2016) DPWH DO No. 152 s. 2017: Right-of-Way Acquisition Manual (2017)
Occupational Health and Safety,	<ul style="list-style-type: none"> Presidential Decree 442: Labor Code of the Philippines (1974) Republic Act 10691: Public Employment Service Office (2015) Republic Act 1105sk48: Occupational Safety and Health Standards (2018)

Topic	Related Policies
and Labor Standards	
Gender and Development	<ul style="list-style-type: none"> • Republic Act No. 9710: Magna Carta of Women (2010) • Republic Act 7192: Women in Development and Nation Building Act (1992) • PCW MC No. 2018-04: Revised Guidelines for the Preparation of the Gender and Development Agenda (2018) • Harmonized Gender and Development Guidelines (2019) • Republic Act 9262 – Anti-Violence Against Women and Their Children Act (2004) • Republic Act 7877– Anti-Sexual Harassment Act (1995)
Indigenous Peoples	<ul style="list-style-type: none"> • Republic Act No. 8371 Indigenous Peoples' Rights Act(1997)
Vulnerable and Disadvantaged Groups	<ul style="list-style-type: none"> • Republic Act 9994: Expanded Senior Citizens Act (2010) • Republic Act 7277 (1991) as amended by Republic Act 9442: Magna Carta for Disabled Persons (2006) • Republic Act No. 7607: Magna Carta of Small Farmers (1992) • Presidential Decree 603: Child and Youth Welfare Code (1974) • Republic Act 8425: Social Reform and Poverty Alleviation Act (1998)
Stakeholder Engagement and Public Participation	<ul style="list-style-type: none"> • DENR AO No. 2017 - 15: Guidelines on Public Participation under the PEISS (2017)

8.2.2 International Practices and Frameworks

International organizations and multilateral finance institutions have established safeguard policy frameworks to ensure that adverse impacts to the environment and the community are avoided, mitigated and managed, while at the same time maximizing the potential benefits from the development projects. These policies summarized in **Table 87** can serve as possible references and benchmarks in ensuring the observance of safeguard policies in the project implementation.

Table 87: International Frameworks on Environmental and Social Assessments

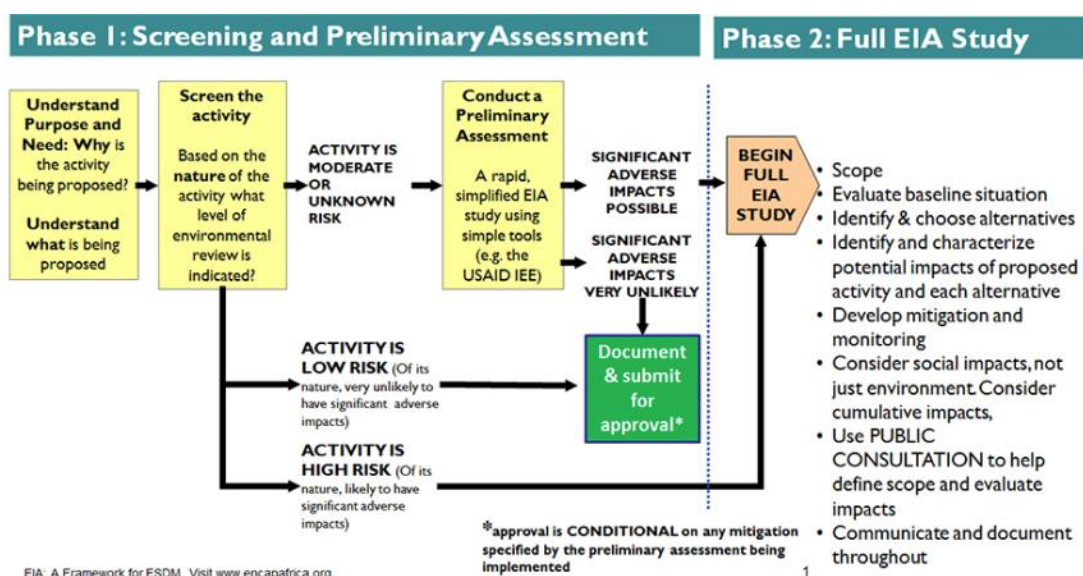
Framework	Summary
World Bank Environment and Social Framework (2017)	<p>The Environmental and Social Framework (ESF) of the World Bank lays out the mandated policies, and guidelines, and standards to be adhered to and aligned with by projects to undergo financing from the World Bank. The ESF also includes ten (10) environmental and social standards (ESS) with the objective of facilitating the identification of environmental and social risks and impacts of the proposed project, to prevent and mitigate undue harm to people in the development process, and to further enhance the social benefits from the proposed project:</p> <ul style="list-style-type: none"> • ESS 1: Assessment and Management of Environmental and Social Risks and Impacts • ESS 2: Labor and Working Conditions • ESS 3: Resource Efficiency and Pollution Prevention • ESS 4: Community Health, Safety, and Security • ESS 5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement • ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources • ESS 7: Indigenous Peoples • ESS 8: Cultural Heritage • ESS 9: Financial Intermediaries • ESS 10: Stakeholder Engagement and Information Disclosure <p>Each safeguard policy of the ESS establishes the standards and requirements to ensure that the principles of environmental and social sustainability, stakeholder engagement, nondiscrimination, and transparency and accountability in governance is adhered to.</p>
Asian Development	The objectives of the Asian Development Bank Safeguards are to avoid adverse impact on the environment and the project-affected people, to minimize, mitigate and/or compensate for adverse

Framework	Summary
Bank Safeguards (2009)	<p>impacts where avoidance is not possible, and to help strengthen the safeguard systems of borrowers and to develop their capacity to manage environmental and social risks. The safeguard policies of ADB covers the following safeguard areas:</p> <ol style="list-style-type: none"> 1. <u>Environmental Safeguards</u>: Its primary objective of ensuring the environmental soundness and sustainability of the project; 2. <u>Involuntary Resettlement Safeguards</u>: Its primary objectives are to avoiding involuntary resettlement whenever possible through exploring project and design alternatives, to enhance or restore livelihoods of displaced persons to pre-project levels, and to improve living standards of the displaced and vulnerable; and 3. <u>Indigenous Peoples Safeguards</u>: Its primary objectives are to ensure that the identity, dignity, human rights, livelihoods systems, and cultural uniqueness defined by the indigenous peoples are respected and will not be subjected to adverse impacts due to the project (ADB, 2009). <p>The scope of the social safeguards varies depending on the categorization of the project after undergoing a screening process of its potential impacts (ADB, 2009). . The policy framework provides that no projects will be financed by ADB unless its clients comply with their policy statement. As of November 2020, the safeguard policies of ADB are undergoing review and set to be revised for a more updated and effective safeguards implementation (ADB, 2020).</p>
Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (2010)	<p>The objectives of the social and environmental guidelines are to facilitate the assessment of environmental and social impacts for proponents implementing projects receiving support from JICA, including air, water, soil, ecosystem, flora, and fauna, as well as social impacts including involuntary resettlement, and indigenous people's rights. Among the information specified in the guidelines include processes on project categorization and the respective reporting requirements, parameters of impacts assessment, information disclosure, stakeholder consultations, human rights, and alignment with existing laws and regulations. These guidelines are currently undergoing review and revisions as of July 2021 (JICA, 2021).</p>

USAID Environmental Impact Assessment Process

The process followed for the environmental impact assessments under USAID follows two main phases: (a) Screening and Preliminary Assessment, and (b) Conducting a Full Environmental Impact Assessment (EIA) Study. During the first phase, the proposed undertaking undergoes a screening process on the anticipated level of risk of the proposed project due to its nature. An overview of the general EIA process of USAID projects are illustrated in **Figure 47**.

Figure 47: Overview of the General EIA Process



Full EIAs differ from Initial Environmental Examination (IEEs) in that the former will require the following:

- Formal scoping process to identify the issues to be addressed;
- Detailed analysis of environmental impacts;
- Formally defined alternatives and a detailed evaluation of their respective impacts of these alternatives (alternatives include project as proposed, no-action alternative, and at least one other real alternative);
- Conduct of public consultation is required; and
- Often requires a professional team to complete (USAID, 2018).

Certain undertakings have been identified to generally have a significant effect on the environment, including sewerage projects as highlighted in **Table 88**. These projects are not eligible for categorical exclusions and generally requires the conduct of an environmental impact assessment.

Table 88: Classes of Actions Normally Having a Significant Effect on the Environment

Ineligible Activity Types for Categorical Exclusion (as provided by 22 CFR 216.2)	
Programs of river basin development	Large-scale construction
Irrigation or water management projects, including dams and impoundments	Involve assistance for procurement or use or both of pesticides
Agricultural land leveling	Affects public health or safety
Drainage projects	May affect Indigenous People
Large-scale agricultural mechanization	Affects wetlands; cultural, historic, or archeological resource; or a hazardous waste site
New lands development	Affects Tropical Forests
Resettlement projects or projects with resettlement or displacement	Involves a highly uncertain or scientifically controversial effect on the human environment, or a unique or controversial risk
Penetration road building or road improvement projects	Genetically engineered organisms
Powerplants	Hazardous waste or toxic materials
Industrial plants	Establishes precedents or makes decisions, for future actions that may have significant effects

Ineligible Activity Types for Categorical Exclusion (as provided by 22 CFR 216.2)	
Potable water and sewerage projects other than those that are small-scale	Threatens a violation of federal, state, local or tribal law, or requirements of those laws, imposed for the protection of the environment
Affecting endangered or threatened species or critical habitat such as those in a conservation area or national park	

Based on the USAID Environmental Compliance Procedures (2013), given that the proposed project falls under the same category as those aforementioned, and thus will require the development of a full-blown Environmental Assessment or Environmental Impact Statement prior to its implementation, with exception to instances wherein the project originator can justify and establish that the project will not have a significant effect on the environment:

“An Initial Environmental Examination normally will not be necessary for activities within the classes described in [list above], except when the originator of the project believes that the project will not have a significant effect on the environment. In such cases, the activity may be subjected to the procedures set forth in these procedures.

Preparation of Environmental Assessments and Environmental Impact Statement. the originator of the action will be responsible for the preparation of an Environmental Assessment or Environmental Impact Statement as required. Draft Environmental Impact Statements will be circulated for review and comment as part of the review of Project Papers and as outlined further in [the procedures specified for EA and EIS].” (p. 12, 15)

Apart from guidance documents and procedures on environmental impact assessments, USAID has released Sector Environmental Guidelines for Water Supply and Sanitation to facilitate sound design and management which consider environmental considerations by providing guidelines on the general potential adverse impacts and mitigating measures to be considered (USAID, 2017)

8.2.3 Project Categorization and Reporting Requirement

The Revised Guidelines for Coverage Screening and Standardized Requirements released in 2014 (DENR-EMB, 2014) includes the categorization of various infrastructure projects under the the Philippine Environmental Impact System as shown, including septage treatment facilities.

Based on the proposed septage volume capacity per day identified in **Section 4**, the proposed SpTP is covered by the PEISS, and falls under Category B: Non-ECP Project, and will require the completion of an IEE Checklist Form.

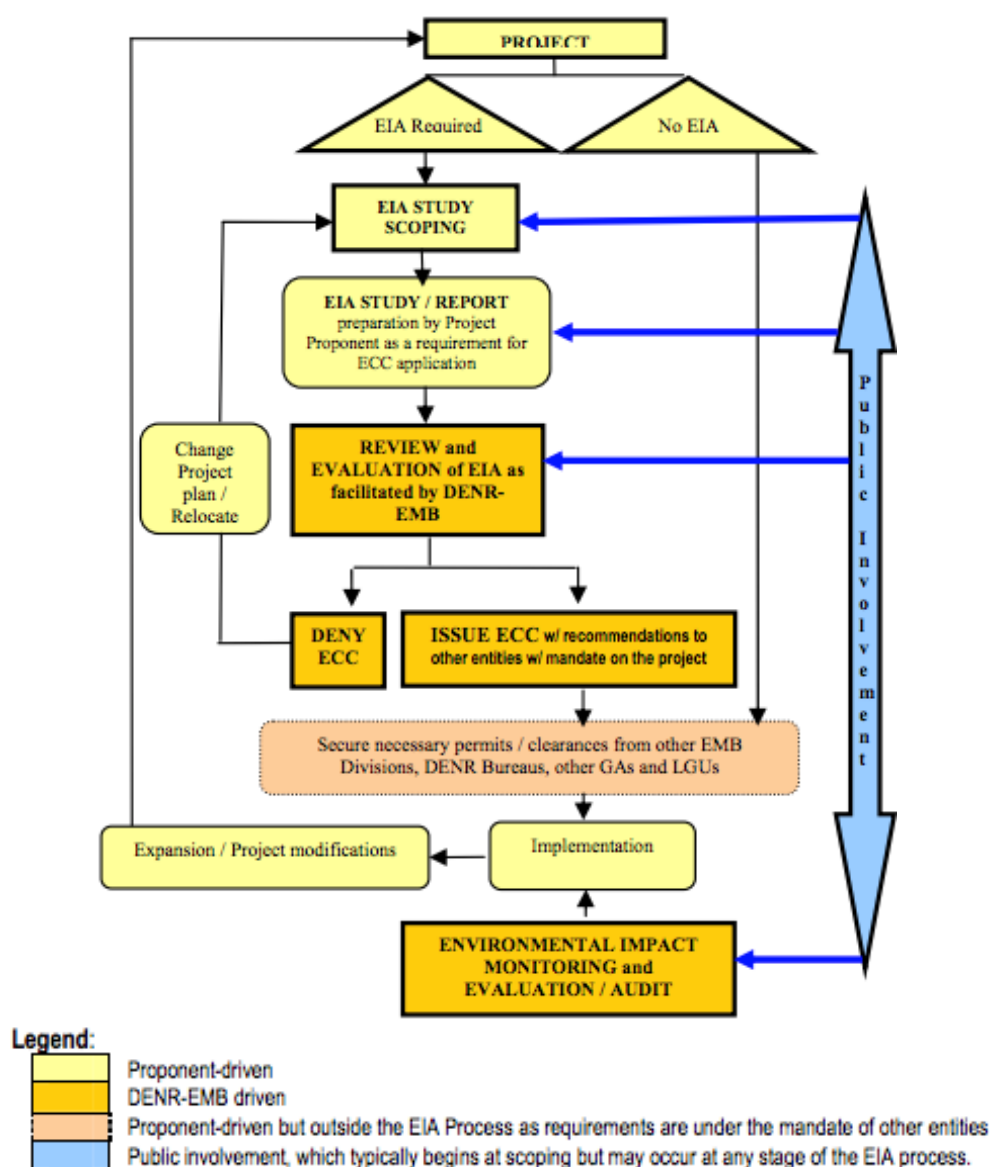
The process of the development of environmental impact assessments under the PEISS is presented in **Figure 48**.

Table 89: Thresholds for Coverage Screening and Categorization for Septage Treatment Facilities

Projects/Description	Covered (Required to secure ECC)			Not Covered (may secure CNC)	Project Size Parameters/ Remarks
	Category A: ECP	Category B: Non-ECP		Category D	
	EIS	EIS	IEE Checklist	PD (Part I only)	
3.8 Waste Management Projects					
3.8.5 Domestic wastewater treatment facility (including septage treatment facility)	None	≥ 5,000 m³	> 30 m³ but < 5,000 m³	< 30 m³	Based on system capacity

Source: 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippine EIS System

Figure 48: Flowchart of the EIA Process in the Philippines



8.3 Project Description

To promote the protection of water resources along with promoting improved environmental and health conditions, a septage management program, including a resource recovery component, is being proposed for the City of Zamboanga. The proposed design capacity and projected service connection for the two phases of the project are shown in **Table 90**.

Table 90: Key Features of the Proposed SpTP

Characteristics	Phase I (2025 – 2032)	Phase II (2033 – 2040)
Total Service Connections	82,446	99,670
<i>ZCWD Customers</i>	<i>78,909</i>	<i>92,765</i>
Residential	72,876	85,664
Non-Residential	6033	7101
Government	525	618
Commercial/Industrial	5,508	6,483
<i>Non-ZCWD Customers</i>	<i>3,537</i>	<i>6,905</i>
Residential	3,455	6,817
Non-Residential	82	88
SpTP Design Capacity (m³/day)	190	260

Note: Septage volume and service connections shown are the end-of-phase figures.

The proposed site has a land area of 1.61-hectare situated along the Zamboanga Bypass Road and Lupong Road, as shown in **Figure 49**. The property is owned by the ZCWD property and is located in Barangay Cabatangan, Zamboanga City.

Figure 49: Location of the Proposed SpTP Site in Cabatangan

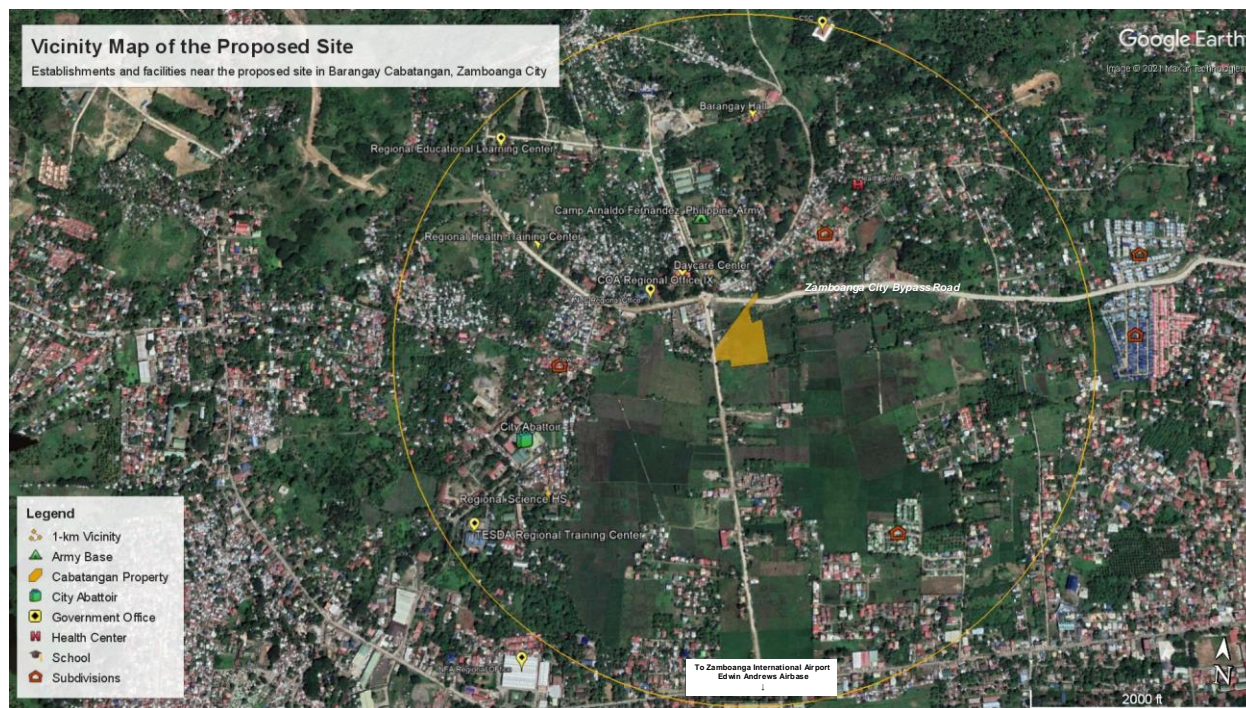


8.4 Baseline Socioeconomic and Environmental Conditions

The proposed site in Barangay Cabatangan can be found at the approximate coordinates: 6°56'15.25"N, 122° 3'27.06"E. The host barangay has a population of 17,812 (as of 2020), which by 5.71% from its 2015 population. Cabatangan is landlocked and shares a common border with barangays Capisnan (northwest), Pasonanca (east), Lunzuran (northeast), Dulian (northeast), Santa Maria (southeast), and San Roque (southwest), as illustrated in **Figure 51**.

Its current zoning is classified as residential (Western portion) and protection agricultural land uses (Eastern portion). **Figure 50** shows the vicinity within the 1-km radius around the proposed site. It may be observed that the site is located within the community, surrounded by residential and agricultural areas, as well as several institutional facilities. Its location is easily accessed through paved municipal/barangay roads, about 9m in width.

Figure 50: Vicinity Map of Proposed Site



Source: Imagery ©2021 Maxar Technologies, Map data ©2021

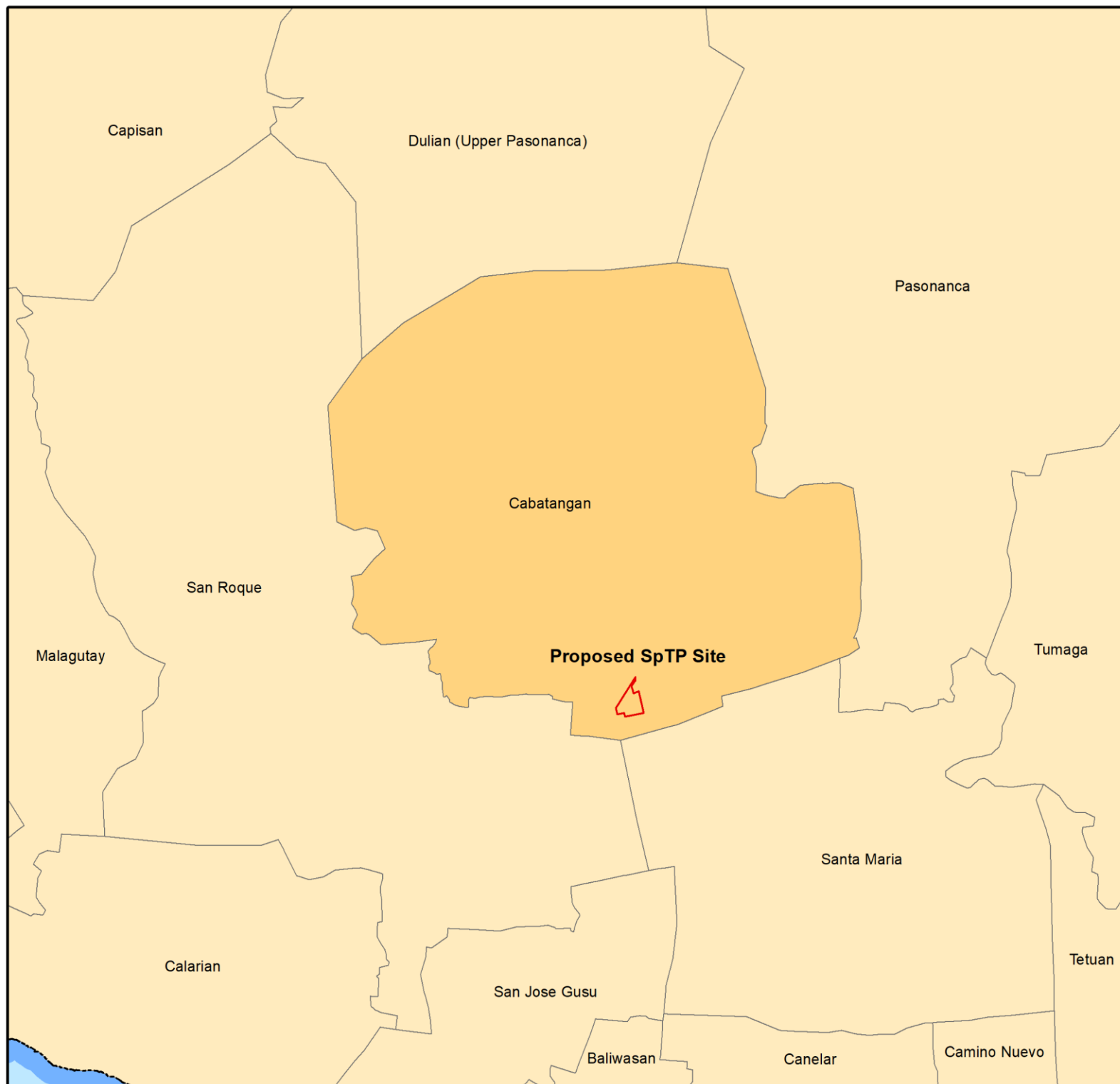
The proposed project is set to discharge the treated effluent at the nearby NIA canal that leads to irrigation networks for agriculture for reuse. However, the effluent may alternately be discharged downstream of Tumaga River classified as a Class C water body, to which the quality of the effluent from the treatment plant is designed. According to the latest water quality monitoring report of DENR-EMB from the first quarter of 2021, the water quality conditions of this area of the Tumaga River are presented in **Table 91**. It may be observed that the amount of fecal coliform detected is significantly greater than the limit set by DENR Standards.

Table 91. Tumaga River Station 2 Water Quality Conditions

Parameter	Unit	April	May	June	July
DO	mg/L	0.7	7.7	6.7	4.6
BOD	mg/L	6	2.1	4.9	5.2
TSS	mg/L	5	19	18	25
pH	-	7	7	7	7
Temp	°C	28	24	28	29
Chloride	mg/L	14.57	7.13	7.6	20.79
Color	TCU	5	5	5	7
Phosphate-P	mg/L	0.429	0.057	0.076	0.137
Fecal Coliform	MPN/100mL	920,000	280,000	170,000	140,000

Using readily-available assessments from various agencies, namely Philippine Institute of Volcanology and Seismology (PHIVOLCS) and DENR-MGB, through published assessment matrices and quick hazard susceptibility assessment using HazardHunterPH, the hydrometeorological and seismic hazards of the proposed sites were then analyzed.

Based on the Barangay-level Geohazard Susceptibility Assessment conducted by DENR-MGB in 2010, Barangay Cabatangan, where the proposed site is located, has a landslide susceptibility rating of moderate to high. Based on the same data, no flood susceptibility was identified for the barangay. The assessment recommends the regular monitoring of soil changes in the area, particularly the presence of vertical placement and cracks perpendicular to the steep slopes (DENR-MGB, 2010). However, based on findings of HazardHunterPH, the proposed site is located in an area with very high susceptibility, which pertains to flood heights of more than two meters or more than 3 days of flooding, especially in areas with active or abandoned river channels, and areas along river banks. Based on the assessment, these are areas considered as critical geohazard areas and are not suitable for development.



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

- City/Municipal Boundaries
- Proposed SpTP Site
- Barangay Cabatangan
- Barangay Boundaries



1:30,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Administrative Maps (OCHA, 2016)
Proposed SpTP Sites (ZCWD, 2021)

FIGURE 51

Barangay Cabatangan
Location Map

8.5 Analysis of Alternatives

The analysis of alternatives covers the technology options for the wastewater treatment, along with the zero or no-project alternative. Among the options considered for the technical design of the wastewater management system for Zamboanga City include the septage management program, a combined sewerage system, and a separate sewerage system. The environmental and social implications of these alternatives are provided in **Table 92**.

Table 92: Environmental and Social Implications of Project Alternatives

Alternatives	Description	Environmental and Social Implications
No Project	<ul style="list-style-type: none"> <i>Pollution Reduction Efficiency</i>: Not applicable <i>Cost per kg-BOD removed</i>: Not applicable <i>Cost per household</i>: No direct capital cost, but may have health, economic, and environmental costs 	<p>The following existing conditions in water quality and health may persist or potentially worsen:</p> <ul style="list-style-type: none"> Based on the Water Quality Monitoring Report of EMB Region IX, some of the water bodies in the city do not meet the DENR WQS, especially for fecal coliform levels wherein all water bodies with reported parameters went over the DENR Standard (City Government of Zamboanga, 2018). Water-borne diseases were reported to be among the leading causes of illness in the city from 2016 to 2020, particularly UTI, skin diseases, acute gastroenteritis, and Diarrhea (Zamboanga City Health Office, 2020).
Septage Management Program	<ul style="list-style-type: none"> <i>Pollution Reduction Efficiency</i>: 50% <i>Cost per kg-BOD removed</i>: PhP55-130 (depending on % additional BOD reduction) <i>Cost per household</i>: PhP4,500 <i>Implementation considerations</i>: Households that have non-existing, or non-compliant septic tanks must construct or retrofit their septic tanks 	<ul style="list-style-type: none"> Improved water quality of receiving bodies of water Reduction in incidence of water-borne diseases Potential contribution to reduced economic burden from health and hospitalization expenses High operating, maintenance and replacement requirements
Combined Sewerage System	<ul style="list-style-type: none"> <i>Pollution Reduction Efficiency</i>: 90% (during dry weather) <i>Cost per kg-BOD removed</i>: PhP 90 <i>Cost per household</i>: PhP90,000 <i>Implementation considerations</i>: during rainy weather conditions, a portion of the wastewater is directly discharged to as only a part of the flow is conveyed to the treatment plant 	<ul style="list-style-type: none"> Higher pollution reduction efficiency which can better protect the receiving bodies Reduction in incidence of water-borne diseases Potential contribution to reduced economic burden from health and hospitalization expenses Requires higher capital investment costs Higher operating, maintenance and replacement requirements
Separate Sewerage System	<ul style="list-style-type: none"> <i>Pollution Reduction Efficiency</i>: 90% <i>Cost per kg-BOD removed</i>: PhP 185 <i>Cost per household</i>: PhP90,000 <i>Implementation considerations</i>: high capital investment costs 	<ul style="list-style-type: none"> Highest pollution reduction efficiency which can better protect the receiving bodies Reduction in incidence of water-borne diseases Potential contribution to reduced economic burden from health and hospitalization expenses Requires higher capital investment costs May exclude households who are unable to afford to connect Utilization may not be optimized due to less households able to avail High operating, maintenance and replacement requirements
Inclusion of Resource Recovery	<ul style="list-style-type: none"> Serves as a complementary facility to the selected wastewater management system 	<ul style="list-style-type: none"> Maximize the benefits from wastewater treatment as detailed in Section 3 Availability of an alternative water supply source

Alternatives	Description	Environmental and Social Implications
	<ul style="list-style-type: none"> Characteristics of the wastewater management system identified as optimal 	<ul style="list-style-type: none"> Reduced pressure on water sources from competing water uses Acceptability issues

Note: Description adopted from discussion from the technical analysis sections of the Study. Pollution efficiency pertains to percent of BOD pollution load removed and assumes that septic tanks within the system follow technical standards in design, construction, and maintenance (including desludging frequency) for the system.

A discussion elaborating on the selected system is elaborated in **Section 5**.

8.6 Environmental Assessment

8.6.1 Environmental Impact Assessment and Mitigating Measures

The key potential impacts to air, water, and land identified at the current stage of the report preparation only cover the general risks and impacts of sanitation infrastructure, including septage treatment plants. These impacts will be further finetuned and contextualized at the succeeding iterations of the report. Furthermore, these will also be further verified during the finalization of the IEE Checklist Report following the guidance provided in DAO 005-14 to be conducted at the future stages of the project development during the development of the full-blown feasibility study.

Key Impacts to Land

Based on the assessment of the technical design and site evaluation, the potential impacts to land across the project phases are shown in **Table 93**.

Table 93: Key Potential Impacts to Land by Project Phase

Key Potential Impacts to Land	Project Phase						Remarks
	1		2		3		
	Yes	No	Yes	No	Yes	No	
Change or Inconsistency in land use	x			x		x	To be further verified during the finalization of the IEE Checklist following the guidance provided in DAO 005-14.
Encroachment in ECAs		x		x		x	
Possible tenurial/land issues		x		x		x	
Change in surface landform, topography, terrain, or slope		x	x			x	
Inducement of subsidence, liquefaction and other geological and hydrometeorological hazards		x	x		x		
Soil erosion/loss of topsoil/ overburden		x	x			x	
Change in soil quality		x	x		x		
Vegetation removal		x		x		x	
Threat to existence and/or loss of important local species		x		x		x	
Threat to abundance, frequency and distribution of important species		x		x		x	
Hindrance to wildlife access		x		x		x	

Legend: 1 - Pre-construction; 2 – Construction; 3 - Operations and Maintenance

The Cabatangan site is situated in an area classified as residential (Western portion) and protection agricultural land uses (Eastern portion), as shown in **Annex 2**. During the conduct of the field investigation, it was found that the agricultural area of the lot has irrigated rice fields as

agricultural/residential, while section in the lot is an irrigated rice field). The proposed project will therefore require the conversion of agricultural land and land reclassification. No tenurial or land issues are anticipated since the water district owns the proposed site. Additionally, since the site is in an area surrounding mostly urban land uses and is relatively far from forest protection areas, impacts to wildlife and biodiversity is not likely.

Using the provided coordinates of the proposed site, HazardHunterPH was used to perform a rapid hazard assessment. The proposed site has exposure to the following hazards: ground shaking, ashfall, and flood. The key findings and recommendations from the assessment are shown in **Table 94**. It should be noted that at the time wherein the rapid assessment was ran in September 2021, that the data for earthquake-induced landslide, and storm surge, are being updated. With this, the barangay-level assessment from MGB (2010) can be considered wherein Cabatangan rates at moderate to high for landslide susceptibility.

Table 94: Results of the Rapid Hazard Assessment

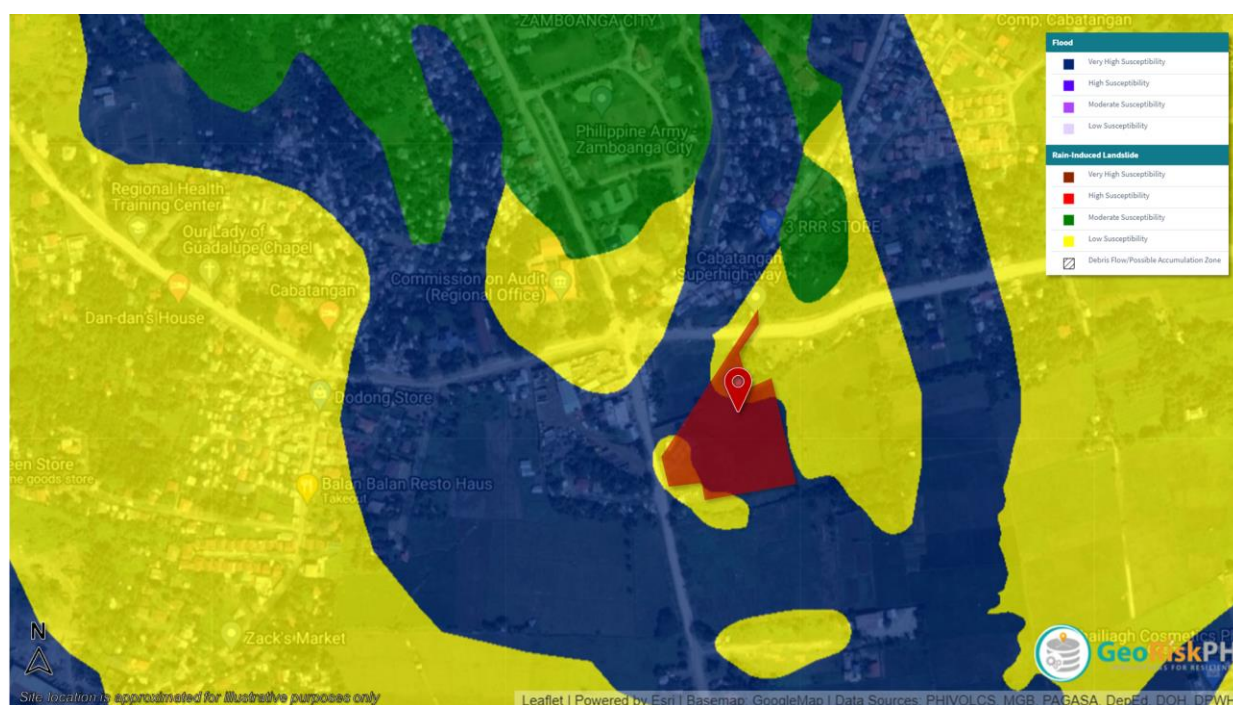
Type	Hazard	Assessment	Explanation and Recommendation
Seismic	Ground Shaking	Prone	All sites may be affected by ground shaking in the event of an earthquake and can be mitigated by following the provisions of the National Building code and the Structural code of the Philippines.
Volcanic	Ashfall	Prone	In case of future eruptions, the site may be affected by ash fallout, depending on the scale of eruption and prevailing wind direction at the time of eruption. Generally, ashfall is heavier near the active vent and thins out indefinitely away from the eruption center. Nearest active volcano: Bud Dajao
Hydro-meteorological	Flood ⁷	Very High Susceptibility; more than 2 meters flood height and/or more than 3 days flooding	Areas with very high susceptibility to floods are likely to experience flood heights of greater than 2 meters and/or flood duration of more than 3 days . These include active river channels, abandoned river channels, and areas along riverbanks, which are immediately flooded during heavy rains of several hours and are prone to flash floods. These are considered critical geohazard areas and are not suitable for development. It is recommended that these be declared as “No Habitation/No Build Zones” by the LGU, and that affected households/communities be relocated. The implementation of appropriate mitigation measures as deemed necessary by project engineers and LGU building officials is recommended for areas that are susceptible to various flood depths. Site-specific studies including the assessment for other types of hazards should also be conducted to address potential foundation problems.

Source: HazardHunterPH

In consideration of the latest available information on these hazards, the critical hazards to be considered are flooding and landslide. As shown in illustrated in **Figure 52**, a large part of the site has very high susceptibility to flooding, while the northern and southwestern areas of the site have low susceptibility to landslide.

⁷ Flood assessment from HazardHunterPH uses data from the provided coordinates and the available susceptibility maps from the MGB database. It was assumed that the latest available data is as of 2015 based on the Landslide and Flood Susceptibility Map used in the Zamboanga City CLUP.

Figure 52: Flood and Rain-Induced Landslide Susceptibility of the Proposed Site



Data Sources: DENR-MGB (2015), and ZCWD (2021)

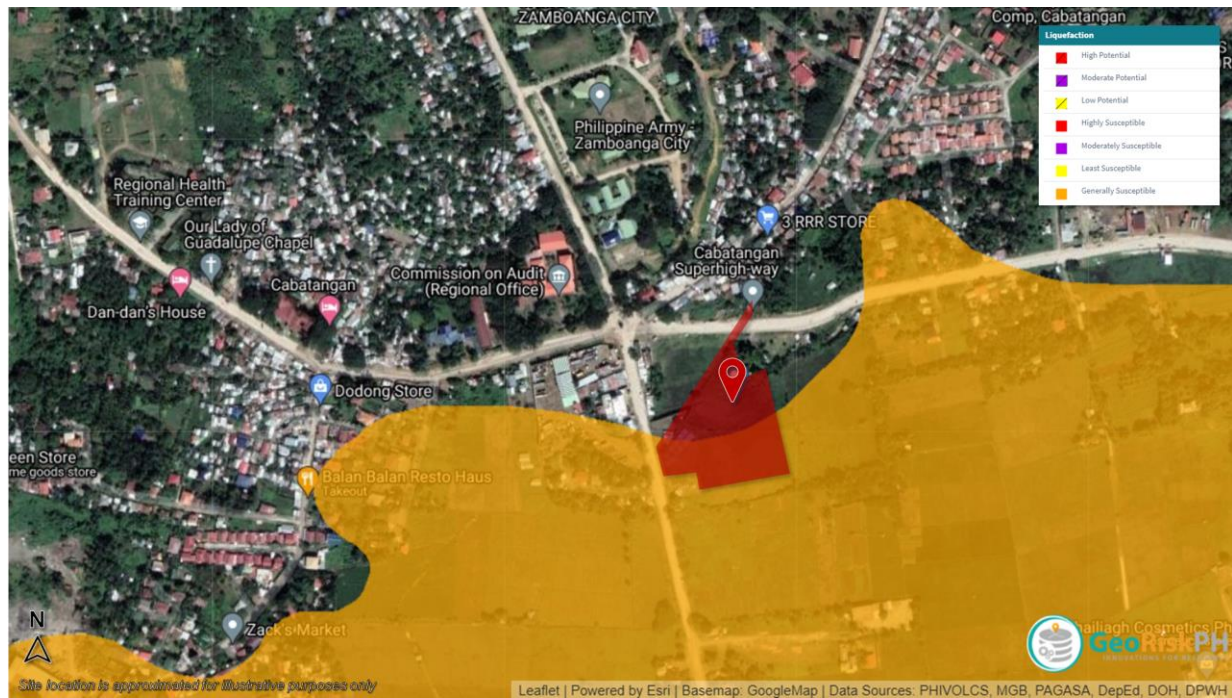
Note: Boundaries of the proposed site was approximated and is used for illustrative purposes only.

Based on the discussion from the Virtual Consultation Meeting with the Association of Barangay Captains conducted last 13 September 2021, representatives from ZCWD and Barangay Cabatangan conveyed that, based on historical data and previously reported hazard events, the barangay is not prone to flooding. This discussion is documented in **Annex 4**. The representative from Barangay Cabatangan added that only the riverside areas experience flooding occasionally. These statements are echoed in their Local Disaster Risk Reduction and Management Plan (LDRRMP) where they specified the barangays affected by recent flash flood events, which excludes Cabatangan (City Government of Zamboanga, 2019).

With these disparities from these data sources, the findings from the hydrometeorological hazard assessment can be further validated for succeeding studies for the site considering the development limitations of the city due to its degree of hazard exposure as shown and discussed in the Site Evaluation Report. This can be implemented in coordination with Zamboanga City Disaster Risk Reduction & Management Office (DRRMO) and MGB Region IX. Alternatively, the assessment of other proposed sites considered may also undergo more thorough site assessment and analysis.

Apart from exposure to hydrometeorological hazards, portions of the property are generally susceptible to liquefaction and tsunamis resulting from seismic activity as seen in **Figure 53** and **Figure 54**. Susceptibility to these geohazards may also be validated in the conduct of future site-specific hazard assessments. The hazard assessment findings must be considered in the development of the full-blown feasibility study, and detailed engineering design of the proposed project.

Figure 53: Liquefaction Susceptibility of the Proposed Site



Data Sources: PHIVOLCS (2021), and ZCWD (2021)

Note: Boundaries of the proposed site was approximated and is used for illustrative purposes only.

Figure 54: Tsunami Susceptibility of the Proposed Site



Data Sources: PHIVOLCS (n.d.), and ZCWD (2021)

Note: Boundaries of the proposed site was approximated and is used for illustrative purposes only.

Among the hazards identified, typhoon, flood, and drought were perceived to have the highest-level of threat at medium to medium-low levels at 2.80, 2.60, and 2.60 out of 5.00 respectively.

Conversely, response to flooding held the highest perceived adaptive capacity level within the city (USAID, 2016). Based on the urban systems analysis of the same study, water and sanitation have been identified among the critical concerns in Zamboanga City with regard to the changing climate conditions.

It was observed during site evaluation is that the lot is partially backfilled, hence being below the road elevation. The site being in a depressed land was also among the concerns expressed during discussions with stakeholders. With such site characteristics, impacts from geological and hydrometeorological hazard susceptibility may be induced even while the plant is operational. Appropriate mitigating measures must be included in the design of the SpTP as to reduce the risks from these hazards.

As shown in **Table 93**, most of the potential impacts to land are possible during the construction phases, which are attributed to the ground clearing and excavation works, and other construction activities during this phase. The key potential impacts during this phase includes change in surface landform and terrain, induced effects of hazards geological and hydrometeorological hazards, soil erosion and loss of topsoil, and change in soil quality. During the operations phase, the possible impacts to land include changes in soil quality given the risks of spillage and soil contamination, along with the induced effects of hazards.

Key Impacts to Water

The site assessment assessed the proximity of the proposed site to bodies of water. Based on the findings, there were no nearby surface water sources, while for groundwater, an existing production well is located within the proposed site. However, this production well is currently non-operational due to non-compliance to water quality parameters, particularly concentration of copper. A nearby NIA Canal was identified as receiving drainage of the treated effluent.

Soil siltation from ground preparation activities during the construction phase can impact the quality of nearby water sources. Another impact under the construction phase is the change in natural drainage morphology due to modifications in ground cover. This can result to increased vulnerability of the site to flooding, which remains present even during the operations phase.

The potential impacts to water by project phase are presented in **Table 95**.

Table 95: Key Potential Impacts to Water by Project Phase

Key Potential Impacts to Water	Project Phase						Remarks
	1		2		3		
	Yes	No	Yes	No	Yes	No	
Change in drainage morphology, inducement of flooding, or reduction in stream volumetric flow		x	x		x		To be further verified during the finalization of the IEE Checklist following the guidance provided in DAO 005-14.
Change in river, stream, or lake water depth		x		x		x	
Depletion of water resources, or competition in water use		x		x		x	
Change or disruption in the circulation pattern; potential for coastal erosion		x		x		x	
Degradation of ground water quality		x	x		x		
Degradation of surface water quality		x		x		x	

Key Potential Impacts to Water	Project Phase						Remarks
	1		2		3		
	Yes	No	Yes	No	Yes	No	
Threat to existence and/or loss of important local species and habitat		x		x		x	
Threat to abundance, frequency, and distribution of important species		x		x		x	

Legend: 1 - Pre-construction; 2 – Construction; 3 - Operations and Maintenance

Key Impacts to Air and Noise

Degradation of air quality is expected during the construction phase may occur with the increased total suspended particulates in construction sites. This can also cause nuisance to the residential and institutional establishments near the site, especially during dry and windy conditions.

Increased generation of noise can cause nuisance to the vicinity of the site, especially that the land use of the surrounding areas includes mostly residential and institutional uses. The construction and operation of the SpTP uses equipment and vehicles that can generate noise up to 80 dB(A) from a distance of 30 meters. Proper mitigating measures should be implemented in these phases to avoid causing disturbance in the area.

The potential impacts to air and noise by project phase are presented in **Table 96**.

Table 96: Key Potential Impacts to Air and Noise by Project Phase

Key Potential Impacts to Air and Noise	Project Phase						Remarks
	1		2		3		
	Yes	No	Yes	No	Yes	No	
Change in local climate		x		x		x	To be further verified during the finalization of the IEE Checklist following the guidance provided in DAO 005-14.
Contribution in terms of greenhouse gas emissions		x		x	x		
Degradation of air quality		x	x			x	
Increase in ambient noise level		x	x			x	

Legend: 1 - Pre-construction; 2 – Construction; 3 - Operations and Maintenance

Climate Change Impacts

Based on the climate projections and studies conducted, a drier and warmer city has been projected for Zamboanga. Among its climate change concerns are extreme temperatures characterized by a rise in average temperature (increase by 2.1°C in 2050), reduced precipitation (decline of -5.2 percent by 2050), consecutive droughts, and more frequent occurrence of El Niño phenomenon (ZC LCCAP Core Team and TWG, 2015). These can have significant impacts to the water supply of the city and consequently can affect wastewater treatment.

Based on the experiences of wastewater systems in areas that encountered prolonged droughts, the water supply restrictions has led to the changes in human behaviors and wastewater characteristics (Hughes, Cowper-Heays, Oleson, Bell, & Stroombergen, 2021). The latter results to high concentration of wastewater, including traces of pathogens, oils and greases, and debris. Blockage, odors and corrosion tend to occur more often in the treatment of more concentrated wastewater. Other impacts to wastewater systems attributed to reduced rainfall and temperature

extremes are shown in **Table 97**. To mitigate such impacts, redundancies can be integrated into the system such as provision of holding tanks to maintain the wastewater characteristics which are optimal for the system.

Table 97: Climate Change Impacts on Various Wastewater System Elements

Wastewater System Element	Climate Hazards /Stressor	
	Reduced rainfall	Temperature Extremes
Wastewater conveyance (all types; separated and combined gravity and pressure)	<ul style="list-style-type: none"> Corrosion due to low flows resulting in increased concentration Blockages or siltation when combined with increased temp, and reduced water use. 	<ul style="list-style-type: none"> Increased odours
Pump station	<ul style="list-style-type: none"> Corrosion due to low flows resulting in increased concentration 	<ul style="list-style-type: none"> Blockages due to user behaviour changes in hot weather (e.g., flushing of wet wipes)
WWTP – general	<ul style="list-style-type: none"> Increased strength of influent risking breach of toxicity levels 	<ul style="list-style-type: none"> Performance of biological systems, oxidation ponds and sludge management varies with temperature Odours (due to higher temperatures)
On-site wastewater	<ul style="list-style-type: none"> Ecological changes to soakage fields 	<ul style="list-style-type: none"> Performance varies with temperature Odours increase

Degree of Severity:

High	Medium	Low
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Source: Hughes, Cowper-Heays, Olsson, Bell, & Stroombergen (2021)

8.6.2 Proposed Mitigating Measures

Based on the assessment of the potential impacts to land, water, air, and noise identified in the previous section, measures to avoid, minimize, and mitigate these impacts are enumerated in **Table 98**. The costs for these mitigating measures are essentially included in the costs allotted for each project phase.

Table 98: Proposed Mitigating Measures for Environmental Impacts

Project Phase / Specific Activity	Potential Environmental Impacts		Mitigating Measures
	Component	Potential Impact	
Pre-Construction Phase			
Land and ROW Acquisition	Land: Land use	Land Conversion and Reclassification	<ul style="list-style-type: none">• Conduct detailed site assessment for site options• Follow proper processes for conversion and reclassification
		Loss of irrigated rice fields	<ul style="list-style-type: none">• Ensure just compensation of any affected crops and other livelihood losses
Construction Phase			
Provision of temporary work camps, power and water supplies, and	Land: Waste generation	Waste generation from temporary work camps and ancillary facilities	<ul style="list-style-type: none">• Implement the proper disposal of wastes to the designated area including the establishment of temporary material recovery facility during construction.

Project Phase / Specific Activity	Potential Environmental Impacts		Mitigating Measures
	Component	Potential Impact	
other ancillary facilities (i.e., stockpile, storage, disposal)			<ul style="list-style-type: none"> Provision of adequate toilet facilities for workers (i.e., portlets)
Ground Clearing and Preparations, and Earthworks	Land: Soil	Loss of topsoil and soil erosion	<ul style="list-style-type: none"> Determine the geotechnical description of the site Secure necessary permits for trees to be removed Limit the excavation works to the appropriate depth
	Land: Hazards	Induced effects of seismic and hydrometeorological hazards	<ul style="list-style-type: none"> Conduct detail seismic and hydrometeorological hazards assessment Integrate findings of the hazard assessment in engineering design to avoid, minimize and mitigate hazard impacts (i.e., alternative sites, flood protection measures)
	Water: Water pollution	Degradation of ground water quality from silt run-off	<ul style="list-style-type: none"> Conduct earthworks during dry season as much as possible Provide short-term drainage to avoid soil run-off
Construction Activities (including formworks, concrete pouring, installation and use of machine, vehicles and equipment)	Land: Soil	Earth disturbance from erosion of topsoil	<ul style="list-style-type: none"> Revegetation of embankment with fast growing and resilient species of plants and grasses
	Land: Waste generation	Generation of debris	<ul style="list-style-type: none"> Disposal site of debris must be identified prior to start of construction Set regular schedule of debris disposal to avoid accumulation on-site
	Water: Water Quality	Water contamination from spills from vehicles and equipment., and other construction activities	<ul style="list-style-type: none"> Ensure proper handling and disposal of discards and other unsuitable materials
	Air Quality	Dust particles from construction activities and vehicles	<ul style="list-style-type: none"> Spray site regularly with water, especially during dry and dusty conditions Maintain equipment and vehicles regularly
		Air emission from vehicles and construction equipment and localized traffic congestion close to the construction site.	<ul style="list-style-type: none"> Ensure all equipment are in good condition and are maintained regularly Notify nearby residences and establishments on the schedule of heavy equipment to be used
	Noise	Increase in noise levels from construction activities causing nuisance to nearby residents	<ul style="list-style-type: none"> Inform barangay and nearby residents of schedule of construction Use of mufflers and silencers Observe existing road weight limits for trucks Refrain the use of high noise-generating equipment during nighttime Designate buffer areas from the nearest structure
Operations and Maintenance			
Operations of Septage Treatment Plant (including Resource	Land: Hazards	Induced effects of seismic and hydrometeorological hazards	<ul style="list-style-type: none"> Ensure all hazard mitigating design measures work properly Improve vegetation in proposed site
	Water: Groundwater pollution	Pollution of receiving drainage from chemicals, fuels and contaminants in	<ul style="list-style-type: none"> Schedule regular plant inspection and maintenance

Project Phase / Specific Activity	Potential Environmental Impacts		Mitigating Measures
	Component	Potential Impact	
Recovery Facility)		the event of SpTP failure or breakdown.	<ul style="list-style-type: none"> If <i>discharged</i>, secure proper permit from DENR If <i>reused</i>, monitor quality of treated effluent and biosolids regularly
		Contamination of water from accidental spills and overflows in the event of surplus wastewater to be treated	
	Noise	Increase in noise levels from construction activities causing nuisance to nearby residents	<ul style="list-style-type: none"> Observe existing road weight limits for vacuum trucks Designate buffer areas from the nearest structure Refrain use equipment during nighttime
Repair and Maintenance Works from SpTP operations	Air quality	Airborne dust vacuum trucks	<ul style="list-style-type: none"> Maintain equipment and vehicles regularly
		Air emission from vehicles and other repair equipment	
	Noise	Increase in noise levels from construction activities causing nuisance to nearby residents	<ul style="list-style-type: none"> Observe existing road weight limits for vacuum trucks Designate buffer areas from the nearest structure Refrain use equipment during nighttime
	Odor	Generation of odor from raw sludge processing	<ul style="list-style-type: none"> Include odor control or removal system in plant design Designate buffer areas around the plant, which can include vegetation and trees

8.6.3 Environmental Compliance Certificate Requirements

To secure an Environmental Compliance Certificate (ECC) from DENR-EMB, an IEE Checklist has to be completed. The IEE Checklist for Waste Management Projects includes the following:

- Project Fact Sheet
- Project Description (including Project Type, Size, Area)
- Project Components (including the corresponding number of units, area and/or capacity, and specifications for main facility, support facilities, administrative support, among others)
- Anticipated Utility Requirements during Operation Phase
- Manpower Requirements
- Timetable of Construction
- Indicative Project Cost
- Environmental Impact and Management Plan
- Abandonment Policies and Generic Guidelines

8.7 Social Assessment

The social assessment looks into the dimensions that contribute to the well-being of communities and individuals that may be affected with the introduction of the proposed project, namely (a) land, (b) living environment, (c) housing, (d) infrastructure and services, (e) livelihoods, (f) culture, (g) movement and mobility, and (h) community and social support (Smyth & Vanclay, 2017). Furthermore, other predispositions and conditions of the vulnerable sectors have been integrated into the analysis given that these groups are often are disproportionately affected by the impacts of the projects.

8.7.1 Social Analysis of the Survey Results

The socioeconomic and willingness-to-pay survey covered most barangays⁸ of the Zamboanga City and had a total of 464 respondents 425 of which are households, while 39 are commercial establishments⁹. Majority (73.65 percent) of the respondents for both the households and commercial establishments are female. Most of the respondents are among the working age group between 18 to 59 years old.

Profile of Household Heads

Majority of the surveyed household have males as heads of the households. On the other hand, one in five households are female-headed households. Most of the household heads are older adults with more than half of the responding households having heads of at least 45 years of age. Two in three of the responding households (68.00 percent) have household heads that are currently working, while the rest are receiving monthly pension (5.65 percent) and are not employed (12.94 percent). Among those who have responded that the household head is currently working, majority of them are engaged in the agriculture sector (30.72 percent), followed by those engaged in trade (16.99 percent) and working professionals (15.03 percent).

Sources of Income

About half of the households earn a total household income greater than the monthly minimum wage¹⁰ in Zamboanga Peninsula of PhP316 per day or almost PhP7000 per month. The income range with the highest frequency of household income are households that have an average household income ranging between PhP3,001 to 5,000 (25.65 percent).

When asked to identify other sources of income of the households, one-third (33.41 percent) of the households indicated that the income of the household head was their sole source. About one in four (27.76 percent) households are recipients of government transfers through the Pantawid Pamilyang Pilipino Program (4Ps), which can also indicate the economic vulnerability of these households as among the criteria to be eligible to the program is to be a resident of the poorest municipalities in the country or to have an income level below the provincial poverty threshold. Other sources of income include farming (7.29), pension (4.24 percent), fishing (3.53 percent), OFW remittances (3.53 percent), rental income (2.59 percent), and real estate (1.41 percent).

Housing Characteristics

One in three (34.12 percent) households have multiple families living in the same households. The typical housing characteristics of the surveyed households are single detached (89.2 percent) one-storey (84 percent) households. Majority (92.5 percent) of the surveyed households' own houses they currently reside in. There is a small share of households who are currently renting (4.2 percent). Among the households who are paying rent monthly, almost half of them are paying between PhP1,001 to 3,000 monthly. On the other hand, about one in five renting households (20.69 percent) are paying less than PhP1,000, and between PhP3,001 to 5,000 respectively. The rest of the households are paying greater than PhP5,000 monthly.

⁸ Island barangays were not covered by the survey due to the limitations stipulated in the Philippine Clean Water Act of unauthorized transport of sludge over waters.

⁹ Most of the commercial establishment refuses to be interviewed, hence only 39 establishment were surveyed.

¹⁰ Based on DOLE (2018) Wage Order No. RIX-20. <https://nwpc.dole.gov.ph/regionandwages/region-ix-zamboanga-peninsula/>.

Health

Only a limited number of respondents gave their responses as to their household's experience of water-borne diseases. Among those who respondent, majority (87.50 percent) of them specified diarrhea, followed by typhoid fever and amoebiasis which have 6.25 percent respectively. Majority of the households who experienced these diseases spent between PhP1,001 to 2,000 for hospitalization and/or home medication. This is followed by those who spent between PhP2,001 to 5,000 (25.00 percent) and those who spent less than PhP1,000 (18.75 percent). The results concerning water-borne diseases.

Access to Water Supply

Among the surveyed households, about half (49.94 percent) of the respondents are not current customers of the ZCWD, while the use other sources to access water supply. For households who are not customers of the ZCWD, majority (46.63 percent) use their own well or pump, followed by those who use BAWASA and Barangay Waterworks (16.83 percent).

Majority (37.65 percent) of the households pay a monthly water bill within the range of 500 pesos or less, followed by those who pay between 501 to 1000 pesos (21.65 percent). It must be noted, however, that about a third (29.41 percent) of the respondents did not specify the amount of their monthly water bill.

Access to Sanitation

All surveyed households have some form of toilet facility. Majority (74.35 percent) of the households have flush toilets equipped with its own septic tanks and their own toilet facility (80.24 percent). About one in five (16.24 percent) households share their toilet facility with another household.

Flush to pit latrine toilet facilities are common in Barangays Cacao, Capisan, Culianan, Sta. Barbara, Talabaaan and Zambowood. Flush to open drain toilet is notable in Sta. Barbara, Taluksungay, and Tumitus. The household survey revealed that there are still households with poor sanitation facilities. Pit latrines with slab and were accounted in Barangay Lapakan, Latuan, Lubigan, Pasobolong and Salaan. Pit latrines without slab or open pits are nevertheless present in Barangay Lapakan, Panubigan, and Sta. Barbara 1. In spite of government effort to improve local sanitation, hanging toilets still exist in Sta. Barbara 1.

Two in five (44.71 percent) households have their own septic tanks, while one in four (24.71 percent) households dispose their wastewater directly to the ground. One in ten (13.88 percent) households use municipal drainage canals for their wastewater. It was noted during the survey that there are no existing canals in some barangays. Based on the household interviews conducted, there are areas with no existing drainage outfalls.

About half (46.82 percent) of the households expressed their willingness to construct their own sanitary toilet. The same proportion (46.82 percent) of households also responded that they have available space in their homes to construct their own toilet. Among those who would not be willing to install their own facility, the primary reasons were due to lack of space (42.70 percent), lack of budget (41.57 percent) and land ownership issues (11.24 percent).

About two in three (63.53 percent) households have never desludged their septic tanks, while only about one in five (22.35 percent) households have. Majority (62.11 percent) of those who have desludged their septic tanks were unable to identify when, followed by those who have done so within the past five years (29.47 percent). For those who have not desludged their septic tanks, a large majority (89.63 percent) have never emptied them out, while one in ten (10.37 percent) of these households constructed a new septic tank instead when it was full, particularly in residential areas of Bolong, Cacao, Calabasa, Calarian, Campo Islam, Cawit, Curuan, Guisao, Latuan, Lumayang, Lumbangan, Malagutay, Mercedes, San Jose Gusu, San Roque, Santa Barbara 1, Tumaga, and Zambowood.

For the households that have desludged their septic tanks, one in three (31.58 percent) spent between PhP1000 to 2999 pesos for each service, followed by those who spent between PhP3000 to 5000. However, it must be noted that a third of the respondents were not able to specify the amount they spent for desludging services.

Over half (57.88 percent) of the respondents expressed willingness to construct or retrofit their septic tanks to adhere to the design standards and specifications of the Department of Health, while 8.98 percent responded with maybe. When asked if they have available space to implement these changes, about half (53.65 percent) responded with yes, while a significant share did not provide a response for this question.

Many (67.53 percent) of the respondents were unable to specify their reasons for opting out of constructing or retrofitting their septic tanks. For those who were able to indicate this, most provided the lack of funds (17.65 percent), lack of space (6.35 percent), and their tenure status.

When asked to estimate the amount they would be willing to pay for the construction of a DOH-compliant septic tank, most respondents had no idea on the amount. Among those who were able to specify an amount, the range holding the highest proportion of responses are those willing to pay between 10001 to 15000 (17.18 percent), followed by 7501 to 10000 (10.59 percent) and 5001 to 7500 (8.24 percent).

Perception of Proposed Project

Majority (84.5 percent) of the households were aware that there is an existing local ordinance on sanitation in Zamboanga City. More than half of the households expressed that they are aware and have previously heard of the Septage Management Program in the city. When asked about the potential benefits that can be brought about by the proposed project, majority responded with the reduction in water pollution (59.3 percent), followed by the reduced occurrence of water-borne diseases (13.9 percent), and the prevention of septic tank overflow (13.4 percent).

The respondents were asked to rank environmental concerns in the city based on which they think should be regarded of the highest priority. Most (87.2 percent) respondents responded with water supply as top priority, followed by sanitation and toilet facilities (28.2 percent), and lastly, solid waste disposal (11.3 percent).

Among the questions asked to the survey respondents are to state the primary reason to install new toilet facilities and septic tanks. When asked to specify what might be their reason for installing toilets, majority shared the desire to have their own facility for their family (57.2 percent), followed by those (24.5 percent) who wish to have a safe and clean environment, followed by those (14.1 percent) who wish to protect their families. More than half (57 percent) of the total respondents

shared the same reason for having the need to install sanitary toilet facilities for their own family only. The other 25 percent responded that installing sanitary toilet facilities for a clean and safe environment, and 14 percent knows that it would protect the health of their family members.

Over half (55.8 percent) of the households expressed willingness to pay regular desludging services, and among those who specified the payment arrangements corresponding these services, majority 33.4 percent) preferred that the costs be subsumed as part of the water bill. For those who responded that they would not be willing to avail of the regular desludging services, one in three respondents (35.5 percent) said that it was due to the high cost of services.

8.7.2 Potential Social Impacts

The proposed improvements in septage treatment plant in the City of Zamboanga can bring about both beneficial and adverse impacts to people and the community. The key potential impacts across the project phases outlines **Table 99** and are further discussed in the succeeding sections. At the current stage of the report preparation, only general impacts to people and the communities in the impact area have been identified. These impacts will be refined for the final report based on the final specifications of the proposed design of the technical analysis. Additionally, additional activities to validate these findings are expected to be conducted in development of the full-blown feasibility study, including the conduct of census of the project-affected persons and stakeholder consultations.

Table 99: Key Potential Social Impacts per Project Phase

Key Potential Impacts	Project Phase		
	Pre-Construction	Construction	Operations and Maintenance
Displacement and Involuntary Resettlement	●		
Possible Influx of Migrants	●	●	
Chance finds of cultural heritage artifacts		●	
Temporary employment for locals		●	
Increased revenue for LGU		●	
Limited mobility for areas within vicinity of construction		●	
Traffic congestion and route changes		●	
Threat to delivery of basic services		●	
Disturbance from ground vibration, noise and odor		●	●
Exposure to potential community health and safety risks		●	●
Threats to occupational health and safety		●	●
Potential disruptions in practice of religion due to work		●	●
Reduction of time poverty among those with domestic responsibilities			●
Reduction of incidence of water-borne diseases			●
Protection of water resources			●
Increased availability of sanitation infrastructure for public facilities			●
Increased local awareness and capacity	●	●	●
Promotion of gender equity	●	●	●

Legend: ● – Positive Impact
● – Negative Impact

Among the potential benefits of the project include:

- Improved sanitation can contribute time saving benefits reduced time poverty from accessing sanitation facilities;
- Reduction of incidence of water-borne diseases;
- Opportunities for temporary employment for locals, including those who are working directly for the construction, and those indirectly benefiting from increased workers such as small businesses;
- Increased revenue for the local government from purchase of locally-available materials and equipment, translating to additional taxes;
- Protection of water resources;
- Increased availability of sanitation infrastructure that schools, health centers, and other public facilities may avail of;
- Increased awareness and capacity of local through IEC campaigns and trainings in relation to the project; and
- Potential opportunity for promotion of gender equity by ensuring that women and men are well represented during consultations, surveys, IEC campaigns, and trainings. Their respective concerns should inform the siting, design, and implementation decisions.

Land and ROW Acquisition, Displacement and Involuntary Resettlement

The site is owned by the ZCWD and consequently will not require land acquisition. Its land classification is for agricultural use, particularly an irrigated rice field. It must be validated whether there are farmers who are using some sections of the property for agricultural use, and if they have an existing agreement with the Water District on the use of the land. To mitigate loss of crops and other productive agricultural assets that may exist in the property, the farmers can be informed of the start date of ground clearing, and whenever possible, time it after harvest of these crops as to not cause any livelihood losses to any farmers affected.

Additionally, there are existing structures in the site as highlighted in **Figure 55**. The type and ownership of these structures, along with the availability of ROW for the property is undergoing validation with ZCWD.

Figure 55: Existing Structures in the Proposed Site



Source: Imagery ©2021 Maxar Technologies, Map data ©2021

In the event of possible displacement, the use of the concerned land parcels should be prior established and justified that there is no other viable alternative than its use. Furthermore, a Livelihood Restoration and Resettlement Plan shall be developed which should involuntary resettlement be necessitated. This plan includes an inventory of affected parties and their respective assets, procedures for just compensation for loss of land and assets, grievance mechanisms, and stakeholder consultation.

Possible project-induced labor migration

A possible migration of workers looking for work may be induced due to the employment opportunities brought about by the project activities, especially during the construction stage. To minimize this, and as well as maximize the generation of employment opportunities for the local labor force, local employment can be facilitated through an inventory of skills may be conducted in coordination with the local government and the Public Employment Service Office to facilitate the hiring and job matching processes. Local employment may also be prioritized in consideration of merits and capability to perform the requirements of the job, which may be articulated in the hiring policies of the contractor of the project.

Increased exposure of community to violence against women and girls, and gender-based violence

In the event that project-induced labor migration is not managed, the increased presence of non-locals in the area can pose potential safety risks to the project-affected areas, particularly violence against women and girls (VAWG), and gender-based violence (GBV). Migrant workers brought about by the work opportunities due to the construction works are often predominantly male. Thus, the exposure of the community to such safety threats are increased especially for those areas

near construction sites. (Fraser, Viswanath, & MacLean, 2017) Among the structures near the proposed site are workplaces, schools and residential clusters. Social safeguards, including policies related to sexual harassment and VAWG must then be incorporated among the operating procedures. Specific reporting and grievance mechanisms for such incidences must be set in place prior to the construction to facilitate its implementation.

Chance finds of cultural heritage artifacts

Due to its rich colonial past, the City of Zamboanga hosts various cultural heritage sites. As of August 2021, there are eighteen structures and properties in the city registered in the Philippine Registry of Cultural Property (PRECUP). These are shown in **Table 100**.

Table 100: National and Local Inventory of PRECUP-Registered Cultural Properties

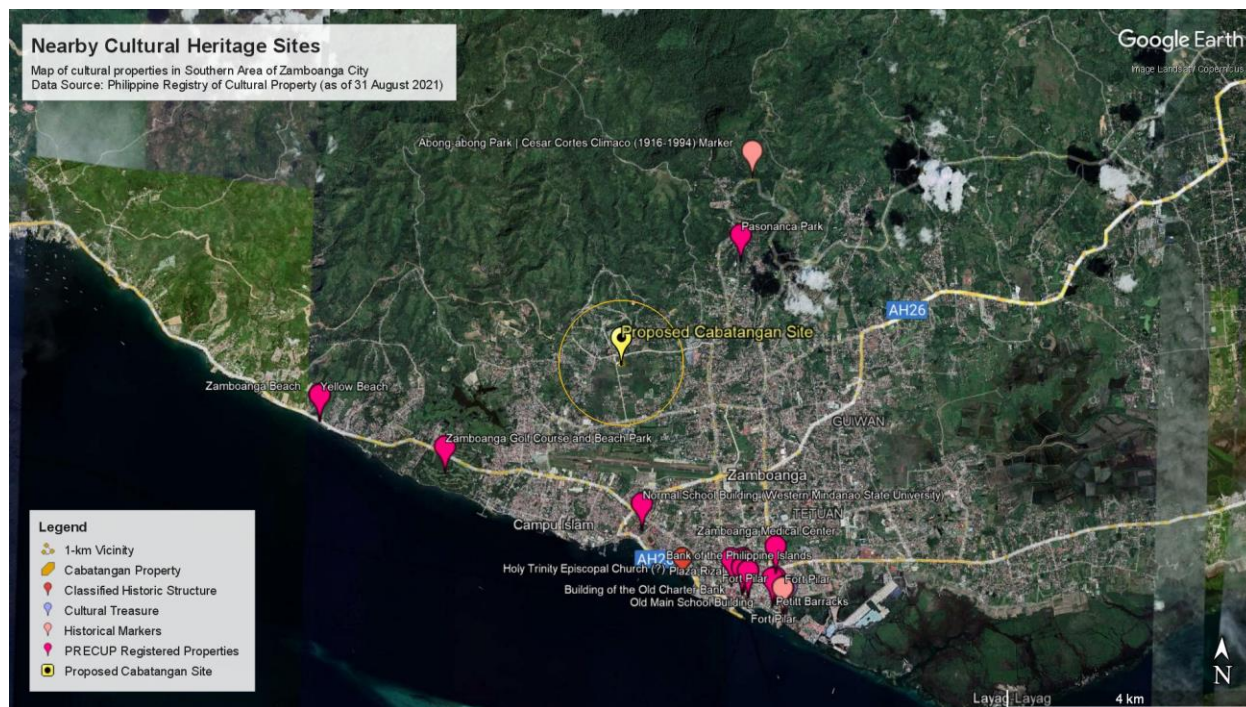
Official Name	Common Name	Inventory	Declaration/ Classification	Type
Bahay-Pamahalaan ng Lungsod ng Zamboanga	Ayuntamiento de Zamboanga/ City Hall of Zamboanga	National/Local	Marked Structure, NHCP; Registered Property, Zamboanga City	Tangible-Immovable
Bank of the Philippine Islands Zamboanga	BPI	National/Local	Marked Structure, NHCP; Registered Property, Zamboanga City	Tangible-Immovable
San Ramon Prison and Penal Farm		National/Local	Marked Structure, NHCP; Registered Property, Zamboanga City	Tangible-Immovable
Building of the Old Charter Bank	Zamboanga City Medical Center	Local	Registered Property, Zamboanga City	Tangible-Immovable
Normal School Building (Western Mindanao State University)		Local	Registered Property, Zamboanga City	Tangible-Immovable
Fort Pilar	Fuerza Pilar; Fort Pilar; Real Fuerza de Nuestra Señora del Pilar de Zaragoza	National/Local	National Cultural Treasure, National Museum; Marked Structure, NHCP; Registered Property, Zamboanga City	Tangible-Immovable
Pettit Barracks	Zamboanga Golf Club and Beach Resort	Local	Registered Property, Zamboanga City	Tangible-Immovable
Pasonanca Park		Local	Registered Property, Zamboanga City	Tangible-Immovable
Plaza Pershing		Local	Registered Property, Zamboanga City	Tangible-Immovable
Plaza Rizal		Local	Registered Property, Zamboanga City	Tangible-Immovable
Old Main School Building		Local	Registered Property, Zamboanga City	Tangible-Immovable
Talungsangay Mosque Taluksangay Mosque	Moske de Taluksangay	National/Local	Marked Structure, NHCP; Registered Property, Zamboanga City	Tangible-Immovable
Zamboanga Medical Center		Local	Registered Property, Zamboanga City	Tangible-Immovable

Official Name	Common Name	Inventory	Declaration/ Classification	Type
First Concrete City Hall of Zamboanga (Zamboanga Police Station, Main Office)		Local	Registered Property, Zamboanga City	Tangible-Immovable
Yellow Beach Zamboanga Beach Marker		National/Local	Marked Structure, NHCP; Registered Property, Zamboanga City	Natural
Zamboanga Golf Course and Beach Park		Local	Registered Property, Zamboanga City	Tangible-Immovable
Abong-abong Park Cesar Cortes Climaco (1916-1994) Marker				Tangible-Immovable
Plaza Alvarez Vicente S. Alvarez Marker				Tangible-Immovable

Source: National and Local Inventory of the Philippine Registry of Cultural Property, NCCA 2021

The nearest cultural heritage sites to the proposed site in Cabatangan are Normal School Building (Western Mindanao State University) and Pasonanca Park, both of which are approximately 2.5 kilometers from the site as shown in **Figure 56**. Given this distance, there are no anticipated impacts to the registered cultural properties in the city.

Figure 56: Nearby Cultural Heritage Sites



Source: Imagery ©2021 Maxar Technologies, Map data ©2021

While it is unlikely that chance finds, or unanticipated sighting or recognition of cultural artifacts, due to its relative proximity to the cultural heritage sites in Zamboanga, the City Contractor may include a Chance Find Procedure in its Operations Manual given the historical context and

significance of the city. The procedure can detail the specific procedures in incidence of chance finds, which often occur at the construction phase, particularly from ground clearing and excavation works. The Chance Find Procedure can specify the steps for the identification, notification, documentation, and management of chance finds (World Bank, 2017). Incidences of chance finds are immediately reported to the designated agencies of the National Commission for Culture and the Arts (NCCA), through the National Historical Commission of the Philippines (NHCP), or the relevant offices of the LGU given the existing policies prohibiting the transfer of immovable national cultural treasures and mandates for site activities to be halted to notify the designated entities (Republic Act No. 10066 Implementing Rules and Regulations, Rule X, Section 33.5).

Competing Use of Utilities

During the construction stage, increased consumption of basic utilities such as electricity and water may be observed from the project site. To mitigate this, the consumption of basic services during construction shall be confined to the most important uses and sanitation requirements, and lighting of the work areas during operations. There must be close coordination between the Contractor and ZCWD for instances wherein significant volumes of water will be necessary during construction works.

Disturbance from ground vibration, noise and odor

Nuisances from ground vibration, noise and odor from construction works, plant operations and sewage transport will be present at the construction and post-construction stages of the project. Particular attention must be given to this, especially with the proximity of residential clusters and subdivision just parallel to the proposed site. For sewage transport, the roads to be utilized by the vacuum trucks may also cause disturbance to these households, especially residential and commercial areas within 30 meters.

Buffer areas, using noise barriers, odor control or removal systems may also be integrated into the site design given that the close proximity of the proposed site to residential and institutional areas. As an additional mitigating strategy, coordination with local government and barangay officials can be observed to inform them of the timeline of these construction works. Nearby residents and establishments may also be informed as soon as the schedule on the use of heavy equipment is available.

Disruptions in Movement and Mobility

While the proposed site is situated farther from the city center and in areas with less density, it is still near residential areas and workplaces as seen in **Figure 50**. This may disrupt the usual traffic routes, not just during earthworks and construction, even during operations due to the vacuum trucks that will be transporting the sludge from the households. During the construction phase, it is a possibility that traffic may slow down or build up especially when access roads are temporarily closed or detoured. It may also cause traffic delays during deliveries of materials and equipment to the site.

To ensure accessibility to road users, the contractor must provide temporary access in areas needed in order not to restrict the movement of the public. Provision of additional manpower and logistics support may be considered by the Contractor to ensure that traffic laws are strictly enforced. Proper signages must be provided and located in areas that are visible to the public to

keep them informed about the status of the project. As the proposed area is in an urban area with potentially high volume of vehicles, a Traffic Management Plan for may be developed by the Contractor to establish the procedures to be observed related to these concerns.

Exposure to potential community health risks

There may be possible threats to the safety and health of nearby communities, due to exposure to emissions from heavy equipment used. Accidents due to the heavy materials and equipment utilized in the construction can also be a potential threat during construction activities. Given such risks, existing medical personnel and facilities should be identified prior to the construction. This should be included in an Emergency Response Plan and should be included among the trainings given to the workers, including the specific protocols in the case of accidents. Additionally, provision of safety equipment should be ensured by the contractor, including personal protective equipment, safety signages, and lighting signs. During transport of sludge and septage at the operation phase of the facility, accidental spill during hauling may occur, thus a safety and emergency protocols for such instances should also be integrated into the operations plan.

For the reuse component of the of the SpTP, among the identified potential uses of treated biosolids and effluent include irrigation, fire protection, landscaping, and soil conditioning. All by-products intended for reuse must secure all permitting requirements from DA and DENR, and regularly undergo quality monitoring to ensure that the use of these products to ensure the safety of its users. Utmost standards must be ensured to void any risks of causing sickness among individuals directly reusing the treated by products (i.e., farmers for irrigation, maintenance workers for landscaping/cleaning of equipment, firefighters for firefighting). For agricultural use in particular, trainings on specific guidelines on applications may also be implemented as some studies have found that incorrect application of treated byproducts, such as provision of excessive nutrients, can lead to irregular growth and maturity of plants and crops (Ungureanu, Vlăduț , & Voicu, 2020).

Threats to occupational health and safety

Sites holding construction works are classified as high risk¹¹ according to the 2018 Occupational Safety and Health Standards (RA 11058). The standards and requirements prescribed by the OSH Law, particularly in the availability of health workers, facilities, and equipment, should be adhered to ensure the safety of the project workers. The availability of medical personnel on-site or access to equipped health facilities must be ascertained prior to the start of construction works to prepare for any accidents. Equipped hospitals must be prior identified and negotiated on to anticipate incidences that may necessitate highly specialized surgical requirements. This is to avoid causing strain on existing nearby health facilities of the city LGUs. The Contractor shall be required to prepare and implement its own emergency medical aid and rescue plan to address construction-related accidents.

Accidents are a risk both during the plant construction and operations. Thus, proper training of facility workers must be ensured. Additionally, the operator must be well-equipped and knowledgeable in the daily operations of the SpTP and should be able to properly diagnose and

¹¹ High-risk workplaces include those whose presence of hazard or potential hazard may affect the health and/or safety of workers not only within but also persons outside the premises of the workplace. There is high level of exposure to safety and health hazards, and probability of a major accident resulting to disability, death, or major illness is likely to occur if no preventative or control measures are in place.

resolve potential issues that may occur as to avoid any accidents or harm to workers, and potentially to the surrounding areas of the plant.

Potential disruptions in practice of religion due to work

Based on the 2015 Census of Population and Housing, Zamboanga City holds at least half (50.19 percent or 302,792 persons) of the Muslim population in Zamboanga Peninsula Region, and also has the highest Muslim population across all cities in Mindanao. Given the significant share of persons practicing Islam along with the proposal to promote local employment for the work opportunities brought about by the project, their religious obligations must be taken into consideration across the project phases. During the construction stage, the Contractor must provide worship/prayer room and ablution facilities in workplaces as needed. Lunch breaks can be aligned with the prayer time so that, after lunch, the workers may join the prayer session before coming back to work, or alternatively, consider the employment of flexible working schedule as needed or in case work schedules so required. If possible, the work schedule can be modified to assign Friday among the days-off during the week as Juma, or Friday, is the holiest day of the week in Islam and is a dedicated day for worship where special congregational prayers are offered (Aslan, 2019). Alternatively, flexible working schedule may also be employed. These measures can be further modified in consultation and agreement with the project workers.

8.7.3 Proposed Mitigating Measures

In consideration of the identified potential adverse impacts in the previous section, mitigation measures are identified in order to minimize and reduce them. These measures are summarized in **Table 101**.

Table 101: Proposed Mitigating Measures to Potential Adverse Impacts

Potential Adverse Impact	Mitigating Measures
Displacement and Involuntary Resettlement	<ul style="list-style-type: none"> • Validate potential for displacement and involuntary resettlement from ROW Acquisition • Include policy of no involuntary resettlement unless justified and qualified as unavoidable • Preparation of Livelihood Restoration and Resettlement Plan as needed, including an inventory of affected parties and their respective assets, procedures for just compensation for loss of land and assets, grievance mechanisms, and stakeholder consultation
Possible project-induced labor migration	<ul style="list-style-type: none"> • Incorporate prioritization of local hires among the recruitment policies of the Contractor • Maximize potential to contribute to local employment by prioritizing existing job seekers in the city in coordination with PESO
Increased exposure of community to VAWG and GBV from unmanaged project-induced labor migration	<ul style="list-style-type: none"> • As much as possible, reduce and manage incidence of project-induced labor migration • Require training on gender and cultural sensitivity as part of the onboarding process for project employees and workers • Include anti-sexual harassment policies in the operations manual • Establish specific guidelines for cases of VAWG and GBV for proposed grievance mechanisms
Chance finds of cultural heritage artifacts	<ul style="list-style-type: none"> • Include Change Find Procedures into operational procedures • Verify potential cultural heritage concerns during public consultations
Competing Use of Basic Utilities	<ul style="list-style-type: none"> • Conduct initial coordination with concerned service providers on anticipated volume of utility requirement for construction and operation activities

Potential Adverse Impact	Mitigating Measures
	<ul style="list-style-type: none"> Establish information dissemination protocol for schedules of water interruption together with the water service providers concerned Schedule construction activities that require high energy consumption during off-peak hours
Limited mobility and traffic congestion in nearby areas	<ul style="list-style-type: none"> Install safety signage in strategic locations Use of IEC materials in construction sites to inform road users of ongoing works where possible Provide traffic aides to ensure smooth flow of traffic to and from the project site when necessary Close coordination with local government and barangay officials can be observed to inform them of the timeline of these construction works that may have impacts on access roads Designate temporary access roads wherever needed Require the Contractor to prepare a Traffic Management Plan
Disturbance from ground vibration, air, noise, and odor	<ul style="list-style-type: none"> Indicate in the operations manual that the use of noise-generating equipment and vehicles are to be refrained during nighttime Use of buffer areas and/or noise barriers whenever possible Compliance with road weight limits for hauling and vacuum trucks Notify nearby residences and establishments on the schedule of heavy equipment to be used Include of odor control or removal system in site design Consider addition of vegetation and trees around the plant to serve as a buffer Observe proper waste disposal procedures in coordination with the City Environment and Natural Resources Office (CENRO) Practice waste segregation
Exposure to potential community health and safety risks	<ul style="list-style-type: none"> Full compliance to the requirements prescribed by the OSH Law Designate OSH personnel, including safety officers Identify available and accessible medical personnel or medical facility in case of accidents Provide strategically-located safety signages Use of IEC materials in construction sites to inform nearby residents and workers of ongoing works Establish reporting and grievance mechanisms Creation of Emergency Response Plan Ensure that design of facilities is compliant to Department of Health (DOH) standards Regular environmental parameters monitoring for treated by-products intended for reuse
Threats to occupational health and safety	<ul style="list-style-type: none"> Provide orientation for occupational risks for direct and indirect workers including accidents and increased exposure to hazardous substances Provide regular training and safety drills for workers. Designate OSH personnel, including safety officers Identify available and accessible medical personnel or medical facility in case of accidents Provide adequate and quality personal protective and safety equipment Provide strategically-located safety signages
Potential disruptions in practice of religion due to work	<ul style="list-style-type: none"> Provision of worship/prayer room and ablution facilities in workplaces Consult with Muslim project workers on more culturally sensitive operational procedures

8.7.4 Gender Responsiveness

Provision of infrastructure to improve access to basic services serve as catalyst and potential entry points to address issues in the social and gender dimensions, including reducing women's time poverty, strengthening resilience to external shocks, and addressing VAWG. For sanitation infrastructure, among entry points include the participation of women, especially those who have vulnerabilities, in the planning and decision-making process for siting, design, and management of these facilities. Investing in basic infrastructure, particularly for vulnerable groups including women can contribute to reducing time poverty for those that dedicate significant time of their day for these domestic needs. Making such facilities more available, accessible and gender-responsive, opens economic opportunities and can improve their overall wellbeing (ADB, 2013; World Bank, 2020).

With this, gender considerations should be integrated into the siting, design, and implementation arrangements decisions to ensure that the needs of both men and women are addressed. NEDA and Philippine Commission on Women (PCW) promotes the mainstreaming of gender and development into government projects through use of the Harmonized Gender and Development Guidelines (HGDG) for Project Development, Implementation, Monitoring, and Evaluation (2019), which includes a checklist and score card for projects that undergo their review of the agency. The HGDG Checklist serve as guide for project implementors of various sectors, of which includes infrastructure projects, where septage treatment plants fall under. The HGDG Checklist specific for infrastructure projects is found in **Appendix C**.

Apart from the HGDG Checklist, there are other various approaches as to how sanitation infrastructure can be more gender responsive. Among the reference documents assessed for the gender analysis include ADB Gender Checklist: Water Supply and Sanitation (2006), Infrastructure & Cities for Economic Development (ICED) Entry Points to Address VAWG through Infrastructure (2017), and World Bank Handbook for Gender-Inclusive Urban Planning Design (2020). A summary of potential gender considerations for siting, design, and operations lifted from these references are provided in **Table 102**. The use of all indicators of these frameworks and checklists in their entirety may also be considered in the development of a Gender Action Plan, and Monitoring and Evaluation Plan during the implementation and monitoring phases.

Table 102: Gender Considerations for Project Development

Gender Considerations	Reference Document
<p>Gender-disaggregated data collection to ensure inclusive assessment of impacts, including but not limited to:</p> <ul style="list-style-type: none"> • Effect on time-use (i.e., travel time to and from) of beneficiary population • Number of people and households with access to improved sanitation, and how many of which are women or are female-headed households • Generation of employment among women by project phase and type of job • Percentage of income spent by women and men in accessing services • Participation of women in decision-making (i.e., participation in consultation sessions, holding management positions for the operation of the facility, etc.) • Changes in VAWG attitudes and behaviors using knowledge, attitudes, and perception surveys • Changes in VAWG incidence and prevalence rates over time • Level of participation of women in community/ neighborhood development associations/ committees • Availability of separate toilets and places for women, according to needs identified by women in public facilities (e.g., public toilets, community 	<p>HGDG Checklist (2019)</p> <p>WB Handbook for Gender-Inclusive Urban Planning Design (2020)</p>

Gender Considerations	Reference Document
centers, emergency shelters, municipal offices, bus and train stations, public markets) <ul style="list-style-type: none"> Income levels of female-headed households for tariff or payment structure design 	
Inclusion of urban upgrading projects among potential household connections for installation of sewerage or septage treatment	WB Handbook for Gender-Inclusive Urban Planning Design (2020)
Inclusion of gender equality targets and indicators among measures monitored	HGDG Checklist (2019)
Participation of women in stakeholder engagement and consultation activities	HGDG Checklist (2019)
Consultation with community organizations engaging with women	WB Handbook for Gender-Inclusive Urban Planning Design (2020)
Consider preference of men and women of community for physical design of the infrastructure, including but not limited to location, sharing arrangement, type, and intermediary means to access	ADB Gender Checklist for Water Supply and Sanitation Project (2006) WB Handbook for Gender-Inclusive Urban Planning Design (2006)
Consider preference of men and women of community for financing options, including but not limited to financing options (i.e., fixed cost, labor contribution, etc.), access to savings, and access to credit.	ADB Gender Checklist for Water Supply and Sanitation Project (2006)
Incorporate reporting mechanisms, including HR management procedures, that allow workers and local community members to report incidences of violence or harassment without fear of reprisal (Fraser, Viswanath, & MacLean, 2017). p. 47	ICED Entry Points to Address VAWG through Infrastructure (2017)
Incorporate gender analysis into monitoring and evaluation of project goals and success indicators <ul style="list-style-type: none"> Percentage of women and female-headed households with improved health outcomes attributed to improved sanitation infrastructure Percentage of women and female-headed households with reduced economic burden from waterborne disease-related expenses 	WB Handbook for Gender-Inclusive Urban Planning Design (2020)

Note: Identified based on review of NEDA, PCW, and ODA-GAD Network (2019), ADB (2017), ADB (2006), Fraser, Viswanath & MacLean (2017), and WB (2020).

8.7.5 Social Development Framework

The social development framework (SDF), as provided in **Table 104**, aligns how the proposed project can contribute towards improved standard of living and overall well-being of its target beneficiaries, affected communities, including the welfare of vulnerable groups. The enumerates proposed programs for the affected communities and other stakeholders for concerns identified from the potential impacts of the project. It also identifies designated entities, indicative timeline, and funding sources to facilitate the implementation of these programs.

8.7.6 Reporting Requirements

Upon validation of the applicability and extent of the potential social impacts due to the proposed project, corresponding documents are to be developed to facilitate the implementation of mitigating measures. These documents are outlined in **Appendix C**.

Table 103: Reporting Requirements for Social Sector Concerns

Social Sector Concerns	Documents to be Developed	Entities Responsible
Community Health and Safety	Labor Management Plan	Contractor
Occupational Health and Safety	Emergency Response Plan	Contractor
	Traffic Management Plan	Project Proponent
	Grievance Redress Mechanism	Project Proponent
Involuntary Resettlement	Livelihood Restoration and Resettlement Plan	Project Proponent
Gender	Gender Action Plan	Project Proponent
Indigenous Peoples	Indigenous Peoples Development Plan	Project Proponent
Stakeholder Engagement	Stakeholder Engagement Plan	Project Proponent
	Communication Plan	Project Proponent
	IEC Materials	Project Proponent

Table 104: Social Development Framework

Concern	Proposed Program/s	Beneficiary	Responsible Entity	Indicative Timeline	Source of Fund
Employment generation	<ul style="list-style-type: none"> Inventory of available labor force with skills required for the proposed project Inventory of indirect services needed during construction Skills training 	Local labor force	CLGU - PESO TESDA	Pre-Construction	CLGU / Project Proponent
Occupational health and safety	<ul style="list-style-type: none"> Orientation and Regular Training Provision of complete and adequate protective gear and equipment 	Project Employees	Contractor	Construction Operations and Maintenance	Contractor
Public Safety Issues, including concerns in gender-based violence	<ul style="list-style-type: none"> Orientation on Gender Sensitivity, Cultural Sensitivity Inclusion of Anti-sexual Harassment Policies for all project employees from construction to operations Appropriate Grievance Mechanism equipped to Handle VAWG/GBV-related concerns 	Communities near the proposed site	Project Proponent / Contractor	Construction Operations and Maintenance	Project Proponent / Contractor
Community health and safety	<ul style="list-style-type: none"> Regular health indicators monitoring of communities within the service area Integrate health indicators monitoring in existing monitoring activities of the City Health Office Use of wastewater monitoring data for monitoring state of community health (in partnership with laboratories and the academe)¹² 	Residents and establishments	CLGU-MHO / Project Proponent	Construction Operations and Maintenance	CLGU / Project Proponent
Environment	<ul style="list-style-type: none"> Regular monitoring of potential permanent and/or prolonged environmental impacts to affected communities including flooding, water quality, wastewater monitoring, among others. 	Residents and establishments	CLGU-CENRO / Project Proponent	Construction Operations and Maintenance	CLGU / Project Proponent
Gender equity and inclusivity	<ul style="list-style-type: none"> Collection of gender-disaggregated data in all monitoring activities Inclusion of gender considerations among success indicators of the proposed project (i.e., utilization, physical access, affordability, etc.) Inclusion of vulnerable and disadvantaged groups (i.e., women, children, elderly, persons with disability, indigent) in all stakeholder engagement activities, including gathering their inputs and feedback on the 	Residents	CLGU-CSWDO / Project Proponent	Pre-Construction Construction Operations and Maintenance	CLGU / Project Proponent

¹² Wastewater-Based Epidemiology (WBE) has been emerging in relevance in public health monitoring for a more systematic approach in surveillance and detection of spread of disease and outbreaks. Globally, this approach has been used to facilitate data-driven decision-making on which areas can be prioritized for manpower and resource allocation (Sims & Kasprzyk-Hordern, 2020; CDC, 2021).

Concern	Proposed Program/s	Beneficiary	Responsible Entity	Indicative Timeline	Source of Fund
	proposed coverage area and tariff computation <ul style="list-style-type: none"> • Employment matching for women for relevant project activities 				
Stakeholder engagement	<ul style="list-style-type: none"> • Conduct stakeholder consultations prior to finalization of site, engineering design, financing options, sharing arrangements, etc. • Development and Dissemination of IEC Materials for proper wastewater and solid waste management which are audience-specific (for various sectors), and in their local language • Establish grievance redress mechanism in coordination with barangays 	Residents and establishments	Project Proponent	Pre-Construction Construction Operations and Maintenance	Project Proponent

9 Financial Analysis

9.1 Overview

This section evaluates the financial viability of the Zamboanga City Water District Septage Management Project. A project is considered viable if it can recover capital expenditures and operating and maintenance costs of the project. Moreover, the project should be able to recover the cost of equity and debt borrowed for the project. The standard measure of financial sustainability is that the Financial Internal Rate of Return (FIRR) must be at least equal or higher than the weighted average cost (WACC) of the project (i.e., $FIRR > WACC$). Another criterion of financial sustainability is when the price of the service provided by the project is affordable. For water and sanitation projects, the metric of affordability is the guideline set by the LWUA in that water and sanitation charges must not exceed the 5 percent income of the Low-Income Households in the municipality.

9.2 Cost Estimates

9.2.1 Project Cost

Table 105 shows the total investment cost of the project in current and escalated prices. This initial analysis considers current prices but are subject to change due to actual market conditions at the start of the project life in 2025; thus, shall be re-evaluated by the creditor and proponent prior to the finalization of loan agreements. The 2025 prices are indicative of the possible cost implications from inflation at the start of the project. The investment for consideration for the initial financing includes the cost of the Septage Treatment Plant (PhP111.66 million) and the Vacuum Trucks (PhP52.58 million). There is a Reuse Facility investment shown separately, as an optional strategy for the WD, in order to further treat the effluent and the biosolids for possible sale to interested users such as agricultural establishments. Total investment costs amount to PhP174.28 million inclusive of the interest expenses during construction. The Reuse facility will amount to PhP5.458 million. Without the reuse facility, total investment is PhP168.67 million.

Table 105: Investment Cost (in 2021 and 2025 Prices, PhP)

Year 2024-2025 CAPEX	in 2021		In 2025*	
	Total	% Total	Total	% Total
Vacuum Trucks (VTU)	52,575,500	31.0%	61,980,388	31.0%
Septage Treatment Plant (SpTP)	111,662,669	65.8%	131,637,274	65.8%
Reuse Facility	5,458,230	3.2%	6,434,617	3.2%
Total Project Cost	169,696,399	100%	200,052,278	100%
Add: Interest During Construction	4,581,803	2.6%	5,401,412	
of which: IDC of Reuse Facility	147,372	0.1%	173,735	
Total Investment Cost with Reuse Facility	174,278,201		205,453,690	
Total Investment Cost w/out Re - Use Facility	168,672,599		198,845,338	
<i>Reuse Facility as % of total investment cost</i>	3.2%		3.2%	

Note: The price escalation uses 4.2% per year, which is the average nationwide inflation in the past 20 years.

9.2.2 Operation and Maintenance Cost (O&M)

Table 106 shows the major assumptions for the financial planning per major cost items. Personnel Costs were assumed to increase by 5.0 percent based on standard LWUA practice. Power and utilities are assumed to increase by 2.7 percent based on the 10 Year average growth of the Fuel Group in the National Statistics Authority historical data. Maintenance, Spare Parts and other items were conservatively assumed to grow by 4.2 percent based on the average inflation in the past 20 years.

Table 106: Inflation Assumption per Major Cost Group (per Annum)

Basis		
Personnel	5.00%	Based on LWUA practice in personnel expense projections.
Power and Utilities	2.70%	Based on 10-year average inflation of Fuel Group in National Statistics Authority.
Maintenance, Spare Parts, Materials and Supplies	4.20%	Based on average inflation (CPI) the past 20 years.
Others	4.20%	Based on average inflation (CPI) the past 20 years.

Table 107 shows the projected operational and maintenance expenses with the reuse facility in real terms in the forecasted period. Maintenance and spare parts accounts for 31 percent of the O&M expense, followed by Personnel (26 percent), Power, Utilities and Oil (8 percent), and others (8 percent). Reuse expenses represent 11 percent of total O&M.

Table 107: Projected O&M Costs (in Constant PhP)

Year	Power, Utilities, Oil	Maintenance and Spare Parts	Personnel	Others	Total O&M	Reuse O&M	Total O&M less Reuse O&M
2025	5,245,908	6,514,222	6,962,622	1,925,712	22,390,856	2,403,542	19,987,313
2026	5,532,846	6,624,228	6,962,622	1,792,434	22,718,943	2,461,150	20,257,793
2027	5,870,984	6,753,671	6,962,622	1,792,578	23,262,472	2,528,937	20,733,535
2028	6,174,279	6,869,558	6,962,622	1,926,706	23,883,647	2,589,624	21,294,023
2029	5,995,603	7,614,449	7,337,536	2,105,858	25,084,564	2,661,730	22,422,833
2030	6,527,423	7,817,965	7,337,536	2,106,084	25,939,307	2,768,307	23,171,000
2031	6,837,806	7,936,465	7,337,536	2,106,215	26,437,717	2,830,363	23,607,354
2032	7,217,958	8,081,915	7,337,536	2,106,376	27,048,658	2,906,532	24,142,127
2033	7,581,771	8,221,321	7,337,536	2,106,530	27,633,671	2,979,536	24,654,135
2034	7,481,151	8,995,286	7,712,450	2,285,715	28,958,776	3,066,867	25,891,909
2035	7,849,028	9,136,163	7,712,450	2,285,871	29,550,186	3,140,641	26,409,545
2036	8,269,110	9,296,640	7,712,450	2,286,049	30,224,900	3,224,680	27,000,221
2037	8,737,456	9,932,945	8,087,364	2,447,247	31,970,786	3,318,683	28,652,103
2038	9,406,375	10,131,642	8,087,364	2,447,468	32,954,983	3,422,736	29,532,247
2039	9,406,375	10,215,039	8,087,364	2,447,449	33,131,622	3,506,133	29,625,489
2040	9,607,164	11,078,252	8,462,278	2,623,543	34,852,137	3,600,478	31,251,659
2041	9,607,164	11,078,252	8,462,278	2,623,543	34,852,137	3,600,478	31,251,659
2042	9,607,164	11,078,252	8,462,278	2,623,543	34,852,137	3,600,478	31,251,659
2043	9,607,164	11,078,252	8,462,278	2,623,543	34,852,137	3,600,478	31,251,659

Year	Power, Utilities, Oil	Maintenance and Spare Parts	Personnel	Others	Total O&M	Reuse O&M	Total O&M less Reuse O&M
2044	9,607,164	11,078,252	8,462,278	2,623,543	34,852,137	3,600,478	31,251,659
Total	156,169,893	179,532,770	154,248,997	45,286,008	585,451,777	61,811,852	523,639,925
%	27%	31%	26%	8%	100%	11%	

Table 108 shows the projected operational and maintenance expenses in nominal pesos during the forecasted period. In inflation adjusted terms, O&M expenses are expected to rise from PhP23.31 million to PhP59.83 million.

Table 108: Projected O&M Costs (in Nominal PhP)

Year	Power and Utilities, Oil	Maintenance and Spare Parts	Personnel	Others	Total O&M
2025	5,387,548	6,787,820	7,310,753	2,006,592	23,308,284
2026	5,835,653	7,192,349	7,676,290	1,946,161	24,612,225
2027	6,359,489	7,640,874	8,060,105	2,028,061	26,218,459
2028	6,868,597	8,098,408	8,463,110	2,271,362	28,000,869
2029	6,849,913	9,353,563	9,364,762	2,586,829	30,650,085
2030	7,658,865	10,006,911	9,833,000	2,695,764	32,946,901
2031	8,239,671	10,585,250	10,324,650	2,809,162	34,919,249
2032	8,932,600	11,231,972	10,840,882	2,927,370	37,136,061
2033	9,636,174	11,905,594	11,382,926	3,050,543	39,431,235
2034	9,765,014	13,573,510	12,562,768	3,449,048	43,098,855
2035	10,521,817	14,365,104	13,190,907	3,594,154	45,707,651
2036	11,384,241	15,231,358	13,850,452	3,745,399	48,570,589
2037	12,353,806	16,957,365	15,249,931	4,177,902	53,460,688
2038	13,658,673	18,023,034	16,012,427	4,353,765	57,174,888
2039	14,027,457	18,934,586	16,813,049	4,536,589	59,826,871
2040	14,027,457	18,934,586	16,813,049	4,536,589	59,826,871
2041	14,027,457	18,934,586	16,813,049	4,536,589	59,826,871
2042	14,027,457	18,934,586	16,813,049	4,536,589	59,826,871
2043	14,027,457	18,934,586	16,813,049	4,536,589	59,826,871
2044	14,027,457	18,934,586	16,813,049	4,536,589	59,826,871

9.3 Project Financing

The project will be financed by a loan with a proposed term of 20 Years with a 1-year grace period on loan principal payment. The equity portion will be assumed to be 10 percent or PhP17.43 million. Interest will be assumed to be 6.0 percent per annum. It will be assumed that debt service ratio (or the ratio earnings before interest, depreciation, amortization (EBITDA) to debt service) is at least 1.3x.

The cost of land is included as part of total project cost as the asset will be used as the site of the Septage Treatment Plant. The cost of the land will be subtracted from the equity required by the creditor.

Table 109: Financing Plan (in 2021 and 2025 Prices, PhP)

	Amount		% Total
	2021 Prices	2025 Prices	
Total Debt	156,850,381	184,908,321	90.0%
Total Equity	17,427,820	20,545,369	10.0%
Total Project	174,278,201	205,453,690	100%

9.3.1 Septage Revenues

Septage revenues will come from (1) existing WD customers to be billed on a monthly basis based on the volume of water consumed; and (2) households who are not connected to the WD but are willing to pay on a per service basis. Revenues will be based on the billed volume water multiplied by a tariff based on the lifecycle cost of the project. Lifecycle cost is equal to total CAPEX plus total O&M plus the cost of capital (debt and equity). The cost of equity is based on the risk-free instrument (i.e., Philippine Government Securities) as reported in the Philippine Dealing System Treasury (PDST).

9.3.2 Tariff Calculation

Table 110 shows the calculation of tariff for the septage service to be provided every four years. The base tariff for the service is estimated at PhP1.95 per cubic meter of water consumed. Without the capex and O&M from the Reuse Facility, the tariff is estimated at Php1.60 per cu. m.

Table 110: Tariff Calculation for ZCWD Septage Management Project (in PhP)

Septage Management Project	
Total CAPEX (constant prices)	174,278,201
Total O&M (constant prices)	585,451,777
Total CAPEX and O&M	759,729,978
Add: Cost of Debt and Equity	112,317,411
Total Project Cost (PhP) (CAPEX + O&M)	879,575,173
Total Billed Volume (m ³) (20 Years)	525,904,598
Cost per cubic meter (PhP)	1.67
Provision for Cash Reserves	0.28
Recommended Tariff per m³	1.95
EBITDA/Debt Service Multiple (X) during term of loan	1.3X
Proposed Tariff without Reuse Facility: (PhP)	1.60

Note: The proposed tariff uses CAPEX in 2021 prices. Subject to the final Capex of the project upon implementation and subject to LWUA's approval, the proposed tariff may change.

9.3.3 Biosolid Revenues

The study has identified that the reuse products that holds the most commercial promise is the sale of biosolids to agricultural establishments that will use them as soil conditioners or organic fertilizers.

The biosolids will be assumed to be given for free to interested parties in the first two years of operation as a promotional marketing strategy. However, the price in Year 3 will be pegged at

PhP15.00 per sack. It will be further assumed that price will be increased to PhP20.00. Note that the market price of fertilizers is between PhP34.00 to PhP37.50 based on data from the Office of the City Environment and Natural Resources and the City General Services Office. **Table 111** shows the forecasted revenues against forecasted costs.

The Net Present Value (NPV) of a reuse facility is positive from the cash flow point of view. As calculated in the table, the NPV of the reuse facility using conservative price assumption is PhP2.99 million.

Table 111. Net Present Value of Reuse Facility

Year	Biosolid (sacks)	Price per Sack (PhP)	Revenues (PhP)	Reuse Cost ¹ (PhP)	Annual Cashflows (PhP)
0				5,458,230	-5,458,230
1	396	0	0	2,403,542	-2,403,542
2	413	0	0	2,461,150	-2,461,150
3	432	15	2,367,626	2,528,937	-161,311
4	450	15	2,463,245	2,589,624	-126,379
5	471	20	3,435,807	2,661,730	774,077
6	501	20	3,659,703	2,768,307	891,396
7	519	20	3,790,070	2,830,363	959,707
8	541	20	3,950,086	2,906,532	1,043,554
9	562	20	4,103,454	2,979,536	1,123,918
10	587	20	4,286,919	3,066,867	1,220,052
11	608	20	4,441,904	3,140,641	1,301,263
12	633	20	4,618,452	3,224,680	1,393,772
13	660	20	4,815,934	3,318,683	1,497,251
14	690	20	5,034,529	3,422,736	1,611,793
15	714	20	5,209,729	3,506,133	1,703,596
16	741	20	5,407,930	3,600,478	1,807,452
17	741	20	5,407,930	3,600,478	1,807,452
18	741	20	5,407,930	3,600,478	1,807,452
19	741	20	5,407,930	3,600,478	1,807,452
20	741	20	5,407,930	3,600,478	1,807,452
NPV (PhP)					7,322,823

Note: ¹Costs at Yr.0 refer to the CAPEX, while the succeeding values refer to the O&M costs of the facility

9.4 Financial Projection and Analysis

The WD's debt service ratio (DSCR) or the ratio of EBITDA to debt service (principal payments plus interest expenses) is assumed to be at least 1.3X. No subsidy is assumed coming from the National Government.

Septage tariff is reviewed every 5 years to evaluate whether the O&M costs are still in line with expectations. It will be assumed tariffs will be adjusted if O&M costs are already out of line.

9.4.1 Projected Financial Statements

Table 112: Projected Income Statements (No Grant Scenario)

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Septage Fees	-	41.75	42.86	46.33	51.40	53.57	55.00	56.33	67.29	68.84	70.45	72.00	85.91	87.77	89.66	91.50	107.14	107.14	107.14	107.14	107.14
Less: O&Mt. Expenses	-	23.31	24.61	26.22	28.00	30.65	32.95	34.92	37.14	39.43	43.10	45.71	48.57	53.46	57.17	59.83	65.60	-	-	-	-
EBITDA	-	18.45	18.25	20.11	23.40	22.92	22.06	21.41	30.15	29.41	27.35	26.29	37.34	34.31	32.49	31.68	41.54	107.14	107.14	107.14	107.14
Less: Depreciation and Amortization	-	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58
EBIT	-	12.86	12.66	14.53	17.82	17.34	16.47	15.83	24.57	23.83	21.76	20.71	31.76	28.73	26.91	26.09	35.95	101.55	101.55	101.55	101.55
Less: Interest Expenses	-	-	9.41	9.13	8.84	8.52	8.19	7.84	7.47	7.07	6.65	6.21	5.74	5.24	4.71	4.15	3.55	2.92	2.25	1.55	0.80
Upfront Expenses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pre-tax Income	-	12.86	3.25	5.40	8.98	8.81	8.28	7.99	17.10	16.76	15.11	14.50	26.02	23.49	22.20	21.95	32.40	98.63	99.30	100.01	100.76
Less: Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Taxes (NIAT)	-	12.86	3.25	5.40	8.98	8.81	8.28	7.99	17.10	16.76	15.11	14.50	26.02	23.49	22.20	21.95	32.40	98.63	99.30	100.01	100.76

Note: All figures are in Php million

Table 113: Projected Cash Flow

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cash flow from Operations																					
EBITDA	-	18.45	18.25	20.11	23.40	22.92	22.06	21.41	30.15	29.41	27.35	26.29	37.34	34.31	32.49	31.68	41.54	107.14	107.14	107.14	107.14
Interest Expenses other finance charges	-	-	-9.41	-9.13	-8.84	-8.52	-8.19	-7.84	-7.47	-7.07	-6.65	-6.21	-5.74	-5.24	-4.71	-4.15	-3.55	-2.92	-2.25	-1.55	-0.80
(Increase)/ Decrease in Receivables	-	-5.15	-0.14	-0.43	-0.62	-0.27	-0.18	-0.16	-1.35	-0.19	-0.20	-0.19	-1.71	-0.23	-0.23	-0.23	-1.93	-	-	-	-
(Increase)/ Decrease in Inventory	-	-2.38	-0.11	-0.16	-0.18	-0.27	-0.23	-0.20	-0.22	-0.23	-0.37	-0.26	-0.29	-0.50	-0.38	-0.27	-0.59	6.65	-	-	-
Increase/ (Decrease) in Payables	-	-	4.05	0.26	0.29	0.44	0.38	0.32	0.36	0.38	0.60	0.43	0.47	0.80	0.61	0.44	0.95	-10.78	-	-	-
Income Taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cash flow from Investing Activities																					
CAPEX	-174.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cashflow from Financing Activities																					
Loans Payable - LWUA	156.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equity Participation from WD	17.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subsidy from National Government/ LGU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loan Principal Payments	-	-	-4.65	-4.92	-5.22	-5.53	-5.87	-6.22	-6.59	-6.99	-7.41	-7.85	-8.32	-8.82	-9.35	-9.91	-10.50	-11.13	-11.80	-12.51	-13.26
Change in Cash Position	0.00	10.92	7.98	5.73	8.83	8.76	7.97	7.32	14.88	15.31	13.32	12.21	21.75	20.33	18.43	17.56	25.92	88.95	93.08	93.08	93.08
Beginning Cash	-	0.00	10.92	18.90	24.63	33.46	42.23	50.19	57.51	72.39	87.70	101.02	113.23	134.98	155.31	173.74	191.30	217.22	306.16	399.24	492.32
Ending Cash	0.00	10.92	18.90	24.63	33.46	42.23	50.19	57.51	72.39	87.70	101.02	113.23	134.98	155.31	173.74	191.30	217.22	306.16	399.24	492.32	585.40

Note: All figures are in PhP million

Table 114. Projected Balance Sheet

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cash	0.00	10.92	18.90	24.63	33.46	42.23	50.19	57.51	72.39	87.70	101.02	113.23	134.98	155.31	173.74	191.30	217.22	306.16	399.24	492.32	585.40
Receivables from Customers	-	5.15	5.28	5.71	6.34	6.60	6.78	6.94	8.30	8.49	8.69	8.88	10.59	10.82	11.05	11.28	13.21	13.21	13.21	13.21	13.21
Inventory	-	2.38	2.49	2.66	2.84	3.11	3.34	3.54	3.76	4.00	4.37	4.63	4.92	5.42	5.80	6.06	6.65	-	-	-	-
Net Fixed Assets	174.28	168.70	163.11	157.53	151.95	146.36	140.78	135.20	129.61	124.03	118.45	112.87	107.28	101.70	96.12	90.53	84.95	79.37	73.79	68.20	62.62
Gross Fixed Assets	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28	174.28
Accumulated Depreciation	-	5.58	11.17	16.75	22.33	27.91	33.50	39.08	44.66	50.25	55.83	61.41	67.00	72.58	78.16	83.74	89.33	94.91	100.49	106.08	111.66
Total Assets	174.28	187.14	189.79	190.53	194.59	198.30	201.10	203.19	214.07	224.22	232.53	239.61	257.78	273.25	286.71	299.18	322.03	398.74	486.24	573.73	661.23
Liabilities																					

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Interest Bearing Liabilities	156.85	156.85	152.20	147.28	142.06	136.53	130.66	124.44	117.85	110.87	103.46	95.61	87.29	78.47	69.12	59.21	48.71	37.57	25.77	13.26	-
Accounts Payable	-	-	4.05	4.31	4.60	5.04	5.42	5.74	6.10	6.48	7.08	7.51	7.98	8.79	9.40	9.83	10.78	-	-	-	-
Stockholder's Equity	17.43	30.29	33.54	38.94	47.92	56.74	65.02	73.01	90.11	106.87	121.98	136.48	162.50	185.99	208.19	230.13	262.53	361.17	460.46	560.47	661.23
Capital	17.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Government Subsidy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paid in Capital	17.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	12.86	16.11	8.65	14.38	17.80	26.08	34.07	51.17	67.93	83.04	97.54	123.56	147.05	169.25	191.19	223.59	322.22	421.52	521.53	622.29
Earnings for the Year	-	12.86	3.25	5.40	8.98	8.81	8.28	7.99	17.10	16.76	15.11	14.50	26.02	23.49	22.20	21.95	32.40	98.63	99.30	100.01	100.76
Liabilities and Stockholders' Equity	174.28	187.14	189.79	190.53	194.59	198.30	201.10	203.19	214.07	224.22	232.53	239.61	257.78	273.25	286.71	299.18	322.03	398.74	486.24	573.73	661.23

Note: All figures are in Php million

Table 115: Selected Financial Indicators and Debt Schedule (No Grant)

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EBITDA	-	18.45	18.25	20.11	23.40	22.92	22.06	21.41	30.15	29.41	27.35	26.29	37.34	34.31	32.49	31.68	41.54	107.14	107.14	107.14	107.14
Total Debt Service	-	-	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06	14.06
Debt Service Coverage Ratio (DSCR)	-	-	1.30	1.43	1.66	1.63	1.57	1.52	2.14	2.09	1.95	1.87	2.66	2.44	2.31	2.25	2.95	7.62	7.62	7.62	7.62
Debt Structure																					
Current Portion of Long Term Debt	-	-	4.65	4.92	5.22	5.53	5.87	6.22	6.59	6.99	7.41	7.85	8.32	8.82	9.35	9.91	10.50	11.13	11.80	12.51	13.26
Long Term Debt	-	156.85	152.20	147.28	142.06	136.53	130.66	124.44	117.85	110.87	103.46	95.61	87.29	78.47	69.12	59.21	48.71	37.57	25.77	13.26	-
Balance Sheet Indicator																					
Current Assets (Cash and equivalents)	-	10.92	18.90	24.63	33.46	42.23	50.19	57.51	72.39	87.70	101.02	113.23	134.98	155.31	173.74	191.30	217.22	306.16	399.24	492.32	585.40
Current Portion of Long Term Debt	-	-	4.65	4.92	5.22	5.53	5.87	6.22	6.59	6.99	7.41	7.85	8.32	8.82	9.35	9.91	10.50	11.13	11.80	12.51	13.26
Current Ratio	-	-	-	-	6.41	7.63	8.56	9.25	10.98	12.55	13.64	14.43	16.22	17.61	18.58	19.30	20.68	27.50	33.83	39.35	44.14
Debts less Cash	-	-145.93	-133.30	-122.65	-108.60	-94.30	-80.47	-66.93	-45.46	-23.17	-2.44	17.62	47.69	76.84	104.62	132.09	168.51	268.59	373.47	479.06	585.40

Note: All figures are in Php million

9.5 Discounted Cash Flow Analysis

9.5.1 Financial Internal Rate of Return and Net Present Value

For the project to be considered acceptable, FIRR must be at least equal or more than the WACC. Alternatively, the project's NPV must be positive.

The project's WACC is estimated at 5.89 percent using a cost of debt of 6.0 percent and cost of equity of 4.9 percent.

Table 116: Weighted Average Cost of Capital

	Cost of Capital	Weight
Debt	6.0%	5.40%
Equity Contribution	4.9%	0.49%
Weighted Average Cost of Capital (WACC)		5.89%

Table 117: Financial Internal Rate of Return and Net Present Value

NPV	FIRR	WACC
223.90	15.0%	5.9%

The computed FIRR is 15.0 percent, which is higher than the WACC of 5.9 percent. The NPV, the discounted at the WACC, is PhP223.90million.

9.5.2 Sensitivity Analysis

A sensitivity analysis was conducted in order to evaluate the impact of a 10 percent and 20 percent increase in CAPEX and O&M expenses. Similarly, a 10 percent and 20 percent reduction in revenues was simulated.

As shown, a 20 percent change in CAPEX has reduced NPV to PhP128.38million. A 20 percent increase in O&M costs has resulted to a still positive PhP58.84 million NPV. Meanwhile, a 20 percent decrease in revenues will lower NPV to PhP-9.37 million. In terms of impact on FIRR, the change that has the most impact on FIRR is a reduction in sanitation revenues by 20 percent. The results for a 10 percent change in these parameters, as well as a combination of these changes, are also shown in **Table 118**.

Table 118: Results of Sensitivity Analysis

	Base	% change	
	Scenario	10%	20%
CAPEX Increased			
NPV	223.903	144.839	128.380
FIRR (%)	15.0%	12.3%	11.2%
WACC	5.9%	5.9%	5.9%
FIRR - WACC	9.1%	6.4%	5.3%

	Base	% change	
	Scenario	10%	20%
O&M Cost Increased			
NPV	223.903	110.067	58.835
FIRR (%)	15.0%	11.4%	9.1%
WACC	5.9%	5.9%	5.9%
FIRR - WACC	9.1%	5.5%	3.2%
Revenues Reduced			
NPV	223.903	77.478	-9.365
FIRR (%)	15.0%	9.9%	5.3%
WACC	5.9%	5.9%	5.9%
FIRR - WACC	9.1%	4.0%	-0.6%
CAPEX Increased and Revenues Reduced			
NPV	223.903	61.019	-39.260
FIRR (%)	15.0%	8.9%	3.8%
WACC	5.9%	5.9%	5.9%
FIRR - WACC	9.1%	3.0%	-2.1%
O&M Cost Increased and Revenues Reduced			
NPV	223.903	26.247	-109.123
FIRR (%)	15.0%	7.4%	-5.7%
WACC	5.9%	5.9%	5.9%
FIRR - WACC	9.1%	1.5%	-11.6%

9.6 Impact on Monthly Water Bill

Table 119: Affordability

	Total Charges
Basic Water Charge - For first 10 cum	21.00
Monthly Basic Water Charge (10 cu m)	210.00
Sanitation Fee (Septage)	
<i>Sanitation Charge (Septage)</i>	1.95
Monthly Septage Fee, PhP per month	19.55
Total Water and Septage Fee per month	229.55
Monthly Income of LIH (PhP)	9,468
As of % Monthly Income	2.42%

The LWUA's guideline on affordability is based on the metric that the basic water and sanitation charge should not be more than 5 percent of the income of the household in the Low-Income Group (LIG) based on Census data. The additional charge brought about by the Septage Management Project will result into a minimal additional charge. As shown in the table, the total water and septage charge will still remain the 5 percent affordability cap for the LIG households. For Zamboanga, total water and septage charge will be only 2.42 percent of the income of the LIG.

9.7 Conclusion and Recommendation

This section has arrived at the following conclusions:

- a) The incremental charges brought about by the Septage Services will be minimal and within the LWUA 5 percent "affordability" guideline,
- b) the addition of a reuse facility and marketing bio-solids to users will enhance the value of the project
- c) the project will be financially sustainable using traditional measure of investment metrics i.e., FIRR \geq WACC and that Net Present Value is greater than zero.

10 Economic Analysis

The section discusses the project's economic viability and worth through Cost-Benefit Analysis. This ensures that the project will have a positive impact to the wellbeing of the citizens and the economy as a whole.

10.1 Cost and Benefit Analysis of a Septage Management Project

Septage management is the process by which fecal sludge are collected, transported, treated, and disposed of properly or reused. When properly implemented, septage management can reduce pollution in the natural environment (i.e., lower BOD, suspended solids and nutrients in rivers). Reduction in water pollution can prevent sanitation-related illnesses associated with pathogens in fecal matter. Moreover, it can prevent contamination of water supply sources such as surface water and ground water. A cleaner environment eventually improves the quality of life of people, boost economic activity and promote tourism. All these greatly impacts on the overall economic output of a city or a municipality.

On the other hand, implementing a septage management program will require incremental use of resources by the project at the expense of other activities. The resources include foreign exchange, labor, equipment, and land. Their economic costs reflect the true cost involved by diverting these resources away from alternative productive activities in agriculture. Economic costs differ from the actual market value of the resources, with the latter distorted by legal mandates, subsidies, taxes, equity considerations, and disregard of economic scarcity value.

10.2 Methodology

The standard approach used for establishing economic feasibility is economic cost-benefit (ECB) analysis. For the septage management program, the cost-benefit analysis covers a 30-year projection period – which covers the economic life of the major capital expenditure of the septage project, which are the treatment facilities and structures. This period, however, calls for the replacement of major electro-mechanical SpTP equipment and VTUs – the economic lifespans of which are less than 30 years. The economic viability of the project is determined by calculating the economic internal rate of return (EIRR) and the benefit-cost ratio (BCR) of the project. A project is considered economically viable if the EIRR is higher than 10 percent, the social discount rate (SDR) prescribed by the National Economic and Development Authority (2016), and if the BCR is greater than 1.0.

Financial costs are converted into economic costs using factors suggested by NEDA (2004) to reflect the relative scarcity of each input. The conversion factors for each cost component are shown below.

Table 120. Conversion Factors for Economic Costs

Description	Conversion Factor
Foreign exchange/imported inputs	1.2
Utilities	1.0
Skilled labor	1.0
Unskilled labor	0.6
Local materials/supplies	1.0

Description	Conversion Factor
Local equipment and machinery	1.0

Note. Data for parameters in estimating the economic stream of costs and benefits from ICC Project Evaluation Procedures and Guidelines p. 8, by NEDA, 2004.

Moreover, costs are adjusted for taxes and subsidies, with taxes (mostly VAT and import tariffs) deducted and subsidies added back.

10.2.1 Costs of Poor Sanitation according to a World Bank Study (2008)

The World Bank estimates that the economic cost of poor sanitation in the Philippines is around 1.5 percent of Gross Domestic Product (GDP) or US\$1.412 billion. On a per capita basis, the cost is US\$16.8 per capita per year or PhP923.69 in 2005. Adjusting for inflation, the cost of poor sanitation is estimated at PhP1,535 per capita per year in 2020. It is worth noting that 72 percent of the cost is accounted for health costs (i.e., premature death due to water borne illnesses) and 23 percent due to losses of domestic and drinking water sources and fishery sources.

10.3 Contingent Valuation Method

10.3.1 Benefit Valuation of Septage Management Program

Estimating the economic benefits of a Septage Management Project is difficult as it is a part of a much larger water and wastewater strategy of a local government. For instance, high incidences of water borne illnesses such as diarrhea may be due to insufficient water supply or poor hygiene practices. Hence, prevention of health costs may be attributed more to better water supply or simply better hygiene practices.

Due in large part to the technical and conceptual issues involved in quantifying the numerous economic benefits identified previously, the contingent valuation (CV) method in measuring the economic benefit has been proposed.

Under this method, the peso value elicited from households of what they are willing to pay for the sanitation services, or more specifically regular desludging services, is assumed to encompass the overall economic value of the services, including the value of the health, environmental, quality of life, etc. benefits.

One weakness of this method is its subjectivity as the amount is based on the households' own personal assessment, rather than on a rigid technical basis for establishing the value of specific benefits. But as mentioned, establishing these values would be complicated and technically challenging such that in the end, calculating them would also have subjective elements.

The valuation of the benefits using CV method must be taken only as a partial estimate as other benefits or 'externalities' such as prevention of contamination of water supply sources and commercial and tourism activities are not captured in the CV.

Willingness to Pay Survey for Zamboanga

Willingness to pay (WTP) was included in the household and commercial survey for sanitation services conducted for the City of Zamboanga. In the survey, heads of households were asked how much they were willing to pay per month for regular septic tank desludging and septage

treatment assuming a 4-year desludging cycle. The average amount, in peso per month, derived from this exercise is deemed as the economic unit value of the service. **Table 121** presents the computation of the weighted average WTP for households within the WD service area.

Table 121: Willingness to Pay for Septage Management Services in Zamboanga City Sanitation Service Area

WTP (PhP/Month)	% of Respondents	Weighted Average WTP (PhP/Month)
200	0%	-
150	19%	29.14
100	21%	21.14
80	16%	12.80
60	41%	24.34
50	3%	1.43
Total (PhP/Month)		88.86

The survey results show WTP values ranging from PhP50 to 200, with a weighted average of PhP88.86/month. This represents the value ZCWD concessionaires are willing to pay for desludging services, in addition to their monthly water bill. The economic unit value of the ZCWD SMP is therefore taken as PhP88.86/month.

It is important to note that the survey was conducted without discussing the benefits of the sanitation service (e.g., information, education, and communication campaigns). The WTP value thus reflects the respondents' limited understanding of the importance of sanitation. This may increase with the implementation of an IEC campaign. A detailed discussion on the household survey, which includes the methodology, questionnaire sample, profile of respondents, and aggregated results, is presented in **Annex 1**.

Comparison to other Willingness to Pay Survey

The results of the Zamboanga WTP survey are comparable to the WTP value established in a survey of 30 WDs in 2018, conducted for a NEDA and LWUA study. The average WTP in that survey is PhP84.69 per month versus Zamboanga's PhP88.86 (**Table 122**).

A similar survey was undertaken for in an earlier year (2016). The table for 2016 bigger variance across municipalities. (For comparison, see **Table 123**).

Table 122: Average WTP Across 20 Non-Mandamus Water Districts (2018)

Coverage	Ave. Monthly WTP (PhP)
Zamboanga City WD	88.86
Luzon	98.72
Visayas	65.13
Mindanao	79.94
All 30 Municipalities and Cities	84.69

Table 123: Average WTP from NEDA (2016) Study

Cluster/Province	Covered Cities/Municipalities	Ave. Monthly WTP (PhP)
Luzon		76.30
Bataan	Orani, Balanga, Limay, Orion, Hermosa	80.71
Pampanga	Masantol, Lubao, Guagua, Santa Rita, Bacolor, Porac, Macabebe	88.31
Bulacan	Bulakan, Obando, Sta. Maria, Hagonoy, Meycauayan	96.14
Batangas	Lipa	64.50
Sorsogon	Sorsogon City	75.51
Visayas	Sagay, Negros Occidental and Kalibo Aklan	48.67
Mindanao	Gingoog City	87.14

Note. Data for WTP from Conduct of Feasibility Studies of the Various Projects under the Feasibility Studies Fund: Concept Design for Sanitation Projects (32 Water Districts) by NEDA and LWUA, 2016.

10.3.2 Total Economic Benefits

The total economic benefit of developing a septage management program in the Zamboanga City was computed by multiplying the weighted average WTP derived from the survey responses to the projected number of household connections over the 30-year period of analysis, multiplied further by 12 or the number of months of collection per year. The benefit is still conservative as this does not include non-connected households wishing to desludge their septic tanks on a one-time payment basis. The estimates of yearly benefits are presented in **Table 124**.

Table 124: Total Economic Benefits

Year	Service Connections	WTP (PhP/Month)	Annual Benefit ('000 PhP)
2024	64,981	88.86	-
2025	66,733	88.86	71,156.44
2026	68,473	88.86	73,011.78
2027	70,221	88.86	74,875.65
2028	71,961	88.86	76,730.99
2029	73,707	88.86	78,592.72
2030	75,455	88.86	80,456.59
2031	77,184	88.86	82,300.20
2032	78,909	88.86	84,139.54
2033	80,643	88.86	85,988.48
2034	82,384	88.86	87,844.88
2035	84,091	88.86	89,665.03
2036	85,835	88.86	91,524.63
2037	87,575	88.86	93,379.97
2038	89,322	88.86	95,242.77
2039	89,322	88.86	95,242.77
2040	89,322	88.86	95,242.77
2041	89,322	88.86	95,242.77
2042	89,322	88.86	95,242.77

Year	Service Connections	WTP (PhP/Month)	Annual Benefit ('000 PhP)
2043	89,322	88.86	95,242.77
2044	89,322	88.86	95,242.77
2045	89,322	88.86	95,242.77
2046	89,322	88.86	95,242.77
2047	89,322	88.86	95,242.77
2048	89,322	88.86	95,242.77
2049	89,322	88.86	95,242.77
2050	89,322	88.86	95,242.77
2051	89,322	88.86	95,242.77
2052	89,322	88.86	95,242.77
2053	89,322	88.86	95,242.77
2054	89,322	88.86	95,242.77
Total			2,657,126.42

The benefits are still conservative as they do not cover those arising from non-WD concessionaires who may avail of desludging services for a separate fee, or third-party desludging service providers who may pay for septage treatment.

10.4 Total Economic Costs

The prescribed conversion factors presented in **Table 120** were used in deriving economic costs out of financial costs, after adjusting the cost items for taxes. The results are shown in **Table 125**, **Table 126**, and **Table 127** for converted CAPEX, O&M, and total cost, respectively. The total economic cost is estimated at PhP1.43 billion.

Year 0 consists largely of CAPEX. There is also capex in years when the useful life of the VTUs end and they are replaced, or when new units need to be added because of an increase in demand.

Table 125: Converted CAPEX (in '000 PhP)

Year	Forex Costs	Local Equipment & Materials	Skilled Labor	Unskilled Labor	Total Economic Costs
2024	62,239.42	73,558.73	10,517.11	554.54	146,869.79
2025	-	-	-	-	-
2026	-	-	-	-	-
2027	-	-	-	-	-
2028	3,186.01	4,381.65	-	-	7,567.66
2029	-	-	-	-	-
2030	-	-	-	-	-
2031	-	-	-	-	-
2032	14,050.29	11,367.56	2,835.45	91.12	28,344.41
2033	6,372.02	8,763.30	-	-	15,135.32
2034	35,343.48	48,607.09	-	-	83,950.57
2035	-	-	-	-	-

Year	Forex Costs	Local Equipment & Materials	Skilled Labor	Unskilled Labor	Total Economic Costs
2036	4,488.74	6,173.26	-	-	10,661.99
2037	-	-	-	-	-
2038	6,372.02	8,763.30	-	-	15,135.32
2039	-	-	-	-	-
2040	-	-	-	-	-
2041	-	-	-	-	-
2042	14,050.29	11,367.56	-	-	25,417.84
2043	6,372.02	8,763.30	-	-	15,135.32
2044	35,343.48	48,607.09	-	-	83,950.57
2045	-	-	-	-	-
2046	-	-	-	-	-
2047	-	-	-	-	-
2048	3,186.01	4,381.65	-	-	7,567.66
2049	-	-	-	-	-
2050	-	-	-	-	-
2051	-	-	-	-	-
2052	14,050.29	11,367.56	-	-	25,417.84
2053	6,372.02	8,763.30	-	-	15,135.32
2054	35,343.48	48,607.09	-	-	83,950.57
Total	246,769.58	303,472.40	13,352.56	645.66	564,240.19

Table 126: Converted O&M ('000 PhP)

Year	Forex Costs	Local Equipment & Materials	Skilled Labor	Unskilled Labor	Utilities	Total Economic Costs
2024	-	-	-	-	-	-
2025	9,448.89	4,947.69	5,595.50	935.76	664.58	21,592.41
2026	9,806.77	4,916.13	5,403.03	935.76	683.19	21,744.87
2027	10,228.40	5,017.14	5,403.03	935.76	705.09	22,289.41
2028	10,606.47	5,225.49	5,403.03	935.76	724.69	22,895.44
2029	10,936.66	5,650.75	5,607.05	1,038.29	747.99	23,980.75
2030	11,599.77	5,809.56	5,607.05	1,038.29	782.42	24,837.09
2031	11,986.63	5,902.03	5,607.05	1,038.29	802.46	25,336.46
2032	12,460.61	6,015.53	5,607.05	1,038.29	827.07	25,948.54
2033	12,914.33	6,124.31	5,607.05	1,038.29	850.65	26,534.63
2034	13,341.42	6,572.26	5,811.08	1,140.82	878.86	27,744.45
2035	13,800.17	6,682.19	5,811.08	1,140.82	902.70	28,336.95
2036	14,323.80	6,807.41	5,811.08	1,140.82	929.84	29,012.96
2037	15,241.74	7,209.76	6,015.10	1,243.36	960.21	30,670.17
2038	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2039	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2040	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51

Year	Forex Costs	Local Equipment & Materials	Skilled Labor	Unskilled Labor	Utilities	Total Economic Costs
2041	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2042	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2043	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2044	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2045	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2046	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2047	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2048	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2049	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2050	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2051	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2052	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2053	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2054	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
Total	429,467.74	202,081.89	175,544.86	34,737.41	27,354.85	869,186.75

Table 127: Total Economic Costs (in '000 PhP)

Year	Forex Costs	Local Equipment & Materials	Skilled Labor	Unskilled Labor	Utilities	Total Economic Costs
2024	62,239.42	73,558.73	10,517.11	554.54	-	146,869.79
2025	9,448.89	4,947.69	5,595.50	935.76	664.58	21,592.41
2026	9,806.77	4,916.13	5,403.03	935.76	683.19	21,744.87
2027	10,228.40	5,017.14	5,403.03	935.76	705.09	22,289.41
2028	13,792.48	9,607.14	5,403.03	935.76	724.69	30,463.10
2029	10,936.66	5,650.75	5,607.05	1,038.29	747.99	23,980.75
2030	11,599.77	5,809.56	5,607.05	1,038.29	782.42	24,837.09
2031	11,986.63	5,902.03	5,607.05	1,038.29	802.46	25,336.46
2032	26,510.89	17,383.08	8,442.50	1,129.41	827.07	54,292.95
2033	19,286.35	14,887.60	5,607.05	1,038.29	850.65	41,669.95
2034	48,684.91	55,179.35	5,811.08	1,140.82	878.86	111,695.02
2035	13,800.17	6,682.19	5,811.08	1,140.82	902.70	28,336.95
2036	18,812.54	12,980.67	5,811.08	1,140.82	929.84	39,674.95
2037	15,241.74	7,209.76	6,015.10	1,243.36	960.21	30,670.17
2038	22,417.44	16,128.10	6,015.10	1,243.36	993.83	46,797.83
2039	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2040	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2041	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2042	30,095.71	18,732.36	6,015.10	1,243.36	993.83	57,080.35
2043	22,417.44	16,128.10	6,015.10	1,243.36	993.83	46,797.83
2044	51,388.90	55,971.89	6,015.10	1,243.36	993.83	115,613.08
2045	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51

Year	Forex Costs	Local Equipment & Materials	Skilled Labor	Unskilled Labor	Utilities	Total Economic Costs
2046	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2047	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2048	19,231.43	11,746.45	6,015.10	1,243.36	993.83	39,230.17
2049	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2050	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2051	16,045.42	7,364.80	6,015.10	1,243.36	993.83	31,662.51
2052	30,095.71	18,732.36	6,015.10	1,243.36	993.83	57,080.35
2053	22,417.44	16,128.10	6,015.10	1,243.36	993.83	46,797.83
2054	51,388.90	55,971.89	6,015.10	1,243.36	993.83	115,613.08
Total	676,237.32	505,554.29	188,897.42	35,383.06	27,354.85	1,433,426.94

10.5 Results of Economic Cost-Benefit Analysis

10.5.1 Contingent Valuation Approach

The results of the economic analysis using the WTP approach are shown in **Table 128**. The project's EIRR of 33.5 percent is much higher than the required EIRR of 10 percent. Thus, the project clearly passed the economic viability criteria set by NEDA.

Table 128: Economic Cost-Benefit Analysis: WTP Approach (in '000 PhP)

Year	Benefits	Costs	Net Benefit
2024	-	146,869.79	-146,869.79
2025	71,156.44	21,592.41	49,564.03
2026	73,011.78	21,744.87	51,266.91
2027	74,875.65	22,289.41	52,586.24
2028	76,730.99	30,463.10	46,267.89
2029	78,592.72	23,980.75	54,611.97
2030	80,456.59	24,837.09	55,619.50
2031	82,300.20	25,336.46	56,963.74
2032	84,139.54	54,292.95	29,846.59
2033	85,988.48	41,669.95	44,318.53
2034	87,844.88	111,695.02	-23,850.14
2035	89,665.03	28,336.95	61,328.08
2036	91,524.63	39,674.95	51,849.69
2037	93,379.97	30,670.17	62,709.81
2038	93,379.97	46,797.83	46,582.15
2039	93,379.97	31,662.51	61,717.46
2040	93,379.97	31,662.51	61,717.46
2041	93,379.97	31,662.51	61,717.46
2042	93,379.97	60,006.92	33,373.05
2043	93,379.97	46,797.83	46,582.15
2044	93,379.97	115,613.08	-22,233.11

Year	Benefits	Costs	Net Benefit
2045	93,379.97	31,662.51	61,717.46
2046	93,379.97	31,662.51	61,717.46
2047	93,379.97	31,662.51	61,717.46
2048	93,379.97	39,230.17	54,149.80
2049	93,379.97	31,662.51	61,717.46
2050	93,379.97	31,662.51	61,717.46
2051	93,379.97	31,662.51	61,717.46
2052	93,379.97	60,006.92	33,373.05
2053	93,379.97	46,797.83	46,582.15
2054	93,379.97	115,613.08	-22,233.11
Total	2,657,126.42	1,439,280.07	1,217,846.35
EIRR			33.50%
BCR			1.85
NPV			269,797.93

10.6 Sensitivity Analysis

The ZCWD Septage Management Project was subjected to further analysis in which the impact of numerous possible negative developments on its economic feasibility was determined. A number of conceivable factors could affect the project, including: (a) lower-than-expected acceptance of the project, resulting in higher payment delinquencies and lower project revenues; (b) weaknesses in the measurement of WTP; and (c) unanticipated rise in costs, such as in the case of a sharp foreign exchange depreciation.

NEDA (2004) prescribes certain negative scenarios for economic sensitivity analyses which the study used as reference, specifically: (a) a 10 percent decrease in benefits and a 10 percent increase in costs; (b) a 20 percent decrease in benefits; (c) a 20 percent increase in costs; (d) a 20 percent decrease in benefits and a 20 percent increase in costs.

Sensitivity analysis applies only to the outcome adopting the per capita sanitation benefit approach, which determined the project to be economically feasible. As **Table 129** indicated, the project remains feasible under all scenarios. The project BCR is more than 1.0 in all scenarios.

Table 129: Sensitivity analyses: Per Capita Sanitation Benefit Approach

Scenario	Net Benefit ('000 PhP)	EIRR (%)	BCR (x)	NPV ('000 PhP)
Base	1,217,846.35	33.50%	1.85	269,797.93
10% ↓ in benefits, 10% ↑ in costs	808,205.70	23.22%	1.51	154,170.54
20% ↓ in benefits	727,330.17	22.15%	1.55	129,322.06
20% ↑ in costs	929,990.34	24.12%	1.54	181,150.33
20% ↓ in benefits, 20% ↑ in costs	398,565.05	13.48%	1.23	38,543.14

10.7 Conclusion

Using the CV method (i.e., using WTP value in calculating the economic benefit), the Zamboanga Septage Management Project is deemed economically viable with a relatively high EIRR of 33.5 percent and a Benefits-Cost Ratio of 1.85X. The high price of actual desludging services offered by private operators in many municipalities (PhP4000 – PhP6000 range per service) indicates the high importance given by households to regular desludging.

The Zamboanga City Septage project covers a large customer base with more than 66 thousand connections by the time the project is operational by 2025. This large customer base by the WD means that the project will enjoy economies of scale (lower average cost per desludging service performed). It also means that the WD will be able to charge a lower service fee to its subscribers.

As previously discussed, using the CV method represents only a partial estimate of the larger benefits of a Septage Management Project. Many other externalities such as avoided economic losses (i.e., contamination of water supply sources and reduction in the incidence of water borne illnesses) were not captured in the analysis.

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APPENDIX A: RELEVANT LAWS, POLICIES AND STANDARDS WASTEWATER TREATMENT AND SANITATION RESIDUALS REUSE

This appendix details the pertinent provisions of selected policies covered by the policy review as provided in **Section 3** of the report, namely:

- Revised Implementing Rules and Regulations of the Chapter XVII of the Code on Sanitation of the Philippines
- DENR General Effluent Standards
- Revised Guidelines on Requirements for Certification for Safe Reuse of Wastewater for Irrigation and Other Agricultural Uses (2019)
- DOH and USAID Operations Manual on the Rules and Regulations Governing Domestic Sludge (2008)
- PNS/BAFS 183: Organic soil amendments (2020)
- PNS/BAFS 291: Code of practice for the production of organic soil amendments (2019)
- Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippine EIS System (2014)

Revised Implementing Rules and Regulations of the Code on Sanitation of the Philippines (2021)

In 2021, the Revised Implementing Rules and Regulations of Chapter XVII- “Sewage Collection and Disposal, Excreta Disposal, and Drainage” of the Presidential Decree 856 or the Code on Sanitation of the Philippines was promulgated and thereafter released by the Department of Health through the DOH Department Circular No. 2021-0240.

SECTION 4: OFFSITE SANITATION

Sewage, septage, and fecal sludge must be collected and transported to sewage and/or septage treatment facilities before these can be discharged to water bodies or land, or reused. Septage and fecal sludge management is integral to safe sanitation practices and must be done to protect public health and the environment. Collection and treatment of the accumulated septage, fecal sludge, or excreta shall be disposed of in a manner approved by the DOH. Pertinent guidelines on collection, transfer stations, and processing and treatment:

- Collection and Transport: Septage, fecal sludge, and excreta collected from any mobile or stationary toilet and sewage treatment facilities shall be collected and transported in a manner that will prevent public nuisance. An emergency response plan must be provided during the collection and transport. Raw sludge (untreated sludge) can be transported by land to a stationary treatment facility. In case of inter-island transport, a pre- treatment and proper containment of sludge is required. The transfer of septage and sludge from the original vehicle to another collection vehicle during transport is prohibited. However, when such transfer is unavoidable, transfer techniques, such as loading and unloading, shall be included in the operational process and must be submitted to the DOH-Center for Health and Development (CHD) to ensure the protection of public health and the environment (Section 4.1.2 a. v. & ix)
- Septage and Fecal Sludge Transfer Station: Transfer stations or underground holding tanks act as intermediate dumping points for fecal sludge when it cannot be easily transported to a treatment facility. A vacuum truck is required to empty transfer stations

when these are full. Transfer stations shall be designed and constructed, but not limited to the following requirements:

- Transfer stations should consist of a parking place for vacuum trucks or sludge carts, a connection point for discharge hoses, and a storage tank.
 - The dumping point should be built low enough to minimize spills when laborers manually empty their sludge carts.
 - Transfer stations should include a vent, a trash screen to remove large debris (garbage), and a washing facility for vehicles.
 - The holding tank must be well-constructed to prevent leaching and/or surface water infiltration.
 - For variations, such as a sewer discharge station (SDS), which is similar to a transfer station but is directly connected to a conventional gravity sewer main, sludge may be emptied and released into the sewer main, either directly or at timed intervals (e.g., by pumping), to optimize the performance of the sewer and the wastewater treatment plant and to reduce peak loads.
 - Transfer stations shall be equipped with recording systems to track operation-specific information, such as quantity, input type, and origin, to enable the service provider to plan and adapt to differing loads more accurately (Section 4.1.2 b. i. - vi.).
- Septage and Fecal Sludge Processing and Treatment: It is mandatory that septage and fecal sludge shall be processed and treated prior to disposal. In processing and treating domestic sludge and septage, the service provider shall apply the best applicable and cost-effective techniques as approved by the DOH, but not limited to the following:
 - *Thickening*. This is the physical process of increasing the solids concentration of the sludge to reduce its water content and volume to facilitate the subsequent sludge treatment stages.
 - *Stabilization*. This refers to the process of treating septage or sludge through digestion of the biodegradable fraction of the organic matter present to decrease the risk of putrefaction, as well as reduce the concentration of pathogens.
 - *Conditioning*. This is the process of adding chemicals, such as coagulants and polyelectrolytes, to increase sludge dewatering capability and improve the capture of solids in the sludge dewatering system.
 - *Disinfection*. This is the process of deactivating or destructing pathogenic microorganisms in sludge.
 - *Dewatering*. This is the removal of water and further reduction of its volume through natural or mechanical processes.
 - *Thermal Treatment*. This waste treatment technology uses heat to either remove the water from the sludge (e.g., heat drying) or reduce the sludge volume by both evaporation of water and destruction of organic matter, such as incineration, pyrolysis, or gasification (Section 4.1.2 d. i. – vi.).

SECTION 8: REUSE AND DISPOSAL

Onsite Sanitation: Every new household or other establishment to be constructed shall be provided with a plan and specifications for excreta or sewage disposal system approved by the Local Health Office prior to construction. The city or municipal Building Official shall refer all applications for Sanitary/Plumbing Permit to the Local Health Office for the review of Sanitary Plans and checking of sanitary facilities. The reuse or disposal of excreta, sewage, and septage in an onsite system should conform to the following minimum requirements:

- a. The dried fecal sludge or humus of a fully utilized ventilated pit latrine shall be reused or disposed in accordance with the existing national guidelines on safe use and application.
- b. The effluent of septic tanks and other onsite sewage disposal system shall be discharged into a subsurface soil or absorption field, where applicable, or shall be treated further with some type of a purification device/process.
- c. The treated effluent may be discharged into a sewer/drainage leading to a stream or body of water if it conforms to the effluent quality standards prescribed by the DENR in DAO 2016-08.
- d. The design, construction, and location of leaching tile fields and leaching beds are set forth in Annex B of the IRR (Leaching Tile System).
- e. Oils, greases, industrial/commercial liquid wastes, toxic chemicals, and wastewater shall not be discharged to a (leaching field) subsurface sewage disposal system.
- f. For onsite sanitation facility that requires septage treatment and disposal, refer to Section 4 (Offsite Sanitation).
- g. Other alternative sewage disposal system that utilizes a method of treatment other than a subsurface sewage disposal system (e.g., sand filtration, chlorination, disinfection, effluent filter, etc.) or those classified as areas of distinct concern must be approved by the DOH (Section 8.1).

Offsite Sanitation: The effluent from sewage/septage treatment plant may be discharged into a stream or body of water or reuse provided that it conforms to effluent quality standards prescribed by the DENR. For **treated sludge or biosolids, the quality must conform to the standard set by the national government, such as the DA, DOH, DENR, and other agencies (Section 8.2).** The **specific reuse or application of effluent and biosolids shall be subject to the guidelines to be developed for agricultural and aquaculture purposes, public parks and landscaping, golf courses, domestic (household) landscaping, sanitary landfill cover, firefighting, and sanitation products**, such as bricks, which human beings come in close contact with.

For **treated sewage**, disinfection of the effluent shall be provided as applicable based on national standards. The design shall consider meeting both the bacterial standards and the disinfectant residual limit in the effluent; dichlorination process shall apply to the use or disposal of effluent that underwent chlorine disinfection to reduce the toxicity due to chlorine residuals; the proper disposal of treated sewage shall conform to the provisions of the RIRR; guidelines on the disposal and use of treated sewage shall be developed by DOH in coordination with other government

agencies; and all effluent discharge must comply with the DENR General Effluent Standards (Section 8.2.1).

For **treated /processed domestic septage and fecal sludge**, these shall be reused and disposed through (1) **landfilling**, which involves co-disposal of domestic sludge with solid waste in a sanitary landfill; (2) **land application**, which is the process of spreading sludge on or just below the soil subsurface; (3) **fuel for heat and energy recovery**; and (4) other methods for reuse and disposal accepted by the DOH. Under land application, the sludge may be applied to agricultural land or forest land to facilitate nutrient transport and increase water retention. The application of processed sludge as fertilizer, soil enhancer, and conditioner shall be in accordance with the standards and guidelines set by the Bureau of Soils and Water Management (BSWM) of the DA. The application and disposal of treated sludge or biosolids that are not within the scope of the DA should conform to the minimum requirements set by the DOH, including but not limited to landscaping, backfilling, and soil covering materials (Section 8.2.2).

DENR General Effluent Standards (2016)

The Water Quality Guidelines and General Effluent Standards was released by DENR in 2016 and defined the waterbody classification and their intended beneficial use, along with criteria on primary/physical parameters as well that on concentration of significant organics, inorganics, and metals for monitoring of water quality and effluent parameters. In 2021, the guidelines for water and effluent quality have been revised, particularly for the parameters of ammonia as NH₃-N, boron, copper as dissolved copper, fecal coliform, phosphate as phosphorus, and sulfate. The maximum allowable limits specified from these documents are consolidated in DENR General Effluent Standards (2016).

Table 130: Maximum Allowable Limit of General Effluent Standards for Selected Parameters

Parameters	Unit	Water Body Classification	
		C ¹³	SC ¹⁴
Ammonia as NH ₃ -N	mg/L	4	4
BOD	mg/L	50	100
Chloride	mg/L	450	N/A
COD	mg/L	100	200
Color	TCU	150	150
Fluoride	mg/L	2	3
Nitrate as NO ₃ -N	mg/L	14	20
pH (range)		6.0 – 9.5	6.0 – 9.0

¹³ The intended beneficial use for Class C is “(1) Fishery Water for the propagation and growth of fish and other aquatic resources, (2) Recreational Water Class II - For boating, fishing, or similar activities, and (3) for agriculture, irrigation, and livestock watering” (DENR AO No. 2016 – 08, p.4).

¹⁴ The intended beneficial use for Class SC is “(1) Fishery Water Class III - For the propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing, (2) Recreational Water Class II - For boating, fishing, or similar activities, and (3) Marshy and/or mangrove areas declared as fish and wildlife sanctuaries” (DENR AO No. 2016 – 08, p.4).

Parameters	Unit	Water Body Classification	
		C ¹³	SC ¹⁴
Phosphorus (Total, Reactive)	mg/L	4	4
Selenium	mg/L	0.04	0.2
Sulfate	mg/L	550	-
Surfactants (MBAS)	mg/L	15	15
Temperature	°C change	3	3
Total Suspended Solids	mg/L	100	100
Arsenic	mg/L	0.04	0.04
Barium	mg/L	6	2
Cadmium	mg/L	0.01	0.01
Chromium as Hexavalent Chromium	mg/L	0.02	0.1
Total Copper	mg/L	1	1
Iron	mg/L	7.5	7.5
Lead	mg/L	0.1	0.1
Manganese	mg/L	2	4
Mercury	mg/L	0.004	0.004
Nickel	mg/L	1	0.3
Zinc	mg/L	4	1.5
Oil and Grease	mg/L	5	10
Fecal Coliform	MPN/100mL	400	400
Total Coliform	MPN/100mL	10,000	10,000

Note: Maximum Allowable Limit for the following parameters were updated in 2021 by virtue of DENR Administrative Order No. 2021 - 19: Ammonia as NH₃-N, Total Copper (previously Copper as dissolved copper), Fecal Coliform, Sulfate, and Phosphorus (Total, Reactive).

“- means no recommended values due to the natural occurrence in marine/brackish waters

Source: DENR Administrative Order No. 2016 – 08 on Water Quality Guidelines and General Effluent Standards of 2015, and DENR Administrative Order No. 2021 – 19 on Updated Water Quality Guidelines and General Effluent Standards for Selected Parameters

DA Revised Guidelines on Requirements for Certification for Safe Reuse of Wastewater for Irrigation and Other Agricultural Uses (2019)

The Department of Agriculture released Administrative Order No. 2019-11– Revised Guidelines on the Procedures and Technical Requirements for the Issuance of a Certification Allowing the Safe Reuse of Wastewater for Purposes of Irrigation and Other Agricultural Uses in 2019 which applies to all establishments where they have to reuse wastewater for agriculture purposes, specifically for fertilizers, irrigation and aquaculture.

Landscape and Crop Irrigation

A certification must be secured from the National Irrigation Administration (NIA) if the treated sewage will be reused for irrigation. Section 6.A of the AO provides the lists of requirements that must be submitted as part of the application for the certificate.

As provided in Section 9 of the AO, the quality of the wastewater that can be reused for irrigation is shown in the table below. The reuse of the treated sewage for irrigation can only be applied during dry weather conditions to prevent runoff or ponding in the ground surface. Direct contact of the irrigation water to people shall be avoided. Furthermore, the precautionary measures listed

in Section 11.A3 of DA 2019-11 shall be observed to ensure the protection of the health of the workers and others that may be affected.

The specific parameters for wastewater reuse in irrigation are provided in **Table 131**.

Table 131: Limits on Wastewater Quality for Irrigation according to DA AO No. 11 s. 2019

Parameter	Unit	Landscape Irrigation	Crop Irrigation		
			Food eaten raw and not commercially processed	Food crops commercially processed	Non-food crops
For crop productivity and protection of environment					
Bicarbonates ¹	mg/L	<500	<500	<500	<500
BOD ₅	mg/L	<150	<150	<150	<150
Electrical Conductivity	µS/cm	<2000	<1000	<1000	<2000
Free Residual Chlorine	mg/L	<1	<1	<1	<1
pH		6.5 – 8.0	6.5 – 8.0	6.5 – 8.0	6.5 – 8.0
Sodium Adsorption Ration		<18	<18	<18	<18
Sodium (Na)	mq/L	<3	<3	<3	<3
Total Nitrogen	mg/L	<30	<30	<30	<30
Total Phosphorus	mg/L	<30	<30	<30	<30
TSS	mg/L	<140	<140	<140	<140
For protection of animal and human health					
Ascaris	MPN/100 mL	0	0	0	0
Fecal Coliform	MPN/100 mL	<200	Not detectable ²	<200	<200
Nematodes	MPN/100 mL	0	0	0	0

Notes: ¹ None to moderate degree of restriction for Bicarbonates.

² Not detectable – means the total number of total fecal coliform organisms shall not exceed 14 MPN/100 ML in any sample

Source: Department of Agriculture (2019) Administrative Order No. 11 s 2019

Fertilizer

If the wastewater will be reused as fertilizer, the certification should be secured from the Fertilizer and Pesticide Authority (FPA). The requirements for the certification can be seen in Section 6B of DA AO No. 2019-11.

The quantity and quality of the wastewater that will be used as fertilizer will depend on the nutrient requirements of the crops where it will be applied to. The major constituents of wastewater for fertilizer used as foliar spray or applied in the soil are the following. Soil analysis should be conducted to determine the quantity of nutrients to be supplied to the soil to meet the crop's nutrient requirements.

Table 132: Major Constituents of Wastewater for Fertilized Use

Wastewater Constituents	Description
Macronutrients	Group of nutrients needed by the plants in large amount.

Wastewater Constituents	Description
<ul style="list-style-type: none"> Primary plant nutrients 	Include readily available forms of nitrogen, phosphorus, and/or potassium or any combination of these.
<ul style="list-style-type: none"> Secondary plant nutrients 	Include readily available forms of sulfur, calcium and magnesium.
Micronutrients	Group of nutrients which are essential for plant growth in small amount. These include readily available forms of iron, manganese, boron, molybdenum, copper, zinc, chlorine and cobalt.
pH	6.5 to 8.5

Source: DA AO 2019-11

The limits set in **DA AO No. 11 s. 2019** were adopted from the 2012 United States Environmental Protection Agency (USEPA) Guidelines for Water Reuse.

Table 133. Limits of Trace Elements and Heavy Metals in Irrigation Waters according to DA AO No. 11 s. 2019

Parameters	Landscape/Crop Irrigation (mg/L)
<i>Trace Elements</i>	
Aluminum ¹	5.00
Barium	6.0
Beryllium	Not detectable ²
Boron	0.75
Cobalt	0.05
Fluoride	1.00
Iron	5.00
Lithium ³	2.50
Manganese	0.20
Molybdenum	0.01
Nickel	0.20
Selenium	0.02
Vanadium	0.10
Zinc ⁴	2.00
<i>Heavy Metals</i>	
Arsenic	0.10
Cadmium ⁵	0.01
Chromium	0.10
Copper	0.20
Lead	5.00
Mercury	0.002

Notes: ¹ High toxicity in acid soils, not a concern if soil pH > 6.5

² Not detectable

³ Citrus: 0.075 mg/L

⁴ 1 mg/L recommended for sandy soil (pH<6)

⁵ Higher toxicity in acid soils

Source: Department of Agriculture (2019) Administrative Order No. 11 s 2019

Aquaculture

For the reuse of wastewater in aquaculture, the certification must be secured from the Regional Offices of the Bureau of Fisheries and Aquatic Resources (BFAR). The applicant shall submit the accomplished application form and the requirements stated in Section 6C of DA AO No. 2019-11. The wastewater can be reused in freshwater and brackish water ponds. Table 3 below shows the limits of the wastewater quality that can be reused for aquaculture. At least one meter level must be maintained in the pond, depending on the type of species being cultured. In the event of abnormal or adverse water condition (i.e., occurrence of disease, very turbid water, abnormal water coloration), at least one-third of the pond water must be replaced.

On the other hand, parameters to be followed for wastewater reuse in aquaculture for freshwater and brackish water are presented in **Table 134**.

Table 134: Limits on wastewater quality for fresh and brackish water fish culture

Parameter	Unit	Quality Requirements	
		Freshwater	Brackish water
For Fish Productivity			
Alkalinity (CaCO ₃)	mg/L	20 – 300	> 80
Ammonia-Nitrogen (NH ₃ -N)	mg/L	≤ 0.06	≤ 0.01
Bacterial Count: Vibrio sp.	cfu/mL	Not applicable	≤ 1.3 x 10 ³
Bacterial Count: Luminous Bacteria	cfu/mL	Not applicable	≤ 2.0 x 10 ³
BOD ₅	mg/L	≤ 9	≤ 9
Carbon Dioxide (CO ₂)	mg/L	≤ 7	≤ 15
Dissolved Oxygen	mg/L	> 5	> 5
Hydrogen Sulfide (H ₂ S)	mg/L	≤ 0.003	≤ 0.02
Nitrate-Nitrogen (NO ₃ -N)	mg/L	≤ 0.067	≤ 0.4
pH		6.5 – 9.0	7.5 – 8.5
Phosphate (PO ₄ 3-)	mg/L	≤ 0.025	0.2 – 0.4
Salinity	ppt	> 5	25 - 30
Temperature	°C	25 - 32	25 - 32
TSS	mg/L	≤ 1000	≤ 1000
For Human Health			
Coliform bacteria	MPN/100mL	≤ 5,000	≤ 1,000

Source: Department of Agriculture (2019) Administrative Order No. 11 s 2019

All wastewater generators must secure proper certification for wastewater reuse for irrigation, fertilization, and aquaculture purposes from National Irrigation Administration, Fertilizer and Pesticide Authority, and Bureau of Fisheries and Aquatic Resources, respectively.

DOH and USAID Operations Manual on the Rules and Regulations Governing Domestic Sludge (2008)

The manual serves as a guide for public and private entities engaged in sludge and septage management activities. Among the guidelines included are the nutritional specifications,

maximum allowable levels for pathogens and heavy metals for fertilizers and soil conditioner as shown in **Table 135**.

Table 135: Nutritional Specifications, Maximum Allowable Levels for Pathogens and Heavy Metals for Fertilizers and Soil Conditioner (2008)

Parameter	Unit	Type of Fertilizer		
		Plain Organic Fertilizer	Compost/Soil Conditioner	Fortified Organic Fertilizer
Nutrient Specifications				
Total Nitrogen, Phosphorus, Potassium	%	5-7	3-4	8% Minimum
Carbon Nitrogen Ratio		12:1		
Moisture Content	%	≤ 35		
Organic Matter	%	≥ 20		
Pathogens (for Organic Fertilizers and Soil Conditioner)				
Fecal streptococci	/g compost	<5 x 10 ³		N/A
Total Coliforms	/g compost	<5 x 10 ³		N/A
Salmonella		0		N/A
infective parasitic		0		N/A
Allowable Levels of Heavy Metals (for Organic Fertilizers and Soil Conditioner)				
Zinc	mg/kg	1000		N/A
Lead	mg/kg	750		N/A
Copper	mg/kg	300		N/A
Chromium	mg/kg	150		N/A
Nickel	mg/kg	50		N/A
Mercury	mg/kg	5		N/A
Cadmium	mg/kg	5		N/A

*Note: For the allowable levels of heavy metal as Organic Fertilizers and Soil Conditioner, levels provided pertain to their dry weight.
Source: DOH and USAID (2008) Operations Manual on the Rules and Regulations Governing Domestic Sludge*

PNS/BAFS 183: Organic soil amendments (2020)

PNS/BAFS 183, which cancels and replaces PNS/BAFS 183:2016, specifies the minimum standards of organic fertilizer, soil conditioner, and plant supplement (See **Table 136**). According to the standards, these soil amendments may come in solid or liquid form.

The main difference between organic fertilizer and soil conditioner is the nutrient content or the total nitrogen, phosphorous, and potassium. Organic fertilizers typically have higher nutrient content (total N-P₂O₅-K₂O) compared to organic soil conditioners. Solid organic fertilizers and soil conditioners must adhere to carbon to nitrogen ratio (C:N), organic matter (OM), moisture content (MC), and odor standards.

Unlike organic fertilizers and soil conditioners, organic plant supplements are not required to adhere to carbon to nitrogen ratio, organic matter, moisture content, and odor specifications. Organic supplements are any compound of organic origin that has total nutrient content of 0.5 percent to 10 percent for solids or 0.5 percent to 5 percent for liquids.

Table 136: Specification for organic fertilizer, organic soil conditioner, and organic plant supplement

Specifications	Organic Fertilizer (Solid)	Organic Fertilizer (Liquid)	Organic Soil Conditioner (Solid and Liquid)	Organic Plant Supplement (Solid and Liquid)
Total N-P ₂ O ₅ -K ₂ O, %	5-10	5-10	2.5-5	Solid: 0.5-10 Liquid: 0.5-<5
C:N ratio	10:1 – 20:1	---	10:1 – 20:1	---
Organic Matter (OM), %	≥ 20	---	≥ 20	---
Actual Moisture Content (MC), %	≤ 35	---	Solid: ≤ 35 Liquid: none	---
Odor	No foul odor: (ammonia, rotting, or fermentation)	---	No foul odor: (ammonia, rotting, or fermentation)	---

Source: PNS/BAFS 183:2020

Aside from specifications of organic soil amendments, allowable levels of contaminants are also stated in PNS/BAFS 183. Allowable levels of pathogens are in **Table 137**, while maximum allowable levels of heavy metals are in **Table 138**.

The guideline also stipulates that the raw materials and finished products must be tested using the methods stated in Annex A of PNS/BAFS 183:2020.

Table 137: Allowable level of pathogens for solid and liquid organic fertilizer, organic soil conditioner, and organic plant supplement

Pathogens	Allowable Level
Fecal Streptococci	<5 x 10 ² cfu/g <2 MPN/g
Total coliforms	<5 x 10 ² cfu/g <2 MPN/g
Salmonella	Absent in 25 g

Source: PNS/BAFS 183:2020

Table 138: Maximum allowable level of heavy metals for solid and liquid organic fertilizer, organic soil conditioner, and organic plant supplement

Heavy Metals	Maximum Allowable Level (mg/kg dry wt.)
Arsenic (As)	20
Lead (Pb)	50
Chromium (Cr)	150
Mercury (Hg)	2
Cadmium (Cd)	5

Source: PNS/BAFS 183:2020

PNS/BAFS 291: Code of practice for the production of organic soil amendments (2019)

The code of practice to produce organic soil amendments (PNS/BAFS 291:2019) discusses general practices to achieve the minimum requirements specified in PNS/BAFS 183:2020. The

guidelines put emphasis on minimizing contamination from microbiological, physical, and chemical hazards to ensure safety of workers and limit the possible environmental hazards associated with the production of organic soil amendments.

There are no specific requirements for the design of the production facility if the quality of the product and safety of workers are not compromised. Proper ventilation and cleanliness must be prioritized. Furthermore, the production site must comply with related and applicable regulations of competent authorities. The production site and its immediate vicinity must be clean and free from possible sources of contamination such as stray animals, non-biodegradable wastes, and hazardous wastes. In terms of site management, practices to prevent environmental pollution must be done.

It is imperative that raw materials undergo proper decomposition. During processing, the product must attain a minimum temperature of 60°C to destroy pathogens. The staff of the facility must adhere to the applicable labor rules and regulations. Personal protective equipment and adequate training must be provided to workers.

Choice of raw materials are limited to the National List of Permitted Substances for Organic Agriculture provided by BAFS (Annex 1, PNS/BAFS 291). Moreover, raw materials contaminated with heavy metals and hazardous chemicals are not allowed for production of organic soil amendments. It must be mentioned that biosolids or dried sludges from septage treatment facilities are not on the list of permitted raw materials. However, raw materials that may pose health risks such animal manure is approved. It was also stated on PNS/BAFS 291:2019 that the “Code does not pose limit to the advancement on the technology for the production of organic soil amendments as long as it is consistent with the minimum requirement recommended by PNS/BAFS 183.” With these precedents, it can be argued that use of treated biosolids for agricultural purposes is possible provided that the quality of the composted biosolids adhere to the standards set by PNS/BAFS 183.

Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippine EIS System (2014)

The guidelines and documentary requirements and procedures for the projects under the EIS system are detailed in the EMB Memorandum Circular No. 005 s. 2014. The memorandum circular specifies the standardized documentary requirements and procedures for the Environmental Compliance Certificate – Environmental Impact Statement (EIS), Initial Environmental Examination Checklist Report, Environmental Performance Report and Management Plan (EPRMP), Programmatic EIS, or Programmatic EPRMP; and the Certificate of Non-Coverage – Pro-forma Project Description. The documentary requirements for each project category is summarized in **Table 139**. Projects under Category A are under the regulatory jurisdiction of the EMB Central Office, while the rest of the categories are under the respective EMB Regional Office where the proposed project is located.

Table 139: Documentary Requirements for each project category

Category			Applied to	Documents Required
Description		Type		
A	Projects or undertakings which are classified as Environmentally Critical	A-1: New	Co-located projects	Programmatic EIS
			Single Project	EIS

Category			Applied to	Documents Required
Description		Type		
	Projects ¹⁵ (ECP) which significant potential to cause negative environmental impacts	A-2: Existing and to be expanded, modified and/or rehabilitated	Co-located projects	Programmatic EPRMP
		A-3: Operating without ECC	Single Project	EPRMP if monitoring data are available EIS if no monitoring data available
B	Projects or undertakings which are classified as ECPs, but which are likewise deemed to significantly affect the quality of the environment by virtue of being located in Environmentally Critical Areas ¹⁶ , pertaining to areas delineated as environmentally sensitive such that significant environmental impacts are expected if certain types of proposed projects or programs are located, developed or implemented in it	B-1: New	Co-located projects	Programmatic EIS
			Single Project	EIS IEE Checklist
		B-2: Existing and to be expanded, modified and/or rehabilitated	Co-located projects	PEPRMP if monitoring data are available
		B-3: Operating without ECC	Single Project	EPRMP EPRMP Checklist
C	Projects or undertakings intended to directly enhance environmental quality or address existing environmental problems not falling under Category A or B		Co-located projects or Single Project	Project Description (Part I and to only) ¹⁷
D	Projects or undertakings unlikely to cause adverse environmental impacts and are not covered by the Philippine EIS system ¹⁸	Projects after 1982		Project Description (Part I only)
		Projects Prior to 1982		Project Description (Part I only) Proof of Project Implementation prior to 1982 without expansion/ alteration/ modification

¹⁵ As defined by Presidential Proclamation No. 2146 (1981), Proclamation No. 804 (1995), and other projects that may be declared as such by the President of the Philippines.

¹⁶ Ibid.

¹⁷ For confirmation of eligible for CNC or if to be further classified as Category A or B.

¹⁸ Proponents of projects under Category D are not required to submit any document to EMB, but may opt to secure CNC from EMB (EMB Memorandum Circular No. 005 s. 2014, Section 2.4).

APPENDIX B: OPTIMAL VACUUM TRUCK SELECTION MODEL

This appendix discusses the mathematical optimization model used in the formulation of the optimal truck procurement as mentioned in **Subsection 5.6.1** of this report. This model aims to minimize the cost of vacuum truck unit (VTU) procurement considering the expenditures, operating expenses, and salvage value of the depreciated VTUs. This appendix discusses the variables, equations, and constraints utilized by the model.

It should be noted that the initial schedule computed by the selection model should still be assessed further during the detailed engineering design stage of the project and should be continuously updated during the course of the operations stage.

Assumptions

The following assumptions are considered by the model:

- The total demand is based on the projected septage volume.
- Total demand and truck capacities are in terms of year.
- Depreciated trucks will be disposed and sold after its maximum service life.
- Purchase of trucks will be on the start of the year and can be utilized in that same year.

Indices and Variables

The following table lists the convention for the indices and variables used in the model.

Table 140: Optimal Truck Selection Model Indices & Variables

Index/Variable	Description
Indices	
i	Truck Type
j	Zone of Service
k	Year of Purchase of Truck
t	Current Year
d	Disposal Period of Truck
Decision Variables	
$CAPEX_{it}$	Capital Expenditure of truck type i at year t
$OPEX_{it}$	Operating Expense of truck type i at year t
SV_{it}	Salvage value of truck type i at year t
SAL_{it}	Residual value of truck type i at year t
DEM_t	Total annual demand of the system at year t
$TTCAP_{it}$	Total truck capacity of truck type i at year t
$TVOL_i$	Volume capacity of truck type i
$DAYS_t$	Number of days of operation at year t
$TRIPDAY_{it}$	Number of trips in a day of truck type i at year t
$TRIPMAX_{it}$	Maximum number of trips possible in a year of truck type i at year t
$DIST_{ijt}$	Distance covered to operating location of truck type i in zone j at year t
OPH_i	Operating hours of truck i

Index/Variable	Description
SP_i	Speed of truck i
$PROC_i$	Processing time of truck i
$FUEL_{it}$	Fuel expense of truck type i at year t
$LABOR_{it}$	Labor expense of truck type i at year t
$MAIN_{it}$	Maintenance expense of truck type i at year t
$TPRICE_i$	Purchase price of truck type i
$PLANTMAX_t$	Treatment plant ultimate capacity at time period t
$TRLIFEMAX$	Maximum truck life
Switch Variable	
$TRLIFE_{itd}$	1 if truck type i at year t is less than the maximum operating life of a truck d 0 otherwise

Objective Function

The objective function is segmented into three main components used in minimizing the cost. This consists of the costs from capital expenditures, from operating expenses, and cost recovered from the sale of depreciated trucks.

Cost from Capital Expenditures

This is the cost generated in purchasing the trucks needed for the operation. This takes into account the purchase price based on type of trucks with respect to its volume capacity to satisfy the total demand capacity of the service area.

Cost from Operating Expenses

These are the costs related to operation of the logistics of the trucks. This includes several factors which are distance of service, consumption of fuel, maintenance, and labor expense to operate the truck.

Cost Recovered from Sale of Depreciated Asset

The sale of the depreciated truck when it reaches its maximum operating life is subtracted to the total actual cost incurred. It is expected that the truck can still be sold at a state of salvage or scrap. This is set depending on the truck type and year when the truck is unusable for operations.

Total Minimize Cost Function

The total cost function that consists of the objective function of the model is given below.

$$Min z = \sum_{i=1}^I \sum_{t=1}^T CAPEX_{it} + \sum_{i=1}^I \sum_{t=1}^T OPEX_{it} - \sum_{i=1}^I \sum_{t=1}^T DEP_{it} - \sum_{i=1}^I \sum_{t=1}^T SV_{it} \quad (\text{Eq. 6})$$

Constraints

For the model to calculate the optimal truck mix, there are several constraints that the model is subjected to. These constraints ensure that the model is restricted into certain parameters to replicate the system.

Demand Capacity Constraint

This constraint ensures that the total demand in every year for desludging in the service area is satisfied and lower than or equal to the total truck capacity. This guarantees that there is sufficient truck capacity for the service that needs to be fulfilled in the planning horizon.

$$DEM_t \leq \sum_{i=1}^I TTCAP_{it} \quad (\text{Eq. 7})$$

Truck Capacity Constraint

This constraint looks into the total truck capacity with respect to the volume of the truck, number of days of operation and maximum number of trips per year. This guarantees that the truck transportation capacity can fulfill the total demand in the service area.

$$TTCAP_{it} = \sum_{i=1}^I (TR_{it} \times N_{ikt} \times TVOL_i) \times DAYS_t \times TRIP_{it} \quad (\text{Eq. 8})$$

Treatment Plant Ultimate Capacity Constraints

These constraints ensure that the total demand and total truck capacity per year does not exceed the ultimate capacity of the treatment plant. This means that the total volume transported can be processed by the treatment plant.

$$DEM_t \leq PLANTMAX_t \quad (\text{Eq. 9})$$

$$TTCAP_{it} \leq PLANTMAX_t \quad (\text{Eq. 10})$$

Maximum Truck Trips Constraints

This constraint ensures that the number of trips of the truck in operation does not exceed the maximum possible trips of any truck in a year with respect to the location, distance covered and days of operation.

$$DAYS_t \times TRIP_{it} \leq TRIPMAX_{it} \quad (\text{Eq. 11})$$

$$TRIP_{it} = \frac{OPH_i}{\frac{DIST_{ijt}}{SP_i} + PROC_i} \quad (\text{Eq. 12})$$

Operating Expense Equation

This equation consolidates all operating cost. This consists of the fuel cost based on the distance travelled in a specific zone, labor cost in operating the truck and maintenance cost of the truck.

$$OPEX_{it} = \{[(DIST_{ijt} \times FUEL_{it}) + LABOR_{it} + MAIN_{it}] \times N_{ikt}\} \quad (\text{Eq. 13})$$

Capital Expenditure Equation

This equation combines all capital expenditures of purchasing the truck based on the specific price per truck type.

$$CAPEX_{it} = \sum_{i=1}^I (N_{ikt} \times TR_{it} \times TPRICE_i) \quad (\text{Eq. 14})$$

Truck Life Constraint

This constraint ensures that the truck has a serviceable year based on its maximum operating life.

$$TRLIFE_{itd} \leq TRLIFEMAX \quad (\text{Eq. 15})$$

Sale of the Depreciated Asset Constraints

These constraints ensure that the salvage value of the depreciated trucks is not greater than the purchase price of a new truck.

$$SAL_{it} < TPRICE_i \quad (\text{Eq. 16})$$

$$SV_{it} = (SAL_{it} \times N_{ikt}) \quad (\text{Eq. 17})$$

Non-Negativity Constraint

To ensure that all the variables solved by the model will turn out to be positive, a non-negativity constraint is placed.

$$all\ variables \geq 0 \quad (\text{Eq. 18})$$

VTU Specifications and Calculations

VTU Specifications

As discussed in **Section 5** of the report, the procurement of VTUs considered conventional VTUs with capacities of 3, 5, and 10 m³. **Table 141** provides the general specifications for these VTUs.

Table 141: Conventional VTU General Specifications

Details		General Specifications		
		10-m ³ VTU	5-m ³ VTU	3-m ³ VTU
General	Chasis Brand	Japan Brand	Japan Brand	China Brand
	Overall Dimension (L x W x H)	7620 x 2300 x 3100 mm	5995 x 2300 x 2705 mm	5420 x 1950 x 2500 mm
	GVW / Kerb Wiegth	10,000kg / 4,580kg	7,000kg / 3,280kg	6495 kg / 3600 kg
Cabin	Cab Capacity	3 persons with sleeper	Single row, 3 persons	Single row, 2 persons
	Air Conditioner and GPS	Equiped	Equiped	Equiped
Engine and Transmission	Fuel Type	Diesel	Diesel	Diesel
	Power	190 HP (139 KW)	120 HP (88 KW)	100 HP (75 KW)
	Displacement	5.2 Liters	3.0 Liters	3 liters
	Emission Standard	Euro IV	Euro IV	Euro IV
	Transmission	6 Forward and 1 Reverse, Manual	5 Forward and 1 Reverse, Manual	5 Forward and 1 Reverse, Manual
Chasis	Drive Type	4X2, left hand drive	4X2, left hand drive	4X2, left hand drive
	Wheelbase/No. of axle	4175 mm / 2	3360 mm / 2	3300 mm / 2
	Tyre Specification	8.25-20	7.00-16	7.00-16
	Tyre Number	6 tyres and 1 spare tyre	6 tyres and 1 spare tyre	6 tyres and 1 spare tyre
	Max Speed	95 km/h	95 km/h	95 km/h
Vacuum Pump and Drive	Brand	U.S.A. Brand, Rotary Vane Vacuum Pump	U.S.A. Brand, Rotary Vane Vacuum Pump	U.S.A. Brand, Rotary Vane Vacuum Pump
	Rotation Speed	1,500 RPM	1,100 RPM	1,100 RPM
	Free Air Capacity	460 CFM (780 m ³ /hr)	350 CFM (595 m ³ /hr)	250 CFM (425 m ³ /hr)
	Air Capacity (50% vacuum)	388 CFM (660 m ³ /hr)	350 CFM (460 m ³ /hr)	210 CFM (355 m ³ /hr)
	Nominal Vacuum	24" Hg	28" Hg	28" Hg
	Maximum Pressure	29 psig (200 kPa)	29 psig (200 kPa)	22 psi (150 kPa)
	Power rqrmnt' at 15" vacuum	17 HP	11 HP	9 HP
	Power rqrmnt' at max. pressure	42 HP	35 HP	20 HP
	Power rqrmnt' at max. vacuum	15 HP	15 HP	12 HP
	Working Manager	Power Take-Off (PTO) Dirven, Manual	Power Take-Off (PTO) Dirven, Manual	Power Take-Off (PTO) Dirven, Manual
Superstructure and Accessories	Vacuum Tank Capacity	10,000 liters	5,000 Liters	3,000 Liters
	Sewage/Septage Tank	Carbon steel, rear cover opened	Carbon steel, rear cover opened	Mild steel, rear cover opened

Details		General Specifications		
		10-m ³ VTU	5-m ³ VTU	3-m ³ VTU
		hydraulically, with water level indicator and warning lights	hydraulically, with water level indicator and warning lights	hydraulically, with water level indicator and warning lights
	Water Tank	Equiped with high pressure water pump	Equiped with high pressure water pump	Equiped with high pressure water pump
	Suction Hose	diameter 75mm Ø (3" Ø), 80-350m	diameter 75mm Ø (3" Ø), 80-200m	diameter 75mm Ø (3" Ø), 80-100m

Calculation of Desludging and Tank Emptying

Total time for desludging and tank emptying were calculated based on previous time-and-motion study conducted by the Consultants on Maynilad's operation. The results of this study are summarized in **Table 142**.

Table 142: Estimates of Total Desludging and Tank Emptying per m³ septage

Parameters	Index	Unit	Value			Notes / Equation
Assumptions & Equations:						
1 Nominal Truck Capacity	TC	m ³	10.00	5.00	3.00	
2 Avg. Desludging and Tank Emptying Time per m ³ septage	TDET	min/m ³	3.97	3.51	3.38	TDET = TWC / T9
Avg. septage vol. desludged per septic tank	VST	m ³	2.50	2.50	2.50	residential tanks
Allowance for tank capacity	TCA	%	98%	95%	95%	safety allowance
Truck avg. working capacity	TWC	m ³	9.80	4.80	2.90	TWC = TC * TCA
Avg. no. of septic tank desludged per trip	STT	no.	3.92	1.92	1.16	SST = TWC ÷ VST
Transfer set-up time to succeeding septic tank	T5	min	5.00	5.00	5.00	Set-up and filling-up of manifest system
Total transfer set-up time to succeeding septic tank	T6	min	14.60	4.60	0.80	T6 = (STT - 1) * T5
Vacuum Pump-out rate	POR	m ³ /min	1.37	1.24	0.74	from specifications with allowance
Total Pump-out time for all septic tanks to be desludged	T7	min	7.15	3.87	3.92	T7 = TWC ÷ POR
Tank emptying rate at treatment plant	TER	m ³ /min	1.75	1.75	1.75	for 75mm Ø hose
Tank emptying at SpTP at full load	T8	min	17.15	8.40	5.08	T8 = TWC *
Total Desludging and Tank Emptying Time (at full load)	T9	min	38.90	16.87	9.80	T9 = T6 + T7 + T8

Given the above assumptions and the average hauling distances (presented in **Table 60**), the average turn-around time (from dispatch to desludging and unloading at SpTP) per VTU capacity is shown in **Table 143**.

Table 143: Estimates of Turn-around Time per VTU capacity

Parameters	Index	Unit	Value			Notes / Equation
Assumptions & Equations:						
1 Nominal Truck Capacity	TC _N	m ³	10.00	5.00	3.00	

Parameters	Index	Unit	Value			Notes / Equation
2 Avg. Travel Time per Trip	TTT	min/Trip	105.71	95.71	95.71	$TTT = TTR + T1 + T2 + T3 + T4$
Avg. One-way Hauling Distance	AHD	km	11.43	11.43	11.43	from Table
Avg. Travel Speed	S	km/h	30.00	30.00	30.00	from Table
Avg. Travel Time on Road per Round Trip	TTR	min	45.71	45.71	45.71	$TTR = AHD * 2 / S * 60$
Dispatch from SpTP	T1	min	10.00	10.00	10.00	Final checking and booking for dispatch
Parking and hose set-up at desludging area and first septic tank	T2	min	20.00	15.00	15.00	Assumes one parking position to fill capacity
Reeling-back hose alighting and from parking position	T3	min	20.00	15.00	15.00	Alighting from site and clean-up
Record transfer and sign-off at SpTP	T4	min	10.00	10.00	10.00	For record keeping before dispatch
3 Travel Time and Trips per Day						
Operational Hours per Day	OHD	hr	8.00	8.00	8.00	regular working hours
Total Desludging and Tank Emptying Time (at full load)	T9	min	38.90	16.87	9.80	from previous table
Total Operational Time per Round-Trip at full load	TOT	hr	2.41	1.88	1.76	$TOT = (TTT + T9) \div 60$
Avg. No. of Trips per Day (at full load)	TPD	no.	3.32	4.26	4.55	$TPD = OHD \div TOT$
Maximum Trips per Day	MDT	trips/day	5.00	6.00	6.00	For practicality purposes and safety allowance
4 Total No. of Max Trips per Day	MTPD	trips/day	3.32	4.26	4.55	MTPD = if TPD < MDT, value is TPD, else value is MDT
5 Max Septage Vol. Collected per Day	MSV	m³/day	32.54	20.45	13.20	$MSV = TWC * MTPD$

Model Results

Using the inputs discussed in this appendix, the optimization model was run in using a spreadsheet and resulted in the capacity of truck required and the year it should be purchased. These results were presented to ZCWD and were adjusted to consider their additional input to require the use of 5-m³ VTUs for narrow roads. The adjusted results are presented in **Table 144** with the summary of the septage volumes, distances traveled, and the corresponding costs of these trucks.

Table 144: Optimization Model Results

Year		Ave. Septage Vol.		Demand (m³/yr.)	Fleet Procurement			Total Current Fleet			Total Truck Capacity (m³/yr.)	VTU Utilization	Total Septage Vol. Allocation (m³/year)			Total Round-Trips per Year			Total Distance Traveled			
		m³/day	m³/yr.		10 m³ VTU	5 m³ VTU	3 m³ VTU	10 m³ VTU	5 m³ VTU	3 m³ VTU			10 m³ VTU	5 m³ VTU	3 m³ VTU	10 m³ VTU	5 m³ VTU	3 m³ VTU	10 m³ VTU	5 m³ VTU	3 m³ VTU	Total
1	2025	140	32,204	32,204	4	2		4	2		40,342	79.8%	29,933	2,271		3,055	474		69,818	10,833		80,651
2	2026	146	33,551	33,551				4	2		40,342	83.2%	29,933	3,618		3,055	754		69,818	17,232		87,050
3	2027	153	35,136	35,136				4	2		40,342	87.1%	29,933	5,203		3,055	1,084		69,818	24,773		94,592
4	2028	159	36,555	36,555				4	2		40,342	90.6%	29,933	6,622		3,055	1,380		69,818	31,538		101,356
5	2029	166	38,241	38,241	1			5	2		47,978	79.7%	37,416	825		3,818	172		87,255	3,931		91,186
6	2030	177	40,733	40,733				5	2		47,978	84.9%	37,416	3,317		3,818	691		87,255	15,792		103,047
7	2031	183	42,184	42,184				5	2		47,978	87.9%	37,416	4,768		3,818	994		87,255	22,717		109,972
8	2032	191	43,965	43,965				5	2		47,978	91.6%	37,416	6,549		3,818	1,365		87,255	31,195		118,451
9	2033	199	45,672	45,672				5	2		47,978	95.2%	37,416	8,256		3,818	1,720		87,255	39,308		126,564
10	2034	207	47,714	47,714	1			6	2		55,614	85.8%	44,900	2,814		4,582	587		104,716	13,415		118,131
11	2035	215	49,439	49,439	4	2		6	2		55,614	88.9%	44,900	4,539		4,582	946		104,716	21,620		126,335
12	2036	223	51,404	51,404				6	2		55,614	92.4%	44,900	6,504		4,582	1,356		104,716	30,990		135,705
13	2037	233	53,602	53,602			1	6	2	1	58,754	91.2%	44,900	8,702		4,582	1,813		104,716	41,434		146,150
14	2038	244	56,035	56,035				6	2	1	58,754	95.4%	44,900	9,406	1,729	4,582	1,960	597	104,716	44,793	13,644	163,153
15	2039	244	56,035	56,035	1			6	2	1	58,754	95.4%	44,900	9,406	1,729	4,582	1,960	597	104,716	44,793	13,644	163,153
16	2040	262	60,191	60,191				7	2	1	66,390	90.7%	52,383	7,808		5,346	1,627		122,176	37,183		159,359
Year		Ave. Septage Vol.		VTU CAPEX (PhP x 1,000)				Total Fuel Cost (PhP x 1,000)				Labor Cost (PhP x 1,000)	Maintenance Cost (PhP x 1,000)				Salvage Cost (PhP x 1,000)				Total Cost (PhP x 1,000)	
		m³/day	m³/yr.	10 m³ VTU	5 m³ VTU	3 m³ VTU	Total	10 m³ VTU	5 m³ VTU	3 m³ VTU	Total		10 m³ VTU	5 m³ VTU	3 m³ VTU	Total	10 m³ VTU	5 m³ VTU	3 m³ VTU	Total		
1	2025	140	32,204	32123.5	12421.1		44544.6	3072.0	366.6		3438.6	3301.9	3144.8	1251.8		4396.6						55,682
2	2026	146	33,551					3072.0	583.2		3655.2	3301.9	3144.8	1251.8		4396.6						11,354
3	2027	153	35,136					3072.0	838.5		3910.5	3301.9	3144.8	1251.8		4396.6						11,609
4	2028	159	36,555					3072.0	1067.4		4139.4	3301.9	3144.8	1251.8		4396.6						11,838
5	2029	166	38,241	8030.9			8030.9	3839.2	133.0		3972.3	3676.8	3931.0	1251.8		5182.8						20,863
6	2030	177	40,733					3839.2	534.5		4373.7	3676.8	3931.0	1251.8		5182.8						13,233
7	2031	183	42,184					3839.2	768.9		4608.1	3676.8	3931.0	1251.8		5182.8						13,468
8	2032	191	43,965					3839.2	1055.8		4895.1	3676.8	3931.0	1251.8		5182.8						13,755
9	2033	199	45,672					3839.2	1330.4		5169.7	3676.8	3931.0	1251.8		5182.8						14,029
10	2034	207	47,714	8030.9			8030.9	4607.5	454.1		5061.5	4051.7	4717.2	1251.8		5969.0						23,113
11	2035	215	49,439	32123.5	12421.1		44544.6	4607.5	731.7		5339.2	4051.7	4717.2	1251.8		5969.0	3212.4	1242.1		4454.5		55,450
12	2036	223	51,404					4607.5	1048.9		5656.4	4051.7	4717.2	1251.8		5969.0						15,677
13	2037	233	53,602			5657.3	5657.3	4607.5	1402.4		6009.9	4426.6	4717.2	1251.8	648.8	6617.8						22,712
14	2038	244	56,035					4607.5	1516.1	400.2	6523.8	4426.6	4717.2	1251.8	648.8	6617.8						17,568
15	2039	233	53,602			5657.3	5657.3	4607.5	1402.4		6009.9	4426.6	4717.2	1251.8	648.8	6617.8						22,712
16	2040	262	60,191					5375.7	1258.5		6634.2	4801.5	5503.4	1251.8	648.8	7404.0						18,840
																					Total	341,901

APPENDIX C: RELEVANT SOCIAL AND ENVIRONMENTAL POLICIES AND FRAMEWORKS

Legal and Policy Framework Environmental and Social Assessments in the Philippines

The summaries of existing environmental and social sector policies in the Philippines are provided in **Table 145**.

Table 145: Key Provisions of Philippine Environmental and Social Sector Policies

Policy	Summary and Key Provisions
<i>Environmental and Social Impact Assessments</i>	
Presidential Decree No. 1151: Philippine Environmental Policy (1977)	In line with the responsibility of the State to uphold a healthy environment for its citizens, PD 1151 required all government entities to develop environmental impact statements (EIS) for all undertakings that have potentially significant impacts to the environment. Serves as the legal basis of the promulgation of the PEISS
Presidential Decree No. 1586: Establishing an Environmental Impact Statement System including other Environmental Management Related Measures (1978)	<p>There is hereby established an Environmental Impact Statement System founded and based on the environmental impact statement required, under Section 4 of Presidential Decree No. 1151, of all agencies and instrumentalities of the national government, including government-owned or controlled corporations, as well as private corporations, firms and entities, for every proposed project and undertaking which significantly affect the quality of the environment. (Section 2)</p> <p>The President of the Philippines may, on his own initiative or upon recommendation of the National Environmental Protection Council, by proclamation declare certain projects, undertakings, or areas in the country as environmentally critical. No person, partnership or corporation shall undertake or operate any such declared environmentally critical project or area without first securing an Environmental Compliance Certificate issued by the President or his duly authorized representative. For the proper management of said critical project or area, the President may by his proclamation reorganize such government offices, agencies, institutions, corporations or instrumentalities including the re-alignment of government personnel, and their specific functions and responsibilities. (Section 4)</p>
DENR-EMB MC No. 005 - Revised Guidelines for Coverage Screening and Standardized Requirements under the PEISS (2014)	Revises the screening for categorization of various infrastructure projects under the Philippine Environmental Impact System (including septage treatment facilities), defines the scope of types of projects covered by the PEISS, and standardizes the requirements for applications for environmental compliance certificates, and certificates of non-coverage
<i>Environmental Management and Protection</i>	
Republic Act No. 7586: National Integrated Protected Areas System Act (1992)	Establishes the policy framework governing the declared protected areas and classifies them into: strict nature reserve, natural park, natural monument, wildlife sanctuary, protected landscapes and seascapes, resource reserve, natural biotic areas; and other categories established by law, conventions or international agreements which the Philippine Government is a signatory (Section 3).
Republic Act No. 11038 Expanded NIPAS Act (2018)	Strengthens existing policies governing protected areas and protecting the biodiversity of the country, and updates the list of protected areas covered included the National Integrated Protected Areas System
Republic Act No. 9147: Wildlife Resources Conservation and Protection Act	<p>The Act prohibits any person to willfully and knowingly exploit wildlife resources and their habitats, or undertake the following acts:</p> <ul style="list-style-type: none"> • Killing and destroying wildlife species, except in the instances defined by the Act; • Inflicting injury which cripples and/or impairs the reproductive system of wildlife species; • Affecting any of the following acts in critical habitat(s): • Introduction, reintroduction or restocking of wildlife resources; • Trading of wildlife;

Policy	Summary and Key Provisions
	<ul style="list-style-type: none"> Collecting, hunting or possessing wildlife, their by-products and derivatives; Gathering or destroying of active nests, nest trees, host plants and the like; Maltreating and/or inflicting other injuries not covered by the preceding paragraph; and Transporting of wildlife (Section 27)
Presidential Decree No. 1067 of 1976: The Water Code of the Philippines	<p>No person shall, without prior permission from the National Pollution Control Commission, build any works that may produce dangerous or noxious substances or perform any act which may result in the introduction of sewage, industrial waste, or any pollutant into any source of water supply. (Article 75)</p> <p>The establishment of waste disposal areas that may affect the source of a water supply or a reservoir for domestic or municipal use shall be subject to the rules and regulations promulgated by the Department of Health. (Article 76)</p>
Republic Act No. 9275 – Philippine Clean Water Act (2004)	Establishes a framework for a comprehensive water quality management system for protection, preservation, and revival of water resources in the country
DENR AO No. 2016-08 – Water Quality Guidelines and General Effluent Standards (2016)	Defines waterbody classification by the intended beneficial use and their respective water quality guidelines (WQG), and establishes the general effluent standards (GES) according to waterbody classification per activity including discharge from sewerage and wastewater management
DENR AO No. 2021-19 – Updated WQG and GES for Selected Parameters (2021)	Modifies the threshold for selected environmental parameters of the water quality guidelines and general effluent standards, namely ammonia as NH ₃ -N, boron, copper as dissolved copper, fecal coliform, phosphate as phosphorus, and sulfate.
<i>Disaster Risk Reduction and Management, and Climate Change Adaptation</i>	
Republic Act No. 9729: Climate Change Act (2009)	Adopts the UN Framework Convention on Climate Change, intends to strengthen, integrate, consolidate and institutionalize government initiatives to achieve coordination in the implementation of plans and programs to address climate change in the context of sustainable development, and serves as the legal basis for the creation of the Climate Change Commission which serves as the body who coordinates, monitors, and evaluates all plans and programs in line with climate change concerns (Section 2, 4)
Republic Act No. 10121: Philippine Disaster Risk Reduction and Management Act (2010)	Mainstreams disaster risk reduction and management approaches to be integrated into policy formulation, socioeconomic development planning, budgeting, and governance, and serves as the legal basis for the creation of DRRM offices and councils at the national down to barangay levels (Section 2, 6, 10-11)
DENR-EMB Memorandum Circular 2011-005: Incorporating DRR-CCA Concerns in the PEISS (2011)	Provides EIA Technical Guidelines to mainstream DRR and CCA concerns and considerations into the processes and requirements of PEISS
<i>Cultural Heritage</i>	
Republic Act No. 10066 – National Cultural Heritage Act (2009)	<ul style="list-style-type: none"> Defined the categories and privileges of cultural property Identified specific cultural properties that are considered as Important cultural properties Serves as the mandate for the designation and maintenance of heritage zones Established the Philippine Registry of Cultural Property Specifies Archaeological Impact Assessments in areas declared as Heritage Zones (RA 10066 IRR, Rule X, Section 33.5).
Republic Act No.10086 – Strengthening People's Nationalism through Philippine History Act (2009)	<ul style="list-style-type: none"> Established the National Historical Commission of the Philippines (NHCP), an independent attached agency to the National Commission for Culture and the Arts with the mandate for conservation and preservation of the country's historical legacies through historical studies, curatorial works, architectural conservation, Philippine heraldry, historical information dissemination activities, restoration and preservation of relics and memorabilia of heroes and other renowned Filipinos (Section 5) Established the Historic Sites and Structures Documentation Center within the NHCP undertaking the survey, identification, documentation and recommendation for declaration of historic structures and edifices such as national shrines,

Policy	Summary and Key Provisions
	monuments and landmarks or heritage houses and maintaining the National Registry of Historic Sites and Structures (Section 20)
Republic Act No. 11333 – National Museum of the Philippines Act (2018)	Defines the role of the National Museum as the primary institution of the State for the management and development of museums and collections of national scope or significance in the areas of arts, cultural heritage, and natural history
<i>Land and ROW Acquisition, and Involuntary Resettlement</i>	
The 1987 Philippine Constitution	<p><u>Article III, Bill of Rights</u></p> <ul style="list-style-type: none"> • “No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws.” (Section 1) • “Private property shall not be taken for public use without just compensation” (Section 9) <p><u>Article XIII, Urban Land Reform and Housing:</u></p> <ul style="list-style-type: none"> • “The State shall undertake a continuing program of urban land reform and housing which will make available at affordable cost decent housing and basic services to underprivileged and homeless citizens in urban centers and resettlements areas. It shall also promote adequate employment opportunities to such citizens. In the implementation of such program the State shall respect the rights of small property owners.” (Section 9) • “Urban or rural poor dwellers shall not be evicted, nor their dwelling demolished, except in accordance with law and in a just and humane manner. No resettlement of urban or rural dwellers shall be undertaken without adequate consultation with them and the communities where they are to be relocated.” (Section 10)
Republic Act No. 7160: Local Government Code (1991)	<p>This Code establishes the system and defines powers of provincial, city, municipal and barangay governments in the Philippines.</p> <p>Local government units are given the authority to exercise eminent domain for public use. The power of eminent domain by the local government unit may not be exercised unless a valid and definite offer has been previously made to the owner (Chapter II, Section 19)</p>
Republic Act 7279: Urban Development Housing Act (1992)	<p>The law stipulates that it is the policy of the state, in coordination with the private sector, to uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available decent housing at affordable cost, basic services, and employment opportunities (Article I)</p> <p>The law provides that the land inventory of the LGUs should include the identification of potential sites for socialized housing and resettlement. (Article IV, Section 8).</p> <p>The law provides that all resettlement areas should be provided with accessible and cost-efficient basic services and utilities such as potable water, power, sewage, solid waste disposal system, access to primary roads and transportation facilities. As much as possible, resettlement areas are to be located in areas accessible to employment opportunities and should be linked with livelihood programs. (Article V, Section 21-23)</p>
Republic Act 10752: The Right-of-Way Act (2016)	The Act facilitating the Acquisition of Right-of-Way, Site or Location for National Government Infrastructure Projects provides that modes of acquiring real property for national government infrastructure projects and its supporting facilities, service contracts, and BOTs and establishes the compensation price for property owners with the sum of (1) current market value, (2) replacement cost of structures and improvements; and (3) current market value of crops and trees. (Section 3,5)
DPWH DO No. 152 s. 2017: Right-of-Way Acquisition Manual (2017)	The manual serves as a general guide in the implementation of the improved ROW process to establish a clear, specific, and operational guidelines ROW Acquisition Procedure for DPWH projects, including (1) Preparation of Preliminary ROW/Resettlement Action Plan (RAP); (2) Preparation of Final RAP under DED; (3) Update and Validation of RAP based on DED; and (4) Environmental Impact Assessment and Environmental Compliance Certificate.

Policy	Summary and Key Provisions
	<p>The DRAM is also intended to be a reference for property owners and other Project-Affected Persons (PAPs) on the requirements and procedures to be followed to facilitate ROW acquisition, while ensuring that they obtain due process and fair compensation which covers: (1) land based on market value, (2) structures and improvements based on replacement cost, including relocation and installation cost of machinery and equipment, as applicable, (3) crops and trees based on market value, and (4) compensable utilities; and entitlements for project-affected persons.</p> <p>The manual provides that the budget of projects requiring ROW acquisition should include the compensation of PAPs, cost of development resettlement projects in accordance with the BP220 Standards, among others.</p>
<i>Occupational Health and Safety</i>	
Presidential Decree 442: Labor Code of the Philippines (1974)	Standards on labor and employment are specified in the code such as recruitment and placement, training, working conditions, wages, benefits, labor relations, labor organization, and unfair labor practices.
Republic Act 10691: Public Employment Service Office (2015)	General employment services of the Department of Labor and Employment (DOLE) was devolved to the local government through the establishment of Public Employment Service Office (PESO) at the city or municipal levels.
Republic Act 1105sk48: Occupational Safety and Health Standards (2018)	<p>Promotes protection of health and safety of all workers by establishing the duties and rights of employers and workers in the workplace, particularly against hazards in their work environment. The law stipulates the workers' right to know, refuse unsafe work, report accidents, and receive personal protective equipment. The Occupational Safety and Health Program prescribed by DOLE depends on their risk classification</p> <ul style="list-style-type: none"> • <i>Low risk</i>: low level of danger or exposure to safety and health hazards or with low probability to result in accident, harm or injury, or illness • <i>Medium risk</i>: moderate exposure to safety and health hazards and with probability of an accident, injury or illness if no preventative control measures are in place • <i>High risk</i>: presence of hazard or potential hazard may affect the health and/or safety of workers not only within but also persons outside the premises of the workplace. There is high level of exposure to safety and health hazards, and probability of a major accident resulting to disability, death, or major illness is likely to occur if no preventative or control measures are in place.
<i>Indigenous peoples</i>	
Republic Act No. 8371 Indigenous Peoples' Rights Act(1997)	The IPRA defines the identity and entitlements of indigenous peoples, as also their rights and remedies available under national law to protect their interests. IPRA was a landmark law, not only for recognition of the rights of IPs in the Philippines but also as a milestone in recognition of the rights of IPs globally. Involuntary resettlement triggers may occur within ancestral domains. The IPRA sets conditions, requirements, and safeguards for plans, programs, and projects affecting IP communities.
<i>Gender and Development</i>	
Republic Act No. 9710: Magna Carta of Women (2010)	The magna carta establishes the universal and inalienable rights of women embodies all the rights guaranteed by international, national, and local laws to promote, protect, uphold and fulfill women's human rights.
Republic Act 7192: Women in Development and Nation Building Act (1992)	The law, along with its corresponding implementing rules and regulations, recognizes the fundamental equality between men and women and that a portion of official development assistance funds and other programs be allocated for programs targeted to women.
PCW MC No. 2018-04: Revised Guidelines for the Preparation of the Gender and Development Agenda (2018)	The guidelines ensure that gender equality is integrated and mainstreamed into development planning in performance assessments, defining challenges, identification of goals and objectives, target-setting, determination of policy and strategies, and creating a legislative agenda.
Harmonized Gender and Development Guidelines (2019)	The harmonized GAD guidelines intend to provide a common set of analytical concepts and tools for mainstreaming gender concerns in development programs and

Policy	Summary and Key Provisions
	<p>projects in order to help achieve gender equality and empower women through these programs.</p> <p>The document specifies the general GAD requirements for identification and design or development project, along with detailed list of requirements for the following sectors: agriculture and agrarian reform, natural resources management, infrastructure, private sector development, education, health, housing and settlement, women in areas of armed conflict, justice, information and communication technology, microfinance, labor and employment, child labor, migration, fisheries, and checklist for funding facilities. It also includes an implementation, and monitoring checklist for these projects.</p> <p>A specified checklist to mainstream gender and development outcomes into the implementation of infrastructure projects, where the proposed project falls under. This checklist can serve as a reference for the development of a more detailed gender assessment at the full-blown feasibility stage.</p>
Republic Act 9262 – Anti-Violence Against Women and Their Children Act (2004)	Defines the acts considered as crimes of violence against women and their children, and their corresponding penalties and punishment, and establishes protection mechanisms to reporting of incidence of such crimes.
Republic Act 7877– Anti-Sexual Harassment Act (1995)	Defines what constitutes sexual harassment in work, education and training settings, and specifies the duty and liabilities of employers, heads of office and institution, in preventing such acts through establishing procedures for reporting, resolution and prosecution of acts of sexual harassment into their rules and regulations.
<i>Vulnerable and Disadvantaged Groups</i>	
Republic Act 9994: Expanded Senior Citizens Act (2010)	The law defines senior citizens or the elderly as citizens at least 60 years of age. It sets out the privileges, government assistance in employment, education, health, social services, housing, public transportation, forest care, among others.
Republic Act 7277 (1991) as amended by Republic Act 9442: Magna Carta for Disabled Persons (2006)	Magna Carta for Disabled Persons grants the rights and privileges for disabled persons to ensure their rehabilitation, self-development and self-reliance, and prohibition on discriminating disabled persons.
Republic Act No. 7607: Magna Carta of Small Farmers (1992)	<p>The magna carta details the rights and entitlements of small farmers, or those whose income from agricultural activities do not exceed 180,000 per year:</p> <ul style="list-style-type: none"> • Right to organize farmers' organization, • Rights of small farmers • Provision of infrastructure support inputs and services such as transportation (i.e., FMR, feeder roads), communication, post-harvest-facilities, farming inputs, machinery and equipment, irrigation facilities, agricultural credit, wage and incentives.
Presidential Decree 603: Child and Youth Welfare Code (1974)	<p>The code states the rights of the child, among which include:</p> <ul style="list-style-type: none"> • Protection against exploitation, improper influences, hazards, and other conditions or circumstances prejudicial to their physical, mental, emotional, social and moral development • Right to live in a community and a society that can offer him an environment free from pernicious influences and conducive to the promotion of his health and the cultivation of his desirable traits and attributes. • Children below sixteen years of age may be employed to perform light work which is not harmful to their safety, health or normal development and which is not prejudicial to their studies and is aligned with the provisions of the Labor Code.
Republic Act 8425: Social Reform and Poverty Alleviation Act (1998)	<p>The Act institutionalizes the Social Reform Agenda through its integration in the National Anti-Poverty Action Agenda, and its multidimensional approach (i.e., social, economic, ecological, and governance) to poverty, particularly:</p> <ul style="list-style-type: none"> • Equitable access to quality basic and social services, • Reforms in asset and resource ownership, distribution, management and control, • Sustainable use of natural and ecological resource base, and • Democratization of decision-making and management processes.

Policy	Summary and Key Provisions
	<p>The agenda will include specific programs for the following sectors:</p> <ul style="list-style-type: none"> • Farmers and landless rural workers: agricultural development • Fisherfolk: fisheries and aquatic resources conservation, management and development, • Indigenous cultural communities/indigenous peoples: respect, protection and management of the ancestral domains, • Workers in the informal sector: workers' welfare and protection, • (c) Urban poor: socialized housing, and • Members of other disadvantaged groups, such as the women, children, youth, persons with disabilities, the elderly, and victims of natural and man-made calamities: Comprehensive Integrated Delivery of Social Services (CIDSS). <p>The law also institutionalized the National Anti-Poverty Commission (NAPC) with the mandate to serve as the coordinating and advisory body for the implementation of the law.</p>
Stakeholder Engagement and Public Participation	
DENR AO No. 2017 - 15: Guidelines on Public Participation under the PEISS (2017)	<p>The guidelines specify which steps in the EIA process where public participation and stakeholder engagement are necessary:</p> <ul style="list-style-type: none"> • Activities Prior to Public Scoping • Public Scoping • Report Preparation • Review of EIA Report • Monitoring of Impacts <p>The guidelines specify that the engagement of stakeholders should be done at the earliest possible time in the wherein adequate, appropriate (at the local language) timely and information should be provided, along with an effective feedback mechanism where they can participate.</p>

HGDG Checklist

The National Economic and Development Authority (NEDA) in partnership with the Official Development Assistance Gender and Development Network (ODA-GAD Network) and the PCW to aid in the empowerment of women's rights and gender equality in the development of projects. The HGDG Checklist was developed by National Economic and Development Authority together with the Philippine Commission on Women, and Official Development Assistance Gender and Development Network (ODA-GAD Network) to serve as a guide for project implementation, monitoring, and evaluating in different sector projects of government projects. The HGDG Checklist shown in **Table 146** is for the use of infrastructure projects, including septage treatment plants.

Table 146: HGDG Checklist for Infrastructure Projects

Dimension and Question	Response			Score for the Item/Element	Result or Comment
	No	Partly Yes	Yes		
Project Identification					
1.0. Participation of women and men in project identification (max. score: 2; for each item or question, 0.67)					
1.1. Has the project consulted women on the problem or issue that the intervention must solve and on the development of the solution? (possible scores: 0, 0.33, 0.67)					
1.2. Have women's inputs been considered in the design of the project? (possible scores: 0, 0.33, 0.67)					

Dimension and Question	Response			Score for the Item/Element	Result or Comment
	No	Partly Yes	Yes		
1.3. Are both women and men seen as stakeholders, partners, or agents of change in the project design? <i>(possible scores: 0, 0.33, 0.67)</i>					
2.0. Collection of sex-disaggregated data and gender-related information prior to project design <i>(possible scores: 0, 1.0, 2.0)</i>					
2.1. Has the project tapped sex-disaggregated data and gender-related information from secondary and primary sources at the project identification stage? OR, does the project document include sex-disaggregated and gender information in the analysis of the development issue or problem?					
3.0. Conduct of gender analysis and identification of gender issues <i>(possible scores: 0, 1.0, 2.0)</i>					
3.1. Has a gender analysis been done to identify gender issues prior to project design? OR, does the discussion of development issues in the project document include gender gaps that the project must address?					
Project Design					
4.0. Gender equality goals, outcomes, and outputs <i>(max score: 2; for each item, 1)</i>					
4.1. Do project objectives explicitly refer to women and men? Do they target women's and men's need for infrastructure? <i>(possible scores: 0, 0.5, 1.0)</i>					
4.2. Does the project have gender equality outputs or outcomes? <i>(possible scores: 0, 0.5, 1.0)</i>					
5.0. Matching of strategies with gender issues <i>(max score: 2; for each item, 1)</i>					
5.1. Do the strategies match the gender issues and gender equality goals identifies? That is, will the activities or interventions reduce gender gaps and inequalities? <i>(possible scores: 0, 0.5, 1.0)</i>					
5.2. Does the project build on women's and men's knowledge and skills? <i>(possible scores: 0, 0.5, 1.0)</i>					
6.0. Gender analysis of the designed project <i>(max score: 2)</i>					
6.1. Gender division of labor <i>(max score: 0.67; for each question, 0.33)</i>					
6.1.1. Has the project considered whether the infrastructure or participation in the project will affect current activities and responsibilities of women and men, girls and boys? <i>(possible scores: 0, 0.17, 0.33)</i>					
6.1.2. Will the needs of women and men, including those affected by involuntary resettlement, be considered in the design of the infrastructure? <i>(possible</i>					

Dimension and Question	Response			Score for the Item/Element	Result or Comment
	No	Partly Yes	Yes		
<i>scores: 0, 0.17, 0.33)</i>					
6.2. Access to and control of resources (<i>max score: 0.67; for each question: 0.33</i>)					
6.2.1. Will women and men have equal access to the infrastructure and other resources (including employment) distributed by the project? (<i>possible scores: 0, 0.17, 0.33</i>)					
6.2.2. Will women be involved in the decision making over rules for the use and operation and maintenance of the infrastructure or transport-related resources? (<i>possible scores: 0, 0.17, 0.33</i>)					
6.3. Constraints (<i>max score: 0.67; for each item. 0.33</i>)					
6.3.1. Is the proposed infrastructure socially or culturally acceptable and accessible to women? Or, can they use it? (<i>possible scores: 0, 0.17, 0.33</i>)					
6.3.2. Has the project designed measures to address constraints to equal participation and benefits of women and men? (<i>possible scores: 0, 0.17, 0.33</i>)					
7.0. Monitoring targets and indicators (<i>possible scores: 0, 1.0, 2.0</i>)					
7.1. Does the project include gender equality targets and indicators for welfare, access, consciousness raising, participation, and control? For instance, will the following gender differences be monitored:					
<ul style="list-style-type: none"> - Utilization rate of the infrastructure or facility - Membership and leadership in users' organizations - Participate in training and similar project activities, by type of training/activity - Employment generated by the project - Loss of livelihood as a result of the project 					
8.0. Sex-disaggregated database (<i>possible scores: 0, 1.0, 2.0</i>)					
8.1. Does the proposed project monitoring framework or plan include the collection of sex-disaggregated data?					
9.0. Resources (<i>max score: 2; for each question, 1</i>)					
9.1. Is the budget allotted by the project sufficient for gender equality promotion or integration? (<i>possible scores: 0, 0.5, 1.0</i>)					
9.2. Does the project have the expertise to integrate GAD or promote gender equality and women's empowerment? OR, will the project invest in building capacity for integrating GAD or promoting gender equality? (<i>possible scores: 0, 0.5, 1.0</i>)					
10.0. Relationship with the agency's GAD efforts					

Dimension and Question	Response			Score for the Item/Element	Result or Comment
	No	Partly Yes	Yes		
<i>(max score: 2; for each item or question, 0.67)</i>					
10.1. Will the project build on or strengthen agency/PCW/government's commitment to the advancement of women? <i>(possible scores: 0, 0.33, 0.67)</i>					
10.2. Does the project have an exit plan that will ensure the sustainability of GAD efforts and benefits? <i>(possible scores: 0, 0.33, 0.67)</i>					
10.3. Will the project build on the initiatives or actions of other organizations in the area? <i>(possible scores: 0, 0.33, 0.67)</i>					
TOTAL GAD SCORE – PROJECT IDENTIFICATION AND DESIGN STAGES <i>(Add the score for each of the ten [10] main elements)</i>					

Source: Harmonized Gender and Development Guidelines for Project Development, Implementation, Monitoring and Evaluation, Third Edition

APPENDIX D: ORGANIZATION AND LOCAL POLICY ANALYSIS

This annex elaborates further on the recommended organizational structure, as well as the methods, findings, and references of the ordinance review discussed in **Section 7.4: Organizational Arrangement and Staffing Pattern** and **Section 7.5: Enabling Support Environment**, respectively.

Organization Structure and Staffing Pattern

Table 147 Error! Reference source not found. presents the breakdown and estimated annual labor cost based on the new positions and its salary grade.

Ordinance Benchmarking

To benchmark existing ordinances in the country, the main septage management ordinances of following cities and municipalities were reviewed:

- Municipality of Baliuag, Bulacan: Municipal Ordinance No. 16-2009
- Dumaguete City, Negros Oriental: City Ordinance No. 18-2006
- Municipality of Bay, Laguna: Municipal Ordinance No. 02 – 2013
- Cebu City, Cebu: Sangguniang Panlungsod Resolution No. 13 – 1580A – 2014

These local policies were reviewed and analyzed according to key facets of a successful septage ordinance:

1. Scope and Coverage of Septage Management Program
2. Institutional Arrangement
3. Service Providers,
4. Tariff, and
5. Penalty.

The findings are shown in **Table 148**.

Table 147: Organizational Requirements for a Septage Treatment Plant

#	Position Name	Function	Position Level	Salary Grade ^[1]	Monthly Salary ^[2]	Fixed Bonus ^[3]	Annual Salary ^[4]	Monthly GSIS ^[5]	Annual GSIS	Total Annual Labor Cost
1	Wastewater Management Officer	Wastewater Management	Managerial	18	40,637.00	81,274.00	568,918.00	4,876.44	58,517.28	627,435.28
2	Accounting Processor	Wastewater Admin & Accounting	Supervisory	12	22,938.00	45,876.00	321,132.00	2,752.56	33,030.72	354,162.72
3	Wastewater Supervising Engineer	Operations	Supervisory	14	27,755.00	55,510.00	388,570.00	3,330.60	39,967.20	428,537.20
4	Treatment Plant Operator	Operations	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
5	Treatment Plant Operator	Operations	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
6	Treatment Plant Operator	Operations	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
7	Senior Maintenance Technician	Operations	Rank and File	10	19,233.00	38,466.00	269,262.00	2,307.96	27,695.52	296,957.52
8	Maintenance Technician	Operations	Rank and File	6	14,847.00	29,694.00	207,858.00	1,781.64	21,379.68	229,237.68
9	Desludging Coordinator	Desludging Services	Supervisory	10	19,233.00	38,466.00	269,262.00	2,307.96	27,695.52	296,957.52
10	Desludging Coordinator	Desludging Services	Supervisory	10	19,233.00	38,466.00	269,262.00	2,307.96	27,695.52	296,957.52
11	Survey Aide	Desludging Services	Rank and File	6	14,847.00	29,694.00	207,858.00	1,781.64	21,379.68	229,237.68
12	Survey Aide	Desludging Services	Rank and File	6	14,847.00	29,694.00	207,858.00	1,781.64	21,379.68	229,237.68
13	VTU Driver	Logistics	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
14	VTU Driver	Logistics	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
15	VTU Driver	Logistics	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
16	VTU Driver	Logistics	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
17	VTU Driver	Logistics	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
18	VTU Helper	Logistics	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92
19	VTU Helper	Logistics	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92

#	Position Name	Function	Position Level	Salary Grade ^[1]	Monthly Salary ^[2]	Fixed Bonus ^[3]	Annual Salary ^[4]	Monthly GSIS ^[5]	Annual GSIS	Total Annual Labor Cost
20	VTU Helper	Logistics	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92
21	VTU Helper	Logistics	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92
22	VTU Helper	Logistics	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92
23	Cargo Truck Driver	Reuse Operations	Rank and File	4	13,214.00	26,428.00	184,996.00	1,585.68	19,028.16	204,024.16
24	Water Tanker Helper	Reuse Operations	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92
25	Water Tanker Helper	Reuse Operations	Rank and File	1	11,068.00	22,136.00	154,952.00	1,328.16	15,937.92	170,889.92
26	Janitor / Utility	Admin and Security	Rank and File	2	11,761.00	23,522.00	164,654.00	1,411.32	16,935.84	181,589.84
27	Security Guard	Admin and Security	Rank and File	3	12,466.00	24,932.00	174,524.00	1,495.92	17,951.04	192,475.04
28	Security Guard	Admin and Security	Rank and File	3	12,466.00	24,932.00	174,524.00	1,495.92	17,951.04	192,475.04
Total										6,587,707.60

^[1] Positions are based on Revised Local Water District Manual on Categorization, Re-Categorization and Other Related Matters. Department of Budget Management (2011)

^[2] Based on Executive Order No. 201, s. 2016. Fourth Tranche Increase (1 January 2019). Retrieved from: <https://www.officialgazette.gov.ph/2016/02/19/executive-order-no-201-s-2016/>; Salary rates are based on the standardized rates for a first-class city.

^[3] The computation of the Fixed Bonus includes Mid-Year Bonus (1 month) and Year End Bonus (1 month).

^[4] The computation of the Annual Salary includes the 13th month bonus

^[5] GSIS Monthly Contribution is based on the Employer Share of 12% of Monthly Salary of the Employee. Retrieved from: <http://www.gsis.gov.ph/agencies/remittances2/premium-payments/>

^[6] Positions are based on Category A Water District

^[7] Operations based on 8 hours, 5 days a week

Table 148: Key Features of Selected Septage and Sewerage Management Ordinances in the Philippines

Location	Ordinance	Ordinance Key Features				
		Scope and Coverage of Septage Management Program / Sewerage	Institutional Arrangement	Service Providers	Tariff	Penalty
Zamboanga City	Sangguniang Panlungsod Ordinance No. 2009-152	<ul style="list-style-type: none"> • Considered natural and mechanized system as the treatment technology for Septage Treatment Facility • Owners must upgrade their septic tanks to be up to standard and cost shall be borne by them. • Immediate enforcement in all buildings, facilities and plants in the City of Zamboanga especially buildings and institutions in Senator R.T. Lim Boulevard. • Septic tanks require desludging when it is half filled or once every five years, whichever comes first. The next desludging within the 5-year period will be an add-on cost to the household. 	<ul style="list-style-type: none"> • Creation of Septage Management Council (CSMC) which consist of 15 members from various city and regional offices • Functions of the CSMC includes accreditation of private septage and desludging providers or wastewater treatment facilities. • CSMC shall serve notices of non-conformance to the provisions of this ordinance to the owners/administrators, or occupants 	<ul style="list-style-type: none"> • City government may operate a treatment facility and provide desludging services or contract out to private service providers • No specific mention of ZCWD as possible operator of the desludging and treatment services (but ZCWD can be categorized as part of the Private Service Providers). 	<ul style="list-style-type: none"> • PhP1.75 per cubic meter per month • Collected by ZCWD to their concessionaires on a monthly basis • ZCWD remits the collected fees back to the CTO 	<ul style="list-style-type: none"> • The violator, or owner of a non-complying establishment or household, who fails to comply with the provisions shall be fined up to PhP3,000.00. • Failure to comply with the provisions herein shall result in the cancellation of business permits for commercial establishments.
	IRR for Sangguniang Panlungsod Ordinance	<ul style="list-style-type: none"> • Includes households and establishments with any activity/endeavor that are currently 	<ul style="list-style-type: none"> • Maintains the creation of the CSMC and its corresponding functions. 	<ul style="list-style-type: none"> • City Government may choose from these options 	<ul style="list-style-type: none"> • Maintains PhP1.75 per cubic meter of consumed water per month as septage fee 	<ul style="list-style-type: none"> • Maintains the provisions of the City Ordinance and the corresponding

Location	Ordinance	Ordinance Key Features				
		Scope and Coverage of Septage Management Program / Sewerage	Institutional Arrangement	Service Providers	Tariff	Penalty
	No. 2009-152	<p>connected and supplied with water by the ZCWD.</p> <ul style="list-style-type: none"> • A supplemental IRR will be formulated in the future for those who are not currently connected and supplied with water from ZCWD. • Buildings, structures or businesses that have approved on-site wastewater treatment facilities and authorized connections to ZCWD's sewerage system shall be exempted from this Ordinance. 		<ul style="list-style-type: none"> - Purchase VTUs and build a septage facility - Enter into a MOA with ZCWD to provide septage collection, treatment and disposal - Enter into a contract with private companies to provide septage collection, treatment and disposal 	<ul style="list-style-type: none"> • Non ZCWD consumers are still charged a septage fee however will be further addressed in a supplemental IRR 	penalties for non-compliance.
Baliwag Municipality	Municipal Ordinance No. 16-2009	<ul style="list-style-type: none"> • Septage and sewage management ordinance applies to public or private residential, commercial, institutional and industrial buildings and structures • Desludging of septic tank is mandatory every 3-7 years • New development of subdivisions is required to install appropriate sewerage 	<ul style="list-style-type: none"> • MEO shall designate field inspectors that checks general design, construction and maintenance requirements of septic tanks • MENRO shall be in-charge of regulating and monitoring wastewater discharge • MHO shall be in-charge of regulating and monitoring 	<ul style="list-style-type: none"> • Baliwag Water District is the lead local institution in implementing the Septage Management Program 	<ul style="list-style-type: none"> • A specific value of the tariff was not discussed in the ordinance • Did not also tackle the payment arrangement of households whether it is connected with the water district or not 	<ul style="list-style-type: none"> • Violation of the ordinance are penalized PhP5,000.00 of each offense

Location	Ordinance	Ordinance Key Features				
		Scope and Coverage of Septage Management Program / Sewerage	Institutional Arrangement	Service Providers	Tariff	Penalty
		facilities and wastewater treatment facility	septage collection, transport and disposal			
Dumaguete City	City Ordinance No. 18-2006	<ul style="list-style-type: none"> • No septage hauler/pumper can unload or dispose of septage in other places, including bodies of water, agricultural fields, and the drainage system • within the city • Considered only natural system as the treatment technology • Did not consider sewerage as a conveyance option • Septic tanks require desludging on an average of every 3 to 5 years. • Septic tanks should have 3 compartments. 	<ul style="list-style-type: none"> • Creation of City Septage Management Authority (CSMA) which consist of 10 members from various City Offices, WD and NGO. • CSMA shall serve notices of non-conformance to the provisions of this ordinance to the owners/administrators, or occupants 	<ul style="list-style-type: none"> • There is no specific discussion on the accredited desludgers or provider of the service. • WD has been mentioned in the user fee collection and in estimating tariff for WD non-customers. 	<ul style="list-style-type: none"> • A user fee of PhP2.00 per cubic meter of water consumed shall be charged and added to the Dumaguete City Water District (DCWD) monthly water bill. The fee may be adjusted periodically following public consultations. • Funds collected from users' fee or the desludging and treatment fees shall be held in Trust by the City Treasurer's Office. Said Trust Fund shall only be disbursed upon proper authorization by the CSMA. 	<ul style="list-style-type: none"> • The violator, or owner of a non-complying establishment or household, who fails to comply with the provisions shall be fined up to PhP3,000.00 or be imprisoned up to 1 year. • Failure to comply with the provisions herein shall result in the cancellation of business permits for commercial establishments.
Bay Municipality	Municipal Ordinance No. 02 – 2013	<ul style="list-style-type: none"> • Shall apply to all buildings and structures whether public or private, residential or commercial, proposed/planned or existing 	<ul style="list-style-type: none"> • Municipal Building Official is in charge to check the design, construction, and maintenance requirements of septic tank 	<ul style="list-style-type: none"> • LWD is the service provider given authority by the Bay LGU and may choose to contract out the construction and operations of the facility 	<ul style="list-style-type: none"> • LWD is in charge in collecting tariff. Non-customers will be billed separately. 	<ul style="list-style-type: none"> • Failure to comply with the provisions of the ordinance within one year after the approval of the ordinance code will be fined per violation set

Location	Ordinance	Ordinance Key Features				
		Scope and Coverage of Septage Management Program / Sewerage	Institutional Arrangement	Service Providers	Tariff	Penalty
		<ul style="list-style-type: none"> • Desludging of Septic Tanks once every 5 years • Considered natural and mechanized system as the treatment technology for Septage Treatment Facility • Sewerage was not tackled in the City Ordinance 	<ul style="list-style-type: none"> • MENRO shall be in charge in regulating and monitoring wastewater discharge • MHO shall be in charge of regulating and monitoring of septage collection, transport, and disposal 	<ul style="list-style-type: none"> • Other desludging companies not contracted by LWD will not be allowed to operate in Bay 		
Cebu City	Sangguniang Panlungsod Resolution No. 13 – 1580A – 2014	<ul style="list-style-type: none"> • Shall cover the entire territorial jurisdiction of Cebu City • Septic tank must be water-tight having two to three chamber and accessible for desludging • Mandatory desludging of septic tanks every three to five years 	<ul style="list-style-type: none"> • Design, construction, installation, location, maintenance and operation of individual sewage disposal system including septic tank shall be oversee by Cebu City Septage Management Board (CCSMB). • CCSMB comprises of 10 members led by the City Mayor. GM of WD is included in the Board. 	<ul style="list-style-type: none"> • Only service provider accredited by the CCSMB • City Government is open for Joint Venture with any individual, partnership or corporation in the establishment of septage treatment facility 	<ul style="list-style-type: none"> • Government shall impose a disposal fee upon accredited service providers • Metro Cebu Water District was not mentioned as primary service provider 	<ul style="list-style-type: none"> • Any service provider who violates the ordinance, improperly dispose of septage waste, violate Prohibited Act No. 4 shall be penalized and/or imprisoned

Ordinance No. 2009-151: Septage Management System Ordinance



Republic of the Philippines
OFFICE OF THE SANGGUNIANG PANLUNGSOD
CITY OF ZAMBOANGA

ORDINANCE NO. 2009-152

**AN ORDINANCE ESTABLISHING A SEPTAGE MANAGEMENT SYSTEM IN
THE CITY OF ZAMBOANGA**

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EXPLANATORY NOTE

WHEREAS, several Philippine laws provide the legal basis for the establishment of Septage Management Program;

WHEREAS, R.A. 9275 otherwise known as the "Philippine Clean Water Act of 2004" requires water utilities to provide sewerage or septage management services within five years from the passage of the law;

WHEREAS, the National Building Code of the Philippines (R.A. 6541) and the Revised National Plumbing Code have also provided the proper designs of operations and maintenance of septic tanks;

WHEREAS, to implement the provisions of the above-mentioned laws, the Chief Executive issued Executive Order No. CL-166-2007 creating the Executive Committee for the Clean Water Act;

WHEREAS, sewage is currently collected through the sewage system built by the Americans in 1935, and the same is dumped into the sea without treatment, approximately, 982 households in the city are using this sewage system;

WHEREAS, majority of the residents, businesses and other institutions in Zamboanga City use septic tanks for wastewater treatment and disposal;

WHEREAS, most of the septic tanks in the city are not desludged every three to five years;

ay *a f*

WHEREAS, surface water is the city's primary source of water but ground water is also utilized;

WHEREAS, the improvement, maintenance, conservation and protection of the ecosystem from pollution and degradation vis-à-vis the protection of public health are the primordial concerns of the city.

NOW THEREFORE, Be it ordained by the Sangguniang Panlungsod of Zamboanga, that:

SECTION 1 - TITLE – This Ordinance shall be known as the “**Septage Management System Ordinance.**”

SECTION 2. SCOPE AND COVERAGE – This Ordinance shall apply to all buildings, facilities and structures whether public or private, residential or commercial, industrial, institutional, recreational, proposed/planned or existing, or any activity/endeavor that shall use water and produce wastewater with permanent or prolonged effect to environment. However, buildings, structures or businesses that have on-site wastewater treatment facilities approved by the City Government and the Environmental Management Bureau (EMB) shall be exempted from this Ordinance.

SECTION 3. DECLARATION OF POLICY – In consonance with the Clean Water Act of 2004 that pursues a policy of economic growth in a manner consistent with the protection, preservation and revival of the quality of our water, and other related laws, particularly Section XVII of the Code on Sanitation of the Philippines (P.D. 856); the Local Government Code (R.A. 7160 – Section on Environmental Services); and the Water District Law (P.D. 198), the City Government of Zamboanga is committed to improve or enhance health, environment and the economic conditions in the city. Towards this end, it is hereby declared the policy of the City to require all households, public and commercial establishments to have proper sewage treatment or septage management.

The City shall declare its policy for any use of water and its discharge of any wastewater that no “spent water” shall be reintroduced to the environment without any proper treatment, and that as a matter of policy, the user of any water shall be held responsible to treat the same.

Lastly, as a matter of policy, all water users using and discharging from 0-40m³ of sewage shall have at least a two-closed chamber septic tank; 41 -500m³ of sewage at least three-closed chamber septic tank, 501- 1,000m³ at least five-closed chamber with pond. Any discharge of industrial or institutional or commercial waste or even from residential that produces more than 1,000m³ sewage shall either have a wastewater treatment facility or shall have an existing contract of service with any duly accredited wastewater treatment facility server.

SECTION 4. DEFINITION OF TERMS – As used in this Ordinance, the following terms and phrases shall mean:

4.1 **Anaerobic ponds** – refer to deep stabilization ponds used to treat high strength organic wastewater that also contains high concentration of solids. Anaerobic treatment does not require the presence and use of oxygen and encourages the growth of bacteria, which breaks down the waste material, releasing methane and carbon dioxide.

[Handwritten signature] *[Handwritten signature]*

4.2 **Baffle** – refers to a device (as a wall or screen) to deflect, check or regulate the flow of sewage and septage. It promotes preliminary and primary treatment of the incoming sewage by allowing the physical separation of solid and liquid components in the sewage.

4.3 **CENRO** – refers to the City Environment and Natural Resources Office.

4.4 **Chamber** – refers to an enclosed space, cavity or compartment of a septic tank.

4.5 **Communal Excreta Disposal System** – refers to an excreta disposal system serving a subdivision or urban group of dwelling units.

4.6 **Desludging** – refers to the process of removing the accumulated sludge or septage from the septic tank.

4.7 **Digestion** – refers to a microbiological process that converts the chemically complex organic sludge to methane, carbon dioxide, and inoffensive humus-like material.

4.8 **Disposal Field or Leaching Bed** – refers to a soil-based effluent disposal system composed of pipes and shallow trenches leading from the outlet of the septic tank, consisting of open jointed or perforated pipes so distributed that effluent from a septic tank is oxidized and absorbed by the soil. The surrounding bedding material of the network of pipes should be of high enough permeability to effect treatment by seepage.

4.9 **Domestic Sewage** – refers to a sewage containing human excrement and liquid household waste. Also called sanitary sewage.

4.10 **Domestic Sludge** – refers to the solid particle of domestic sewage, which settle at the bottom of the sedimentation tank and is digested by anaerobic, bacteria purely from domestic sources, exclusive of industrial and hazardous wastes.

4.11 **Effluent** – refers to a general term denoting any wastewater, partially or completely treated, or in its natural state, flowing out of a drainage canal, septic tank, building, manufacturing plant, industrial plant, treatment plant, etc.

4.12 **Facultative Ponds** – refer to the shallow rectangular ponds that stabilize wastes using a combination of anaerobic, aerobic, and facultative (aerobic-anaerobic) process.

4.13 **Freeboard or Airspace of a Septic Tank** – refers to the distance as measured from the maximum liquid level line to the underside of the septic tank slab or cover.

4.14 **Individual Excreta Disposal System** – refers to an excreta disposal system serving a dwelling unit.

4.15 **Maturation Ponds** – refer to a low-rate stabilization ponds that are designed to provide for secondary effluent polishing and seasonal nitrification.

4.16 **"P" Traps** – refer to the traps used on plumbing fixtures, such as toilets and drains, to prevent sewage gases from entering the plumbing system or the atmosphere.

4.17 **Scum** – refers to a slimy or filmy covering on the surface of the liquid in the septic tank.

4.18 **Seepage Pit** – refers to a loosely lined excavation in the ground that receives the discharge of a septic tank and designed to permit the effluent from the septic tank to seep through pit bottom and sides.

4.19 **Septage** – refers to thickened and partially treated sewage that is removed from a septic tank.

4.20 **Septic Tank** – refers to a watertight receptacle, which receives the discharge of a sanitary plumbing system or part thereof, and is designed and constructed to accomplish the sedimentation and digestion of the organic matter in the sewage within the period of detention/retention and to allow the liquid to discharge to a leaching field, sewer lines, a combined sewerage network or directly to a secondary wastewater treatment facility in accordance with the standards set forth by the Revised National Plumbing Code of the Philippines.

4.21 **Sewage** – refers to any wastewater containing human, animal or vegetable waste matter in suspension or solution including human excreta and urine and may possibly contain liquids consisting of chemicals in solution.

4.22 **Sewer** – refers to an artificial pipe or conduit for carrying sewage and wastewater.

4.23 **Sewerage** – refers to a comprehensive term, including all construction for collecting, transporting, and pumping of sewage. Usually refers to a buried system of underground pipes.

4.24 **Sewage Works** – refer to a comprehensive term for pumping, treating and final disposal of effluent via a centralized treatment plant.

4.25 **Sludge** – refers to the precipitated solid matter with highly mineralized content produced by water and sewage treatment processes.

4.26 **Stabilization Pond** – refers to an artificial pond designed to treat wastewater in general using solely naturally occurring biological treatment processes, and without the need for an electro-mechanical energy input.

4.27 **Subsurface Absorption Bed or Drain Field** – also called leaching bed, leaching field, or soaked-away. An underground system of pipes embedded in a suitably porous soil medium leading from the outlet of the septic tank, consisting of open jointed or perforated pipes so distributed that the effluent from a septic tank is oxidized and absorbed by the soil. Must be located far from environmentally critical/waterways or groundwater wells.

4.28 **Spent or Used Water** – refers to sewage and other wastewater discharge or used water resulting from any human, commercial, institutional activity, facility or endeavor regardless whether pollutive or not.

SECTION 5. SEPTAGE MANAGEMENT SYSTEM – For purposes of this Ordinance, septage management refers to the comprehensive programs for managing septic tanks and the procedures for the desludging, transporting, treating and disposing of

septic tank contents. As such, a Septage Management System is hereby established which includes but not limited to the following:

5.1 Excreta Disposal System. All houses and/or residential buildings shall be required to have an approved excreta disposal system for treatment of domestic sewage.

5.2 Desludging and Transfer of Septage to the Septage Treatment Facility. Liquid and/or solid materials removed from septic tanks shall be transported by a septage hauler/pumper to the approved septage treatment facilities following Department of Health regulations on desludging and transport of sludge. No septage hauler/pumper can unload or dispose of septage in other places, including bodies of water, agricultural fields, and the drainage system within the city until the implementing rules and regulations for proper land application have been issued by the authorized government agencies such as the Office of the City Environment and Natural Resources, Environmental Management Bureau-Department of Environment and Natural Resources, Department of Health and Office of the City Health.

5.3 Septage Treatment Facility. Sludge/Septage shall be processed and treated before disposal and shall be disposed of only in approved and licensed septage treatment facilities such as but not limited to lagoon or stabilization ponds and other approved or integrated technologies. Each approved septage facility shall have an operations and maintenance plan that will include provisions for reducing system upset, including immediate actions to prevent the occurrence of foul smells and release of partially treated effluent from the system.

SECTION 6. DESIGN AND CONSTRUCTION REQUIREMENTS OF SEPTIC TANKS OR WASTEWATER TREATMENT FACILITY -

6.1 Construction of New Buildings or Structures

6.1.1 No building plan for residential dwelling units or commercial, industrial, institutional, or recreational structures shall be approved unless the design of the sanitary plumbing and septic tank or wastewater treatment facility conforms to the specifications as provided under Section 3 and Section 7 herein and other pertinent regulations.

Alternative wastewater treatment systems shall be duly approved and endorsed by the City Government. Further, as governed by DENR regulations, all malls, restaurants, hotels, apartelles and other residential buildings, subdivisions, hospitals and similar establishments are required to utilize sewage treatment facilities as a condition to granting of Environmental Compliance Certificate (ECCs) and permits to operate.

6.1.2 It shall be the duty of the owner, administrator or contractor to inform the City Engineer's Office that the newly constructed septic tank, sewage treatment facility or alternative treatment system, with prior plan approval, is ready for inspection. The new system shall not be covered or used until inspected and approved by the City Engineer's Office.

6.2 Existing Residential Buildings or Structures

6.2.1 Owners of existing septic tanks that are not accessible for desludging are required to repair or upgrade their tank so it can be deslugged. If repairs are not possible, such owners are required to build a new septic tank that will comply with the provisions set herein.





6.2.2 The cost of repair and upgrading shall be borne by the owners.

6.2.3 Communal or shared septic tanks can be used alternatively whenever feasible, particularly for existing clustered structures that are highly dense and characterized by lack of or inadequate land space. The design and the manifest of ownership and joint maintenance shall go through an approval process as determined by the City.

6.3 Owners of Commercial, Industrial and Institutional Buildings of Facilities shall have an operational wastewater treatment facility, either on-site or by service off-site. The said facility shall conform with the standards of EMB-DENR and DOH.

SECTION 7. SPECIFICATIONS - Septic tanks shall be designed and constructed in accordance with the standards set forth by the National Building Code, particularly Chapter IX, Sections 901 and 903 thereof, and as prescribed by the Revised National Plumbing Code of the Philippines, and Chapter XVII of the Code on Sanitation of the Philippines, including proper sizing and layout, and the criteria set forth below:

- 7.1 It shall be designed to produce an effluent consistent with approved engineering and environmental standards.
- 7.2 It shall be built of solid durable materials and shall be watertight. Materials shall conform to applicable Philippine material standards.
- 7.3 It shall not be constructed under any building and not within twenty-five (25) meters from any existing source of water supply.
- 7.4 It shall be divided into a minimum of two compartments.
- 7.5 Where more than one tank is used to accommodate the required liquid volume in a given minimum retention time of 2 days, the tank should be conjoined.
- 7.6 Adequate venting shall be provided in each compartment with the use of ventilating pipes not less than 50 mm in diameter. For buildings where plumbing fixtures have appropriate "p" traps, venting should occur through the plumbing stack in the building, not from the septic tank. For buildings where toilets and sinks are not protected with "p" traps, traps should be installed, or vent directly from the septic tank.
- 7.7 There shall be at least one maintenance hole for each compartment, with a minimum side dimension of 500 mm. All maintenance hole shall extend through the tank cover and shall extend to finished grade. Manhole covers shall be designed with durable and fully coated or non corrosive handles for easy lifting. Septic tank access covers should be secured from unauthorized entry, either through safety screws, locks or a tank lid that weighs 15 kg or more.
- 7.8 Outlet from the septic tank: The design, construction and location of structures receiving effluent from septic tanks shall conform to the Revised Plumbing Code of the Philippines. Effluent treatment is further required but will be covered by a separate ordinance and other infrastructure projects.

7.9 For clustered structures or houses that are highly dense and characterized by lack of or inadequate land space, there shall be designed a communal septic tank consistent with approved engineering and environmental standards.

SECTION 8. ADMINISTRATION AND ENFORCEMENT - The administration and enforcement of this Ordinance for all buildings, facilities and plants are hereby vested in the City Government of Zamboanga.

Upon the approval of this Ordinance, the City Government shall immediately institute and implement this Ordinance in all buildings and institutions along Senator R.T. Lim Boulevard.

SECTION 9. CREATION OF A SEPTAGE MANAGEMENT COUNCIL - There shall be created a City Septage Management Council (CSMC) which shall be composed of the following:

ChairmanCity Mayor or his duly
authorized representative
Secretariat Office of the City Environment and
Natural Resources (OCENR)
(Lead Agency)

Members:

SP Chairperson, Com. On Health &
Sanitation
SP Chairperson, Com. On Environment
& Natural Resources
City Health Officer
City Planning and Development Coordinator
City Engineer
City Treasurer
City Licensing Officer
Zamboanga City Water District
Environmental Management Bureau, (EMB-DENR)
Representative, DOH - Center for Health
& Development
Representative, Pollution Control Officer Association
of the Philippines-Zamboanga City Chapter
Representative from the Barangay
Representative from the Industrial Sector

SECTION 10. FUNCTIONS OF THE COUNCIL - The City Septage Management Council shall have the following functions:

10.1 The City Septage Management Council shall oversee the conduct of a survey of all properties and premises in coordination with barangay officials to determine if a septic tank is present, and if it is accessible for desludging.

10.2 To accredit and license private septage or desludging service providers or waste water treatment facilities.

10.3 To review and approve application for service providers and to recommend the same for approval of the Sangguniang Panlungsod thru the Office of the City Mayor.

10.4 To receive and hear complaints from residential owners and issue decisions.

10.5 If a septic tank is not present or it is inaccessible for desludging, the City Septage Management Council shall serve notices of non-conformance to the provisions of this Ordinance to the owners/administrators, or occupants. At this time, information on proper methods of complying with this Ordinance will be disseminated.

10.6 The City Septage Management Council, or its authorized representatives in coordination with the deputized barangay official shall be permitted to visit properties for the purpose of inspection, observation, measurement, sampling and testing. A prior notice shall be given property-owners to facilitate inspection and provide assistance to the City Septage Management Council or barangay representatives.

10.7 For those property owners, administrators or occupants served with notices of non-conformance, a compliance period shall be set by the property owners, administrators or occupants and the City Septage Management Council. The compliance period shall be based on the proper installation of an acceptable septic tank of which design is specified in this Ordinance and by national law.

10.8 For new developments, the occupancy permit issued by the building officials shall serve as certificate of compliance until the City Septage Management Council conducts another round of inspection.

10.9 The City Septage Management Council shall plan and implement an information and education program on wastewater management and the city's septage management system.



SECTION 11. MONITORING AND EVALUATION. Close monitoring of all activities in the treatment facilities shall be conducted by the OCENR as per their mandate. Should it be determined by OCENR that there is non-compliance, a compliance schedule shall be agreed upon with the City Septage Management Council. Continued non-compliance past the agreed upon compliance schedule, the facility will be closed from accepting septage from this program.

SECTION 12. DESLUDGING. Septic tanks require desludging when the tank is half filled or once every five (5) years, whichever comes first, and the next desludging if done within the five (5) year period, will be an add-on cost to the household.

12.1 The City Septage Management Council shall keep a record of all owners/administrators of buildings, facilities and structures who have desludged their septic tanks, those that are inaccessible, those that do not have septic tanks, and those that do not have water-sealed toilets, and other data that may be deemed necessary by the City Septage Management Council.

12.2 The City Septage Management Council shall implement and adhere to the rules and regulations set forth by the Department of Health and EMB-DENR in handling, transporting, treatment and disposal of septage.

12.3 The City Septage Management Council shall strictly implement an accreditation system and operational guidelines for private desludging service providers that would like to operate in the city, including but not limited to securing an environmental sanitation clearance (ESC) which is discussed more thoroughly in the rules and regulations set forth by the Department of Health in handling, transporting, treatment and disposal of septage.



The City Health Office in conjunction with the City Septage Management Council shall issue Sanitary Permits for all treatment and collection facilities and develop their own procedures for periodic inspections of facilities and equipment, and training programs for septage workers.

SECTION 13. SERVICE PROVIDER. The City Government of Zamboanga may operate a wastewater or treatment facility and/or desludging services and in the absence of service facilities may contract with Private Service Providers, either desludging, transporting or wastewater treatment facility, provided that they shall have the necessary funds to support capital expenditures and operating and maintenance expenses of their septage management systems.

SECTION 14. USER FEE. All residential and commercial/institutional building or structure owners shall pay an amount for the desludging of their septic tanks and treatment of the septage equivalent to the following:

14.1 The amount of P1.75 per cubic meter of water consumed per month will be collected from all residents, government offices and other agencies, and added to the Zamboanga City Water District (ZCWD) monthly water bill. (Refer to Annex "A")

14.2. Commercial establishments that have their own water source shall be required to install a production meter. The quantity of water produced shall be the basis for computing the cost of desludging the septic tank.

14.3 Users who have their own onsite wastewater treatment system, certified by the City Government as functioning and compliant and those who are connected to the existing ZCWD sewerage pipe shall be exempt from paying the required user fee.

14.4 Residential houses without any water connection or temporary facilities sharing communal septic tank shall be charged with the corresponding fee of P1.75 per cubic meter of water consumed per month.

SECTION 15. COLLECTION OF USER'S FEES - The Zamboanga City Water District is hereby authorized to collect the user's fees and shall remit the same to the City Treasurer and shall accrue to the General Fund.

SECTION 16. VIOLATIONS AND PENALTIES.-

16.1. **Issuance of Non-Conformity.** The City Septage Management Council shall issue a notice of non-conformity to property owners, administrators or occupants who do not have a septic tank, whose septic tank is not designed properly, or is inaccessible for desludging unless they have an alternative system approved by the City Government.

16.2. **Penalties.** The violator or owner of a non-complying establishment or household, who fails to comply with the provisions of this Ordinance within one (1) year as provided under Paragraph 1.3, Section 458 of the Local Government Code, must pay the fines per violation set herein in lieu of prosecution:

a. For private residential
buildings P1,000.00



Zamboanga City Septage Management Program
Schedule of Fees

Category (cu.m.)	Services	Consumption (cu.m.)	Ave. consumption	Fee/cu.m.	Ave. fee/service	Monthly Total
Residential						
0 to 10	6,077	42,849	7.05	P 1.75	P 12.34	P 74,985.75
11 to 20	11,925	185,815	15.58	1.75	27.27	325,176.25
21 to 30	9,754	245,710	25.19	1.75	44.08	429,992.50
31 to 40	6,283	220,130	35.04	1.75	61.31	385,227.50
41 to 50	3,695	166,573	45.08	1.75	78.89	291,502.75
51 up	5,821	452,071	77.66	1.75	135.91	791,124.25
Sub-total	43,555	1,313,148	30.15			P 2,298,009.00
Commercial						
0 to 10	860	5,089	5.92	P 1.75	P 10.36	P 8,905.75
11 to 20	498	7,435	14.93	1.75	26.13	13,011.25
21 to 30	288	7,268	25.24	1.75	44.16	12,719.00
31 to 40	180	6,332	35.18	1.75	61.56	11,081.00
41 to 50	119	5,324	44.74	1.75	78.29	9,317.00
51 up	552	117,278	212.46	1.75	371.81	205,236.50
Sub-total	2,497	148,726	59.56			P 260,270.50
Semi						
0 to 10	74	472	6.38	P 1.75	P 11.16	P 826.00
11 to 20	114	1,777	15.59	1.75	27.28	3,109.75
21 to 30	109	2,786	25.56	1.75	44.73	4,875.50
31 to 40	89	3,134	35.21	1.75	61.62	5,484.50
41 to 50	68	3,153	46.37	1.75	81.14	5,517.75
51 up	155	28,403	183.25	1.75	320.68	49,705.25
Sub-total	609	39,725	65.23			P 69,518.75
Government						
0 to 10	56	365	6.52	P 1.75	P 11.41	P 638.75
11 to 20	37	554	14.97	1.75	26.20	969.50
21 to 30	29	756	26.07	1.75	45.62	1,323.00
31 to 40	26	933	35.88	1.75	62.80	1,632.75
41 to 50	15	678	45.20	1.75	79.10	1,186.50
51 up	198	101,084	510.53	1.75	893.42	176,897.00
Sub-total	361	104,370	289.11			P 182,647.50
Grand Total	47,022	1,605,969				P 2,810,446.00

- b. For hotels, apartments,
banks, offices, shops,
lodging houses, malls,
restaurants, and other
commercial establish-
ments P2,000.00
- c. For hospitals, funeral parlors
and similar operation P3,000.00

Failure to comply with the provisions herein shall result in the cancellation of business permits for commercial establishments.

SECTION 17. SEPARABILITY CLAUSE -If for any reason or reasons any provision of this Ordinance be declared illegal by a competent court, other provisions which are not affected shall continue to be in full force and effect.

SECTION 18. REPEALING CLAUSE - All Ordinances, resolutions, executive issuances, or rules and regulations, or parts thereof, which provisions are inconsistent with or contrary to the provision of this Ordinance, the same are hereby repealed, amended or modified accordingly.

SECTION. 19 EFFECTIVITY - This Ordinance shall take effect 15 days after its approval and publication and after the operationalization of the water treatment facility and/or contract of desludging by service providers.

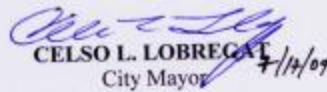
ENACTED: July 8, 2009 as an emergency measure.


CHARLIE M. MARIANO
Temporary Presiding Officer

ATTESTED:


ZENAIDA C. JAYME
City Secretary

APPROVED:


CELSO L. LOBREGAT
City Mayor 7/14/09

/jdr2009

Implementing Rules and Regulations of Ordinance No. 2009-151: Septage Management System Ordinance



Republic of the Philippines
CITY SEPTAGE MANAGEMENT COUNCIL
City of Zamboanga

IMPLEMENTING RULES AND REGULATIONS FOR THE SEPTAGE MANAGEMENT SYSTEM IN ZAMBOANGA CITY IN ACCORDANCE WITH ORDINANCE NO. 2009-152

Pursuant to Section Nos. 9 and 10 of Ordinance No. 2009-152 the City Septage Management Council (CSMC) hereby promulgates and adopts the following rules and regulations; and implements certain provisions and specifications related to septage management of the National Building Code (R.A. 6541), Code on Sanitation (PD 856), Revised National Plumbing Code of the Philippines (R.A. 1378), and Philippine Clean Water Act (R.A. 9275). These implementing rules and regulations include all text of the Ordinance with rules added at the end of each section, as needed.

SECTION 1. TITLE. This Ordinance shall be known as the “**Septage Management System Ordinance.**”

Rule 1. Title. These rules shall be known and cited as the Implementing Rules and Regulations (IRR) of Ordinance No. 2009-152, the “Septage Management System Ordinance” (SMSO).

- 1.1 Reference.** The text of Ordinance No. 2009-152 is reproduced herein for reference purposes.
- 1.2 Effectivity of the SMSO.** Ordinance No. 2009-152 was enacted on July 8, 2009. It will take effect 15 days after its approval and publication and after the operationalization of the septage treatment facility and/or contract of desludging by service providers.

SECTION 2. SCOPE AND COVERAGE. This Ordinance shall apply to all buildings, facilities and structures whether public or private, residential or commercial, industrial, institutional, recreational, proposed/planned or existing, or any activity/endeavor that shall use water and produce wastewater with permanent or prolonged effect to the environment. However, buildings, structures or businesses that have on-site wastewater treatment facilities approved by the City Government and the Environmental Management Bureau (EMB) shall be exempted from this Ordinance.

Rule 2.1 Interpretation of the Scope and Coverage. The Septage Management System Ordinance (SMSO) shall apply to all buildings, facilities and structures whether public or private, residential or commercial, industrial, institutional, recreational, proposed/planned or existing or any activity/endeavor that are currently connected and supplied with water by the Zamboanga City Water District (ZCWD). A supplemental IRR will be formulated in the future for those who are not currently connected and supplied with water from ZCWD.

Rule 2.2 Exemptions. Buildings, structures or businesses that have on-site wastewater treatment facilities approved by (1) the City Government, (2) the Environmental Management Bureau and (3) the Department of Health (DOH); or those that have active and authorized connections to Zamboanga City Water District's (ZCWD's) sewerage system shall be exempted from this Ordinance.

SECTION 3. DECLARATION OF POLICY. In consonance with the Clean Water Act of 2004 that pursues a policy of economic growth in a manner consistent with the protection, preservation and revival of the quality of our water, and other related laws, particularly Section XVII of the Code on Sanitation in the Philippines (P.D. 865); the Local Government Code (R.A. 7160 – Section on Environmental Services); and the Water District Law (P.D. 198), the City Government of Zamboanga is committed to improve or enhance health, environment and the economic conditions in the city. Towards this end, it is hereby declared the policy of the City to require all households, public and commercial establishments to have proper sewage treatment or septage management.

The City shall declare its policy for any use of water and its discharge of any wastewater that no “spent water” shall be reintroduced to the environment without any proper treatment, and that as a matter of policy, the user of any water shall be held responsible to treat the same.

Lastly, as a matter of policy, all water users using and discharging from 0 – 40 m³ of sewage shall have at least a two-closed chamber septic tank; 41 – 500 m³ of sewage at least three-closed chamber septic tank; 501 – 1,000 m³ at least five-closed chamber with pond. Any discharge of industrial or institutional or commercial waste or even from residential that produces more than 1,000 m³ sewage shall either have a wastewater treatment facility or shall have an existing contract of service with any duly accredited wastewater treatment facility server.

Rule 3.1 Interpretation of the Declaration of Policy. The policy statements in Section 2 of this Ordinance shall be interpreted collectively, and all regulations issued pursuant to the Ordinance and decisions over disputes in specific cases shall be implemented or made with due consideration of this policy. Issues and cases shall be resolved in a fair and objective manner. This Ordinance and these rules shall be construed liberally in favor of protecting the quality of water resources and public health.

Rule 3.2 Details. The City Government of Zamboanga is committed to improve or enhance health, environment and economic conditions through proper septage management by requiring all households, public and commercial establishments to have proper sewage treatment or appropriately designed septic tanks with septage management. Discharges from industrial, institutional or residential buildings that exceed 1,000 cubic meters per month of sewage shall either have an onsite wastewater treatment facility or contract of service with a duly accredited wastewater treatment facility.

SECTION 4. DEFINITION OF TERMS. As used in this Ordinance, the following terms and phrases shall mean:

4.1 Anaerobic Ponds – refer to deep stabilization ponds used to treat high strength organic wastewater that also contains high concentration of solids. Anaerobic treatment does not require the presence and use of oxygen and encourages the growth of bacteria, which breaks down the waste material, releasing methane and carbon dioxide.

4.2 Baffle – refers to a device (as a wall or screen) to deflect, check or regulate the flow of septage. It promotes preliminary and primary treatment of the incoming sewage by allowing the physical separation of solid and liquid components in the sewage.

4.3 OCENR – refers to the Office of the City Environment and Natural Resources.

4.4 Chamber – refers to an enclosed space, cavity or compartment of a septic tank.

4.5 Communal Excreta Disposal System – refers to an excreta disposal system serving a subdivision or urban group of dwelling units.

4.6 Desludging – refers to the process of removing the accumulated sludge or septage from the septic tank.

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4.8 Disposal Field or Leaching Bed – refers to a soil-based effluent disposal system composed of pipes and shallow trenches leading from the outlet of the septic tank, consisting of open jointed or perforated pipes so distributed that effluent from a septic tank is oxidized and absorbed by the soil. The surrounding bedding material of the network of pipes should be of high enough permeability to effect treatment by seepage.

4.9 Domestic Sewage – refers to sewage containing human excrement and liquid household waste. Also called sanitary sewage.

4.10 Domestic Sludge – refers to the solid particle of domestic sewage, which settle at the bottom of the sedimentation tank and is digested by anaerobic bacteria purely from domestic sources, exclusive of industrial and hazardous wastes.

4.11 Effluent – refers to a general term denoting any wastewater, partially or completely treated, or in its natural state, flowing out of a drainage canal, septic tank, building, manufacturing plant, industrial plant, treatment plant, etc.

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4.17 Scum – refers to the slimy or filmy covering on the surface of the liquid in the septic tank.

4.18 Seepage Pit – refers to a loosely lined excavation in the ground that receives the discharge of a septic tank and designed to permit the effluent from the septic tank to seep through pit bottom and sides.

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4.21 Sewage – refers to any wastewater containing human, animal or vegetable waste matter in suspension or solution including human excreta and urine and may possibly contain liquids consisting of chemicals in solution.

4.22 Sewer – refers to an artificial pipe or conduit for carrying sewage and wastewater.

4.23 Sewerage – refers to a comprehensive term, including all construction for collecting, transporting, and pumping of sewage. Usually refers to a buried system of underground pipes.

4.24 Sewage Works – refer to a comprehensive term for pumping, treating and final disposal of effluent via a centralized treatment plant.

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4.27 Subsurface Absorption Bed or Drain Field – also called leaching bed, leaching field, or soaked away. An underground system of pipes embedded in a suitably porous soil medium leading from the outlet of the septic tank, consisting of open jointed or perforated pipes so distributed that the effluent from a septic tank is oxidized and absorbed by the soil. Must be located far from environmentally critical/waterways or groundwater wells.

4.28 Spent or Used Water – refers to sewage and other wastewater discharge or used water resulting from any human, commercial, institutional activity, facility or endeavor regardless whether pollutive or not.

SECTION 5. SEPTAGE MANAGEMENT SYSTEM. For purposes of this Ordinance, septage management refers to the comprehensive programs for managing septic tanks and the procedures for the desludging, transporting, treating and disposing of septic tank contents. As such, a Septage Management System is hereby established which includes but not limited to the following:

5.1 Excreta Disposal System. All houses and/or residential buildings shall be required to have an approved excreta disposal system for treatment of domestic sewage.

5.2 Desludging and Transfer of Septage to the Septage Treatment Facility. Liquid and/or solid materials removed from septic tanks shall be transported by a septage hauler/pumper to the approved septage treatment facilities following Department of Health regulations on desludging and transport of sludge. No septage hauler/pumper can unload or dispose of septage in other places, including bodies of water, agricultural fields, and the drainage system within the city until the implementing rules and regulations for proper land application have been issued by the authorized

government agencies such as the Office of the City Environment and Natural Resources, Environmental Management Bureau – Department of Environmental and Natural Resources, Department of Health and Office of the City Health.

5.3 Septage Treatment Facility. Sludge/Septage shall be processed and treated before disposal and shall be disposed of only in approved and licensed septage treatment facilities such as but not limited to lagoon or stabilization ponds and other approved or integrated technologies. Each approved septage facility shall have an operations and maintenance plan that will include provisions for reducing system upset, including immediate actions to prevent the occurrence of foul smells and release of partially treated effluent from the system.

Rule 5.1 Approved excreta disposal systems. Approved excreta disposal systems shall mean any of the following:

- 5.1.1 Flush toilets properly connected to a community sewer;
- 5.1.2 Flush toilets connected to a septic tank constructed in accordance with Section 7 herein;
- 5.1.3 Any approved type pit privy built in accordance with the Sanitation Code (PD 856); and
- 5.1.4 Any disposal device approved by the Secretary of Health or his duly authorized representative.

Rule 5.2 Desludging and Transfer of Septage to the Treatment Facility

5.2.1 Desludging Procedures

5.2.1.1 The city will engage service providers to desludge the septic tanks of ZCWD customers on a 5 year rotating schedule. An additional cost will be imposed if a customer requests desludging before or after their scheduled time.

5.2.1.2 The collection of septage shall be done in coordination with the *Punong Barangay* or his/her duly authorized representative who shall sign the manifest form (CSMC Form 1). Preferably, collection shall be done when traffic is light in the area. All collection vehicles shall have traffic cones or an early warning device. Traffic cones shall be placed behind and in front of the vehicle during operation.

5.2.1.3 It is the responsibility of the service provider to check the safety equipment daily before proceeding to a collection site. Any safety equipment deficiencies shall be reported to the supervisor. After the desludging operation, the operator must clean and disinfect any spills with a bleach solution or by spreading lime on the spillage. It is the service provider's responsibility to verify that sufficient disinfectant (bleach or lime) is on the truck before it goes to a collection site.

5.2.1.4 Desludging workers must wear appropriate personal protective equipment, including rubber gloves, rubber boots, a face mask, and eye protection. After pumping, operators must wash their hands with soap. No employee should enter a septic tank without proper safety equipment, including a rope for retrieval in case the worker becomes unconscious.

5.2.2 Transfer of Septage to the Treatment Facility

5.2.2.1 The driver and service providers are responsible for safe operation of the vehicle and equipment at all times. Traffic rules must be followed at all times. All accidents and citations shall be reviewed and investigated by management to ensure adequately trained and competent drivers are employed for sludge and septage transportation. The collection vehicle used for the transport of septage and domestic sludge shall have a leak-proof body and lock to secure the sludge and septage; and must be able to withstand a collision with another vehicle or any permanent structure.

5.2.3 Accidental Spillage

In the event of accidental spillage of sludge/septage, the operator shall:

5.2.3.1 Immediately take action to contain the sludge/septage, minimize the environmental impact, and begin clean-up procedures. To the extent possible, the operator shall contain the spill by using a shovel to dig a containment trench and disinfect by applying a bleach solution or lime to the area. Then, with a rake, broom or shovel, the operator shall pick up solids and dispose as solid waste.

5.2.3.2 The operator must notify the LGU within 24 hours, using the Accidental Spillage Notification Form (CSMC Form 2).

5.2.3.3 In the event that a service provider fails to perform clean-up operations, the LGU shall perform the clean-up and charge all related expenses incurred to the service provider.

Rule 5.3 Septage Treatment and Disposal

5.3.1 All domestic sludge/septage shall be processed and treated before disposal. Septage facilities, including treatment and disposal facilities and septage truck yards, must maintain a hygienic and safe work environment. Facilities and equipment must be properly designed, installed, and maintained.

5.3.2 Only sludge and septage with corresponding manifest forms shall be accepted by the facility.

5.3.3 The treatment facility shall comply with existing standards and regulations of regulating agencies, including disposal of treated effluent to the receiving environment. As such, it should conform to the DOH *Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage*.

5.3.4 Treatment facilities shall comply with hygienic and sanitation requirements based on the following minimum requirements:

5.3.4.1 Hand washing facility (1)

5.3.4.2 Toilet (1)

5.3.4.3 Bathroom (1)

5.3.4.4 Drinking water fountain/dispenser (1)

5.3.4.5 Utility sink (1)

5.3.4.6 Ventilation and lighting

5.3.4.7 Flooring and walls shall be made of impervious materials

5.3.4.8 All plumbing fixtures must be in accordance with the National Plumbing Code (R.A. 1378)

5.3.4.9 Soap and any approved hand-drying device/material

5.3.4.10 There must be adequate and separate changing rooms for both male and female users with individual lockers for clothes and personal belongings.

Rule 5.4 Record Keeping and Reporting

5.4.1 The requirements for record keeping are applicable to all stages of septage management: desludging, transportation, treatment and disposal. These requirements include, but are not limited to, the following:

5.4.1.1 Properly filled out and complete manifest forms, which include desludging schedule, volume of septage, and the service provider's information.

5.4.1.2 Inventory of tools and notes of deficiencies with the septic tank (e.g., cracks, missing pipes, improper manholes, etc.).

5.4.2 The service provider shall submit these documents to the Office of the City Environment and Natural Resources (OCENR) on a monthly basis and retain copies for a minimum of five (5) years.

SECTION 6. DESIGN AND CONSTRUCTION REQUIREMENTS OF SEPTIC TANKS OR WASTEWATER TREATMENT FACILITY

6.1 Construction of New Buildings or Structures

6.1.1 No building plan for residential dwelling units or commercial, industrial, institutional, or recreational structures shall be approved unless the design of the sanitary plumbing and septic tank or wastewater treatment facility conforms to the specifications as provided under Section 3 and Section 7 herein and other pertinent regulations.

Alternative wastewater treatment systems shall be duly approved and endorsed by the City Government. Further, as governed by DENR regulations, all malls, restaurants, hotels, apartelles and other residential buildings, subdivisions, hospitals and similar establishments are required to utilize sewage treatment facilities as a condition to granting of Environmental Compliance Certificate (ECCs) and permits to operate.

6.1.2 It shall be the duty of the owner, administrator or contractor to inform the City Engineer's Office that the newly constructed septic tank,

sewage treatment facility or alternative treatment system, with prior plan approval, is ready for inspection. The new system shall not be covered or used until inspected and approved by the City Engineer's Office.

6.2 Existing Residential Buildings or Structures

6.2.1 Owners of existing septic tanks that are not accessible for desludging are required to repair or upgrade their tank so it can be deslugged. If repairs are not possible, such owners are required to build a new septic tank that will comply with the provisions set herein.

6.2.2 The cost of repair and upgrading shall be borne by the owners.

6.2.3 Communal or shared septic tanks can be used alternatively whenever feasible, particularly for existing clustered structures that are highly dense and characterized by lack of or inadequate land space. The design and the manifest of ownership and joint maintenance shall go through an approval process as determined by the City.

6.3 Owners of Commercial, Industrial and Institutional Buildings of Facilities shall have an operational wastewater treatment facility, either on-site or by service off-site. The said facility shall conform with the standards of EMB-DENR and DOH.

Rule 6. Requirements for Design and Construction of Septic Tanks or Wastewater Treatment Facilities

6.1 Septic Systems for New Buildings or Structures. Septic permits are required for construction of all new septic tanks, proposed remodeling or repairs, or where the use of commercial properties has changed. The City Health Office issues a septic permit when the septic tank complies with all design, installation and structural requirements. All necessary information to complete a septic permit application form is in CSMC Form 3.

6.2 The Building Official from the City Engineer's Office shall inspect and/or monitor the construction of the system to ensure compliance with the issued septic permit.

SECTION 7. SPECIFICATIONS. Septic tanks shall be designed and constructed in accordance with the standards set forth by the National Building Code, particularly Chapter IX, Sections 901 and 903 thereof, and as prescribed by the Revised National Plumbing Code of the Philippines, and Chapter XVII of the Code on Sanitation of the Philippines, including proper sizing and layout, and the criteria set forth below:

7.1 It shall be designed to produce an effluent consistent with approved engineering and environmental standards.

7.2 It shall be built of solid durable materials and shall be watertight. Materials shall conform to applicable Philippine material standards.

7.3 It shall not be constructed under any building and not within twenty five (25) meters from any existing source of water supply.

7.4 It shall be divided into a minimum of two compartments.

7.5 Where more than one tank is used to accommodate the required liquid volume in a given minimum retention time of 2 days, the tank should be conjoined.

7.6 Adequate venting shall be provided in each compartment with the use of ventilating pipes not less than 50 mm in diameter. For buildings where plumbing fixtures have appropriate "p" traps, venting should occur through the plumbing stack in the building, not from the septic tank. For buildings where toilets and sinks are not protected with "p" traps, traps should be installed, or vent directly from the septic tank.

7.7 There shall be at least one maintenance hole for each compartment, with a minimum side dimension of 500 mm. All maintenance hole shall extend through the tank cover and shall extend to finished grade. Manhole covers shall be designed with durable and fully coated or non-corrosive handles for easy lifting. Septic tank access covers should be secured from unauthorized entry, either through safety screws, locks or a tank lid that weighs 15 kg or more.

7.8 Outlet from the septic tank: The design, construction and location of structures receiving effluent from septic tanks shall conform to the Revised Plumbing Code of the Philippines. Effluent treatment is further required but will be covered by a separate ordinance and other infrastructure projects.

7.9 For clustered structures or houses that are highly dense and characterized by lack of or inadequate land space, there shall be designed a communal septic tank consistent with approved engineering and environmental standards.

SECTION 8. ADMINISTRATION AND ENFORCEMENT. The administration and enforcement of this Ordinance for all buildings, facilities and plants are hereby vested in the City Government of Zamboanga.

Upon the approval of this Ordinance, the City Government shall immediately institute and implement this Ordinance in all buildings and institutions along Senator R.T. Lim Boulevard.

Rule 8. Administration and Enforcement. The Septage Management System in Zamboanga City shall be administered and enforced by the City Septage Management Council with members listed in Section 9 and functions listed in Section 10. Other persons may be invited to provide technical advice to the CSMC.

8.1 Per Rule 2.1 Interpretation of the Scope and Coverage, the City Government shall institute and implement this Ordinance not only along Senator R.T. Lim Boulevard but in all buildings and institutions that are currently connected and supplied with water by the Zamboanga City Water District (ZCWD).

SECTION 9. CREATION OF A SEPTAGE MANAGEMENT COUNCIL. There shall be created a City Septage Management Council (CSMC) which shall be composed of the following:

Chairman.....City Mayor or his duly authorized representative
Secretariat.....Office of the City Environment and Natural
Resources (OCENR) (Lead Agency)

Members:

Chairperson, Committee on Health and Sanitation,
Sangguniang Panlungsod of Zamboanga City

Chairperson, Committee on Environment and
Natural Resources, Sangguniang Panlungsod of
Zamboanga City

City Health Officer

City Planning and Development Coordinator

City Engineer

City Treasurer

City Licensing Officer

General Manager, Zamboanga City Water District (ZCWD), or his duly authorized representative

Regional Director, Environmental Management Bureau, Department of Environment and Natural Resources (EMB-DENR), Regional Office IX, or his duly authorized representative

Regional Director, Department of Health (DOH), Center for Health and Development, Regional Office IX, or his duly authorized representative

President, Pollution Control Officers Association of Region IX, Inc., Zamboanga City Chapter, or his duly authorized representative

President, Liga ng mga Barangay of Zamboanga City, or his duly authorized representative

President, Industrial Group of Zamboanga, Inc. (IGZI), or his duly authorized representative.

SECTION 10. FUNCTIONS OF THE COUNCIL. The City Septage Management Council shall have the following functions:

10.1 The City Septage Management Council shall oversee the conduct of a survey of all properties and premises in coordination with barangay officials to determine if a septic tank is present, and if it is accessible for desludging.

10.2 To accredit and license private septage or desludging service providers or wastewater treatment facilities.

10.3 To review and approve the applications of service providers and to recommend the same for approval of the Sangguniang Panlungsod through the Office of the City Mayor.

10.4 To receive and hear complaints from residential owners and issue decisions.

10.5 If a septic tank is not present or it is inaccessible for desludging, the City Septage Management Council shall serve notices of non-conformance to the provisions of this Ordinance to the owners/administrators, or occupants. At this time, information on proper methods of complying with this Ordinance will be disseminated.

10.6 The City Septage Management Council, or its authorized representatives in coordination with the deputized barangay official shall be permitted to visit properties for the purpose of inspection, observation, measurement, sampling and testing. A prior

notice shall be given property-owners to facilitate inspection and provide assistance to the City Septage Management Council or barangay representatives.

10.7 For those property owners, administrators or occupants served with notices of non-conformance, a compliance period shall be set by the property owners, administrators or occupants and the City Septage Management Council. The compliance period shall be based on the proper installation of an acceptable septic tank of which design is specified in this Ordinance and by national law.

10.8 For new developments, the occupancy permit issued by the building officials shall serve as certificate of compliance until the City Septage Management Council conducts another round of inspection.

10.9 The City Septage Management Council shall plan and implement an information and education program on wastewater management and the city's septage management system.

SECTION 11. MONITORING AND EVALUATION. Close monitoring of all activities in the treatment facilities shall be conducted by the OCENR as per their mandate. Should it be determined by OCENR that there is non-compliance, a compliance schedule shall be agreed upon with the City Septage Management Council. Continued non-compliance past the agreed upon compliance schedule, the facility will be closed from accepting septage from this program.

Rule 11. In case there is non-compliance, OCENR will recommend to the Mayor and to the CSMC that the facility be closed from accepting septage from any source or other appropriate action be taken.

SECTION 12. DESLUDGING. Septic tanks require desludging when the tank is half filled or once every five (5) years, whichever comes first, and the next desludging if done within the five (5) year period, will be an add-on cost to the household.

12.1 The City Septage Management Council shall keep a record of all owners/administrators of buildings, facilities and structures who have desludged their septic tanks, those that are inaccessible, those that do not have septic tanks, and those that do not have water-sealed toilets, and other data that may be deemed necessary by the City Septage Management Council.

12.2 The City Septage Management Council shall implement and adhere to the rules and regulations set forth by the Department of Health and EMB-DENR in handling, transporting, treatment and disposal of septage.

12.3 The City Septage Management Council shall strictly implement an accreditation system and operational guidelines for private desludging service providers that would like to operate in the city, including but not limited to securing an Environmental Sanitation Clearance (ESC) which is discussed more thoroughly in the rules and regulations set forth by the Department of Health in handling, transporting, treatment and disposal of septage.

The City Health Office in conjunction with the City Septage Management Council shall issue Sanitary Permits for all treatment and collection facilities and develop their own procedures for periodic inspections of facilities and equipment, and training programs for septage workers.

Rule 12. Schedule of Desludging. The City shall be grouped into five (5) clusters consisting of 12 zones; each is composed of a group of barangays and takes into consideration the number of water connections/septic tanks and geographical locations. All ZCWD customer septic tanks within each cluster shall be scheduled for desludging on a five (5) year cycle. At the end of every cycle, the clustering shall be updated. The grouping of barangays into clusters is shown in the Annex.

SECTION 13. SERVICE PROVIDER. The City Government of Zamboanga may operate a wastewater or treatment facility and/or desludging services and in the absence of service facilities may contract with Private Service Providers, either desludging, transporting or wastewater treatment facility, provided that they shall have the necessary funds to support capital expenditures and operating and maintenance expenses of their septage management systems.

Rule 13. Service Provider

13.1 City Government. The City Government has three options that it may exercise: (1) purchase septage trucks and build a septage treatment facility, which shall be operated and maintained through administration or management contract(s); (2) enter into a contract with the ZCWD to provide septage collection, treatment and disposal services; and/or (3) enter into a contract(s) with private companies to provide septage collection, treatment and disposal services. Under such a plan,

13.1.1 The contractor(s) will be chosen based on the lowest service fee (cost), demonstrated ability to carry out the contract, and other qualifications.

13.1.2 Payments will be based on monthly billing.

13.1.3 The prime septage treatment contractor(s) may develop a system for accepting septage from other septage hauling operators as long as all septage is properly documented through manifests in accordance with the DOH operations manual.

13.2 Accreditation

13.2.1 To become accredited, service providers are required to obtain the permits/certifications listed below and submit them to OCENR. Only accredited service providers may participate in the bidding process following the Implementing Rules and Regulations of bidding pursuant to RA 9184. These accreditation requirements are applicable to all service providers handling septage desludging, transportation, treatment and disposal.

13.2.1.1 Environmental Sanitation Clearance (ESC) issued by the Center for Health and Development, DOH Region 9. The flow chart for securing the ESC is in CSMC Form 4 and the checklist of requirements and the application for ESC is in CSMC Form 5.

13.2.1.2 Environmental Compliance Certificate (ECC); Wastewater Discharge Permit (WDP); certificate of accreditation of a full-time Pollution Control Officer (PCO) issued by the Environmental Management Bureau, DENR Region 9

13.2.1.3 Sanitary Permit issued by the City Health Office

13.2.1.4 Business Permit issued by the Office of the City Mayor

13.2.1.5 Others that may be required by OCENR or other relevant government agencies.

13.2.2 The CSMC shall review applications for accreditation of service providers and conduct site inspections; and approve the list of accredited applicants.

SECTION 14. USER FEE. All residential and commercial/institutional building or structure owners shall pay an amount for the desludging of their septic tanks and treatment of the septage equivalent to the following:

14.1 The amount of P1.75 per cubic meter of water consumed per month will be collected from all residents, government offices and other agencies, and added to the Zamboanga City Water District (ZCWD) monthly water bill (Refer to Annex "A").

14.2 Commercial establishments that have their own water source shall be required to install a production meter. The quantity of water produced shall be the basis for computing the cost of desludging the septic tank.

14.3 Users who have their own onsite wastewater treatment system, certified by the City Government as functioning and compliant and those who are connected to the existing ZCWD sewerage pipe shall be exempt from paying the required user fee.

14.4 Residential houses without any water connection or temporary facilities sharing a communal septic tank shall be charged with the corresponding fee of P1.75 per cubic meter of water consumed per month.

Rule 14.1 User Fee. The user fee of P1.75 is pursuant to Ordinance No. 2009-152.

Rule 14.2 Non-ZCWD Customers. Charging of user fees for commercial establishments having their own water source and residential houses without any water connection or temporary facilities sharing a communal septic tank will be addressed in a supplemental IRR.

Rule 14.3 Exemptions. The following shall be exempted from paying the user fee:

14.3.1 Users who have their own functioning and compliant on-site wastewater treatment system certified by the City Government through OCENR.

14.3.2 Users with active and authorized connections to the sewerage system of the ZCWD.

SECTION 15. COLLECTION OF USER'S FEES. The Zamboanga City Water District is hereby authorized to collect user's fees and shall remit the same to the City Treasurer and shall accrue to the General Fund.

Rule 15. Collection of User's Fees. A Memorandum of Agreement (MOA) shall be entered into and executed between the City Government and ZCWD that authorizes the latter to collect the fees and remit the net amount monthly to the

City Treasurer. The net amount refers to the total amount collected less the agreed upon administrative cost for the collection services rendered by ZCWD.

SECTION 16. VIOLATIONS AND PENALTIES.

16.1 Issuance of Non-Conformity. The City Septage Management Council shall issue a notice of non-conformity to property owners, administrators or occupants who do not have a septic tank, whose septic tank is not designed properly, or is inaccessible for desludging unless they have an alternative system approved by the City Government.

16.2 Penalties. The violator or owner of a non-complying establishment or household, who fails to comply with the provisions of this Ordinance within one (1) year as provided under Paragraph 1.3, Section 458 of the Local Government Code, must pay the fines per violation set herein in lieu of prosecution:

For private residential buildings	Php1,000.00
For hotels, apartments, banks, offices, shops, lodging houses, malls, restaurants, and other commercial establishments	Php2,000.00
For hospitals, funeral parlors and similar operation	Php3,000.00

Failure to comply with the provisions herein shall result in the cancellation of business permits for commercial establishments.

Rule 16. The CSMC shall review implementation of the ordinance in regards to compliance and penalties, and recommend revisions and amendments as needed.

SECTION 17. SEPARABILITY CLAUSE. If for any reason or reasons any provision of this Ordinance be declared illegal by a competent court, other provisions which are not affected shall continue to be in full force and effect.

SECTION 18. REPEALING CLAUSE. All Ordinances, resolutions, executive issuances, or rules and regulations, or parts thereof, which provisions are inconsistent with or contrary to the provision of this Ordinance, the same are hereby repealed, amended or modified accordingly.

SECTION 19. EFFECTIVITY. This Ordinance shall take effect 15 days after its approval and publication and after the operationalization of the water treatment facility and/or contract of desludging by service providers.

These IMPLEMENTING RULES AND REGULATIONS of ORDINANCE NO. 2009-152 are hereby ADOPTED and APPROVED by the City Septage Management Council of the City Government of Zamboanga, this 23rd day of November 2010 in the City of Zamboanga. This IRR becomes effective upon effectivity of the ordinance as stated in Section 19.

Hon. CELSO L. LOBREGAT
City Mayor and Chairman

ENGR. REYNALDO S. GONZALES
City Environment & Natural Resources Officer and Secretariat

HON. LILIA M. NUÑO
Chairwoman
Committee on Health & Sanitation,
Sangguniang Panlungsod of
Zamboanga City

HON. ABDURAHMAN B. NUÑO
Chairman
Committee on Environment & Natural
Resources, Sangguniang Panlungsod of
Zamboanga City and President of *Liga
ng mga Barangay* of Zamboanga City

DR. RODELIN M. AGBULOS
City Health Officer

MELINDA S. CABATO
City Planning and Development
Coordinator

ENGR. LUIS VICENTE L. DESPALO
City Engineer

SOLEDAD L. LI
City Treasurer

CORAZON I. CAIRO
City Licensing Officer

LEONARDO REY D. VASQUEZ
General Manager
Zamboanga City Water District
(ZCWD)

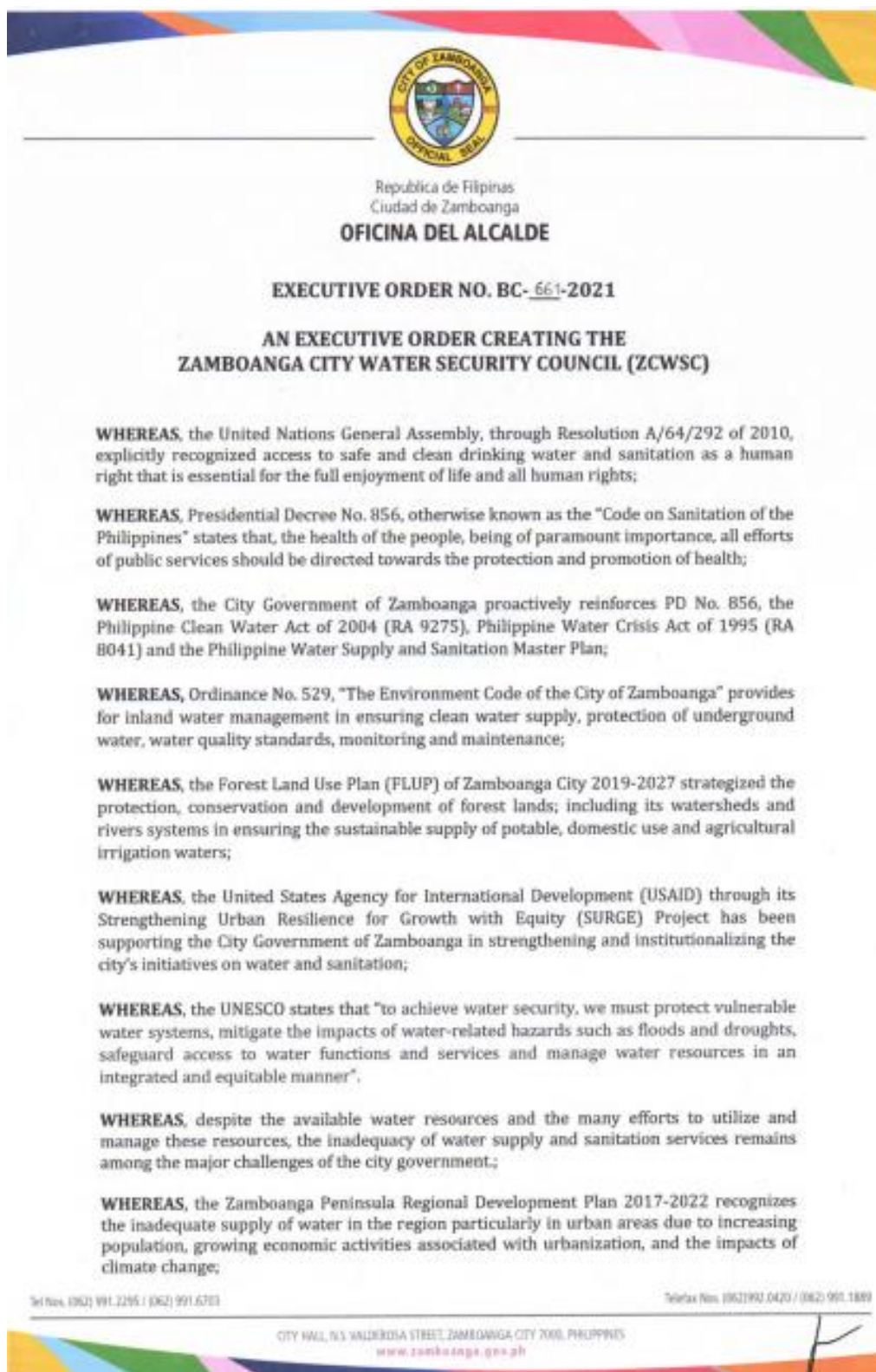
ENGR. ALAN B. DE GALA
Regional Director
Environmental Management Bureau-
Department of Environment and
Natural Resources, Region IX

DR. ARISTEDES C. TAN, MD, MPH
CESO III, Regional Director
Department of Health (DOH), Center
for Health and Development -
Zamboanga Peninsula

ENGR. MAXIMO V. ORTEGA
President
Pollution Control Officer Association
of Region IX, Inc. (PCOA, Inc.)

ENGR. GEORGE G. LEDESMA
President
Industrial Group of Zamboanga, Inc.

Zamboanga City Executive Order No. BC-661-2021: An Executive Order Creating Zamboanga City Water Council





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WHEREAS, the city has felt the adverse impacts of droughts in 2016 and 2019 that particularly compelled the main water service provider to implement water rationing due to significant decrease in drinking water production/supply;

WHEREAS, the adoption of a city-wide Water Demand Management (WDM) program is not only a potent solution to balance water supply and water demand, but, is also an alternative to preserve the available water resources for future generations by reusing grey / waste water for non-domestic purposes among other interventions;

WHEREAS, to ensure adequate, safe, sustainable and resilient water supply and sanitation services in the city, there is a need to proactively engage and encourage multisectoral partnerships and collaborations with the business sector, non-government and civic organizations, indigenous people groups, religious sector, government institutions including mainstream media organizations;

WHEREAS, this Executive Order (EO) expands the composition and broadens the scope of the TWG on Water Security that was created per EO BC 540-2000.

WHEREAS, this EO supersedes EO BC 540-2000.

NOW THEREFORE, I, MARIA ISABEL G. CLIMACO-SALAZAR, Mayor of the City of Zamboanga, by virtue of powers vested in me by law, do hereby order the following:

SECTION 1. OBJECTIVES

- 1.1. Strengthen the enabling environment for sustainable management of water supply and water demand;
- 1.2. Strengthen the capacity of water supply and waste water treatment service providers to expand and improve services;
- 1.3. Strengthen the collection, analysis and sharing of water and climate data;
- 1.4. Reduce risks from climate, natural and other related disasters; and
- 1.5. Engage multistakeholders participation in the governance of water resources;
- 1.6. Improve capacity of service providers in ensuring long-term water Security; and
- 1.7. Engage the expert services and adoption of water conservation-related technologies in ensuring water quality standards.

SECTION 2. CREATION AND COMPOSITION OF WATER SECURITY COUNCIL

There shall be created a Zamboanga City Water Security Council (ZCWSC) with the following composition and the City Mayor as the advisor:

Chair	: City Vice Mayor
Co-Chairperson	: General Manager, Zamboanga City Water District
Vice-Chairperson	: City Environment and Natural Resources Officer



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Members :

1. Chair, SP Committee on Energy and Public Utilities
2. Chair, SP Committee on Natural Resources and Environment Protection
3. Chair, SP Committee on Health and Sanitation
4. City Administrator
5. City Planning and Development Coordinator
6. City Agriculturist
7. City Health Officer
8. City Disaster Risk Reduction Management Officer
9. Office of the City Mayor, Division Head, Barangay Affairs Office
10. Regional Executive Director, DENR IX
 - Regional Director, Environmental Management Bureau IX
 - CENRO Zamboanga City
 - PENRO Zamboanga Sibugay
11. President, Western Mindanao State University
 - Department Head, Environmental Engineering Department
 - Department Head, Sanitary Engineering
12. President, Ateneo de Zamboanga University
 - Head, Ateneo Center for Environment and Sustainability
13. President, Zamboanga City Chamber of Commerce & Industry Foundation, Inc.
14. President, Industrial Group of Zamboanga, Inc.

The memberships to the Council shall not be limited to above-mentioned as other stakeholders may be invited when the need arises.

SECTION 3. FUNCTIONS OF THE MEMBERS OF ZAMBOANGA CITY WATER SECURITY COUNCIL (ZCWSC)

- 3.1 Collaborates with concerned government and non-government agencies, water service providers, and stakeholders in crafting the Zamboanga City Water Security Master Plan and the Zamboanga City Septage Management Plan;
- 3.2 Reviews and recommends to the Local Chief Executive and the City Legislative Council relevant and responsive policies, strategies, guidelines, and innovations on water supply and sanitation development and management that serve as bases in establishing the targets and directions for water and sanitation expansion and improvement programs along the following thematic areas of concerns:
 1. Water Recharge Area Restoration, Protection and Management (Watershed Area Protection)
 2. Water Resources Protection, Development, and Management (Source Development, Water Supply Systems)
 3. Renewable Water Resources (i.e. Rainwater Harvesting, Surface Runoff)
 4. Water Conservation and Efficiency
 5. Wastewater and Sewage Treatment and Re-Use
 6. Septage Management



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7. Point and Non-Point Water Pollution
8. Water Remediation and Rehabilitation
9. Water Supply and Sanitation Services in Emergencies

- 3.3 Reinforces public information, education, and communication (IEC) campaigns, advocacies and promotions on water conservation and proper and efficient water use including the installation / use of rainwater harvesting systems;
- 3.4 Promotes use of water efficient fixtures and products in public and private structures in coordination with the business sector which shall make available fixtures, products, and appliances that are water efficient; and
- 3.5 Reviews plan and programs on the construction of small impounding dams and other water supply system projects in strategic areas across the city and provide recommendations to the LGU and the water service providers.

SECTION 4. MEMBERSHIP OF THE ZCWSC. Membership in the ZCWSC is organizational. Head of organizations should automatically become members but may designate his/her permanent and one alternate representatives to the Council.

SECTION 5. SCHEDULE OF REGULAR MEETINGS. The Zamboanga City Water Security Council (ZCWSC) shall meet either virtual or face-to-face at least once every quarter or as often as necessary to promptly address and respond to pressing issues and concerns in the management of water resources, sanitation services, and water supply and demand.

SECTION 6. TECHNICAL SECRETARIAT. In addition to its being the Vice-Chairperson of the Water Security Council, the Office of the City Environment and Natural Resources Officer shall discharge the functions of technical secretariat to the Council.

SECTION 7. TECHNICAL WORKING GROUP (TWG). The TWG shall be composed of the following:

1. Office of the City Environment and Natural Resources Officer
2. Office of the City Planning and Development Coordinator
3. DENR-CENRO Zamboanga City
4. WMSU – Environmental Engineering Department
5. Zamboanga City Water District

The main function of the TWG is to provide administrative and technical support to the Council.

SECTION 8. REPORTS AND RECOMMENDATIONS. Upon recommendation of the TWG or any other entity, the Zamboanga City Water Security Council (ZCWSC) shall review, deliberate and approve any water and sanitation-related interventions including the utilization of the city's water resources.

SECTION 9. REPEALING CLAUSE. The Executive Order repeals, amends or supersedes all existing executive orders and other issuances inconsistent herewith.



Republica de Filipinas
Ciudad de Zamboanga
OFICINA DEL ALCALDE

SECTION 10. EFFECTIVITY. This Executive Order shall take effect upon signing and after 15 days from date of publication in the local newspapers.

Done in the City of Zamboanga, this 11 day of June, 2021.


MARIA ISABELLE G. CIMACO
City Mayor

ANNEX 1: SOCIO-ECONOMIC AND WILLINGNESS TO PAY SURVEY REPORT

Background

This section presents the summary of results of the baseline household and commercial survey among the target project beneficiaries and willingness to pay survey for the proposed sanitation program.

The household survey covered all the 91 barangays of the city, island barangays were not covered by the survey. Face to face interview were limited as per quarantine classification being observed in the City of Zamboanga. Most of the commercial establishment refuses to be interviewed, hence only 39 establishment were surveyed. The commercial survey was conducted in barangay Baliwasan, Boalan, Cabaluay, Calarian, Camino Nuevo, Guiwan, Lamisahan, Lapaz, Lubigan, Malagutay, Manicahan, Mercedes, Putik, San Jose Cawa, Cawa, San Jose Gusu, Sangali, Sibulao, and Sta. Barbara 1, Sto. Nino, Talisayan, Taluksungay, Victoria, Vitali, Zone 1 and Zone 2.

Baseline Household Survey

Survey Approach and Methodology

Sampling Size

Based on the total number of households within the target barangays, the survey considered a sample size that will give a confidence level of 95 percent. A total number of 464 household respondents corresponding to 425 household members and 39 commercial respondents were randomly selected from the covered barangay for the survey. This number is representative of the population that will potentially benefit from the proposed sanitation program of Zamboanga City Water District.

The households were sampled using Systematic Random Sampling to make sure that the process of selection is not biased. This also ensures that the sample adequately represent the population that is being studied. The sample size per barangay is presented in the table below.

Table 149: Household Survey Sample Size

Barangay		Household Respondents	Commercial Respondents	Total	
		N	N	N	%
1	Arena Blanco	8	-	8	2%
2	Ayala	9	-	9	2%
3	Baliwasan	4	4	8	2%
4	Baluno	3	-	3	1%
5	Boalan	4	1	5	1%
6	Bolong	4	-	4	1%
7	Buenavista	5	-	5	1%
8	Bunguia	4	-	4	1%
9	Cabaluay	2	1	3	1%
10	Cabatangan	7	-	7	2%

Barangay		Household Respondents	Commercial Respondents	Total	
		N	N	N	%
11	Cacao	3	-	3	1%
12	Calabasa	3	-	3	1%
13	Calarian	10	1	11	2%
14	Camino Nuevo	2	2	4	1%
15	Campo Islam	5	-	5	1%
16	Canelar	5	-	5	1%
17	Capisan	3	-	3	1%
18	Cawit	4	-	4	1%
19	Culianan	4	-	4	1%
20	Curuan	6	-	6	1%
21	Dita	3	-	3	1%
22	Divisoria	6	-	6	1%
23	Dulian (Upper Bunguiao)	3	-	3	1%
24	Dulian (Upper Pasonanca)	3	-	3	1%
25	Guisao	3	-	3	1%
26	Guiwan	4	3	7	2%
27	Labuan	8	-	8	2%
28	Lamisahan	2	1	3	1%
29	Lanzones	3	-	3	1%
30	Lapakan	3	-	3	1%
31	La Paz	4	1	5	1%
32	Latuan	3	-	3	1%
33	Licombo	5	-	5	1%
34	Limaong	3	-	3	1%
35	Limpapa	3	-	3	1%
36	Lubigan	1	2	3	1%
37	Lumayang	3	-	3	1%
38	Lumbangan	4	-	4	1%
39	Lunzuran	6	-	6	1%
40	Maasin	4	-	4	1%
41	Malagutay	4	1	5	1%
42	Mampang	10	-	10	2%
43	Mangusu	4	-	4	1%
44	Manicahan	5	1	6	1%
45	Mercedes	6	1	7	2%
46	Muti	3	-	3	1%
47	Pamucutan	2	-	2	0%
48	Panubigan	3	-	3	1%
49	Pasobolong	5	-	5	1%
50	Pasonanca	10	-	10	2%
51	Patalon	5	-	5	1%

Barangay		Household Respondents	Commercial Respondents	Total	
		N	N	N	%
52	Putik	5	2	7	2%
53	Quiniput	3	-	3	1%
54	Recodo	10	-	10	2%
55	Salaan	3	-	3	1%
56	San Jose Cawa, Cawa	2	1	3	1%
57	San Jose Gusu	5	1	6	1%
58	San Roque	10	-	10	2%
59	Sangali	9	1	10	2%
60	Sibulao	2	2	4	1%
61	Sinubong	3	-	3	1%
62	Sinunuc	10	-	10	2%
63	Sta. Barbara 1	29	1	30	6%
64	Sta. Maria	9	-	9	2%
65	Sto. Nino	2	1	3	1%
66	Tagasilay	3	-	3	1%
67	Taguiti	2	-	2	0%
68	Talabaan	4	-	4	1%
69	Talisayan	1	5	6	1%
70	Talon-Talon	12	-	12	3%
71	Taluksungay	4	1	5	1%
72	Tetuan	10	-	10	2%
73	Tictapul	3	-	3	1%
74	Tigbalabag	3	-	3	1%
75	Tolosa	3	-	3	1%
76	Tugbungan	10	-	10	2%
77	Tulungatung	5	-	5	1%
78	Tumaga	11	-	11	2%
79	Tumitus	3	-	3	1%
80	Victoria	2	1	3	1%
81	Vitali	4	1	5	1%
82	Zambowood	7	-	7	2%
83	Zone I (Pob.)	2	2	4	1%
84	Zone II (Pob.)	2	1	3	1%
85	Zone III (Pob.)	3	-	3	1%
86	Zone IV (Pob.)	3	-	3	1%
	Total	425	39	464	100%

Survey Design

The survey, which was implemented through personal interviews, was designed to:

- Determine socio-economic characteristics in the target barangays and their households;
- Assess current condition; sanitation facility, sanitation practices, and
- Determine willingness-to-pay (WTP) for improved sanitation services.

The survey was conducted from August 19 to August 25, 2021.

Approach to Elicitation of WTP

In eliciting WTP for an improved sanitation service, respondents were initially asked if they are willing to pay and to have their septic tank desludged for a fee. The respondents were then asked to express the maximum amount they are willing to pay in order to acquire the potential benefits derived from the proposed services.

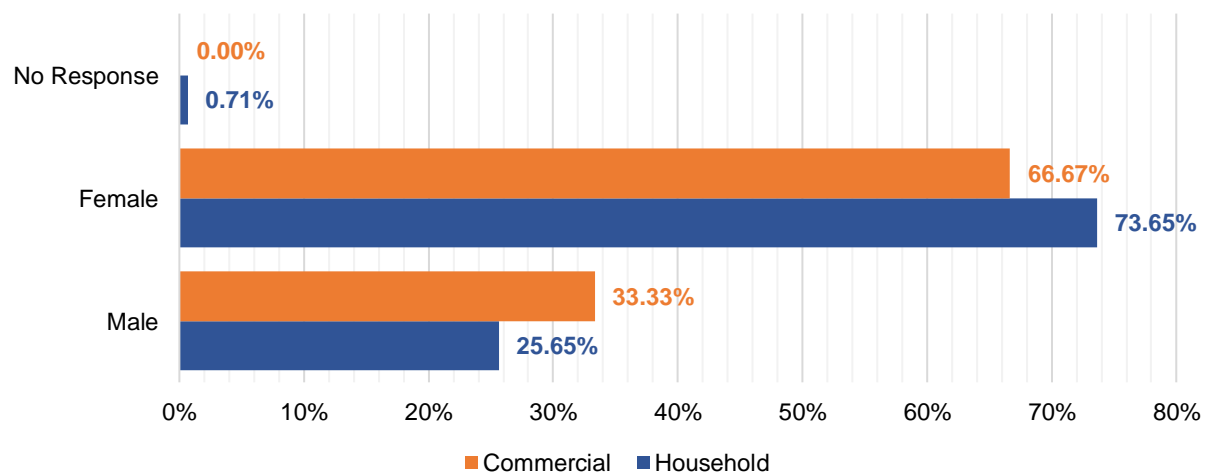
Summary of Result of Household Survey Related to Sanitation

The succeeding table presents the results of the household and commercial survey.

Respondents Profile

Gender. Majority of the respondents were female, about 73 percent as shown in **Figure 57**.

Figure 57: Sex of Respondents by type



Age. Table 150 shows that 16 percent of the respondents are between 45 to 49 years of age, roughly 15 percent are between 40 to 44 years old, 13 percent between 50 to 54 years old, nearly 12 percent are 35 to 39 years old, 9 percent are 55 to 59 years old, and 30 to 34 years old, 7 percent are 25 to 29 years old. Less than 3 percent are 21-24 years old and a few 0.8 percent are below 21 years old.

Working Status of the Household Respondents. Of the household respondents, 81.5 percent are working, some 16.9 percent are none working.

Table 150: Respondents Profile

Particular	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Gender						
Male	109	25.6	13	33.3	122	26.3
Female	313	73.6	26	66.7	339	73
No Response	3	0.7	0	0	3	0.6
Total	425	100	39	100	464	100
Age						
Below 21	4	1	-	-	4	0.8
21 to 24	10	2.5	1	2.6	11	2.4
25 to 29	29	6.9	5	12.8	34	7.3
30 to 34	41	9.6	2	5.1	43	9.3
35 to 39	52	12	3	7.7	55	11.8
40 to 44	63	14.8	6	15.4	69	14.8
45 to 49	70	16.5	5	12.8	75	16.1
50 to 54	57	13.4	6	15.4	63	13.5
55 to 59	38	8.9	6	15.4	44	9.4
60 to 65	56	13.2	5	12.8	61	13.1
No Response	5	1.2	-	-	5	1
Total	425	100	39	100	464	100
Water-District Connection						
Yes	184	43.3	27	69.2	211	45.5
No	209	49.2	11	28.2	220	47.4
No Response	32	7.5	1	2.6	33	7.1
Total	425	100	39	100	464	100
Working status of respondents						
Working	351	82.6	27	69.2	378	81.5
Non-working	67	15.8	11	28.2	78	16.8
No Response	7	1.6	1	2.6	8	1.7
Total	425	100	39	100	464	100

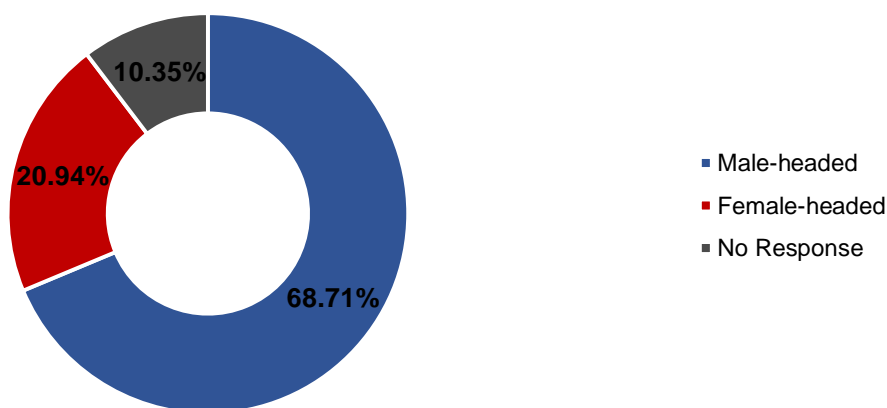
Household Head and Business Profile

Gender. Based on the survey outcome, 68 percent of the household heads are male. Also, **Table 151** shows that 61 percent of the business owners are male. The proportion of female respondents is higher among households than commercial establishments.

Table 151: Household Head/Business Owner Gender

Gender	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Male	292	68.7	24	61.5	316	68.1
Female	89	20.9	13	33.3	102	21.9
No Response	44	10.4	2	5.1	46	9.9
Total	425	100	39	100	464	100

Figure 58: Household Head by Sex



Age. The household heads are normally 60 years and above. As shown in **Table 152**, 17 percent are aged 60 to 65 years old, 16 percent between 50 to 54 years old, 15 percent as aged 45 to 49. Other 14 percent are 40 to 44 years old. Only 10 percent of the household heads are between 55 to 59 years old, roughly 9 percent are aged 35 to 39, 7 percent are 30 to 34, 3 percent are aged 25 to 29, while less than 2 percent are 21 to 24 years old. It should be noted that of the households interviewed, 0.4 percent have family head or breadwinner below 21 years old.

Most of the respondents are among the working age group between 18 to 59 years old - 85.65 percent among household respondents, and 87.18 percent among commercial establishment respondents. The remainder are the elderly, or those with ages sixty and over, and those that did not specify their age.

Table 152: Age Distribution

Age Group	Household Head		Business Owner		Total	
	Number	Percent	Number	Percent	Number	Percent
Below 21	2	0.5	-	-	2	0.4
21 to 24	6	1.4	-	-	6	1.3
25 to 29	16	3.8	1	2.6	17	3.6
30 to 34	30	7.1	2	5.1	32	6.9
35 to 39	37	8.7	4	10.3	41	8.8
40 to 44	65	15.3	2	5.1	67	14.4
45 to 49	65	15.3	7	17.9	72	15.5
50 to 54	68	16	10	25.6	78	16.8
55 to 59	43	10.1	8	20.5	51	10.9

Age Group	Household Head		Business Owner		Total	
	Number	Percent	Number	Percent	Number	Percent
60 to 65	76	17.9	5	12.8	81	17.4
No Response	17	4	-	-	17	3.6
Total	425	100	39	100	464	100

Figure 59: Household Head by Age

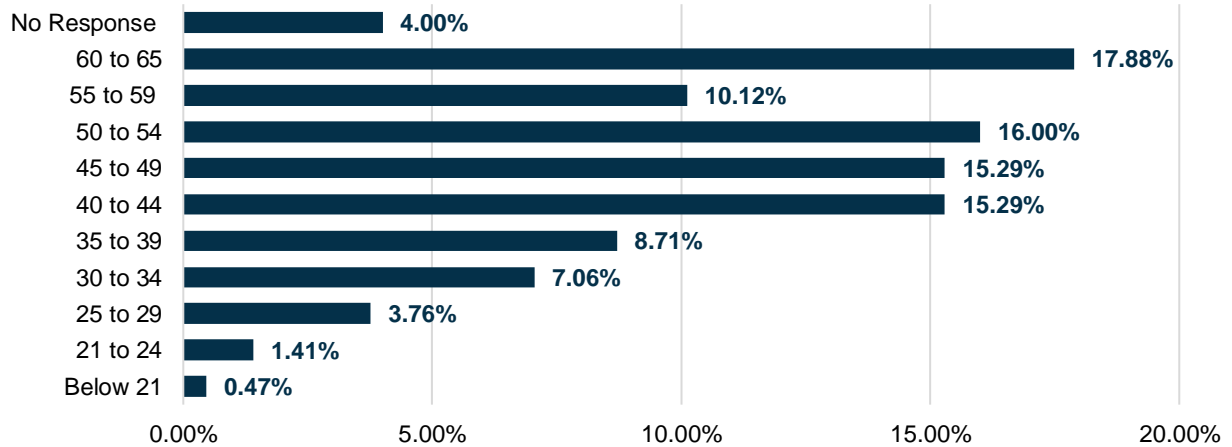
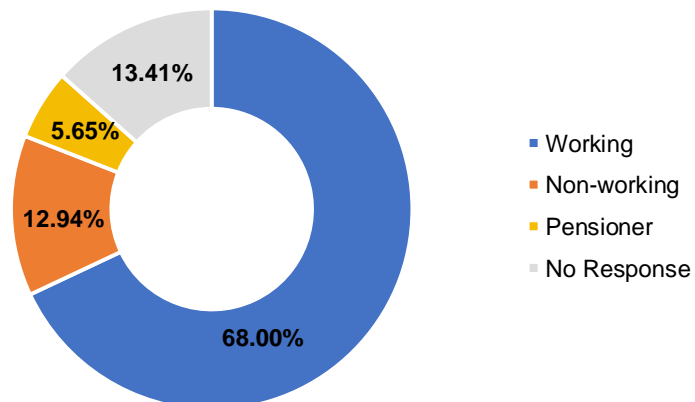


Table 153 provides the working status of household heads. It shows that 68 percent of the households are working. Whereas, 5 percent relied on receiving their monthly pension.

Table 153: Working Status of Household Head

Status	Number	Percent
Working	289	68
Non-working	55	12.9
Pensioner	24	5.6
No Response	57	13.4
Total	425	100

Figure 60: Employment Status of Household Head



Work Classification of Household Head. The occupation of the household heads varies from formal employment to self-employment and ownership of artisanal and micro-enterprises. Specifically, 11 percent were skilled agricultural, forestry, & fishery workers; 6 percent were the skilled crafts and trades occupation, 5 percent were professional workers, 3 percent were engaged in sales and other services. Less than 2 percent were the tasks performed by workers in elementary occupations, technician & associate professional, armed forces occupation, clerical support workers, plant & machine operator & assembler as well as managerial work.

Table 154: Work Classification

Work Group	Number	Percent
Manager	8	1.9
Professional	23	5.4
Technician & Associate Professional	7	1.6
Clerical Support Worker	5	1.2
Service & Sales Workers	15	3.5
Skilled Agricultural, Forestry, & Fishery Workers	47	11.1
Craft & Related Trades workers	26	6.1
Plant & machine Operator & Assembler	6	1.4
Elementary Occupation	8	1.9
Armed Forces Occupation	8	1.9
No Response	272	64
Total	425	100

Figure 61: Work Classification of Household Head

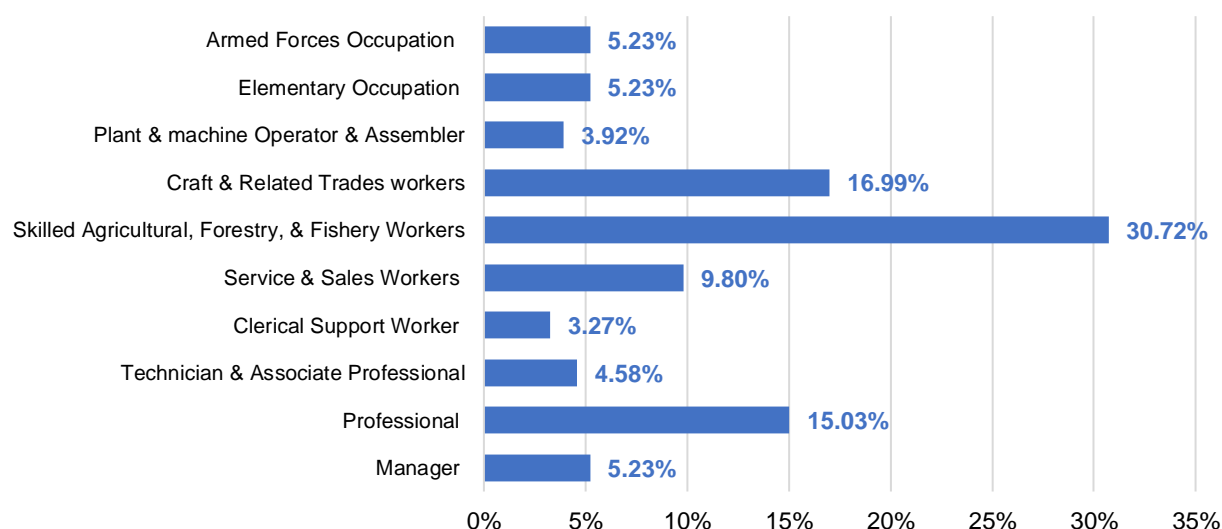


Table 155 shows the number of families living in the household. It appears that 54 percent of households resides exclusively in one family living together, roughly 19 percent resides three or more families in one household, while 13 percent resides two families.

Table 155: Number of Families Living in the Household

Household Size	Household Head	
	Number	Percent
One	230	54.1
Two	57	13.4
Three or More	88	20.7
No Response	50	11.8
Total	425	100

Number of Household having Common Kitchen. About 68 percent of the families living in the household have a common kitchen that they exclusively used and other 6 percent does not share a common kitchen.

Table 156: Number of Household with Common Kitchen

Household with Common Kitchen	Number	Percent (%)
Yes	289	68
No	25	5.9
No Response	111	26.1
Total	425	100

Number of Household having a Common Toilet. Table 157 shows that 67 percent of the families living in a household used a common toilet and only 6 percent of the household doesn't share common toilet.

Table 157: Number of Household with Common Toilet

Indicator	Number	Percent (%)
Yes	285	67.1
No	26	6.1
No Response	114	26.8
Total	425	100

Table 158 indicates the number of people living in the household. It appears that 19 percent of the households is composed of 4 to 5 members, while 12 percent is composed of 3 people. Some 10 percent is composed of 6 members as well as with 9 members and above. There are 9 percent composed of 7 members, and roughly 7 percent is composed of 8 members in the family and a few 5 percent for 2 members.

Table 158: Number of People Living in the Household

Members of Household	Number	Percent (%)
1	3	0.7
2	23	5.4
3	54	12.7
4	83	19.5
5	83	19.5

Members of Household	Number	Percent (%)
6	45	10.6
7	40	9.4
8	29	6.8
9 and above	44	10.4
No Response	21	4.9
Total	425	100

Average Monthly Income. The modal household income is between PhP3, 001 to PhP5,000 registering 25 percent of the interviewed households as shown in the table below. The lower income group, PhP1,001 to PhP3,000 represents 5 percent, while the PhP1,000 or less is measly 0.8 percent only.

Significant households have income above the modal range. Those with income between PhP5,001 to PhP8,000 accounts for 15 percent, PhP8,001 to PhP10,000 represents roughly 10 percent, PhP10,001 to PhP12,000 comprises 9 percent, PhP12,001 to PhP15,000 makes up approximately 7 percent and PhP15,001 to PhP20,000 also at 8 percent. The higher income groups, more than PhP20,000 up to PhP50,000 monthly is most likely 13 percent. Only 2 percent earns above PhP50,000.

Table 159 presents the monthly income of commercial establishments in Zamboanga City. Only 5 percent of the businesses earn above PhP30,000 monthly. Likewise, 5 percent also earns more than PhP50,000 grosses. The rest, mostly small businesses, have income less than PhP15,000.

Table 159: Average Monthly Income

Monthly Income	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
PhP1,000 and Below	3	0.7	1	2.6	4	0.8
PhP1,001 – PhP3,000	25	5.9	1	2.6	26	5.6
PhP3,001 – PhP5,000	109	25.6	8	20.5	117	25.2
PhP5,001 – PhP8,000	70	16.5	3	7.7	73	15.7
PhP8,001 – PhP10,000	43	10.1	3	7.7	46	9.9
PhP10,001 – PhP12,000	39	9.2	6	15.4	45	9.6
PhP12,001 – PhP15,000	28	6.6	4	10.3	32	6.8
PhP15,001 – PhP20,000	32	7.5	6	15.4	38	8.1
PhP20,001 – PhP30,000	28	6.6	3	7.7	31	6.6
PhP30,001 – PhP50,000	27	6.4	2	5.1	29	6.2
PhP50,001 and above	12	2.8	2	5.1	14	3
No Response	9	2.1	-	-	9	1.9
Total	425	100	39	100	464	100

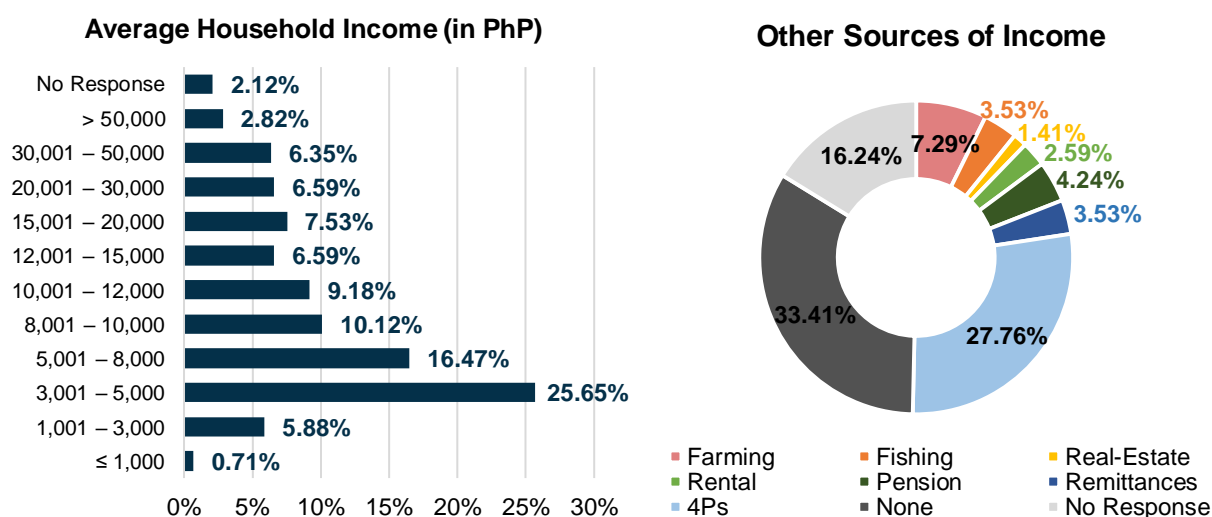
Table 160 also shows other sources of income that the household receives aside from the main source of income. It reveals that 33 percent of the total respondents don't have extra or other sources of income. While 26 percent of household relied on 4P's allocation, nearly 7 percent relied on farming, household that receives pension makes up 4 percent, and only 3 percent covers

on fishing and 4 percent on remittances. Income from real state represents 1.7 percent and partly 2 percent in rental.

Table 160: Other Sources of Income

Other Sources of Income	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Farming	31	7.3	1	2.6	32	6.8
Fishing	15	3.5	-	-	15	3.2
Real-Estate	6	1.4	2	5.1	8	1.7
Rental	11	2.6	2	5.1	13	2.8
Pension	18	4.2	1	2.6	19	4
Remittances	15	3.5	5	12.8	20	4.3
4Ps	118	27.8	4	10.3	122	26.2
None	142	33.4	14	35.9	156	33.6
No Response	69	16.2	1	2.6	70	6.5
Others	-	-	9	23.1	9	15
Total	425	100	39	100	464	100

Figure 62: Average Household Income and Other Income Sources



House/Building Characteristic

Dwelling Type I. Table 161 reveals that majority (88 percent) of the respondents owned single detached house. Roughly 6 percent owned duplex house, while some 0.6 percent are living in an apartment building. For commercial establishments, majority 84 percent of the respondent's dwell in a single detached building, mostly single-story (71 percent).

Table 161: House Characteristics

Dwelling Type	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Type 1						
Single Detached	379	89.2	33	84.6	412	88.7
Duplex Quadruplex	21	4.9	6	15.4	27	5.8
Apartment Building	3	0.7	-	-	3	0.6
Residential Condominium	3	0.7	-	-	3	0.6
No Response	19	4.5	-	-	19	4
Total	425	100	39	100	464	100
Type 2						
One-storey	357	84	28	71.8	385	82.9
Two-storey	48	11.3	11	28.2	59	12.7
No Response	20	4.7	-	-	20	4.3
Total	425	100	39	100	464	100

A 91 percent majority of the household respondents owned their houses as shown in **Table 162**. Those currently renting account only 4 percent. Of the households renting, about 3.2 or 13 households are paying PhP1,001 to PhP3,000 monthly. Others are paying a monthly rental amounting from PhP1,000 and below, while some are paying an amount between PhP3000 and PhP15,000.

Table 162 also indicates that majority or 82 percent of the commercial establishments surveyed are owned by the business owners, nearly 8 percent are renting. Of the 39 establishments, a few 2.6 percent are paying PhP5, 001 to PhP8,000 for monthly rental. While the rest are paying less than PhP8,000 per month.

Table 162: Home Ownership

Indicator	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Home / Building Ownership						
Own House	393	92.5	32	82.1	425	91.5
Renting	18	4.2	3	7.7	21	4.5
Others	7	1.6	4	10.3	11	2.3
No Response	7	1.6	-	-	7	1.5
Total	425	100	39	100	464	100
Monthly Rental						
PhP 1,000 and below	6	1.4	1	2.6	7	1.5
PhP 1,001 - PhP3,000	14	3.3	1	2.6	15	3.2
PhP 3,001 – 5,000	6	1.4	-	-	6	1.2
PhP 5,001 - PhP8,000	2	0.5	1	2.6	3	0.6
PhP 8,001 – 10,000	-	-	-	-	-	-
PhP 10,001 – 15,000	1	0.2	-	-	1	0.2
PhP 15,001 and above	-	-	-	-	-	-

Indicator	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
No Response	396	93.2	36	92.3	432	93.1
Total	425	100	39	100	464	100

Table 163 shows the monthly electric bill of the households. Of the total household surveyed, roughly 28 percent are paying electric bill around PhP500 below, 25 percent are paying PhP1,001 to PhP2,000 and 19 percent are paying PhP501 to 1,000. Also, around 11 percent are paying as high as PhP3,001 and above for electricity. Nevertheless, less than 1 percent of households are using electricity for free.

Average Water Bill. The same table below gives a glimpse of monthly cost on water, 36 percent of the total respondents expressed that the amount they are spending for water is between PhP500 and less. About 21 percent of the respondents are paying PhP501 and above. Less than 1 percent are also using water for free.

Table 163: Electric and Water Bill

Indicators	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Electric Bill						
PhP500 below	125	29.4	4	10.3	129	27.8
PhP501 to PhP1000	86	20.2	5	12.8	91	19.6
PhP1001 to PhP2000	108	25.4	12	30.8	120	25.8
PhP2001 to PhP3000	40	9.4	4	10.3	44	9.4
PhP3001 and above	39	9.2	13	33.3	52	11.2
Free	4	0.9	-	-	4	0.8
No Response	23	5.4	1	2.6	24	5.1
Total	425	100	39	100	464	100
Water Bill						
PhP500 below	160	37.6	10	20.5	170	36.6
PhP501 to PhP1000	92	21.6	8	20.5	100	21.5
PhP1001 to PhP2000	19	4.5	9	23.1	28	6
PhP2001 to PhP3000	7	1.6	3	7.7	10	2.1
PhP3001 and above	21	4.9	1	2.6	22	4.7
Free	1	0.2	-	-	1	0.2
No Response	125	29.4	8	20.5	133	28.6
Total	425	100	39	100.00	464	100

Health Profile

As presented in **Table 164**, 3.2 percent experience diarrhea once and 0.5 percent experience it twice a year. Other 0.2 percent experience amoebiasis once as well as for typhoid fever, while no other cases were accounted.

Table 164: Water-Borne and Sanitation-Related Diseases

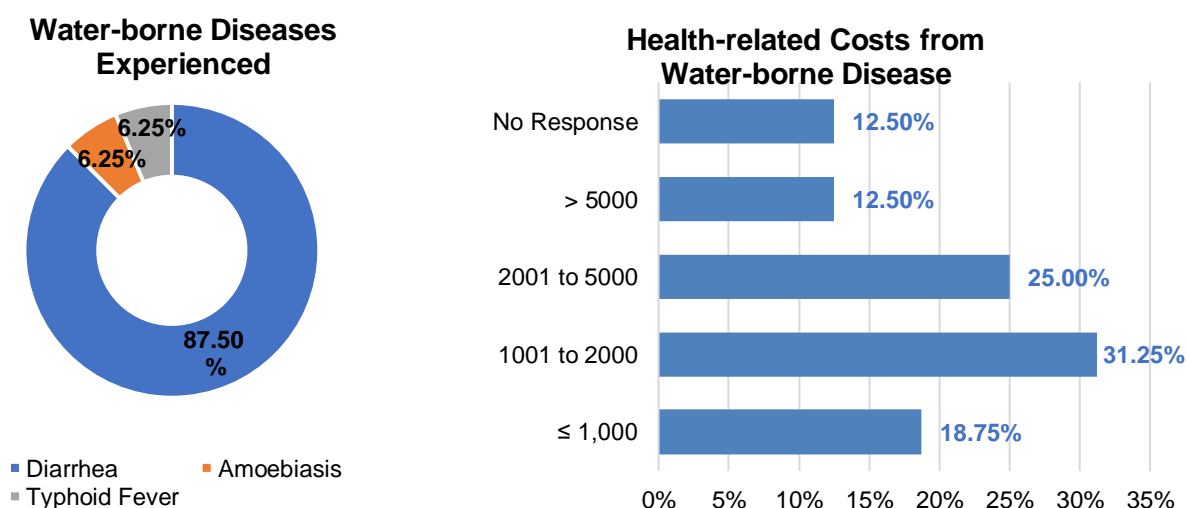
Water-Borne Diseases								
	Diarrhea		Amoebiasis		Typhoid Fever		No Response	
	Once	Twice	Once	Twice	Once	Twice		
Household								
Number	12	2	1	-	1	-	-	-
Percent	3	0.5	0.2	-	0.2	-	-	-
Commercial								
Number	2	-	-	-	-	-	-	-
Percent	5.1	-	-	-	-	-	-	-
Total								
Number	14	2	1	-	1	-	-	-
Percent	3.2	0.5	0.2	-	0.2	-	-	-

Presented in **Table 165** is the annual cost for hospitalization and/or medication incurred by families' experiencing water-borne diseases. Only few 0.8 percent spent annual cost between PhP2,001 to 5,000, other 0.4 percent spent above PhP5,000.

Table 165: Annual Cost for Hospitalization and/or Home Medication

Hospitalization Annual Cost	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
PhP1,000 and Below	3	0.7	1	2.6	4	0.8
PhP1001 to PhP2000	5	1.2	-	-	5	1.0
PhP2001 to PhP5000	4	0.9	-	-	4	0.8
PhP5001 above	2	0.5	-	-	2	0.4
No Response	411	96.7	38	97.4	449	96.7
Total	425	100	39	100	464	100

Figure 63: Water-borne Diseases Experienced and Related Costs



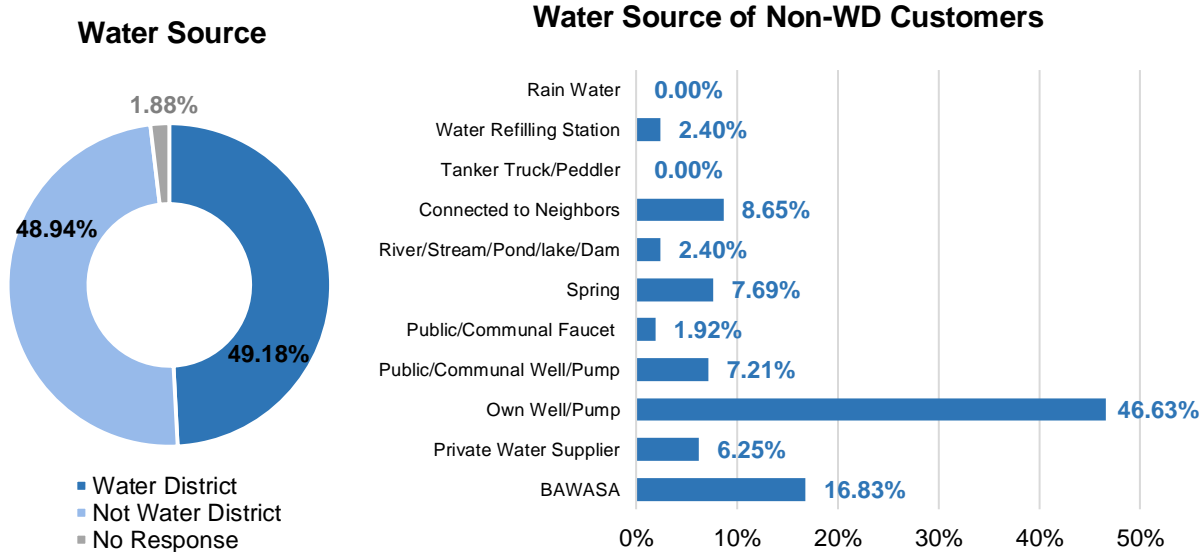
Water Supply

Several types of water supply services exist in Zamboanga City. Fifty percent (50 percent) of households and commercial respondents obtain their water from water district. Other households and commercial establishments derived water from own well/pump (22 percent), BAWASA cooperative (7.7 percent). Less than 4 percent from shared connection with neighbors, obtain water from spring, public communal well or pump and from private. Though, very few (1 percent) abstract waters from rivers, municipal water system, public communal faucet and water refilling stations.

Table 166: Water Supply Services

Sources	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Water District	209	49.1	23	59	232	50
Barangay Water Works System	2	0.4	-	-	2	0.4
Bawasa/Brgy. Water & Sanitation Association	33	7.7	3	7.7	36	7.7
Private Water Supplier	13	3.0	3	7.7	16	3.4
Own Well/Pump	97	22.8	6	15.4	103	22.1
Public/Communal Well/Pump	15	3.5	1	2.6	16	3.4
Public/Communal Faucet	4	0.9	-	-	4	0.8
Spring	16	3.7	2	5.1	18	3.8
River/Stream/Pond/lake/Dam	5	1.1	-	-	5	1.0
Connected to Neighbors/Shared	18	4.2	-	-	18	3.8
Tanker Truck/Peddler	-	-	-	-	-	-
Water Refilling Station	5	1.1	1	2.6	6	1.2
Rain Water	-	-	-	-	-	-
No Response	8	1.8	-	-	8	1.7
Total	425	100	39	100	464	100

Figure 64: Source of Water Supply



In terms of water supply availability, roughly 53 percent of the household respondents conveyed that water is available all year round. Only 19 percent conveyed that water is insufficient during summer and 12 percent conveyed that water is insufficient all year round respectively. For the commercial respondents, 64 percent expressed that water is available all year round. The above translates that almost 54 percent of the total respondents expressed that water is available all year round. While around 31 percent responded that water is insufficient all year round and water is insufficient during summer.

Table 167: Water Availability

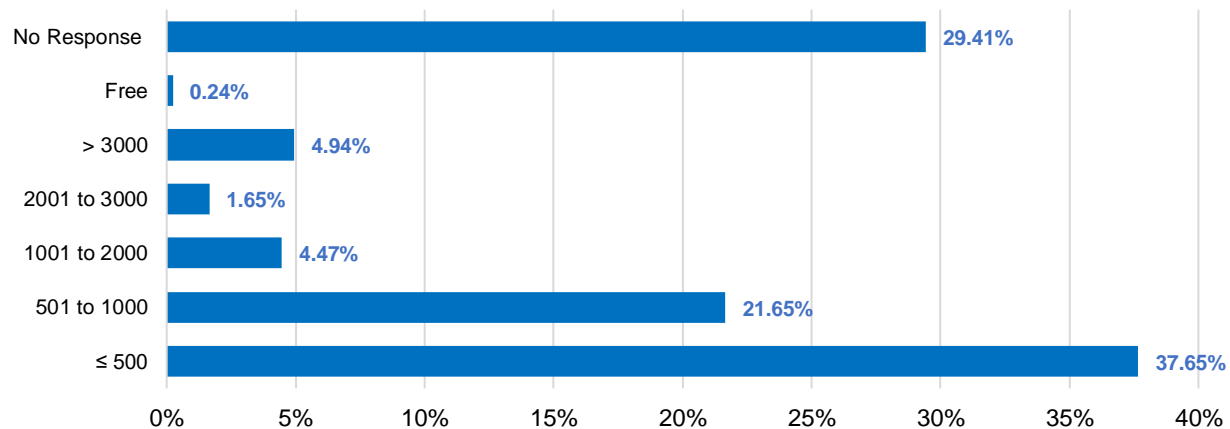
Particular	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Water is available all year round	225	52.9	25	64.1	250	53.8
Water is insufficient during summer	82	19.3	5	12.8	87	18.7
Water is insufficient all year round	54	12.7	4	10.3	58	12.5
No Response	64	15.1	5	12.8	69	14.8
Total	425	100	39	100	464	100

The survey also looked into the household monthly water consumption. The response was validated through water bill. However, some only provided answers based on what they recalled. **Table 168** presents the monthly water consumed by the respondent every month. Out of the 464 respondents, both commercial and household, several of them have no idea (26 percent) and other 25 percent showed no response. However, the usual water consumption for household is in the range 5001 liters to 1001 liters. While, commercial establishments consume 500 liters below (41 percent), other establishments consume more water in the range 1,001 liters to 5,000 liters (10 percent).

Table 168: Average Monthly Water Consumption

Consumption	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
10 m ³ below	27	6.4	1	2.6	28	6.0
10.1 m ³ to 15 m ³	24	5.6	2	5.1	26	5.6
15.1 m ³ to 20 m ³	10	2.4	1	2.6	11	2.3
20.1 m ³ to 25 m ³	8	1.9	1	2.6	9	1.9
25.1 m ³ to 30 m ³	13	3.1	1	2.6	14	3.0
30.1 m ³ to 40 m ³	16	3.8	4	10.3	20	4.3
40.1 m ³ and above	8	1.9	5	12.8	13	2.8
500 Liters Below	10	2.4	16	41	26	5.6
501 Liters to 1001 Liters	4	0.9	-	-	4	0.8
1001 Liters to 5000 Liters	15	3.5	4	10.3	19	4.0
5001 Liters and above	53	12.5	-	-	53	11.4
No Idea	119	28	4	10.3	123	26.5
No Response	118	27.8	-	-	118	25.4
Total	425	100	39	100	464	100

Figure 65: Monthly Water Bill



Sanitation Facility

Septic tank desludging is being carried-out by individuals or private companies with no treatment as prescribed by law.

As shown in **Table 169**, 44 percent of the respondents dispose wastewater directly to their own septic tank. However, about 24 percent dispose wastewater directly to the ground. Other 14 percent discharges into drainage canals, 8 percent disposes directly to body of water, 4 percent utilizes shared septic tank and some 2 percent disposes waste to piped sewer system. It was noted during the survey that there are no existing canals in some barangays. Based on the interview, there are areas with no existing drainage out falls.

Table 169: Discharge Point

Particular	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Piped Sewer System	10	2.4	2	5.1	12	2.5
Municipal Drainage Canal	59	13.9	8	20.5	67	14.4
Owned Septic Tank	190	44.7	17	43.6	207	44.6
Shared Septic Tank	19	4.5	1	2.6	20	4.3
Direct to Body of Water	35	8.2	2	5.1	37	7.9
Backyard/Ground	105	24.7	9	23.1	114	24.5
No Response	7	1.6	-	-	7	1.5
Total	425	100	39	100	464	100

More than three-fourth of the respondents owned flush to septic tank type toilets. Only 7 percent have flush to septic tank toilets shared among neighbors and 5 percent uses ventilated improved pit.

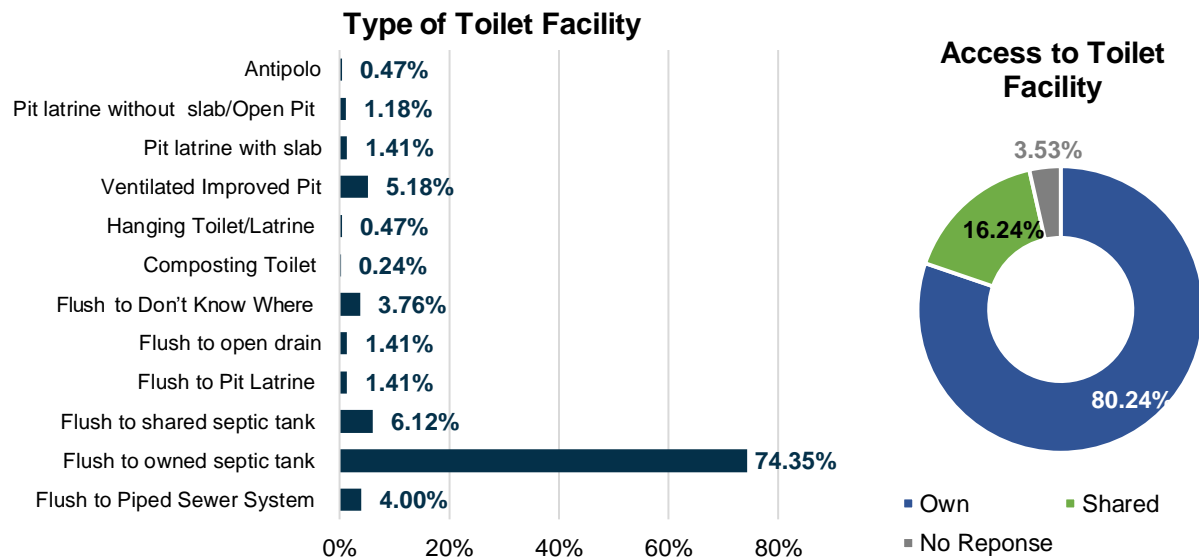
Flush to pit latrine toilet facilities are common in Barangays Cacao, Capisan, Culianan, Sta. Barbara, Talabaaan and Zambowood. Flush to open drain toilet are notable in Sta. Barbara, Taluksungay, and Tumitus. The household survey revealed that there are still households with poor sanitation facilities. Pit latrines with slab and were accounted in Barangay Lapakan, Latuan, Lubigan, Pasobolong and Salaan. Pit latrines without slab or open pits are nevertheless present in Barangay Lapakan, Panubigan, and Sta. Barbara 1. In spite of government effort to improve local sanitation, hanging toilets still exist in Sta. Barbara 1.

For commercial establishments, flush to septic tanks toilets are traditionally owned by 84 percent. Sharing of flush to septic tank toilets is less common at 7 percent.

Table 170: Toilet Facilities

Toilet Facility	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Flush to Piped Sewer System	17	4	-	-	17	3.6
Flush to owned septic tank	316	74.4	33	84.6	349	75.2
Flush to shared septic tank	26	6.1	3	7.7	29	6.2
Flush to Pit Latrine	6	1.4	-	-	6	1.2
Flush to open drain	6	1.4	1	2.6	7	1.5
Flush to Don't Know Where	16	3.8	-	-	16	3.4
Composting Toilet	1	0.2	-	-	1	0.2
Bucket	-	-	-	-	-	-
Hanging Toilet/Latrine	2	0.5	-	-	2	0.4
No Facility/Bush/Field	-	-	-	-	-	-
Ventilated Improved Pit	22	5.2	1	2.6	23	4.9
Pit latrine with slab	6	1.4	1	2.6	7	1.5
Pit latrine without slab/Open Pit	5	1.2	-	-	5	1.0
Antipolo	2	0.5	-	-	2	0.5
Total	425	100	39	100	464	100

Figure 66: Toilet Facility by Type and Access



A total of 349 or 75 percent respondents from commercial and household surveyed used a flush to owned septic tank toilet facility.

Table 171: Shared Toilet Facility

Shared Toilet Facility w/ others	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Yes	69	16.2	7	17.9	76	16.3
No	341	80.2	29	74.4	370	79.7
No Response	15	3.5	3	7.7	18	3.8
Total	425	100	39	100	464	100

As presented in **Table 172**, 80 percent of the household respondents do not share their toilet facility to neighbors. Although 16 percent practice sharing of toilets.

Table 172: Willingness to Construct Own Sanitary Toilet

	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Willingness to Construct Own Sanitary Toilet						
Yes	199	46.8	13	33.3	212	45.6
No	74	17.4	3	7.7	77	16.5
No Response	152	35.8	23	59	175	37.7
Total	425	100	39	100	464	100
Space for constructing Own Sanitary Toilet						
Yes	167	39.3	12	30.8	179	38.5
No	40	9.4	1	2.6	41	8.8
No Response	218	51.3	26	66.7	244	52.5
Total	425	100	39	100	464	100

By means of their willingness to construct own sanitary toilet, 45 percent of the total respondents expressed their idea to have and build own sanitary toilet. A few 16 percent expressed none willingness to build their own sanitary toilet. Hence, about 38 percent of the total respondents expressed having enough space for toilet construction.

Figure 67: Willingness, and Availability of Space to Construct Own Sanitary Toilet

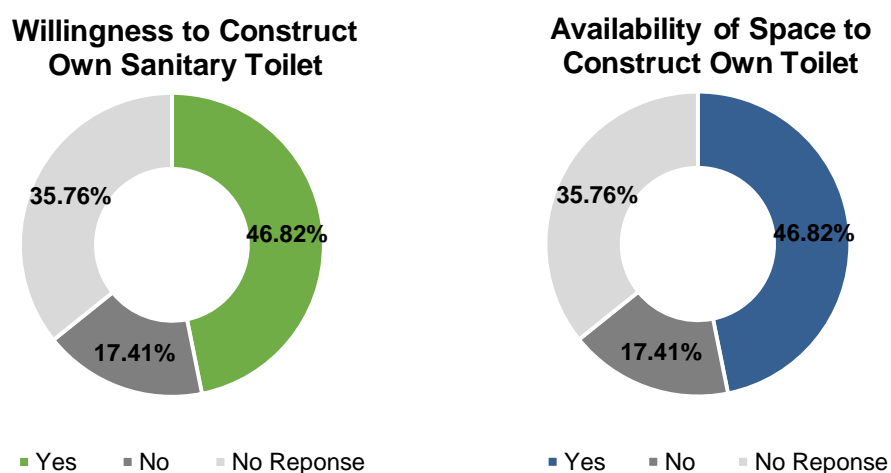
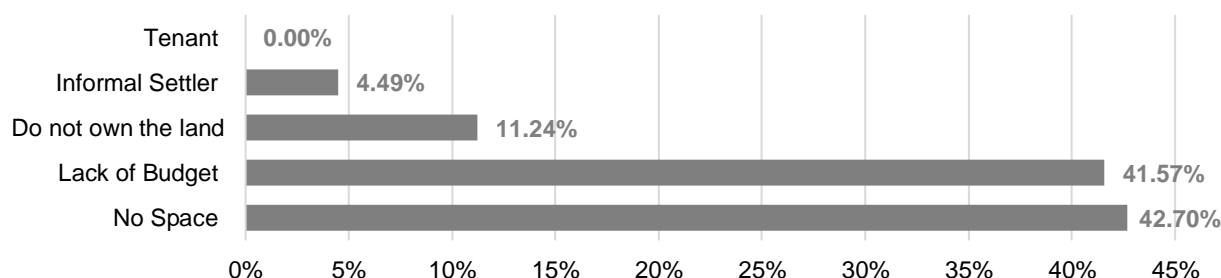


Figure 68: Reason for Not Installing Own Toilet Facility



Presented in **Table 173** are the reasons of the respondents for not installing own toilet facility. As shown, roughly 8 percent of the total respondents conveyed budget constraint in construction of toilet. Other 8 percent expressed lacking required space for the construction, whereas about 2 percent do not own the land. Less than 1 percent are for the reason that they are tenant and/or informal settlers of the place.

Table 173: Reasons for not Installing Own Toilet Facility

Reasons for not Installing Own Toilet Facility	Household		Commercial		Total	
	No.	%	No.	%	No.	%
No Space	38	8.9	-	-	38	8.1
Lack of Budget	37	8.7	-	-	37	7.9
Do not own the land	10	2.4	1	2.6	11	2.3
Informal Settler	4	0.9	-	-	4	0.8
Tenant	-	-	1	2.6	1	0.2
No Response	336	79.1	37	94.9	373	80.3

Reasons for not Installing Own Toilet Facility	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Total	425	100	39	100	464	100

A total of 297 or 64 percent respondents from commercial and household surveyed expressed that their septic tanks does not have outlet or septic tank bottom is open. Other 12 percent allows waste water to soak into the ground, 7 percent uttered that their effluent goes to drainage canal, while 4 percent go directly to body of water.

Table 174: Effluent Discharge Point

Effluent Discharge Point	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Soakage Pit	55	12.9	4	10.3	59	12.7
Drainage Canal	27	6.4	6	15.4	33	7.1
Direct to body of water	21	4.9	-	-	21	4.5
No Outlet or Underground	272	64	25	64.1	297	64.0
No Response	50	11.8	4	10.3	54	11.6
Total	425	100	39	100	464	100

Based on the data presented in **Table 175**, roughly 58 percent of the respondents from commercial and household surveyed have concrete septic tank, whereas 31 percent conveyed the opposite.

Table 175: Concrete Septic Tank

Concrete Septic Tank	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Yes	241	56.8	24	61.5	265	57.1
No	136	32	11	28.2	147	31.6
No Response	48	11.2	4	10.3	52	11.2
Total	425	100	39	100	464	100

Also vital for septage planning is the size or capacity of the septic tank. However, due to Covid-19 pandemic, enumerators refrain from entering premises. Thus, most information was provided by the respondents as they did not allow the enumerators to get inside their premises.

Table 176 presents the size of septic tanks in terms of length, width and depth. A total of 154 or 31 percent of the accounted septic tanks (combined households and commercial establishments) has length in the range of 2 meters below, 28 percent between 2.1 to 5 m, 11 percent from 5.1 meters and above.

Pertaining to septic tanks width, a total of 155 or 33 percent has width in the range between 2.1 to 5m; while 28 percent in the range 2 meters and below, and nearly 9 percent between 5.1 meters and above. It was also accounted that the total respondents' septic tanks depth in the range 2.1 to 5m' reached nearly 35 percent, while 21 percent is in the range 2 meters below, and around 16 percent in the range 5.1 meters and above.

Table 176: Size of Septic Tank

Septic Tank Size	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Length of Septic Tank						
2 meters below	144	33.9	10	25.6	154	30.9
2.1 meters to 5 meters	119	28	17	43.6	136	28.4
5.1 meters above	35	8.2	1	2.6	36	10.8
No Response	127	29.9	11	28.2	138	30
Total	425	100	39	100	464	100
Width of Septic Tank						
2 meters below	112	26.4	20	51.3	132	28.4
2.1 meters to 5 meters	148	34.8	7	17.9	155	33.4
5.1 meters above	39	9.2	1	2.6	40	8.6
No Response	126	29.6	11	28.2	137	29.5
Total	425	100	39	100	464	100
Depth of Septic Tank						
2 meters below	79	18.6	18	46.2	97	20.9
2.1 meters to 5 meters	154	36.2	6	15.4	160	34.5
5.1 meters above	68	16	6	15.4	74	15.9
No Response	124	29.2	9	23.1	133	28.6
Total	425	100	39	100	464	100

Based on the survey, the existing septic tanks mostly have one or two chambers both from commercial establishments and household. Less than 1 percent responded that their septic tanks have three or four compartments.

Table 177: Septic Tank Chamber

No. of Chamber of Septic Tank	Household		Commercial		Total	
	No.	%	No.	%	No.	%
One	224	52.7	13	33.3	237	51.1
Two	158	37.2	21	53.8	179	38.5
Three	1	0.2	-	-	1	0.2
Four	1	0.2	-	-	1	0.2
No Response	41	9.6	5	12.8	46	9.9
Total	425	100	39	100	464	100

The survey indicates that 68 percent from the total respondents expressed that their septic tanks have manhole through which suction pipe for desludging can be introduced, while 21 percent do not have manhole as reflected in **Table 178** below. Only 10 percent of the respondents has not responded whether their septic tanks have manhole.

Table 178: Manhole Provision

Manhole Provision	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	289	68	27	69.2	316	68.1
No	91	21.4	9	23.1	100	21.5
No Response	45	10.6	3	7.7	48	10.3
Total	425	100	39	100	464	100

Table 179: Septic Tank Location

Septic Tank Location	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Outside the house/building/accessible, can be desludge	302	71.1	28	71.8	330	71.1
Outside the house/building/not accessible, cannot be desludge	54	12.7	5	12.8	59	12.7
Inside the house/room, accessible, can be desludge	15	3.5	1	2.6	16	3.4
Inside the house/room, accessible, cannot be desludge	7	1.6	-	-	7	1.5
No Response	47	11.1	5	12.8	52	11.2
Total	425	100	39	100	464	100

Access to septic location is critical for desludging operation. Hence, the location of septic tanks was inquired. About 71 percent of the total respondents conveyed that their septic tanks are located outside the structure and accessible while (1.5 percent) under their room.

Out of the 464 respondents, majority (79 percent) showed no response and only 14 percent were able to desludge their septic tanks but forgot when was the last time their septic tanks were desludged. Only 2 percent practiced desludging after 6 years, while nearly 5 percent after 5 years. And yet 56 percent disclosed that septic tanks was never been emptied and roughly 7 percent responded that new septic tank is constructed when full, particularly in residential areas of Bolong, Cacao, Calabasa, Calarian, Campo Islam, Cawit, Curuan, Guisao, Latuan, Lumayang, Lumbangan, Malagutay, Mercedes, San Jose Gusu, San Roque, Santa Barbara 1, and Tumaga, Zambowood.

Some households abandoned their septic vaults once completely filled-up or clogged-up.

Table 180: Septic Tank Desludging

Particular	Household		Commercial		Total	
	No.	%	No.	%	No.	%
YES, emptied....						
Yes, within the last 5 years	28	6.6	3	7.7	31	4.7
Yes, more than 6 years ago	8	1.9	4	10.3	12	2
Don't know when	59	13.9	5	12.8	64	14
No Response	330	77.6	27	69.2	357	79.3
Total	425	100	39	100	464	100
Not, emptied....						
No, never emptied	242	56.9	19	48.7	261	56.2

Particular	Household		Commercial		Total	
	No.	%	No.	%	No.	%
No, full and new septic tank has been constructed	28	6.6	4	10.2	32	6.8
No Response	155	36.5	16	41.0	171	36.8
Total	425	100	39	100	464	100

Of the 62 respondents that observed desludging, 4 percent claimed that their septic tank emptying is done every 2 years or more. Only 2 percent claimed that their septic tank emptying is done once a year and every 5 years. Less than 2 percent claimed that their septic tank emptying is done every 3 or 4 years.

Table 181: Frequency of Desludging

Frequency of Desludging	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Once a year	13	3.1	-	-	13	2.8
Every 2 years	19	4.5	-	-	19	4.1
Every 3 years	4	0.9	5	12.8	9	1.9
Every 4 years	4	0.9	3	7.7	7	1.5
Every 5 years	10	2.3	-	-	10	2.1
More than 5 years	-	-	4	10.3	4	0.8
No Response	375	88.2	27	69.2	402	86.6
Total	425	100	39	100	464	100

Majority of the respondents both household and commercial (88 percent) cannot recall how much did they pay in desludging septic tank. Only few spent less than PhP3,000 - PhP5,000 (7 percent), others spent between PhP1,000 – PhP2,999 (3 percent). While, less than 1 percent spent above PhP5,000.

Table 182: Cost of Desludging

Cost of Desludging	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
PhP1,000 - PhP2,999	30	7.1	2	5.1	32	3.2
PhP3,000 - PhP5,000	24	5.6	7	17.9	31	6.8
PhP5,001 – PhP7,500	2	0.5	-	-	2	0.5
PhP7,5001 – PhP10,000	1	0.2	-	-	1	0.2
PhP10,001 – PhP15,000	2	0.5	-	-	2	0.5
PhP15,001 and above	4	0.9	-	-	4	0.9
Don't Know	362	85.2	30	76.9	392	88.1
Total	425	100	39	100	464	100

Table 183: Septic Tank Compliance

Willingness to Install New Septic Tank in Compliance with DOH Guidelines	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	246	57.9	24	61.5	270	58.1
No	38	8.9	3	7.7	41	9
Maybe	40	9.4	4	10.3	44	9.4
No Response	101	23.8	8	20.5	109	23.4
Total	425	100	39	100	464	100

More than half of the total respondents 270 (58 percent) are willing to install/retrofit their septic tanks in compliance with the DOH guidelines. Only a few (9 percent) are not willing as well as those indecisive.

Table 184: Space of Installing/Retrofitting Septic Tank

Space for Installing/Retrofit Septic Tank	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	228	53.6	22	56.4	250	55.4
No	24	5.6	2	5.1	26	5.2
No Response	173	40.7	15	38.5	188	39.4
Total	425	100	39	100	464	100

Correspondingly, more than half of the respondents also claimed that they have space within their property for installation or to retrofit their septic tank in compliance to DOH guidelines. A couple of 5 percent said no, while others haven't responded to the question.

Table 185: Reasons for not Installing Septic Tank

Reasons for not Installing/Retrofit Septic Tank	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
No Space	27	6.4	1	2.6	28	6.3
Lack of Budget	75	17.7	1	2.6	76	17.2
Do not own the land	14	3.3	-	-	14	3.2
Informal Settler	22	5.2	4	10.2	26	2.9
No Response	287	67.5	33	84.6	320	69
Total	425	100	39	100	464	100

For those respondents not willing to install/retrofit septic tank because of budget constraint (17 percent), other 6 percent said that they don't have space for it, and about 3 percent are informal settlers plus they do not own the land they live in.

Table 186: Cost of New Septic Tank

Cost of New Septic Tank	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Php1,000 - Php2,999	4	0.9	-	-	4	0.9
Php3,000 - Php5,000	25	5.9	3	7.7	28	6

Cost of New Septic Tank	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
PhP5,001 - PhP7,500	35	8.2	7	17.9	42	9.1
PhP7,501 - PhP10,000	45	10.6	6	15.4	51	11
PhP10,001 - PhP15,000	73	17.2	7	17.9	80	17.2
PhP15,001 and Above	32	7.5	1	2.6	33	7.1
Don't Know	210	49.4	14	35.9	224	48.3
No Response	1	0.2	1	2.6	2	0.4
Total	425	100	39	100	464	100

Figure 69: Desludging Practices

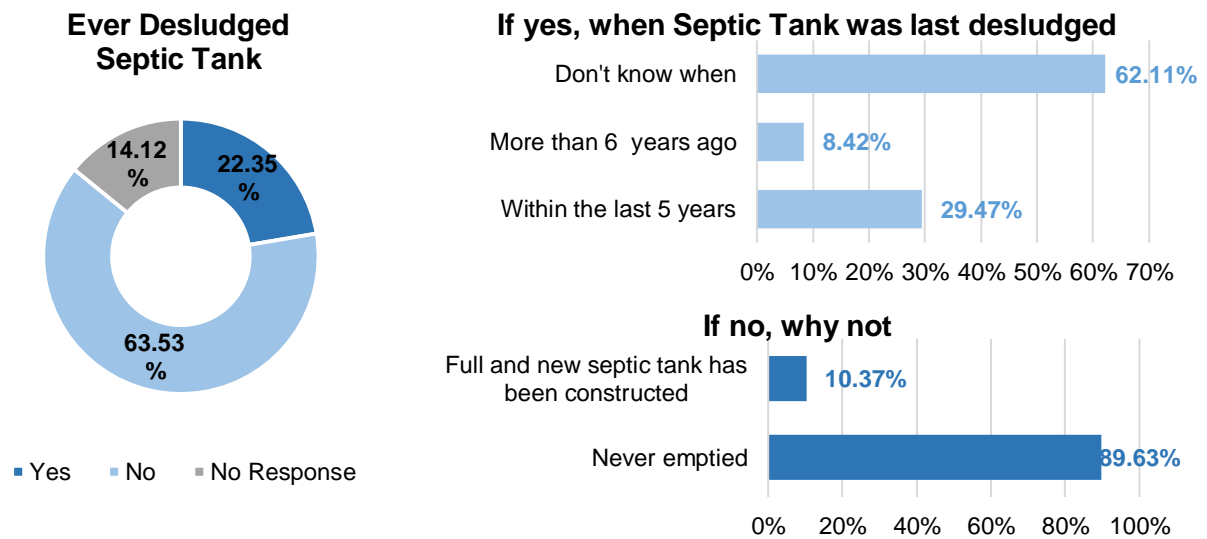


Figure 70: Amount Spent for Desludging Service (in PhP)

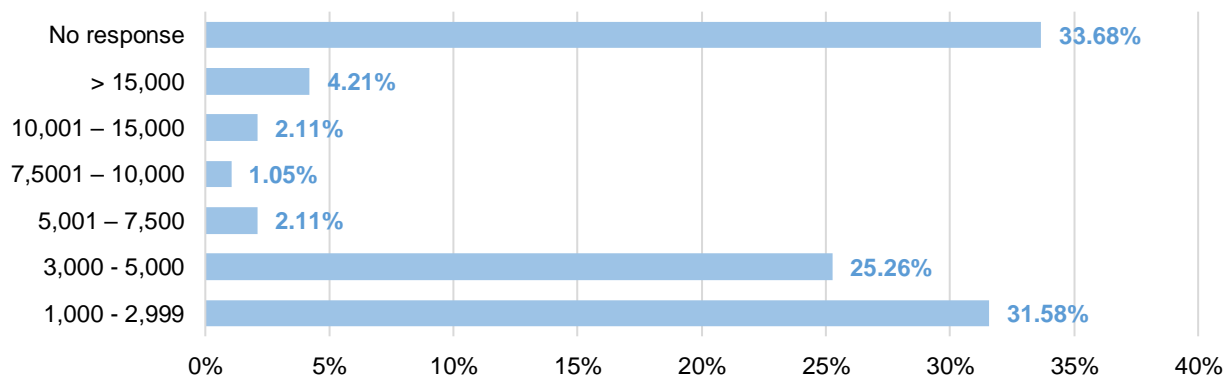


Figure 71: Willingness, and Availability of Space to Construct / Retrofit Septic Tank

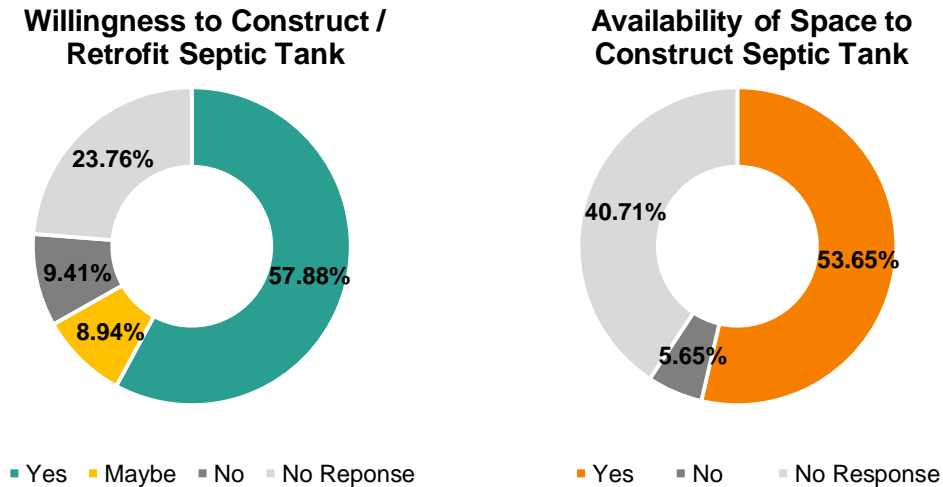
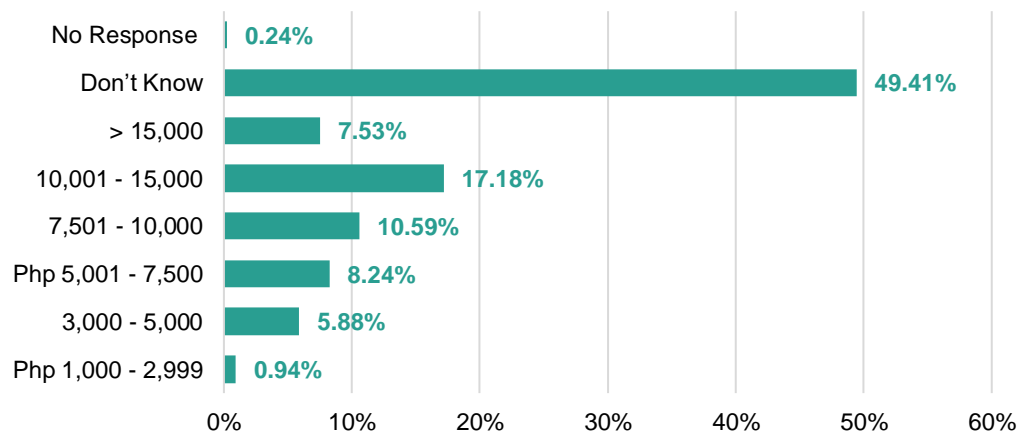


Figure 72: Amount Willing to Pay for Septic Tank Construction (in PhP)



Around 48 percent of the respondents does not have idea on the cost of constructing a new septic tank. Nevertheless, 17 percent claimed that the cost for construction will range between PhP10,001 to PhP15,000, 11 percent between PhP7,501 - PhP10,000, 9 percent between PhP5,001 - PhP7,500, 7 percent between PhP15,001 and above, 6 percent between PhP3,000 - PhP5,000. Less than 1 percent claimed that cost range between PhP1,000 - PhP2,999.

IEC

Table 187 below indicates that majority of the total respondents (84 percent), are aware of the local city ordinance on sanitation.

Table 187: Ordinance Awareness

Knowledge of Local Ordinance on Sanitation	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Yes	359	84.5	30	76.9	389	83.8

Knowledge of <i>Local Ordinance on Sanitation</i>	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
No	58	13.6	9	23.1	67	14.4
No Response	8	1.9	-	-	8	1.7
Total	425	100	39	100	464	100

More than half of the total respondents conveyed that they are aware of the Septage Management Program introduced by the City of Zamboanga.

Table 188: Septage Management Program Awareness

Awareness of Septage Management Program of LGU	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Yes	251	59.2	16	41	267	57.5
No	150	35.4	20	51.3	170	36.6
No Response	24	5.6	3	7.7	27	5.8
Total	424	100	39	100	463	100

More number of respondents (58 percent) perceive that proper waste disposal can lessen water pollution. Other respondents of about 14 percent understands that desludging will reduce occurrence of water-borne diseases and 13 percent believes it will prevent overflowing of septic tanks.

Table 189: Septage Management Benefits

Septage Management Benefits	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
To lessen water pollution	252	59.3	21	53.8	273	58.8
To prevent overflow of septic tanks	57	13.4	6	15.4	63	13.6
To reduce occurrence of water-borne diseases	59	13.9	10	25.6	69	14.9
No Response	57	13.4	2	5.1	59	12.7
Total	425	100	39	100	464	100

Among the three environmental concerns, several respondents (78 percent) from commercial and household responded that water supply is their main concern or priority above all. On the other hand, toilet facility/sanitation and solid waste disposal follows.

Figure 73: Reason for not constructing/retrofitting septic tank

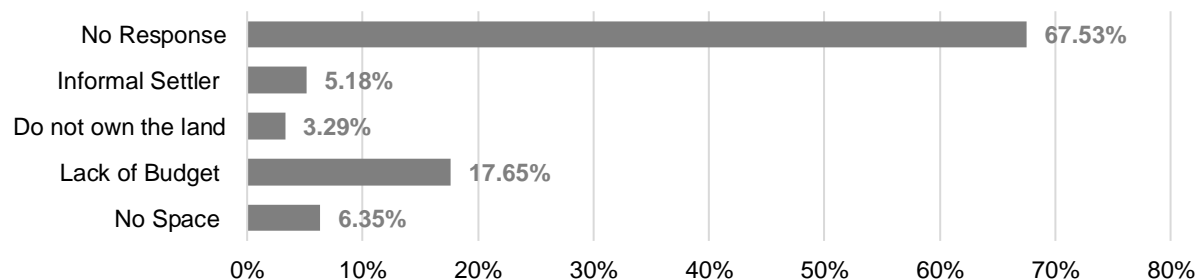


Table 190: Environmental Concerns

Environmental Concern Priority	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
Water Supply						
Rank 1	331	77.9	34	87.2	365	78.6
Rank 2	39	9.2	3	7.7	42	9.1
Rank 3	6	1.4	-	-	6	1.3
No Response	49	11.5	2	5.1	51	11
Total	425	100	39	100	464	100
Toilet Facility						
Rank 1	120	28.2	4	10.3	124	27.7
Rank 2	227	53.4	27	69.2	254	54.1
Rank 3	19	4.5	6	15.4	25	5.4
No Response	59	13.9	2	5.1	61	12.8
Total	425	100	39	100	464	100
Solid Waste Disposal						
Rank 1	48	11.3	2	5.1	50	11
Rank 2	16	3.8	5	12.8	21	4.5
Rank 3	298	70.1	30	76.9	328	70.7
No Response	63	14.8	2	5.1	65	13.7
Total	425	100	39	100	464	100

As presented in **Table 191**, more than half (57 percent) of the total respondents shared the same reason for having the need to install sanitary toilet facilities for their own family only. The other 25 percent responded that installing sanitary toilet facilities for a clean and safe environment, and 14 percent knows that it would protect the health of their family members.

Table 191: Reason/s For Needing to Install Sanitary Toilet Facilities

Reason/s For Needing To Install Sanitary Toilet Facilities	Household		Commercial		Total	
	No.	%	No.	%	No.	%
To have own toilet facility for the family	243	57.2	21	53.8	264	57
To have clean and safe environment	104	24.5	11	28.2	115	24.8
To protect the health of the family members	60	14.1	6	15.4	66	14.2
No Response	18	4.2	1	2.6	19	4
Total	425	100	39	100	464	100

Table 192: Need to Connect Sanitary Toilet Facility to a Septic Tank

Need to Connect Sanitary Toilet Facility to a Septic Tank	Household		Commercial		Total	
	No.	%	No.	%	No.	%
To avoid ground water contamination	317	74.6	30	76.9	347	74.8
To contain human excreta prior disposal	76	17.9	8	20.5	84	18.1
Don't Know	13	3.1	-	-	13	2.8
No Response	19	4.5	1	2.6	20	4.3
Total	425	100	39	100	464	100

Based on the survey conducted, 75 percent of the total respondents perceived the need to connect sanitary toilet facility to septic tank in order to avoid ground water contamination. Some of them (18 percent) sees to contain human waste prior to disposal and a few don't even know the purpose of it.

Table 193: Impacts of Poor Sanitation Systems and Practices

Impacts of Poor Sanitation Systems and Practices	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Ground Water Contamination	241	56.7	27	69.2	268	58
Surface Water Contamination	24	5.6	3	7.7	27	5.8
Foul Odor of Drainage System	78	18.4	6	15.4	84	18
Increase in incidence for Water-Borne Diseases	47	11.1	2	5.1	49	10.5
Increase Medical Expenses	3	0.7	-	-	3	0.6
Don't Know	7	1.6	-	-	7	1.5
No Response	25	5.9	1	2.6	26	5.6
Total	425	100	39	100	464	100

Respondents both from commercial and household (58 percent) believed that poor sanitation system and practices possibly contaminates groundwater, 18 percent responded that it makes foul odor from the drainage system, roughly 11 percent also believes that it will increase the incidence of water-borne diseases, 5.8 percent it could contaminate the surface water. Less than 1 percent noted that it may increase medical expenses, while the remaining does not know the possible impact.

Willingness to Pay

A significant 58 percent of respondents both households and commercial establishments are willing to avail and pay for desludging services being offered by Zamboanga City Water District. Reasons for not availing the program is presented in **Table 194**, wherein 31 percent responded due to cost of services.

Table 194: Willingness to Pay for Desludging Services

Willingness to Avail Pay for the Regular Desludging Services	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Yes	237	55.8	33	84.6	270	58
No	157	36.9	6	15.4	163	35
No Response	31	7.3	-	-	31	7
Total	425	100	39	100	464	100

Table 195: Reasons for Not Willing to Pay

Reasons Not Willing to Avail & Pay for Regular Desludging Services	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Cost of services	150	35.3	4	10.3	154	31.1
Temporary Resident Only	10	2.4	2	5.1	12	2.7
Renting	8	1.9	1	2.6	9	2
I don't understand the program	8	1.9	1	2.6	9	2
No Response	249	58.6	31	79.4	280	61.3
Total	425	100	39	100	464	100

Table 196: Water District Customers

Customer of Water District	Household		Commercial		Total	
	No.	%	No.	%	No.	%
Yes	202	47.5	21	53.8	223	48
No	163	38.4	15	38.5	178	38.4
No Response	60	14.1	3	7.7	63	13.6
Total	425	100	39	100	464	100

Based in the survey results, 48 percent of the households are connected to Zamboanga City Water District and are willing to pay together with monthly water bill (**Table 197**). Though, there are 38 percent of the households not connected to ZCWD.

Table 197: Mode of Payment Preference

Mode of Payment Preference	Household		Commercial		Total	
	No.	%	No.	%	No.	%
One-time payment to Water District per Job Order	50	11.8	5	12.8	55	11.8
Monthly payment together with water bill	142	33.4	18	46.2	160	34.5
No Response	233	54.8	16	41.0	249	53.7
Total	425	100	39	100	464	100

To sum-up, there are only 127 respondents willing to pay with varying amount compared to those respondents who showed no response pertaining to the amount they would like to pay per job order (**Table 197**). The respondents particularly in rural barangay who are willing to avail of the services however conveyed that they could not afford the price of the desludging services.

Table 198: Amount to Pay per Job Order

Amount Willing to Pay per Job Order	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
PhP100	19	4.5	2	5.1	21	4.5
PhP200	23	5.4	4	10.3	27	5.8
PhP300	13	3.1	3	7.7	16	3.4
PhP 500 - 1000	36	8.5	1	2.6	37	8
PhP1001 - 2000	15	3.5	2	5.1	17	3.7
PhP2001 - 3000	10	2.4	-	-	10	2.2
PhP3001 - 5000	11	2.6	1	2.6	12	2.6
No Response	298	70.1	26	66.7	324	69.8
Total	425	100	39	100	464	100

Likewise, several respondents (58 percent) showed no response pertaining on the amount they would like to pay per month for regular desludging every 4 years. To consolidate, there are 42 percent willing to pay for regular desludging with varying amount. Less than 1 percent responded willing to pay Php 200 monthly for regular desludging of septic tank (**Table 199**).

Table 199: Amount to Pay per Month

Amount Willing to Pay per month for Desludging	Household		Commercial		Total	
	Number	Percent	Number	Percent	Number	Percent
PhP200	-	-	2	5.1	2	0.4
PhP150	34	8	6	15.4	40	8.7
PhP100	37	8.7	1	2.6	38	8.1
PhP80	28	6.6	4	10.3	32	6.9
PhP60	71	16.7	8	20.5	79	17
PhP50	5	1.2	-	-	5	1
No Response	250	58.8	18	46.2	268	57.8
Total	425	100	39	100	464	100

ANNEX 2: SITE EVALUATION REPORT

Three candidate sites were identified by the Zamboanga City Water District (ZCWD) for the development of the proposed Septage Treatment Plant (SpTP). The three proposed site locations are located in Barangays Boalan, Mercedes, and Cabatangan, respectively. shows the location map of these sites.

Site visits were conducted by the study team on all sites on 24 August 2021. This annex discusses the data gathered during the site visits and from additional secondary data used to evaluate the locations.

Candidate SpTP Sites

Comparison of the alternative sites is summarized in **Table 200** and the supporting maps are shown in **Figure 74** to **Figure 78**.

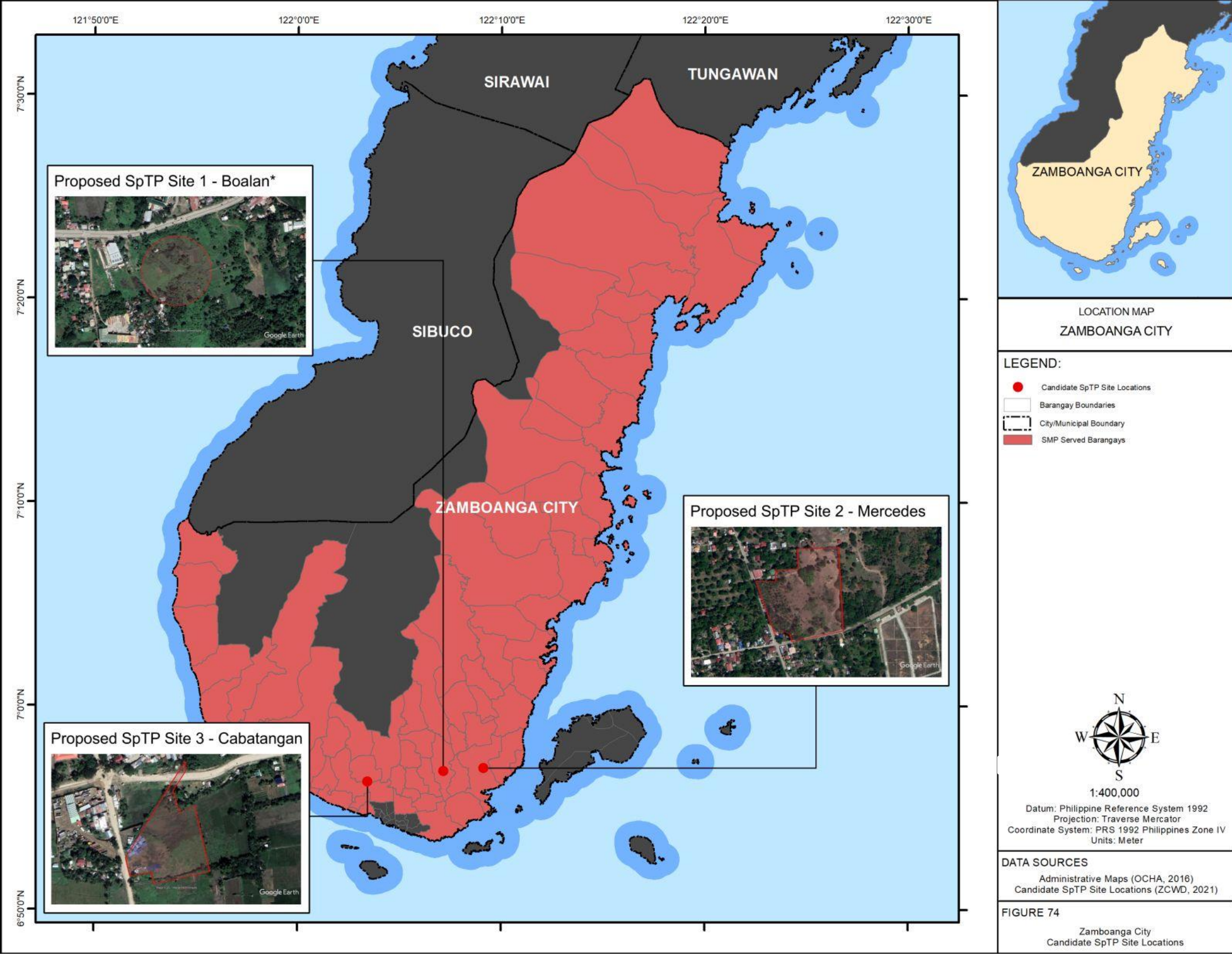
Table 200: Comparison of Candidate SpTP Sites

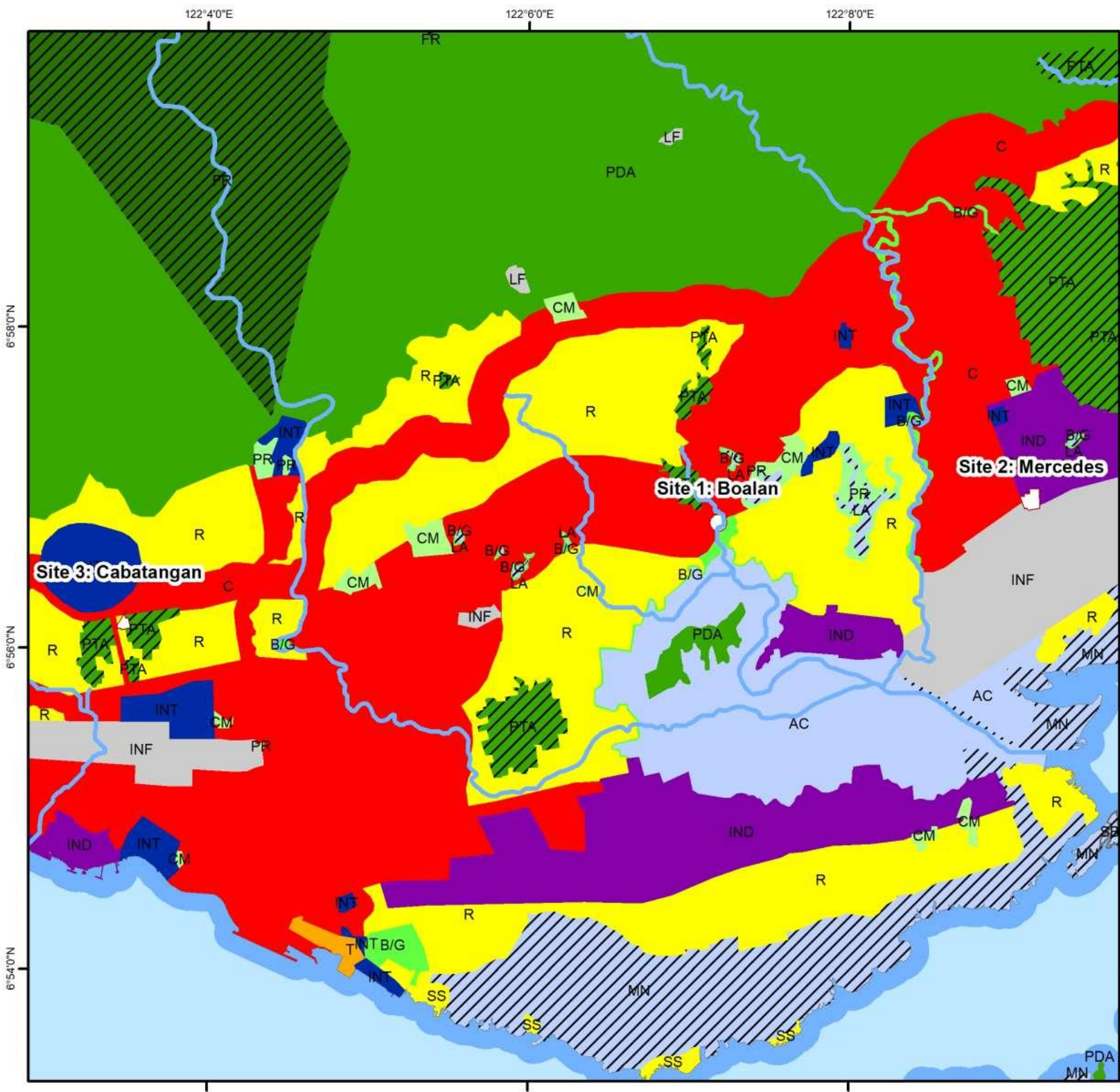
Parameter	Candidate SpTP Site		
	Site 1 Boalan	Site 2 Mercedes	Site 3 Cabatangan
I. Location			
4. Address	Maria Clara Lorenzo Lobregat Highway (National Highway), Barangay Boalan	Arcillas, Barangay Mercedes	Lupong Road, Barangay Cabatangan
5. Owner	Private Property/ under negotiation with ZCWD	ZCWD	ZCWD
6. Approximate Cost of Land	Approximately 3,000 PhP/m ²	Approximately 2,500 PhP/m ²	Approximately 2,800 PhP/m ²
7. Coordinates	6°56'47.06"N, 122° 7'11.10"E	6°56'55.37"N, 122° 9'8.38"E	6°56'15.25"N, 122° 3'27.06"E
II. Area capacity and space availability			
3. Area	1.12 ha	4.05 ha	1.61 ha
4. Surrounding area available for expansion?	Yes	Yes	Yes
III. Local Zoning			
3. Current Land Use/ Zoning	Commercial/Industrial	Industrial/Commercial	Agricultural/ Residential
4. Nearby Establishments	None	Concrete batching plant	None
IV. Availability of Utilities			
3. Power	Available	Available	Available
4. Water	Available	Available	Available
V. Topography			

Parameter	Candidate SpTP Site		
	Site 1 Boalan	Site 2 Mercedes	Site 3 Cabatangan
2. Topography	Flat	Flat	Flat
3. Elevation	3-5 masl	16-18 masl	11-13 masl
4. Slope	0-3 percent (level to nearly level)	0-3 percent (level to nearly level)	0-3 percent (level to nearly level)
VI. Proximity to Water Sources			
3. Groundwater Sources	ZCWD Production Well within lot	None	Non-operational production well (due to copper concentration)
4. Surface Water Sources	None	1.5 km from Mercedes River	None
VII. Receiving Water Body/Drainage (for treated effluent)	Drainage Canal	Mercedes River	NIA Canal
VIII. Natural Hazards			
3. Landslide	None	None	None
4. Flood	High	Low to Moderate	Moderate to High
IX. Accessibility			
5. Access road/ Right of way	Available	Available	Available
6. Estimated average hauling distances (km)	~9.76 km	~14.10 km	~8.84 km
7. Main access road width (range of most narrow to widest)	~15 m (four-lane)	6 m	~ 9 m
8. Main access road condition	National road, concrete & good condition	Municipal/barangay road, concrete & good condition	Municipal/barangay road, concrete & good condition
9. Traffic situation of main access road	None	None	None

Notes. Cost of land was approximated based on online listings.

Photos taken during the site assessment are presented in **Figure 79**, **Figure 80**, and **Figure 81** for Site 1 (Boalan), Site 2 (Mercedes), and Site 3 (Cabatangan), respectively.

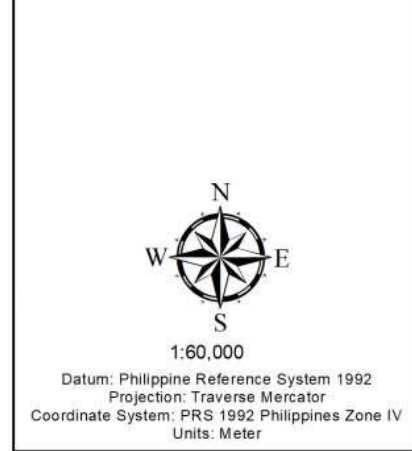




LOCATION MAP
ZAMBOANGA CITY

LEGEND:

River/Creek	Aquaculture
Candidate SpTP Sites	Protected Waters
Urban Land Uses	Mangrove
Residential	Lakes
Silt Settlement	Seagrass Beds
Commercial	Agriculture
Industrial	Protection Agricultural
Institutional	Production Agricultural
Tourism	Forest
Parks and Recreation	NIPAS: Multiple Use (Production Forest)
Buffer/Greenbelt	Forest Reserve (Protection Forest)
Cemetery/Memorial Park	
Infrastructure/Utilities	
Landfill/Dumpsite	



DATA SOURCES
Urban Land Use (CPDO, 2016)
Candidate SpTP Sites (ZCWD, 2021)

FIGURE 75
Land Use Map of Candidate SpTP Sites



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

- River/Creek
 - Candidate SpTP Sites
 - Study
- Contours (masl)
- 50
 - 100
 - 200
 - 300
 - 400
 - 500



1:60,000

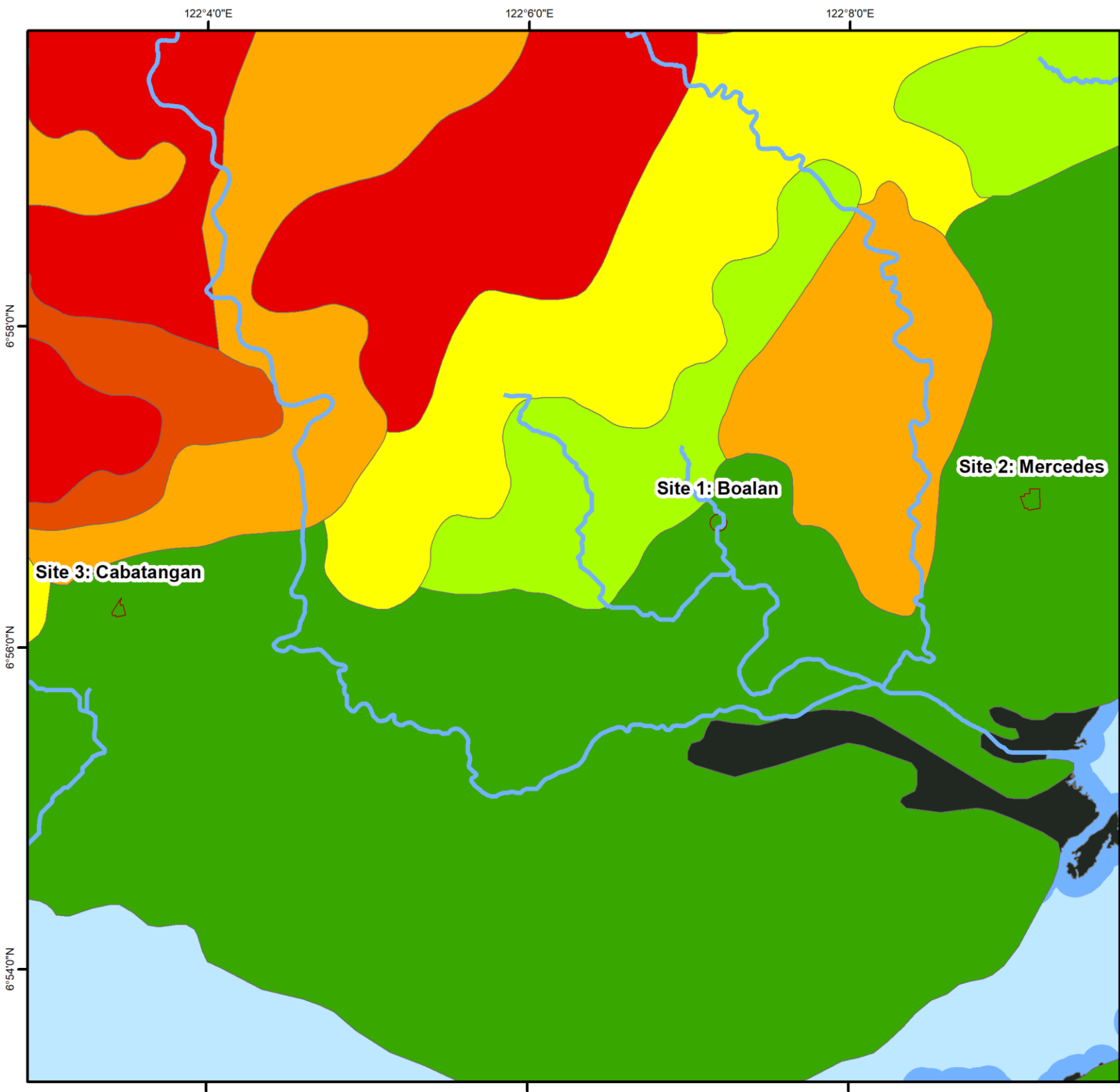
Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES

Contours (PhilGIS, 2013)
Candidate SpTP Sites (ZCWD, 2021)

FIGURE 76

Topographic Map of Candidate SpTP Sites



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

— River/Creek
□ Candidate SpTP Sites

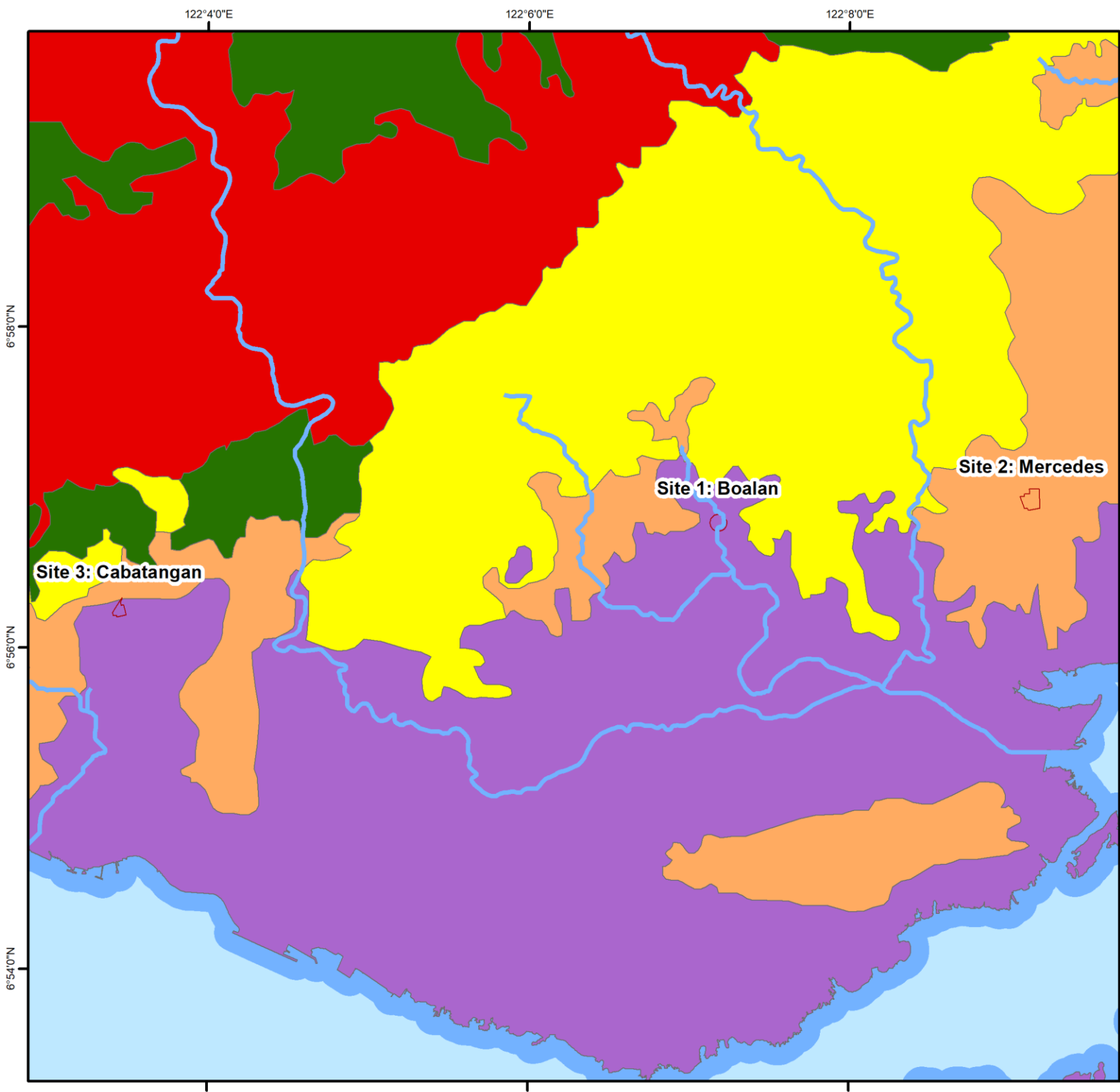
Slope Classification

0-3 (Level to nearly level)
3-8 (Gently sloping to)
8-18 (Undulating to rolling)
18-30 (Rolling to moderately)
30-50 (Steep)
50 and above (Very Steep)

1:60,000
Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES
Slope Classifications (PhilGIS, 2013)
Candidate SpTP Sites (ZCWD, 2021)

FIGURE 77
Slope Map of Candidate SpTP Sites



LOCATION MAP
ZAMBOANGA CITY

LEGEND:

- River/Creek
- Candidate SpTP Sites
- Flood Susceptibility**
 - High
 - Low to Moderate
- Landslide Susceptibility**
 - High
 - Moderate
 - Low

1:60,000

Datum: Philippine Reference System 1992
Projection: Traverse Mercator
Coordinate System: PRS 1992 Philippines Zone IV
Units: Meter

DATA SOURCES
Geohazards Map (MGB, 2010)
Candidate SpTP Sites (ZCWD, 2021)

FIGURE 78
Hazard Map of Candidate SpTP Sites

Figure 79: Photos of Site Assessment for Site 1 (Boalan)

Site 1 (Boalan)



Entrance to Private Property



Drainage and Road Access to site

Figure 80: Photos of Site Assessment for Site 2 (Mercedes)

Site 2 (Mercedes)



Site 2 (Mercedes)



Nearby Concrete Batching Plant



Condition of Access Road (West)¹



Condition of Access Road (South)¹

Note. ¹ Access Road photos taken from Google Earth.

Site 2 (Mercedes)



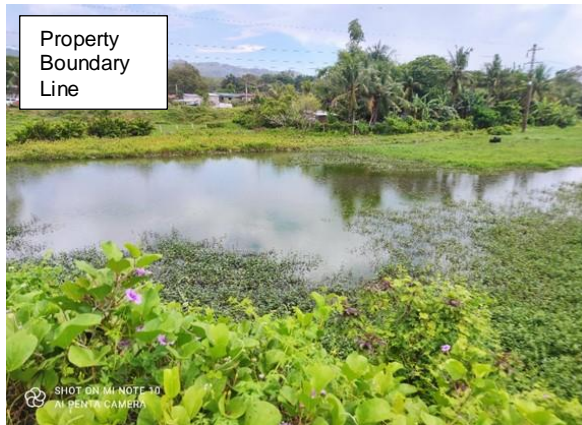
Mercedes River (6°57.419 N, 122°8.47 E)

Figure 81: Photos of Site Assessment for Site 3 (Cabatangan)

Site 3 (Cabatangan)



Site 3 (Cabatangan)



NIA Canal



Nearby Access to Power



Nearby Non-Operational Production Well



Condition of Access Road

Evaluation of Sites

Candidate SpTP sites were evaluated by the Study Team by cost comparison as shown in **Table 201**. Significant differences in costs can be attributed to the CAPEX and OPEX attributed to the vacuum truck units (VTUs) and their operations due to the varying distances of the proposed sites

from the proposed coverage barangays. Based on this comparison, Site 3 (Cabatangan) was found to be the most cost-effective option.

Table 201: Cost Comparison of Candidate SpTP Sites

Cost Item	Candidate SpTP Site		
	Site 1 Boalan	Site 2 Mercedes	Site 3 Cabatangan
CAPEX			
Land Acquisition	4.500	3.750	4.200
Septage Treatment Plant ¹	163.135	163.135	163.135
Vacuum Truck Units	48.643	51.449	45.523
Tota CAPEX	216.278	218.334	212.858
O&M			
Administrative & SpTP Operations	55.478	55.478	55.478
Desludging Operations	62.773	74.235	59.291
Tota O&M	118.252	129.713	114.769
Total PV Cost	334.530	348.047	327.626

Notes.

¹ Land acquisition costs were computed based on online listing prices as presented in **Table 200**.

² Costs for Septage Treatment Plants are ballpark figures, and are the same for all candidate sites.

Upon identification of the recommended site based on cost comparison, the Study Team requested for additional inputs from the ZCWD for the finalization of the proposed site.

ZCWD also conducted an assessment of the candidate sites through a pros and cons list as presented in **Table 202**. ZCWD ultimately concluded that Site 3 (Cabatangan) was most suitable as for the development of the SpTP due to its proximity and accessibility to the service area and potential sanitation residuals users.

Based on the evaluation of both the Study Team and ZCWD, Site 3 (Cabatangan) was identified to be the proposed site location for the Proposed Zamboanga City SpTP.

Table 202: Candidate SpTP Sites Pros and Cons

Candidate SpTP Site	Pros	Cons
Site 1 (Boalan)	<ul style="list-style-type: none"> • 1.1215-hectare private property 	<ul style="list-style-type: none"> • Privately owned/not yet procured by the ZCWD • Classified as commercial area • In the vicinity of the Zamboanga City Integrated Bus Terminal, Toyota, and Wilcon Depot
Site 2 (Mercedes)	<ul style="list-style-type: none"> • 4.065-hectare Property of ZCWD 	<ul style="list-style-type: none"> • The area will be proposed for the construction of production well and other facility should the ZCWD expand its water services to Barangay Mercedes in the near future • 1.24 km away from Mercedes River • 2 km to mangrove area • 14 km away from city proper • Recycled water may not be accessible for distribution
Site 3 (Cabatangan)	<ul style="list-style-type: none"> • 1.6-hectare Property of ZCWD • Proximity to the service area (within 7-km radius of the city proper) • Minimal residential houses • Near the newly constructed ZC Bypass Road, hence more accessible to east and west coast barangays • Recycled water will be within the proximity for firefighting, irrigation, industrial process among others 	<ul style="list-style-type: none"> • Classified as an agricultural area (irrigated rice field) . • The lot is partially backfilled, hence, portion of lot is below the road elevation • There is an existing production well within the vicinity

ANNEX 3: SANITATION RESIDUALS ONLINE SURVEY REPORT

An online survey was conducted to the selected stakeholders in the city to determine the potential reuse applications of the sanitation residual and the willingness of the stakeholders to reuse and pay for the sanitation residuals. The following offices answered the survey.

- Zamboanga City Disaster Risk Reduction and Management Office
- Office of the City Environmental and Natural Resources
- City General Service Office
- National Irrigation Administration in Zamboanga City
- Zamboanga State College of Marine Sciences and Technology

Based on the responses from these offices, it was concluded that the treated effluent can be used as an irrigation water for the National Irrigation Administration, as they already have an irrigation canal within the proposed site. Moreover, the response from NIA suggests that the office is willing to use the treated effluent as an irrigation water.

For the biosolids, two possible options were found; biosolids as a soil amendment/fertilizer or as a soil covering for sanitary landfill. More positive response was gathered by the Study Team for the biosolids reuse. The sanitation residuals online survey is shown at **Figure 82** while the answers of the respondents to the sanitation residuals reuse survey are summarized in **Table 203** and **Table 204**.

Table 203. Summary of the Sanitation Residuals Responses on Treated Effluent

Office	Existing water volume use	Current Water Source	Cost of existing water	Willing to use the treated effluent?	Potential Reuse Applications	Willing to Pay?
ZCDRRMO	-	ZCWD	-	Yes	Firefighting	No
OCENR	0.5 cu.m/day	ZCWD	P 640/ cu.m.	Yes	Agriculture, landscaping, Firefighting, Cleaning of equipment/roads/markets	Yes
CGSO	108 cu.m./month	Private Owner – deep well	P 54.63/ cu.m.	Not sure	-	-
NIA	-	ZCWD	-	Yes	Agriculture, landscaping	Need more info
ZSCMST	-	ZCWD, deep well	-	Yes	Agriculture, landscaping, Firefighting, Cleaning of equipment/roads/markets	Yes

Table 204. Summary of the Sanitation Residuals Responses on Biosolids

Office	Soil/ Fertilizer volume	Current Source of Soil/Fertilizer	Cost of existing soil/fertilizer	Willing to use biosolids?	Reuse Applications	Willing to Pay?
ZCDRRMO	Not s user					
OCENR	-	Biowaste, compost, Mountain/finished product compost	P 37.50/kg	Yes	Agriculture, soil covering for waste materials, backfilling materials, soil conditioner	Yes
CGSO	12 sacks or 600 kg/ year	-	P 20,570/ 600 kg	Not sure	Agriculture	-
NIA	-	-	-	Yes	Agriculture	Need more info
ZSCMST	-	No idea	-	Yes	Agriculture	Need more info

Figure 82. Sanitation Residuals Online Survey

Reuse of Sanitation Residuals

The United States Agency for International Development (USAID) through the Strengthening Urban Resilience for Growth with Equity (SURGE) Project provides technical assistance to Cities Development Initiative (CDI) partner cities, including Zamboanga City, in improving water and sanitation services as part of a larger goal to attain resilient and inclusive economic growth. The SURGE Project is currently conducting a "Pre-Feasibility Study for the Proposed Septage Management Program of Zamboanga City".

In line with this, a meeting was held last August 27, 2021 for the representatives of the potential users of the sanitation facility residuals such as treated effluent and biosolids. With this, we are kindly asking for your inputs regarding the possible usage of treated wastewater and biosolids.

In case of issues and questions regarding the form, please contact Trisha Paniterce at 0917 931 6862 or trisha.paniterce@cest-inc.com.

* Required

1. Name of Organization/Office *

2. Address *

3. Point Person (name) *

4. Contact Number *

5. Email Address *

Current Water Resources

6. Current source of water *

Kasalukuyang pinanggagalingan ng tubig

Check all that apply.

☐ ZCWD

☐ Own water source (sariling tubig)

Other: ☐ _____

7. Do you know the volume of water used per day? *

Alam mo ba ang volume ng ginagamit na tubig sa isang araw?

Mark only one oval.

☐ Yes (Oo)

☐ No (Hindi)

☐ I cannot say at this time (Hindi ko pa masabi)

8. If yes, please indicate volume per day (in cu.m.). Otherwise, put N/A. *

Kung oo, ilagay ang volume sa isang araw (in cu.m.). Kung hindi, isagot ang N/A.

9. Do you know the cost of existing water source? *
- Alam mo ba kung magkano ang presyo ng kasalukuyang ginagamit na tubig?

Mark only one oval.

- ☐ Yes (Oo)
- ☐ No (Hindi)
- ☐ I cannot say at this time (Hindi ko pa masabi)

10. If yes, please indicate the cost (in cu.m.). Otherwise, put N/A. *
- Kung oo, ilagay ang kasalukuyang presyo ng ginagamit na tubig (PHP/cu.m.). Kung hindi, isagot ang N/A.

Skip to question 11

Treated
Effluent
for
Reuse

Treated wastewater or treated effluent is the water discharged from septage and sewage treatment plants. It is usually discharged to bodies of water, but it can also be recycled and used as an alternative source of water. It is used for various applications including, but not limited to, agricultural purposes, landscaping, firefighting, cleaning of equipment/roads/markets.

11. Are you willing to use the treated effluent as a new source of water? *
- Kayo ba ay pumapayag na gumamit "treated wastewater" bilang bagong pagkukunan ng tubig?
- Mark only one oval.
- ☐ Yes (Oo) Skip to question 12
- ☐ No (Hindi) Skip to question 16
- ☐ I don't know if we can commit at this time (Hindi sigurado) Skip to question 16

Treated Effluent for Reuse

12. Possible Treated Wastewater Application in your office/agency *
- Mga posibleng paggamitan ng "treated wastewater" sa inyong opisina o ahensya
- Check all that apply:
- ☐ Agriculture (irigasyon o pandilig ng mga pananim)
- ☐ Landscaping (pandilig ng hardin)
- ☐ Firefighting (pag-apula ng sunog)
- ☐ Cleaning of equipment/roads/markets (panlinis ng kagamitan/daan/pamilihan)
- Other: ☐ _____

13. Do you have a existing tank/reservoir for this purpose? *
- Mayroon ba kayong pwedeng paglagyan na tangke para sa "treated wastewater"?

Mark only one oval.

- ☐ Yes (Meron)
- ☐ No (Wala)
- ☐ I don't know (Hindi ko alam)

14. Do you have existing trucks for the transportation of the needed water? *
- Mayroon ba kayong magagamit na truck para sa pagkuha ng "treated wastewater"?

Mark only one oval.

- ☐ Yes (Meron)
- ☐ No (Wala)
- ☐ I don't know (Hindi ko alam)

15. Are you willing to pay for the treated wastewater? *
- Kayo ba ay pumapayag na magbayad sa paggamit ng "treated wastewater?"

Mark only one oval.

- ☐ Yes (Oo)
- ☐ No (Hindi)
- ☐ I need more information (Kailangan ko pa ng karagdagang impormasyon)

Skip to question 17

Treated Effluent for Reuse

16. What are the reasons why you are hesitant/does not want to use the treated wastewater? *

Ano ang mga dahilan kung bakit ikaw ay nagdadalang-isip o hindi gagamit ng "treated wastewater?"

Check all that apply.

- ☐ Cost (Presyo)
- ☐ Quality of water (Kalidad ng tubig)
- ☐ Unavailability of Storage/Conveyance (Walang imbakan o truck na kukuha ng tubig)
- ☐ Not needed (Hindi kailangan)
- ☐ Handling/safety concerns (Hindi sigurado kung paano ang tamang paraan ng paggamit)

Other: ☐ _____

Skip to question 17

Current Soil/Fertilizer Resources

17. Source of current soil/fertilizer used *

Kasalukuyang pinanggagalingan ng lupa/pataba

18. Do you know the demand/volume for biosolids per day? *
- Alam mo ba ang volume ng kailangang biosolids sa isang araw?

Mark only one oval.

- ☐ Yes (Oo)
- ☐ No (Hindi)
- ☐ I cannot say at this time (Hindi ko pa masabi)

19. If yes, please indicate volume per day (in cu.m.). Otherwise, put N/A. *

Kung oo, ilagay ang volume sa isang araw (in cu.m.). Kung hindi, isagot ang N/A.

20. Do you know the cost of existing soil/fertilizer? *

Alam mo ba ang kasalukuyang presyo ng lupa/pataba?

Mark only one oval.

- ☐ Yes (Oo)
- ☐ No (Hindi)
- ☐ I cannot say at this time (Hindi ko pa masabi)

21. If yes, please indicate the cost (in PhP/cu.m.). Otherwise, put N/A. *

Kung oo, ilagay ang presyo (PhP/cu.m.). Kung hindi, isagot ang N/A.

Skip to question 22

Treated Sludge/Biosolids

Treated sludge is the sludge discharged from the septic and sewage treatment plants for disposal. It can be further treated to be recycled for reuse such as soil covering for sanitary landfill, soil conditioner, fertilizer, backfilling, among others.

22. Are you willing to use biosolids? *
- Kayo ba ay pumapayag na gumamit biosolids?

Mark only one oval.

- ☐ Yes (Oo) Skip to question 23
- ☐ No (Hindi) Skip to question 27
- ☐ I don't know if we can commit at this time (Hindi sigurado) Skip to question 27

Treated Sludge/Biosolids

23. Possible application for biosolids in your office/agency *
- Mga maaring paggamitan ng biosolids sa inyong opisina o ahensya

Check all that apply.

- ☐ Agriculture (pataba sa pananim)
- ☐ Soil covering for waste materials (pantabon ng landfill)
- ☐ Backfilling materials (materyales para sa backfilling)
- ☐ Soil conditioner (pagbabalik ng nutrients sa lupa)
- Other: ☐ _____

24. Do you have a existing storage area/shed for this purpose? *
- Mayroon ba kayong pwedeng paglagyan ng biosolid?

Mark only one oval.

- ☐ Yes (Meron)
- ☐ No (Wala)
- ☐ I don't know (Hindi ko alam)

25. Do you have existing trucks for the transportation of the needed biosolids? *
- Mayroon ba kayong truck para sa pagkuha ng biosolid?

Mark only one oval.

- ☐ Yes (Meron)
- ☐ No (Wala)
- ☐ I don't know (Hindi ko alam)

26. Are you willing to pay for the biosolids? *
- Kayo ba ay pumapayag na magbayad sa paggamit ng biosolids?

Mark only one oval.

- ☐ Yes (Oo)
- ☐ No (Hindi)
- ☐ I need more information (Kailangan ko pa ng karagdagang impormasyon)

Skip to question 28

Treated Sludge/Biosolids

27. What are the reasons why you are hesitant/do not want to use biosolids? *
- Ano ang mga dahilan kung bakit ikaw ay nagdadalwang-isip o hindi gagamit ng "biosolids"?

Check all that apply.

- ☐ Cost (Presyo)
- ☐ Quality of biosolids (Kalidad ng biosolids)
- ☐ Unavailability of Storage/Conveyance (Walang imbakan o truck na kukuha ng biosolids)
- ☐ Not needed (Hindi kailangan)
- ☐ Handling/safety concerns (Hindi sigurado kung paano ang tamang paraan ng paggamit)
- Other: ☐ _____

Reuse of Sanitation Residuals

28. Do you have any comments/suggestions about the reuse of sanitation residuals?
- Mayroon ba kayong mga kumento/suhestyon ukol sa pag-reuse ng mga sanitation residuals?

Thank
you!

Thank you for your time! Your response is a great help to the study team.
For further questions, please contact Trisha Paniterce at 0917 931 6862 or trisha.paniterce@ceest-ilo.com

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Google Forms

Table 205. Raw Data Responses

Office	Existing volume of product used	Current Source	Current cost of product used	Willing to use the product (treated effluent/biosolids)?	Potential Reuse Applications	Existing Storage/trucks for the use of product?	Willing to Pay?
Reuse of Treated Effluent (Raw Data)							
ZCDRRMO	-	ZCWD	-	Yes	Firefighting	Reservoir only	No
OCENR	0.5 cu.m./day	ZCWD	-	Yes	Agriculture, landscaping, Firefighting, Cleaning of equipment/roads/markets	Reservoir only	Yes
OCENR	-	ZCWD	-	Not sure	-	-	-
OCENR	-	ZCWD	-	Not Sure	-	-	-
OCENR	-	ZCWD	PhP 64/cu.m.	Not sure	-	-	-
CGSO	108 cu.m./month	Private Owner - Sta. Maria Deep Well water source	PhP 54.63/cu.m.	Not sure	-	-	Need more info
NIA	-	ZCWD	-	Yes	Agriculture	No	Need more info
ZSCMST	-	ZCWD, deep well	-	Yes	Agriculture, landscaping, Firefighting, Cleaning of equipment/roads/markets	Truck only	Yes
ZSCMST	-	ZCWD	-	Yes	Agriculture, landscaping, Firefighting, Cleaning of equipment/roads/markets	Reservoir only	Need more info
Reuse of Biosolids (Raw Data)							
ZCDRRMO	Not a user	-	-	-	-	-	-
OCENR	-	Biowaste/ organic waste	-	Yes	Agriculture	Truck only	Yes
OCENR	-	Mountain/finished product compost	PhP37.50 /kilo	Yes	Agriculture	Both	No
OCENR	-	-	-	Yes	Soil covering	Truck only	Need more info

Office	Existing volume of product used	Current Source	Current cost of product used	Willing to use the product (treated effluent/biosolids)?	Potential Reuse Applications	Existing Storage/trucks for the use of product?	Willing to Pay?
OCENR	-	Composted soil	-	Yes	Soil covering	Truck only	Need more info
CGSO	12 sacks	complete 1616, Potassium	PhP20,580 /600 kilograms	Not sure	-	-	-
NIA	-	-	-	Yes	Agriculture	No	Need more info
ZSCMST	-	-	-	Yes	Agriculture	Truck only	Need more info
ZSCMST	-	No idea	-	Yes	Agriculture	Storage only	Need more info

ANNEX 4: CONSULTATION MEETING WITH THE ABC AND HOST BARANGAY

Introduction/Background

In accordance with Task 1.4 of the Scope of Work, the Study Team shall meet with the Barangay Captain of the Host Barangay and the Chairman of the Association of Barangay Captains, together with the Water District (WD) of Zamboanga City to introduce the project to the host barangay captain and its local stakeholders. Through this meeting, the Study Team shall also align with the local stakeholders and solicit insights, comments, and suggestions regarding the implementation of the project. The meeting was conducted from 10:00 a.m. to 12:00 n.n. on September 13, 2021 via Zoom.

Objectives

The objectives of the activity are to:

Introduce the project to the Association of Barangay Captains Chairman and the host barangay captain

Present the initial findings and rationale of the chosen site

Solicit insights, comments, and suggestions from these stakeholders

Discuss the importance of the role of the association of their role in the implementation of the project

Methodology/Process

Mode and Hosting

The meeting was conducted virtually through Zoom and hosted by the Study Team. Using the zoom pre-registration function, participants were required to register before joining the Zoom Room. This registration was used for checking the attendance of the participants.

Presentations

The program included a short presentation by Engr. Gerardo Mogol on the background of the project. It was then followed by the discussion of the Pre-Feasibility Study Findings and Results was led by Engr. Eula Pacumio. Lastly, the discussion and consultation on Site Assessment were led by Trisha Paniterce.

Open Forum and Discussion:

Edito M. Bautista Jr. from ZCWD reviewed the data from the Cabatangan Site Evaluation Report. He added that COA is one of the nearby establishments in the site. The site's topography is partially backfilled due to the low elevation compared to the road. Natural hazards can be cross-checked with the maps from the ZCDRRMO.

Coordinate with Engr. Carolyn Torino regarding the contour maps, if available.

Ask DPWH for the data for the incidence of flooding and flood level (for the past 25-50 years), if available

Ms. Genevieve Karen Genel added that based on historical data, Cabatangan is not prone to flooding. Barangay Cabatangan Secretary Christopher Mangcopa seconded and added that only specific areas near the river side experience flood once in a while.

As per the road right-of-way issues, C. Mangcopa mentioned that there are private properties near the proposed sites.

On the topic of potential reuse applications in Barangay Cabatangan, G. Mogol suggested the use of treated effluent in the ricefields. The Study Team will contact NIA and send the sanitation residuals questionnaire.

G.K. Genel inquired from the Study Team regarding the issue of land use conversion since the recommended site is classified as agricultural lands. G. Mogol responded that for environment-enhancement facilities such as the proposed Septage Treatment Plant (SpTP) and sanitary landfills, the ZCWD may request for a special clearance/permit to the City Council in lieu of land conversion.

G.K. Genel asked about the survey form for sanitation residuals. Trisha Paniterce answered that the team sent the form to the LGU last week and will follow up later today with offices who have been unable to answer the questionnaire. The team is also in the process of looking for potential users in the private sector, especially the golf courses in Zamboanga City.

G.K. Genel suggested to survey or consult with the home owners' association of the subdivision near the site to guarantee the social acceptance of the septage treatment plant near the residential area. This was noted by the team but may be considered as an activity for future studies.

Sarah Carido from ZCWD mentioned that she has a detailed landslide and flood hazard map from MGB.

E. Pacumio asked for the available data or map of the road right-of-way, C. Torino answered that the ZCWD has data available from City Assessor's Office, though not as accurate and may contain sensitive information such as lot ownership and plans. E. Pacumio assured that only the lot boundaries will only be used and presented in the reports.

C. Torino also expressed her concern regarding the depressed land of the proposed site. E. Pacumio and G. Mogol noted that this may be tacked if the contour map of the site is available. Otherwise, these may be included as part of the recommendations and future considerations. On this topic, aerial survey previously conducted in the area to be provided by the ZCWD to the team for reference on the topography. DPWH will also be contacted/looked into for more information on topography and flooding in the area.

G.K. Genel asked if there will be another proposed site in case Cabatangan will have problems regarding the social acceptance of the residents. E. Pacumio answered that the Pre-Feasibility Study will only recommend one site, but will include the discussion of the other options including the Mercedes and Boalan. Only preliminary costing will be included for Sites 1 (Boalan) and 2 (Cabatangan).

Highlights/Proceedings

Preliminaries

Preliminaries and hosting by Trisha Paniterce

Presentations:

- Project Background discussed by Engr. Gerardo Mogol
- Pre-Feasibility Study Findings and Results by Engr. Eula Pacumio

Closing

Meeting was adjourned at 11:31 a.m.

Next Steps/Agreements/Recommendations

No comments on the site selection. The proposed site in Cabatangan has been confirmed with the barangay and association of barangay captains.

All the discussions in this meeting were duly noted by the Study Team and will be taken into consideration.

A recommendation to include NIA to the Reuse Questionnaire.

The Home Owners' Association may be invited for future project activities.

Attachments

List of Attendees

Visual Aids/Presentations

Attachment 1: List of Attendees

- Joean Murayao Brgy. Cabatangan Representative
- Christopher Mangcopa Barangay Secretary of Cabatangan
- Liga ng mga Barangay representative
- Carolyn Torino ZCWD – Principal Engineer C
- Genevieve Karen Genel ZCWD – Senior Corporate Planning Specialist
- Sarah May Carido ZCWD – Utilities Services Assistant C
- Michael Angelo Carbon ZCWD – Department Manager
- Edito M. Bautista Jr. ZCWD – Principal Engineer
- Gerardo Mogol Study Team – Team Leader
- Eula Marie Pacumio Study Team – Sanitation Specialist/Deputy Project Manager
- Trisha Paniterce Study Team – Engineering Assistant


Attachment 2: Visual Aids/ Presentations



Consultation Meeting

*Pre-Feasibility Study of the Proposed Septage Management Program for the
CDI City of Zamboanga City*


September 13, 2021
10:00 a.m. – 12:00 n.n.



Consultation Meeting

*Pre-Feasibility Study of the Proposed Septage Management Program for the
CDI City of Zamboanga City*

September 13, 2021
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Strengthening Urban Resilience for
Growth with Equity (SURGE) Project

Ground Rules for the Meeting

- Kindly **rename** your Zoom name in this format:
[Office] Full Name
- Please **turn-off your camera and mute your microphone** while the speaker is presenting.
- Use the **raise hand feature** if you want to speak so the speaker can acknowledge you. Once acknowledged by the moderator, participants may turn on their camera and microphone when raising questions for the open forum.
- Kindly **introduce yourself every time you wish to speak** as not all gadgets can show all participants at the same time.



Strengthening Urban Resilience for
Growth with Equity (SURGE) Project

Program of Activities

Time	Activity
10:00 a.m. – 10:15 a.m.	Preliminaries
10:15 a.m. – 10:40 a.m.	Project Introduction and Meeting Objectives
10:40 a.m. – 11:15 a.m.	Presentation of Initial Results
11:15 a.m. – 12:00 n.n.	Consultation on Site Assessment



Strengthening Urban Resilience for
Growth with Equity (SURGE) Project

Ground Rules for the Meeting

- Please **use the chat box** to input your questions and whom they are addressed to as the discussion is ongoing.
- Please ensure that you are viewing the screen in **side-by-side mode** to see both the speaker and presentation. Slide the screen separator to the left or right to adjust the size of each view.
- **Participate actively** in all activities.

On Recording: Please be informed that we will be recording the webinar. The recording is purely for documentation purposes and will not be shared by the SURGE Project to anyone without prior consent.



Strengthening Urban Resilience for
Growth with Equity (SURGE) Project

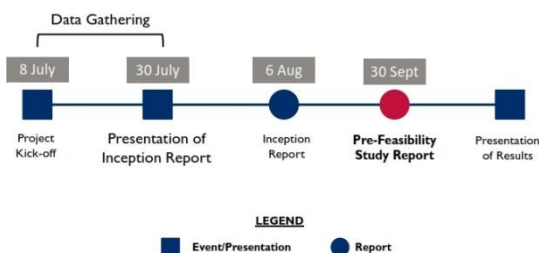
Project Background

Project Background

Project Name:	Pre-Feasibility Study for the Proposed Septage Management Program for the CDI City of Zamboanga City
Project Location:	Zamboanga City
Objective:	To provide technical assistance to CDI Cities aimed at improving access to sustainable and resilient water and sanitation services.



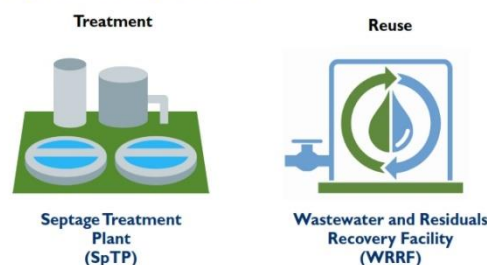
Tentative Project Timeline



Key Objectives

- **Assessment and evaluation** of the study area
- **Verification of local sanitation practices** through household and commercial surveys;
- Recommendation of the **best solution** based on a **technical, financial, economic, and socio-environmental and institutional impact** considerations;
- Adoption and application of relevant **national and international design standards, legislations and codes**;
- Develop a **policy recommendation framework**;
- Incorporation of the **planning framework** of the Department of Health (DOH)

Project Components



Expected Project Outcomes

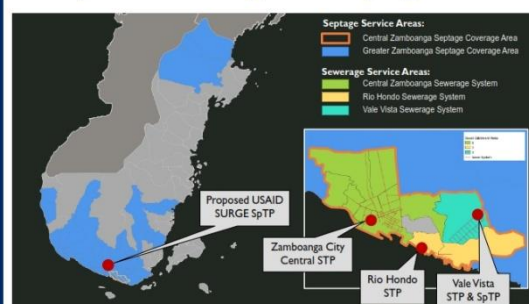
- **Reduce pollution load** to receiving water bodies,
- Improve **access to sanitation services**
- **Reduce health costs** related to poor environmental conditions and water-borne diseases,
- **Increase productivity** of marine resources
- Support **sustainable, resilient and inclusive growth of the city** in line with the objectives of the **USAID CDI SURGE Project**

Meeting Objectives

- Introduce the project to the Association of Barangay Captains Chairman and the host barangay captain
- Present the initial findings and rationale of the chosen site
- Solicit insights, comments, and suggestions from these stakeholders
- Discuss the importance of the role of the association of their role in the implementation of the project

Pre-Feasibility Study Findings and Results

Proposed Sewerage and Septage Plan



Zamboanga City Profile

- **Highly Urbanized City** in the Zamboanga Peninsula (Region IX)
- Land Area: **145,327.02 hectares**
- **98 barangays**
- Total Population (2020): **977,234**
- **Agriculture and Fisheries** sector as primary economic driver



(Taken from ZC CLUP 2016-2025)

Central Zamboanga System



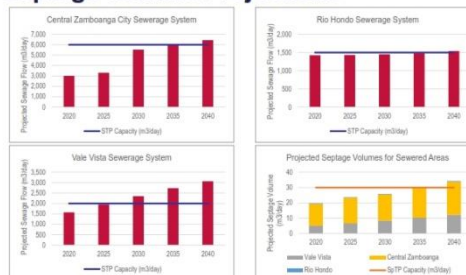
Zamboanga City Water District

- ZCWD covers **61/98 barangays**
- Service connections (as of 2019)
 - Residential: 57,809
 - Commercial: 6,230
 - Institutional: 563
 - **Total: 64,602**



(Taken from ZCWD 2019 Data)

Central Zamboanga System Sewage & Septage Volume Projections



Greater Zamboanga Septage System

Assumptions

- Considered non-customers from inland barangays only
- Frequency: Every 4 years
- Accessibility:
80% for residential
100% for non-residential
- Septage Volume:
2 m³, 5 m³



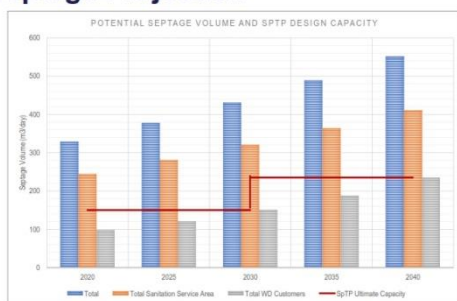
Septage Collection Scheme



Vacuum Truck Requirement

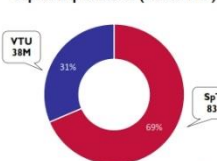
10 m³ x 4
3 m³ x 1
(initial)

Septage Projection

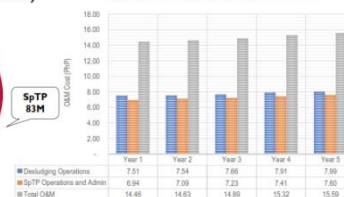


SpTP Preliminary Costs

Capital Expenditures (Million PhP)



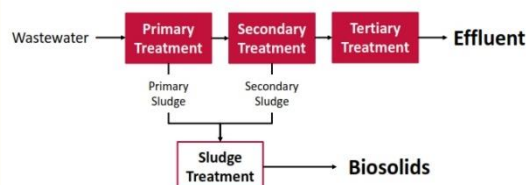
Operations and Maintenance Costs



Greater Zamboanga Septage System



Wastewater Treatment By-products



Reuse Potential at Ultimate Treatment Plant Capacities


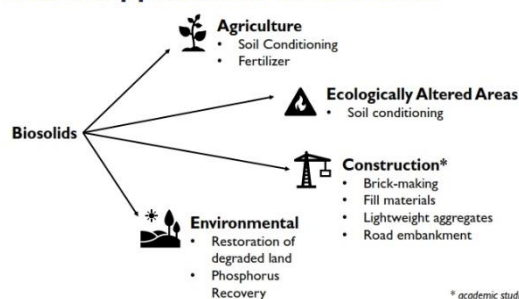


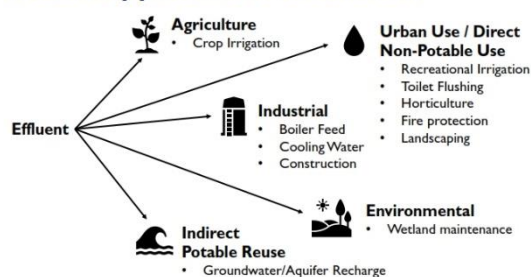
Photo from Alibaba.com

	Reclaimed Water Volume (m ³ /day)	Biosolids Volume (m ³ /day)
	~6,000	3 (69.6 sacks)
	~15	0.02 (0.42 sacks)
	~1,500	0.75 (17.4 sacks)
	~2,000	1 (23.2 sack)
	~15	0.02 (0.4 sack)
USAID SURGE SpTP	235	~235 0.3 (6.5 sacks)
Total	9,500	265 ~9,765 5.07 (117.5 sacks)

Reuse Applications of Biosolids



Reuse Applications of Effluent

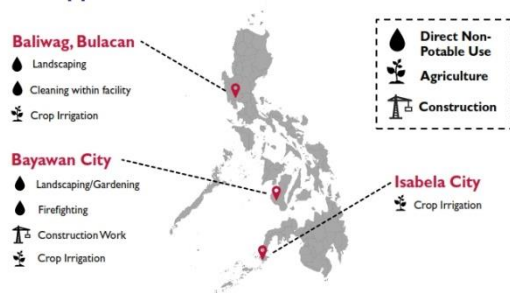


Source: 2012 US EPA Guidelines of Water Reuse

Local Applications of Biosolids Reuse



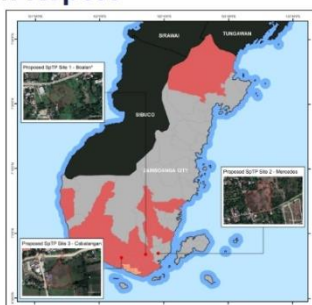
Local Applications of Effluent Reuse



Consultation on Site Assessment

Site Evaluation Report

Three candidate sites, **Barangays Boalan, Mercedes, and Cabatangan**, were identified by the Zamboanga City Water District (ZCWD) for the development of the proposed Septage Treatment Plant (SpTP).



Barangay Cabatangan



Site Reconnaissance

Top to bottom: Condition to Access Road, Nearby Non-Operational Well

Top to bottom: Nearby access of power, NIA Canal

Barangay Boalan



Access to Private Property



Drainage and Road Access to Site

Cost Comparison of Candidate Sites

Cost Item	Candidate SpTP Site		
	Site 1 Boalan	Site 2 Mercedes	Site 3 Cabatangan
CAPEX			
Land Acquisition	4,500	3,750	4,200
Septage Treatment Plant ¹	163,135	163,135	163,135
Vacuum Truck Units	48,643	51,449	45,523
Total CAPEX	216,278	218,334	212,858
O&M			
Administrative & SpTP Operations	55,478	55,478	55,478
Desludging Operations	62,773	74,235	59,291
Total O&M	118,252	129,713	114,769
Total PV Cost	334,530	348,047	327,626

Barangay Mercedes



Site Reconnaissance

Condition of Access Roads (top to bottom: West, South)

Top to bottom: nearby Concrete Batching Plant, Mercedes River

ZCWD Pros and Cons

Candidate SpTP Site	Pros	Cons
Site 1 (Boalan)	<ul style="list-style-type: none"> 1,1215-hectare private property 	<ul style="list-style-type: none"> Privately owned/not yet procured by the ZCWD Classified as commercial area In the vicinity of the Zamboanga City Integrated Bus Terminal, Toyota, and Wilcon Depot
Site 2 (Mercedes)	<ul style="list-style-type: none"> 4,065-hectare Property of ZCWD 	<ul style="list-style-type: none"> The area will be proposed for the construction of production well and other facility should the ZCWD expand its water services to Barangay Mercedes in the near future 1.24 km away from Mercedes River 2 km to mangrove area 14 km away from city proper Recycled water may not be accessible for distribution
Site 3 (Cabatangan)	<ul style="list-style-type: none"> 1.6-hectare Property of ZCWD Proximity to the service area (within 7-km radius of the city proper) Minimal residential houses Near the newly constructed ZC Bypass Road, hence more accessible to east and west coast barangays Recycled water will be within the proximity for firefighting, irrigation, industrial process among others 	<ul style="list-style-type: none"> Classified as an agricultural area (irrigated rice field) The lot is partially backfilled, hence, portion of lot is below the road elevation There is an existing production well within the vicinity

Site Evaluation Report

Based on the evaluation of both the Study Team and ZCWD, **Site 3 (Cabatangan)** was identified to be the proposed site location for the Proposed Zamboanga City SpTP.



Site Evaluation Report

Parameter	Cabatangan Site	Parameter	Cabatangan Site
I. Location		VI. Proximity to Water Sources	
1. Address	Lupong Road, Barangay Cabatangan	1. Groundwater Sources	Non-operational production well (due to copper concentration)
2. Owner	ZCWD	2. Surface Water Sources	None
3. Approximate Cost of Land	Approximately 2,800 PHP/m ²	VII. Receiving Water Body/Drainage (for treated effluent)	NIA Canal
4. Coordinates	6°56'15.25"N, 122°3'27.06"E	VIII. Natural Hazards	
II. Area capacity and space availability		1. Landslide	None
1. Area	1.61 ha	2. Flood	Moderate to High
2. Surrounding area available for expansion?	Yes	IX. Accessibility	
III. Local Zoning		1. Access road/ Right of way	Available
1. Current Land Use/ Zoning	Agricultural/ Residential	2. Main access road width (range of most narrow to widest)	~ 9 m
2. Nearby Establishments	None	3. Main access road condition	Municipal/barangay road, concrete & good condition
IV. Availability of Utilities		4. Traffic situation of main access road	None
1. Power	Available		
2. Water	Available		
V. Topography			
1. Topography	Flat		
2. Elevation	11-13 masl		
3. Slope	0-3 percent (level to nearly level)		

Additional Questions/Information

- Road Right-of-Way and issues on Road Conditions
- Incidence of Flooding and flood level (for the past 10 years)
- Additional proposed reuse of byproducts

Photo Opportunity

Thank you!

Consultation Meeting

Pre-Feasibility Study of the Proposed Septage Management Program for the CDI City of Zamboanga City

September 13, 2021
 10:00 a.m. – 12:00 n.n.



ANNEX 5: DOCUMENTATION REPORT FOR THE PROMOTIONAL CAMPAIGN WORKSHOP

Background

For a successful implementation of the Septage Management Program and Resource Recovery Facility in Zamboanga City, a Promotional Campaign Workshop was held for the Zamboanga City Water District and the Local Government Offices. The workshop will demonstrate how the Information, Education, and Communication Framework complementing with the Marketing Strategies can create a promotional and marketing campaign for the sanitation residual byproducts of the proposed Septage Treatment Plant. This helps the Zamboanga City Water District and the Local Government Unit and its offices to implement a program that can increase the awareness of their target audience while also promoting the sanitation residuals as viable products that can compete and create its own market.

Promotional Campaign Workshop Program

To capacitate key stakeholders of Zamboanga City to inform, communicate, and persuade potential buyers of reclaimed water and biosolids, the Study Team facilitated the Promotional Campaign Workshop last September 27-28, 2021 at 1:00 p.m. – 5:00 p.m. via Zoom Video Conferencing. Representatives from the Zamboanga City Water District and the City Government of Zamboanga participated in the two-day workshop to develop their promotional and marketing plan that may be used to promote the use of sanitation byproducts as a viable consumer goods. This also increases awareness of the process of recovering the sanitation residuals and creating a market for a product to be profitable.

The promotional campaign includes the problem identification and setting of objectives, identification of the target market and product, competitor analysis, and development of a strategic marketing plan. As part of the output of the workshop, the pre-assigned groups were tasked to develop promotional materials for the social media platform of their choice, along with its budget. The participants were grouped into three and were given different topics to choose from. These are the following:

1. Water reclamation for agriculture / crop irrigation / aquaculture
2. Reuse of biosolids as fertilizer/soil conditioner
3. Water reclamation for landscaping

There are three groups. Representatives from ZCWD and LGU were grouped together that brought in different perspectives and ideas into the topic they chose as shown in **Table 206**. The groups had two main breakout sessions which tackled the following:

1. Determining the Goals, Product, Market and Competitors
2. Strategic Marketing: Marketing Mix
3. Development of Promotional Plan and Budget
4. Development of Promotional Materials for Social Media

Table 206: Workshop Grouping

Group 1– Water reclamation for agriculture / crop irrigation / aquaculture	
Name	Office
Genevieve Karen Genel	Zamboanga City Water District
Jerhome Sojuaco	City Health Office
Darwisa Salip Akarab	Zamboanga City Water District
Abigail Sogradiel	City Agriculturist Office
Jovelín Acuña	Office of the City Environment and Natural Resources
Group 2 – Reuse of biosolids as fertilizer/soil conditioner	
Name	Office
Valerie Gay Gutierrez	Zamboanga City Water District
Raul Ruben Rivera	Zamboanga City Water District
Michael Angelo Carbon	Zamboanga City Water District
Jasmine Mohammadsali	Public Information Office
Group 3 – Water reclamation for landscaping	
Name	Office
Sarah May Carido	Zamboanga City Water District
Allan Mark Ong	Zamboanga City Water District
Ludweig Look	City Agriculturist Office
Crisaldo Macais	Office of the City Environment and Natural Resources

Attachment 1 to 3 illustrate the workshop outputs of Group 1, 2 and 3, respectively.

Attachment 1: Group 1 Worksheet and Output

1A: Determining the Goals, Product, Market and Competitors

Problem Identification and Setting of Objectives

TOPIC: <ul style="list-style-type: none"> • Reuse of biosolids as fertilizer/soil conditioner • Water reclamation for agriculture/crop irrigation/aquaculture • Water reclamation for non-crop irrigation/landscaping
Water reclamation for agriculture/crop irrigation/aquaculture
PROBLEM STATEMENT: <i>What is the main challenge that hinders people to practice the [topic]?</i>
Every time the city faces a severe drought, shortage in water supply for irrigation and aquaculture occurs, especially when there is a lack of alternative sources of agricultural water, like wastewater treatment facilities that recycles water.
MARKETING GOALS / OBJECTIVES: <i>What are your marketing goals / objectives? How do these goals affect the product and market in the short- and long-term?</i>
<ul style="list-style-type: none"> • Proper information drive for the affected community so they will be able to learn to use the reclaimed water and practice reuse of water. • Convince partnership with agencies/private sector to help address the drought. • Have an alternative source for water supply in agriculture

Determining Target Audience:

PERFECT CUSTOMER: <i>Who is directly affected by the problem identified? Who/what groups are in the best position to solve this problem? Who are the potential users of the product? Who do you want to reach with your promotion?</i>
Irrigation and aquaculture farmers in Zamboanga City
PLACE: <i>Where will I find these perfect customers? Please describe the location or platform.</i>
<ul style="list-style-type: none"> • List from Department of Agriculture • Registry of deeds • National Irrigation Administration • Bureau of Fisheries and Aquatic Resources

Knowing your Product:

PRODUCT: <i>What product (or service) are you trying to convince people to use/buy? (Biosolids / Reclaimed Water) Please specify.</i>
Reclaimed Water for irrigation/aquaculture
KEY BENEFITS: <i>What are the advantages in using/buying this product? What can people gain if they use/buy the product? What specific needs does the product satisfy?</i>
Alternative source of water supply; water table recharge; cut down carbon footprint; additional water supply for irrigation/aquaculture; health benefits to plants/aquaculture

VALUE AND IMPACT: <i>What are the problems that the product can potentially solve? How can this product be a solution to a certain issue?</i>
Impacts of climate change, possible elimination of severe drought in Zamboanga City, lessen/eliminate shortage of water supply for agriculture, promotes sustainability
PRODUCT RISK AND THREATS: <i>What are the potential risks the product may pose to the customer? What are factors need to be considered when marketing this product? How can this affect the customer acceptance of the product?</i>
<ul style="list-style-type: none"> Reclaimed water is limited to certain agricultural products Lack of trucks to transport the reclaimed water No established road right of way to carry reclaimed water
PRODUCT RISK MITIGATION: <i>What can you do to reduce the risk of stated above? How can we protect our customer in these case/s?</i>
<ul style="list-style-type: none"> Have tertiary treatment to meet standard agricultural water for irrigation Have a fee for delivering water or put a pipeline to the irrigation If it is not possible for delivery to enter the site, construct own storage for the reclaimed water
EMOTIONAL TRIGGERS: <i>How do your potential customers feel about your product? What do you want to make the potential customers feel to influence them into using/buying the product?</i> <i>Some examples of emotional triggers:</i>
<ul style="list-style-type: none"> Value – Return is better than cost Fear – Afraid of missing out on opportunity Guilt – Make a change to prevent/avoid a worse situation Leadership – Being the start of something Trust – Assurance for benefit of the customer
<ul style="list-style-type: none"> Guilt - Make a change to prevent/avoid a worse situation Fear – afraid of missing out an opportunity Value – continuous source/supply of water for irrigation
VALUE PROPOSITION: <i>How can you summarize the key benefits and the value of your product in one statement? Why should the customer buy your product? What is the difference between your competitor's product?</i>
<ul style="list-style-type: none"> By buying the products, we are helping the environment and not destroying the future of our planet. Farmers will have a sustainable water supply for irrigation/aquaculture.

Competitor Analysis:

COMPETITOR <i>Who are your competitors? Where are your competitors located/operating?</i>	COMPETITOR'S PRODUCT <i>What is the product being marketed by your competitors?</i>	CHANNEL / MEDIA <i>What channels are your competitors using to market their product?</i>	MARKET <i>Who are the target customers (target market) of your competitors?</i>
<ul style="list-style-type: none"> Private land owners with water supply 	<ul style="list-style-type: none"> Untreated groundwater supply 	<ul style="list-style-type: none"> Word of mouth H2H (Human to Human) 	<ul style="list-style-type: none"> Industrial/ commercial establishments

1B: Strategic Marketing: Marketing Mix (4Ps)

Instruction: Please try to answer all the guide questions to better describe the Marketing Mix for the ease of development of your Marketing Strategy.

PRODUCT:

What do the consumers of my product/service want? What are the benefits it offers? Are there other ways to satisfy the same needs? If so, what advantages and disadvantages does mine have in comparison? What does it look like? Are there different sizes, colors, etc.? What must the consumer's experience be like when using it? What differentiates it from the competition? What is it called? Please be specific and also include packaging (if any) for the produce

- **Product:** Water for irrigation and aquaculture
- **Benefits:** Alternative source of water supply; water table recharge; cut down carbon footprint; additional water supply for irrigation/aquaculture; health benefits to plants/aquaculture
- **Alternate source:** rainwater harvesting, groundwater
- **Advantages:** not using groundwater, not depleting/no over extraction of the groundwater supply, some of the nutrients in reclaimed water are not present in rainwater/groundwater
- **Disadvantages:** distribution of reclaimed water, availability of supply of reclaimed water, acceptability of water quality
- **Odor and color:** odorless and clear, when treated
- **Selling point:** nutrients in reclaimed water not found on other water supply, cost-efficient alternative
- **What is it called?** Agua Fuerza (Strong Water)

PLACE:

Where will I find these perfect customers? Where should be the strategic places the product be placed for optimal reach? Where do customers get my product/service? Specialized stores? supermarkets? online? What other platforms should the product be present? Please define the channels through which a product reaches consumers. Consider as well distribution strategy is to both make it easy for consumers to access to the product optimize the sales process by providing a smooth "shopping experience".

- **Where to find customers?**

List from Department of Agriculture (rely on the list), Registry of deeds, National Irrigation Administration, Bureau of Fisheries and Aquatic Resources

- **Where will the product be placed?**

Treatment Facility

- **Platforms in promotion?**

Advertise it through tri-media, government agency partners

PRICE:

What is the final price of your product? These are the factors to consider to formulate your price: (a) manufacturing cost; (b) revenue you are expected to receive; (c) competitor's price; (d) demand of your product (or substitute product); (e) consumer's purchasing power; and (f) current trends and preferences of the market.

- Consider CAPEX and OPEX for the price
- Consider revenue for future expansion and improvement and maintenance of the facility
- Competitor's price: no idea for now
- Alternate source: rainwater harvesting, groundwater
- Consumers have the capacity to purchase
- Environmental-friendly product, increase in number of people investing in farms and plantations

PROMOTION:

This refers to all the actions taken to communicate the benefits of your products and services in order to increase sales. How can I make my message reach the right audience? Which of the mediums/channels are more appropriate for my product? When is the best time to promote? Does my product or service depend on seasons? What are my competitors doing and how should that influence my decisions?

- **How can I make my message reach the right audience?**

Coordinate/partner with other national government agencies, constant promotion to increase awareness in target communities, provide flyers or infographics, present case studies from Zamboanga City (have own model or prototype farmer from the city for promotional campaign)

- **Which of the mediums/channels are more appropriate for my product?**

Tri-media, government agencies partnerships, school education

- **When is the best time to promote?**

When the STP project is ongoing (construction phase), start the promotion of the product and continue promotion until target audience's acceptance level is high.

- **Does my product or service depend on seasons?**

Yes. The demand is higher during El Niño.

- **What are my competitors doing and how should that influence my decisions?**

Continuous promotion for mind-setting of target market.

2A: Development of Promotional Plan and Budget

PROGRAM TITLE

Water reclamation for agriculture/crop irrigation/aquaculture – Agua Fuerza (*Strong Water*)

PROGRAM TIMEFRAME:

6 months

1. THEME – Key Promise and Message

What one SINGLE benefit and overarching action will the target audience experience upon reading/listening to your materials/media? What call-to-action do you expect?

Using reclaimed water will cost less than groundwater and will help lessen the shortage of water supply in drought season.

2. TONE

What feeling should your promotion have?

Positive - Suggests control, hope, and action
 Serious - Communicates the grave nature of an issue
 Rational - Convinces audience through facts
 Authoritative - Commands that an action be taken
 Peer - Appeals to those with demographics in common

3. PROMOTION MIX			
<i>How do you want to communicate to your target audience / market? What is the best way to reach your intended audience / market?</i>			
Interpersonal - Meetings / Talks (Barangayan), Group Discussions (FGDs) Print – Comics, posters, brochures, infographics Digital – Website, social media, podcasts			
4. UNIQUE SELLING PROPOSITION (USP)			
<i>What product benefit (or value) you want the customer to remember?</i>			
Agua por buen salud (Agricultural water for good health)			
5. PRODUCT SLOGAN			
<i>Be creative. Be catchy. What tagline can help have that lingering effect to the consumers?</i>			
Every drop cares.			
6. MEDIA			
<i>What channels or forms will the promotion take? TV? Radio? Print? If so, what types? Mix of the above? Interpersonal? Frequency?</i>			
Interpersonal - Meetings / Talks (Barangayan), Group Discussions (FGDs) Print – Comics, posters, brochures, infographics Digital – Website, social media, podcasts			
7. CREATIVE CONSIDERATIONS			
<i>Anything the creative people should know? More than one language/dialect? How about the colors?</i>			
Color – green, orange, grey Language/Dialect – Multilingual (Chavacano, English)			
8. MANDATORIES			
<i>Are there pieces that MUST be included on media developed? Cite developing partners?</i>			
Department of Agriculture, Bureau of Fisheries and Aquatic Resources, Zamboanga City Water District, National Irrigation Administration, Local Government Unit (City Health Office)			
Key message			
9. BUDGET			
<i>How much will this promotion effort cost? Be sure to include costs for all approaches to be used.</i>			
Line Item (Description of Material, Activity or Resource Needed)	Number / Units	Cost Per Unit	Total Cost
District Presentation (face-to-face)	6	PhP5,000	PhP30,000
- Presenters (Token/honorarium)			
- Print Material (Brochures, posters, tarpaulins)	-	-	-
- Transportation			
- Meals			
Social Media	-	(In-house)	-
- Ads (Facebook Page)			
- Websites	-	-	-
- Podcasts			

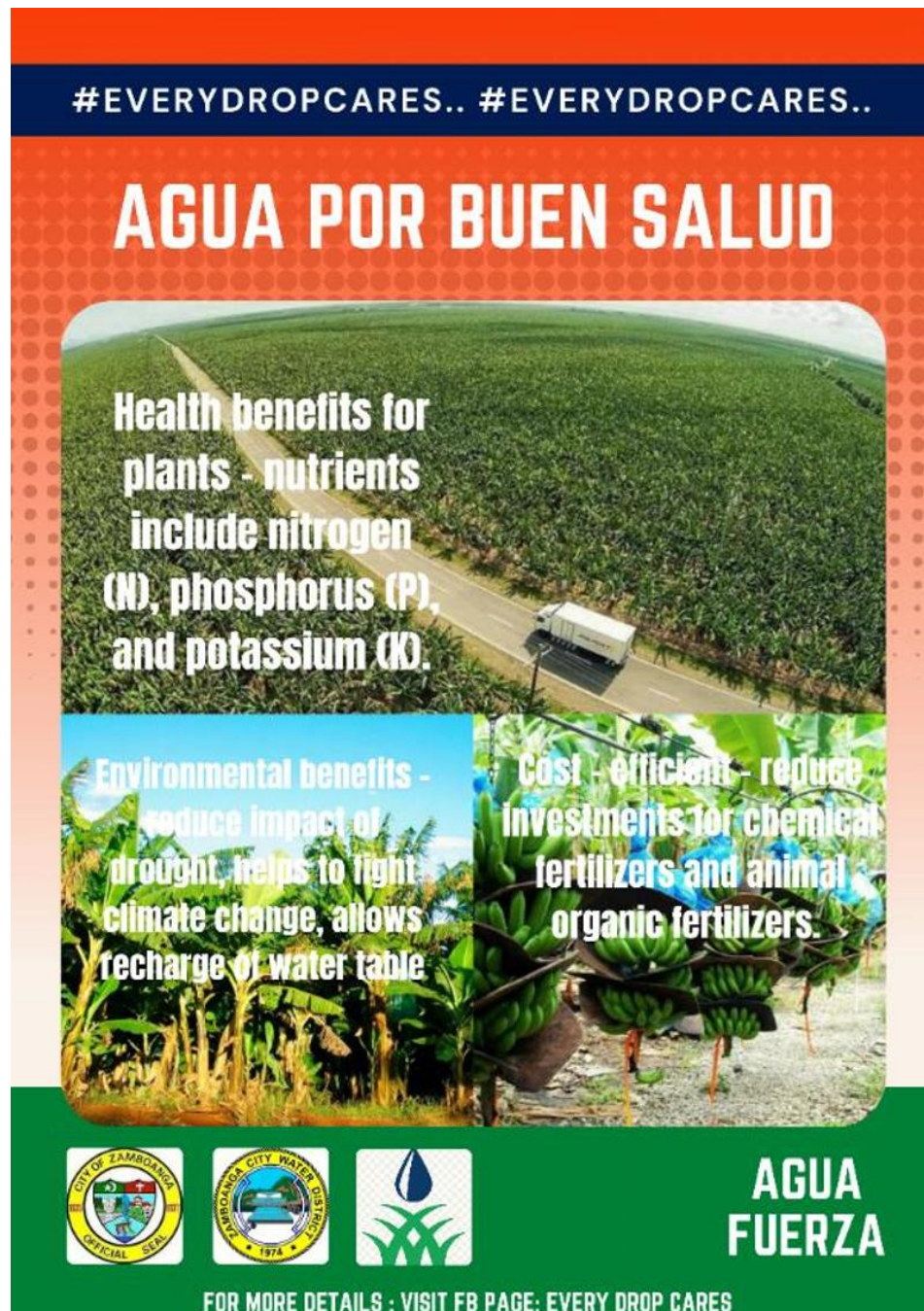
Line Item (Description of Material, Activity or Resource Needed)	Number / Units	Cost Per Unit	Total Cost
Print Materials - Comics - Brochures - Posters	PhP50,000-80,000	-	PhP50,000-80,000
Grand Total			PhP80,000-110,000

2B: Development of Promotional Materials for Social Media

MAIN SOCIAL MEDIA PLATFORM: <i>Where do you plan on posting majority of your campaign materials?</i>
Facebook, Radio, Print Materials
TYPE OF SOCIAL MEDIA: <i>Type of material? (Video, Infographic, Event, Post, Blog/Vlog, Hashtag, Livestream etc.)</i>
Infographic, Video
OBJECTIVE OF MATERIAL: <i>What is the goal of this specific post? (Launching of campaign, general advertisement of product, announcement of event etc.)</i>
Launching of campaign, general advertisement of product, awareness
TIMING OR FREQUENCY: <i>When or how often do you plan on posting this material?</i>
Every 10am, 12nn, 3pm, 6pm, and 8pm daily
MESSAGE AND CONTENT: <i>What is the main message you wish to convey in this material? What are the key points needed to be included in the content of your material to catch the attention of your audience? How can you call your target audience to act on your message?</i>
<ul style="list-style-type: none"> • Health benefits for plants – nutrients include nitrogen (N), phosphorus (P), and potassium (K) • Environmental benefits – reduce impact of drought, helps fight climate change, allows recharge of water table • Cost-efficient – reduces investments for chemical fertilizers and animal organic fertilizers
VISUAL THEME: <i>How do you want your material to generally look like? (Color, images, etc.) How can you capture the attention of your target audience visually?</i>
<ul style="list-style-type: none"> • Include actual images of applications of reclaimed water • Green and orange color scheme • Informational – it should have the benefits of reclaimed water

PROMOTIONAL MATERIAL:

Create a sample promotional material for social media. Can be a designed post, video, story board, infographic, etc.



Points for future enhancement and consideration:

- Good choice of colors. Take into consideration using white as font color for photo background.
- Consider using having more concise text for ease of reading
- If targeting individual people, it is advisable to look at the individual interest first
- The tagline can be more specific to give more clarity in the audience

Attachment 2: Group 2 Worksheet and Output

1A: Determining the Goals, Product, Market and Competitors

Problem Identification and Setting of Objectives

TOPIC: <ul style="list-style-type: none"> • Reuse of biosolids as fertilizer/soil conditioner • Water reclamation for agriculture/crop irrigation/aquaculture • Water reclamation for non-crop irrigation/landscaping
Reuse of biosolids as fertilizer/soil conditioner
PROBLEM STATEMENT: <i>What is the main challenge that hinders people to practice the [topic]?</i>
One of the main challenges that hinder people to practice the reuse of biosolids as fertilizer/soil conditioner is the general public's lack of knowledge on biosolids which includes knowledge on its source that may have stemmed from the absence of SMP in municipalities/cities.
MARKETING GOALS / OBJECTIVES: <i>What are your marketing goals / objectives? How are these goals affect the product and market in the short- and long-term?</i>
<ul style="list-style-type: none"> • To introduce the concept of biosolids as a resource to the general public and inform them on the potential use, health and safety of the product • To craft a proof of concept and test case to illustrate to the public and promote behavioral and perception change • To onboard key stakeholders and agencies (government and private)

Determining Target Audience:

PERFECT CUSTOMER: <i>Who is directly affected by the problem identified? Who/what groups are in the best position to solve this problem? Who are the potential users of the product? Who do you want to reach with your promotion?</i>
<ul style="list-style-type: none"> • Plantitos and Plantitas • Agricultural Industry (non-contact produce, for pilot testing, based on volume)
PLACE: <i>Where will I find these perfect customers? Please describe the location or platform.</i>
<ul style="list-style-type: none"> • Location: Zamboanga City (eventual organic growth) • Platform: If online groups or organizations (e.g., Zamboanga Ornamental Plants Community, Zamboanga Succulents and Cactus)

Knowing your Product:

PRODUCT: <i>What product (or service) are you trying to convince people to use/buy? (Biosolids / Reclaimed Water) Please specify.</i>
Biosolids as compost products such as organic fertilizer
KEY BENEFITS: <i>What are the advantages in using/buying this product? What can people gain if they use/buy the product? What specific needs does the product satisfy?</i>
<ul style="list-style-type: none"> • Good source of nutrients for the plants • Environmentally safe and sustainable

VALUE AND IMPACT: <i>What are the problems that the product can potentially solve? How can this product be a solution to a certain issue?</i>
<ul style="list-style-type: none"> • Promotes sustainable source of organic fertilizer • Lessen the use of chemical fertilizers • Cleaner environment • Educate households on composting of other food wastes
PRODUCT RISK AND THREATS: <i>What are the potential risks the product may pose to the customer? What are factors need to be considered when marketing this product? How can this affect the customer acceptance of the product?</i>
<ul style="list-style-type: none"> • Health hazards (if used for produce) • Not suited for Halal • Cultural sensibilities
PRODUCT RISK MITIGATION: <i>What can you do to reduce the risk of stated above? How can we protect our customer in these case/s?</i>
<ul style="list-style-type: none"> • Conduct regular testing on quality of biosolids • Include instructional use on the product • DTI/FPA registration of the product (once product is marketed) • Should research first where organic fertilizers are applicable
EMOTIONAL TRIGGERS: <i>How do your potential customers feel about your product? What do you want to make the potential customers feel to influence them into using/buying the product?</i> <i>Some examples of emotional triggers:</i> <ul style="list-style-type: none"> • Value – Return is better than cost • Fear – Afraid of missing out on opportunity • Guilt – Make a change to prevent/avoid a worse situation • Leadership – Being the start of something • Trust – Assurance for benefit of the customer
<ul style="list-style-type: none"> • Fear of using human waste • Leadership - green technology • Doubtful
VALUE PROPOSITION: <i>How can you summarize the key benefits and the value of your product in one statement? Why should the customer buy your product? What is the difference between your competitor's product?</i>
The organic fertilizer from the biosolids is environmentally safe, sustainable, and a zero-waste product.

Competitor Analysis:

COMPETITOR <i>Who are your competitors? Where are your competitors located/operating?</i>	COMPETITOR'S PRODUCT <i>What is the product being marketed by your competitors?</i>	CHANNEL / MEDIA <i>What channels are your competitors using to market their product?</i>	MARKET <i>Who are the target customers (target market) of your competitors?</i>
<ul style="list-style-type: none"> • Suppliers of chemical fertilizers in Zamboanga 	<ul style="list-style-type: none"> • Chemical fertilizer • Organic animal waste fertilizer • Other organic fertilizers from 	<ul style="list-style-type: none"> • Agricultural supply store • Online (TBC) 	<ul style="list-style-type: none"> • Farmers • Plantitos/ Plantitas • Plant nursery

COMPETITOR <i>Who are your competitors? Where are your competitors located/operating?</i>	COMPETITOR'S PRODUCT <i>What is the product being marketed by your competitors?</i>	CHANNEL / MEDIA <i>What channels are your competitors using to market their product?</i>	MARKET <i>Who are the target customers (target market) of your competitors?</i>
<ul style="list-style-type: none"> Suppliers of organic fertilizers in Zamboanga 	compost waste SLF		

1B: Strategic Marketing: Marketing Mix (4Ps)

Instruction: Please try to answer all the guide questions to better describe the Marketing Mix for the ease of development of your Marketing Strategy.

<p>PRODUCT: <i>What do the consumers of my product/service want? What are the benefits it offers? Are there other ways to satisfy the same needs? If so, what advantages and disadvantages does mine have in comparison? What does it look like? Are there different sizes, colors, etc.? What must the consumer's experience be like when using it? What differentiates it from the competition? What is it called? Please be specific and also include packaging (if any) for the produce</i></p>
<ul style="list-style-type: none"> Consumers wants to be assured of its safety and benefits. Increase in plant growth by providing the necessary nutrients for healthy plants and it is environmentally sustainable. There are other commercially available, chemical-based fertilizers/spoil conditioners as well as other organic types. It is environmentally safe and sustainable. Product specifications and packaging (no conclusive data as of this time). The consumer must feel psychologically safe in using it, not to loathe in handling it. Its organic, thus, environmentally safe and sustainable.
<p>PLACE: <i>Where will I find these perfect customers? Where should be the strategic places the product be placed for optimal reach? Where do customers get my product/service? Specialized stores? supermarkets? online? What other platforms should the product be present? Please define the channels through which a product reaches consumers. Consider as well distribution strategy is to both make it easy for consumers to access to the product optimize the sales process by providing a smooth "shopping experience".</i></p>
<p>Due to the novelty of the product in the city, a limited market, should be considered. The target market should have the mindset of being environmentally friendly without reservations of the product's nature. The test market, specialized groups (receptive plantitos and plantitas) can be engaged directly thru social media, online selling and must be available directly withdrawn from the facility site.</p>
<p>PRICE: <i>What is the final price of your product? These are the factors to consider to formulate your price: (a) manufacturing cost; (b) revenue you are expected to receive; (c) competitor's price; (d) demand of your product (or substitute product); (e) consumer's purchasing power; and (f) current trends and preferences of the market.</i></p>
<p>No conclusive data at this time as the facility that will produce the product as a by-product is still to be constructed.</p>

PROMOTION:

This refers to all the actions taken to communicate the benefits of your products and services in order to increase sales. How can I make my message reach the right audience? Which of the mediums/channels are more appropriate for my product? When is the best time to promote? Does my product or service depend on seasons? What are my competitors doing and how should that influence my decisions?

- Create a dedicated social media account, increase online presence in target market's chat group to promote the product as well as educate potential market.
- Online, social media promotion to keep overhead costs at the minimum.
- Biosolids are not seasonal, all-year round availability.
- Competitors will surely "malign", discredit the product due to its very nature and capitalize on the limited knowledge of potential market.
- With this, the more intensive online, social media campaign to educate potential users.

2A: Development of Promotional Plan and Budget**PROGRAM TITLE**

Marketing of Biosolids as Organic Fertilizers

PROGRAM TIMEFRAME:

At least 3 months

1. THEME – Key Promise and Message

What one SINGLE benefit and overarching action will the target audience experience upon reading/listening to your materials/media? What call-to-action do you expect?

If I use biosolids as organic fertilizer, then I will be an advocate for Mother Nature.

2. TONE

What feeling should your promotion have?

- Positive
- Rational
- Humorous

3. PROMOTION MIX

How do you want to communicate to your target audience / market? What is the best way to reach your intended audience / market?

- Advertising
- Consumer Sales Promotion

4. UNIQUE SELLING PROPOSITION (USP)

What product benefit (or value) you want the customer to remember?

The product works and it benefits not just the person and plants, but also the environment.

5. PRODUCT SLOGAN

Be creative. Be catchy. What tagline can help have that lingering effect to the consumers?

- Biosolids may not be beautiful, but it creates beautiful things.
- From human waste to greener space.

6. MEDIA <i>What channels or forms will the promotion take? TV? Radio? Print? If so, what types? Mix of the above? Interpersonal? Frequency?</i>			
<ul style="list-style-type: none"> Digital Marketing Print 			
7. CREATIVE CONSIDERATIONS <i>Anything the creative people should know? More than one language/dialect? How about the colors?</i>			
<ul style="list-style-type: none"> Dialects: Chabacano, Bisaya, Tagalog, Tausug Color: Green 			
8. MANDATORIES <i>Are there pieces that MUST be included on media developed? Cite developing partners?</i>			
<ul style="list-style-type: none"> Zamboanga City LGU, Zamboanga City Water District Key message 			
9. BUDGET <i>How much will this promotion effort cost? Be sure to include costs for all approaches to be used.</i>			
Line Item (Description of Material, Activity or Resource Needed)	Number / Units	Cost Per Unit	Total Cost
Graphic Designer	1	PhP1,000/graphic material	PhP4,000/month
Social Media Manager	1	PhP500/day	PhP10,000/month
Flyers	5,000	PhP10/pc	PhP50,000
Grand Total			PhP64,000

2B: Development of Promotional Materials for Social Media

MAIN SOCIAL MEDIA PLATFORM: <i>Where do you plan on posting majority of your campaign materials?</i>
<ul style="list-style-type: none"> Facebook Instagram Twitter Tiktok
TYPE OF SOCIAL MEDIA: <i>Type of material? (Video, Infographic, Event, Post, Blog/Vlog, Hashtag, Livestream etc.)</i>
<ul style="list-style-type: none"> Infographic Vlog/Short Videos Dedicated hashtag
OBJECTIVE OF MATERIAL: <i>What is the goal of this specific post? (Launching of campaign, general advertisement of product, announcement of event etc.)</i>
Launching of campaign, General advertisement of product, Building community/network
TIMING OR FREQUENCY: <i>When or how often do you plan on posting this material?</i>
1-2x a week

MESSAGE AND CONTENT:

What is the main message you wish to convey in this material? What are the key points needed to be included in the content of your material to catch the attention of your audience? How can you call your target audience to act on your message?

- If I use biosolids as organic fertilizer, then I will be an advocate for Mother Nature.
- The product works and it benefits not just the person and plants, but also the environment.

VISUAL THEME:

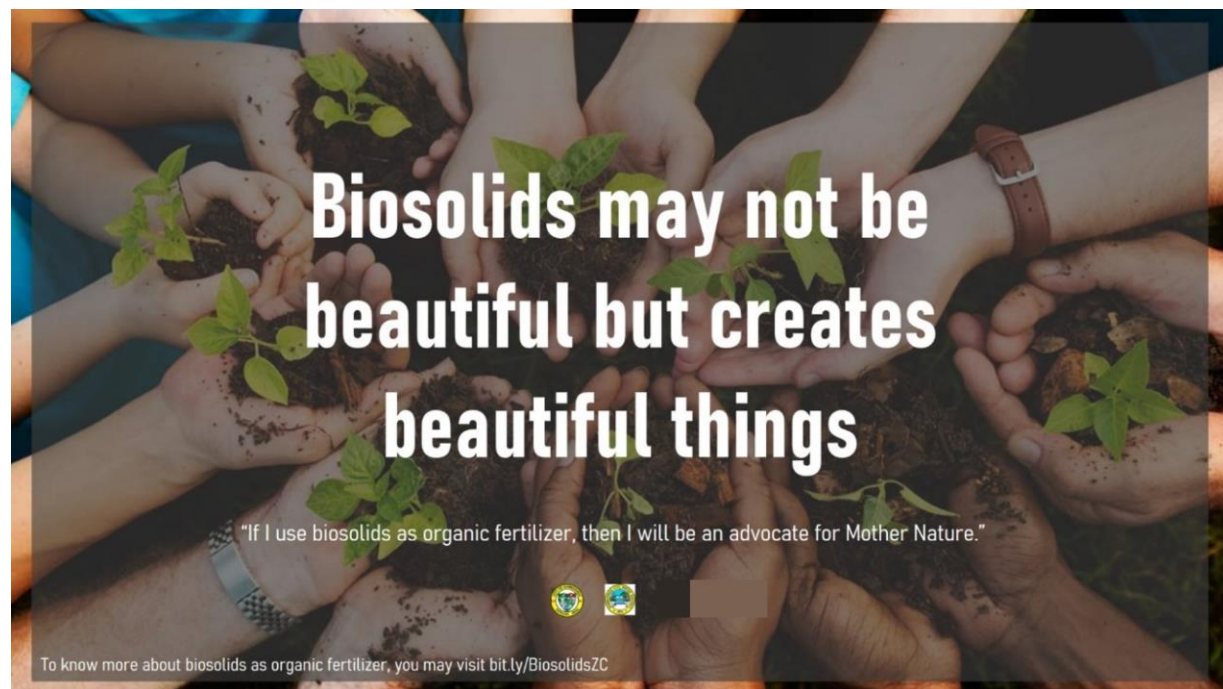
How do you want your material to generally look like? (Color, images, etc.) How can you capture the attention of your target audience visually?

Minimalist images, includes information on benefits of using biosolids

PROMOTIONAL MATERIAL:

Create a sample promotional material for social media. Can be a designed post, video, story board, infographic, etc.

Note: Please make one using PowerPoint (or other format) to be share at the plenary session.

**Points for future enhancement and consideration:**

- Consider putting more emphasis on the key message than the slogan.
- Remove the “if, then” statement in the key message. *“Use biosolids as organic fertilizer, be an advocate for Mother Nature.”*
- Do not forget to credit the owner of the photo. Better, for a more relatable campaign material, you can use your own photos.
- Best to align customer behavior to the campaign.
- You may look at individual’s interest when making the key message/promise
- Include the key message/promise and mandatories to other promotional materials, if applicable

Attachment 3: Group 3 Worksheet and Output

1A: Determining the Goals, Product, Market and Competitors

Problem Identification and Setting of Objectives

TOPIC: <ul style="list-style-type: none">• <i>Reuse of biosolids as fertilizer/soil conditioner</i>• <i>Water reclamation for agriculture/crop irrigation/aquaculture</i>• <i>Water reclamation for non-crop irrigation/landscaping</i>
Water Reclamation for landscaping
PROBLEM STATEMENT: <i>What is the main challenge that hinders people to practice the [topic]?</i>
There is a lack of water supply in Zamboanga City and water reuse is still not acceptable by many.
MARKETING GOALS / OBJECTIVES: <i>What are your marketing goals / objectives? How are these goals affect the product and market in the short- and long-term?</i>
Address the concerns of the people regarding the quality of reused water, show that reclaimed water is a cheaper alternative to water supply (for utility) from the WD

Determining Target Audience:

PERFECT CUSTOMER: <i>Who is directly affected by the problem identified? Who/what groups are in the best position to solve this problem? Who are the potential users of the product? Who do you want to reach with your promotion?</i>
<ul style="list-style-type: none">• "Plantitas"• Public parks – City General Services• Resorts and hotels• Institutional Entities – LGU• Schools and universities
PLACE: <i>Where will I find these perfect customers? Please describe the location or platform.</i>
<ul style="list-style-type: none">• Media – Radio and print, social media• Public parks and spaces - print• Barangays – market for home gardening / "plantitas"

Knowing your Product:

PRODUCT: <i>What product (or service) are you trying to convince people to use/buy? (Biosolids / Reclaimed Water) Please specify.</i>
Reclaimed Water
KEY BENEFITS: <i>What are the advantages in using/buying this product? What can people gain if they use/buy the product? What specific needs does the product satisfy?</i>
Cheaper and greener alternative, sustainable and accessible resource for all

<p>VALUE AND IMPACT: <i>What are the problems that the product can potentially solve? How can this product be a solution to a certain issue?</i></p>
<ul style="list-style-type: none"> • Reduce the demand on fresh water resources • Reduce the cost of water for utility use • Additional resource of water supply
<p>PRODUCT RISK AND THREATS: <i>What are the potential risks the product may pose to the customer? What are factors need to be considered when marketing this product? How can this affect the customer acceptance of the product?</i></p>
<ul style="list-style-type: none"> • Potential odor • Chemical and biological hazards – if effluent is not properly monitored with standards • Parameters for recycled water
<p>PRODUCT RISK MITIGATION: <i>What can you do to reduce the risk of stated above? How can we protect our customer in these case/s?</i></p>
<ul style="list-style-type: none"> • Quality control and quality assurance – proper documentation/strict implementation of water quality testing • Social media page to answer direct questions and concerns of customers • Efficiency of treatment
<p>EMOTIONAL TRIGGERS: <i>How do your potential customers feel about your product? What do you want to make the potential customers feel to influence them into using/buying the product?</i> <i>Some examples of emotional triggers:</i></p>
<ul style="list-style-type: none"> • Value – Return is better than cost • Fear – Afraid of missing out on opportunity • Guilt – Make a change to prevent/avoid a worse situation • Leadership – Being the start of something • Trust – Assurance for benefit of the customer
<ul style="list-style-type: none"> • Value – Cheaper alternative for non-potable water • Leadership and Trust – promotion of the product through own practice WD and LGU (show that it is safe to use); benefits not only the customer but also the environment.
<p>VALUE PROPOSITION: <i>How can you summarize the key benefits and the value of your product in one statement? Why should the customer buy your product? What is the difference between your competitor's product?</i></p>
<p>Safe, affordable, and sustainable utility water for all.</p>

Competitor Analysis:

COMPETITOR <i>Who are your competitors? Where are your competitors located/operating?</i>	COMPETITOR'S PRODUCT <i>What is the product being marketed by your competitors?</i>	CHANNEL / MEDIA <i>What channels are your competitors using to market their product?</i>	MARKET <i>Who are the target customers (target market) of your competitors?</i>
<ul style="list-style-type: none"> • Deep well facilities • Indirect competitors (not monitored but should be under the responsibility of National Water Resource Board, Department of Health) 	<ul style="list-style-type: none"> • Untreated water • groundwater supply (no cost) 	<ul style="list-style-type: none"> • (no promotion) 	<ul style="list-style-type: none"> • Out of service area of ZCWD • Private establishments (for their utility use: flushing/cleaning)

1B: Strategic Marketing: Marketing Mix (4Ps)

Instruction: Please try to answer all the guide questions to better describe the Marketing Mix for the ease of development of your Marketing Strategy.

<p>PRODUCT: <i>What do the consumers of my product/service want? What are the benefits it offers? Are there other ways to satisfy the same needs? If so, what advantages and disadvantages does mine have in comparison? What does it look like? Are there different sizes, colors, etc.? What must the consumer's experience be like when using it? What differentiates it from the competition? What is it called? Please be specific and also include packaging (if any) for the produce</i></p>
<p>Reclaimed Water for landscaping / utility use</p>
<p>PLACE: <i>Where will I find these perfect customers? Where should be the strategic places the product be placed for optimal reach? Where do customers get my product/service? Specialized stores? supermarkets? online? What other platforms should the product be present? Please define the channels through which a product reaches consumers. Consider as well distribution strategy is to both make it easy for consumers to access to the product optimize the sales process by providing a smooth "shopping experience".</i></p>
<p>Media</p> <ul style="list-style-type: none"> - Radio and print, social media (focus on Social Media through video advertising) <p>Public parks and spaces</p> <ul style="list-style-type: none"> - print - installation of demonstration product/facility (small tank where people can get reclaimed water) <p>Barangays (market for home gardening / "plantitas")</p> <ul style="list-style-type: none"> - house to house - print materials <p>Hotel / Resort Partnership</p> <ul style="list-style-type: none"> - installation of demonstration product/facility (small tank where people can get reclaimed water) - collaboration with the hotel association
<p>PRICE: <i>What is the final price of your product? These are the factors to consider to formulate your price: (a) manufacturing cost; (b) revenue you are expected to receive; (c) competitor's price; (d) demand of your product (or substitute product); (e) consumer's purchasing power; and (f) current trends and preferences of the market.</i></p>
<p>60-70% of current price of Zamboanga City Water District</p>

PROMOTION:

This refers to all the actions taken to communicate the benefits of your products and services in order to increase sales. How can I make my message reach the right audience? Which of the mediums/channels are more appropriate for my product? When is the best time to promote? Does my product or service depend on seasons? What are my competitors doing and how should that influence my decisions?

- Installation of demonstration product/facility (small tank where people can get reclaimed water)
- Promotion on social media
- Massive Information Drive – Consultative Meetings with target customers; Caravans
- Timing of promotion – during El Nino

2A: Development of Promotional Plan and Budget**PROGRAM TITLE**

Water Reuse for Utility

PROGRAM TIMEFRAME:

6-month campaign every year

- March – onset of dry season
- July – start of wet season

1. THEME – Key Promise and Message

What one SINGLE benefit and overarching action will the target audience experience upon reading/listening to your materials/media? What call-to-action do you expect?

Affordable and sustainable utility water for all.

2. TONE

What feeling should your promotion have?

Value in terms of savings while giving value to the environment

3. PROMOTION MIX

How do you want to communicate to your target audience / market? What is the best way to reach your intended audience / market?

Promotion on social media as the main platform

- video clips of demonstration facilities
- posts on uses and practicality

Information Drive / Caravan

- events and partnerships for demonstration

4. UNIQUE SELLING PROPOSITION (USP)

What product benefit (or value) you want the customer to remember?

Never lose water again – reiterate the availability of reclaimed water

5. PRODUCT SLOGAN

Be creative. Be catchy. What tagline can help have that lingering effect to the consumers?

Your waste, our water (*Duming Tubig mo, nagagamit mo*)

6. MEDIA

What channels or forms will the promotion take? TV? Radio? Print? If so, what types? Mix of the above? Interpersonal? Frequency?

Social media – video and posts

7. CREATIVE CONSIDERATIONS

<i>Anything the creative people should know? More than one language/dialect? How about the colors?</i>			
<ul style="list-style-type: none"> • Video clips – focus on water quality • Cartoons / Comic Strips – friendlier approach • Multilingual – provide different versions of the material 			
8. MANDATORIES			
<i>Are there pieces that MUST be included on media developed? Cite developing partners?</i>			
<ul style="list-style-type: none"> • Organization logos • Key Message 			
9. BUDGET			
<i>How much will this promotion effort cost? Be sure to include costs for all approaches to be used.</i>			
Line Item (Description of Material, Activity or Resource Needed)	Number / Units	Cost Per Unit	Total Cost
Outsourced production company	-	100,000	100,000
Social Media Manager	1	-	-
Sound systems	1 set	20,000	20,000
Demonstration Facility (storage tanks)	3 (1 cu.m.)	15,000	45,000
Food allowance	120 (3 events)	50	18,000
Contingency Fund	-	50,000	50,000
Grand Total			233,000

2B: Development of Promotional Materials for Social Media

MAIN SOCIAL MEDIA PLATFORM:
<i>Where do you plan on posting majority of your campaign materials?</i>
Facebook, Instagram, Tiktok
TYPE OF SOCIAL MEDIA:
<i>Type of material? (Video, Infographic, Event, Post, Blog/Vlog, Hashtag, Livestream etc.)</i>
Video Series
OBJECTIVE OF MATERIAL:
<i>What is the goal of this specific post? (Launching of campaign, general advertisement of product, announcement of event etc.)</i>
Information on the product – introduce the existence of the product
TIMING OR FREQUENCY:
<i>When or how often do you plan on posting this material?</i>
<ul style="list-style-type: none"> • New video every week (4 weeks) – content is continuous/forms a whole story when put together then to be repeated during campaign season • Repeat of the 4-week series throughout the duration of the campaign (1 full series every month)
MESSAGE AND CONTENT:
<i>What is the main message you wish to convey in this material? What are the key points needed to be included in the content of your material to catch the attention of your audience? How can you call your target audience to act on your message?</i>
Background on wastewater collection and the treatment process until the reuse of byproducts (video series)

VISUAL THEME:

How do you want your material to generally look like? (Color, images, etc.) How can you capture the attention of your target audience visually?

Cartoon / animated videos

- Reach even younger audiences for education

PROMOTIONAL MATERIAL:

Create a sample promotional material for social media. Can be a designed post, video, story board, infographic, etc.

Storyboard for Week 1:

- Background on wastewater
- Families and households with septic tanks
- Show where water goes while using (kitchen, bathroom, cleaning)
- Used water flowing to septic tank
- Features and standards of a proper septic tank
- Wastewater in septic tank – stored, almost overflowing, untouched
- What happens to the wastewater in septic tanks? To be continued.
- Mandatories

Storyboard for Week 2:

- Short recap/last scene of week 1 (show last question)
- Collection/desludging from household
- Bring sludge to treatment plant
- Background on the process in the treatment plant
- what happens after treatment? To be continued.
- Mandatories

Storyboard for Week 3:

- Short recap/last scene of week 2 (show last question)
- Discussion on quality of treated wastewater
- Department of Environment and Natural Resources – Environmental Management Bureau (DENR-EMB) certification process – show that it passes safety/environmental standards (detailed discussion on quality)
- Disposal options: discharge vs. reuse
- What can we do with this product? To be continued.
- Mandatories

Storyboard for Week 4:

- Short recap/last scene of week 3 (show last question)
- Possible applications of treated wastewater for utilities
- Show the benefits: emphasis on affordability and availability of the resource
- Show positive effects on the environment.
- Mandatories

Points for future enhancement and consideration:

- Align the campaign with the target market and audience. Remember, one problem, audience and campaign.
- Check the customer behavior and align with the promotional material and message.
- If the target audience is individual people, it is advisable to look into individual interests to have a more focused and targeted key message/promise
- You can modify key message and key promise depending on the time of the year
- Storyboard series is a great idea, you can even make a season 2 if the promotional materials are a success.
- Include key message/promise at the end of every video.