Septage Management Program in 2015 for Calamba Water District

March 2015

Japan International Cooperation Agency (JICA)

Yokohama Water Co., Ltd.(YWC)

Contents

List of Figures, Tables, and Photographs

Abbreviations

ACWD: Angeles City Water District
CHD: Center for Health Development Office
C/P: Counter Part
CWD: Calamba Water District
DBP: Development Bank of the Philippines
DENR: Department of Environment and Natural Resources
DPWH: Department of Public Works and Highways
EDP: Environment Development Project
ESC: Environmental Sanitation Clearance
FIRR: Financial Internal Rate of Return
F/S: Feasibility Study
LWUA: Local Water Utilities Administration
NPV: Net Present Value
NSSMP: National Sewerage and Septage Management Program
PWRF: Philippines Water Revolving Fund
USAID: United States Agency for International Development
JICA: Japan International Cooperation Agency

Foreign Exchange Rates (December 2014)

1PHP (Philippine Peso) ＝ 2.433JPY (Japanese Yen)

1USD (US Dollar) ＝ 109.45JPY (Japanese Yen)

Summary

Table 1 Summary Sheet

Septage Design Quantity				
	Target Year	Septage Design Quantity (m^3/d)	(Reference) Benefiting Population	
Immediate future	2017	50	99,070	
Future	2027	100	177,385	
Treatment Method				
Examined options	Option 1		Option 2	
Treatment method	Pretreatment + Mechanical dewatering + Johkasou		Pretreatment + Mechanical dewatering + Extended aeration	
Equipment specifications Pretreatment Mechanical dewatering machine Filtrate treatment	 Screen Volute Johkasou		 Screen Volute Extended aeration	
Number of Collection Trucks				
8.5 m^3 vacuum truck 4.5 m^3 vacuum truck 5 m^3 dump truck	1 2 1			
Construction Site				
Necessary area (m^2)	1,500			
Cost				
Treatment method	Option 1		Option 2	
Construction cost (PhP)	76,380,736		77,661,925	
Annual operation and maintenance cost (PhP)	8,806,441		9,562,234	
Financial Plan				
Basic conditions Interest Repayment period Weighted Average Cost of Capital Loan: Own capital Desludging fee (PhP/m^3)	 9.00% 15 years (with 3 year deferment) 9.80% 80:20 2.00			
Examination case (assuming Option 1 for the treatment method)	Case where land is purchased inside the Water District		Case where land is provided by the city authorities	
Cost share (Central Government: City: Water District)	0:0:100	40:0:60	0:0:100	40:0:60
NPV (in 1,000 PhP) FIRR	36,952 18.0	64,777 31.7	50,617 23.2	72,978 39.6

1. Outline of Work

1.1 Background

In the Philippines, sewage and septage are often released into water bodies without being treated first, and this has led to severe water contamination.

In response to these conditions, the Government of the Philippines enacted the Clean Water Act (RA 9275) in 2004 to address environmental degradation caused by water contamination. Furthermore, the government established the National Sewerage and Septage Management Program (NSSMP) led by the Department of Public Works and Highways (DPWH) in 2012, and has in other ways pursued measures focusing primarily on the development of legal and institutional frameworks.

Unfortunately, these plans, laws/ordinances and so forth have not always been implemented smoothly, and environmental degradation has continued unabated, worsening to the point that urgent measures are now needed to prevent further deterioration.

Meanwhile, the Japan International Cooperation Agency (JICA) has been implementing a two-step loan scheme called Environmental Development Project (hereinafter, EDP) through the Development Bank of the Philippines (hereinafter, DBP) since 2008 with the aim of contributing toward environmental improvement efforts through promoting construction of facilities (total committed amount: 24.8 billion yen).

Among environmental improvement facilities targeted for EDP financing, those in the fields of water supply and water quality control utilize a financing program known as the Philippines Water Revolving Fund (PWRF; a guarantee fund that aims to promote private-sector funding for water and sewerage works construction) established jointly by USAID and the DBP based on a Japanese-American water initiative.

Regarding environmental improvement facilities, the DBP (which implements the EDP) has made active efforts to encourage EDP financing for recipients (water districts) with the goal of promoting septage management projects. However, in water districts targeted for funding, the feasibility studies (hereinafter, F/S) for septage management are either nonexistent or the contents of existing F/S are insufficient, which creates a bottleneck in operations and thus obstructing financing efforts in this area.

In consideration of the factors outlined above, with the aim of promoting septage management projects through the EDP, the DBP has applied for support from JICA in basic data collection for the purpose of updating F/S and so forth in two water districts where existing F/S are available: the Calamba Water District (hereafter, "CWD") and Angeles City Water District (hereafter, "ACWD"). The relevant ordinances that are a key factor in actualizing these projects have already been approved by the city councils in both the CWD and ACWD and legal requirements and so forth needed to move forward have been fulfilled. Furthermore, many Japanese-owned enterprises have been established in these areas, and the projects are expected to provide great benefits to these enterprises as well as members of the local communities.

1.2 Objectives

Through collecting and confirming the latest information from the technical, organizational, institutional, and financial aspects concerning the F/S for septage management in ACWD and CWD, this Survey aims to revise existing F/S; to contribute to the disbursement of the EDP; and to promote collaboration with schemes for assisting small and medium enterprises.

1.3 Examination Contents

The contents of examination are as follows.

(1) Confirmation of existing F/S, etc. for septage management
(2) Careful examination of municipal ordinances
(3) Survey of septage management in Japanese-affiliated industrial parks, etc.
(4) Clarification of effluent quality standards and treatment methods
(5) Links with schemes for small and medium enterprises
(6) Careful examination of financial plans
(7) Confirmation of EDP-related documents
(8) Confirmation of environmental and social considerations

2. Outline of Calamba City

Located in the Province of Laguna in the center of Luzon, the Philippines, Calamba City is the core city of Calabarzon Region. It is situated roughly 50 kilometers from the capital Manila.

According to the national census of 2010 (CENSUS 2010), the city's population was 389,377, however, it exceeds 500,000 in 2015 (in 2013 the figure was 507,180).

3. Outline of Calamba Water District

As of 2013, the number of water supply customers is 46,230; average monthly water usage is 21.5 m^3; and the basic tariff for the first 10 m^3 of water usage is 183.00PhP. CWD has 329 employees.

4. Septage Management - Current Conditions and Future Schedule

CWD currently does not implement septage collection and treatment at all. From now on, however, it plans to collect septage, construct and operate facilities, and dispose of sludge. Moreover, the city authorities will provide land for the construction site to CWD.

Calamba City has numerous industrial parks, and the Survey Team surveyed septage management conditions on eight of these. The Survey found that almost all industrial parks treat wastewater at their own sewage treatment plants and there is no particular need to manage septage from septic tanks. Moreover, even at the sole industrial park that doesn't have its own sewage treatment plant, septage and effluent quality management is implemented appropriately.

5. Design Septage Quantity

The septage collection area for the immediate future shall be the current CWD water supply service area.

The following table shows the design daily quantity of septage (m^3/d) that has been calculated based on the future forecast population and number of households, septic tank ownership rate and access rate, the amount of septage removed from septic tanks, annual operating days, and collection frequency years. Incidentally, the septage collection frequency is assumed to be once every five years.

2012	2017	2022	2027
38.7	50.9	66.8	87.4

Based on the above figures and the level of ease of conducting phased expansion, the following table shows the immediate and future target years and septage design quantities.

	Immediate	Future
Target year	2017	2027
Septage design quantity (m^3/d)	50	100

6. Treatment Method and Cost

(Planned Construction Site)

The planned construction site is situated in a mountain area with a lot of trees and large altitude differential, so it will cost a lot to cut trees and cut and level the land. Moreover, the road leading to the planned construction site is narrow and unpaved, meaning that more expense will be incurred in road construction. Furthermore, even following construction, since it is forecast that transporting septage and sludge to and from the site would be difficult, this is deemed to be inappropriate as the planned construction site.

As the future approach, it is desirable to request the city authorities to provide an alternative site. If this isn't possible, the option of having the Water District purchase land will also need to be examined.

(Design Septage Quality)

The design septage quality is as follows.

Important Item	Unit	Design Water Quality
BOD	mg/L	6,000
COD	mg/L	20,000

(Design Effluent Quality)

Since all rivers in the city are Class C, the design effluent quality is as follows.

Item	Unit	CLASS C
pH	—	6.5-9.0
BOD	mg/L	50
COD	mg/L	100
TSS	mg/L	70
Total Coliforms	MPN/mL	10,000

(Treatment Method)

In the existing F/S, the lagoon method is adopted as the treatment method, however, the survey proposes the following two treatment methods as a means of reducing the necessary site area and satisfying the required effluent quality. The survey recommends the adoption of Option 1, which entails cheap construction and maintenance costs and relatively simple construction and maintenance. Moreover, Option 1 also permits the relatively easy expansion of facilities.

	Pretreatment	Mechanical Dewatering	Filtrate Treatment
Option 1	Screen	Volute	Johkasou
Option 2	Screen	Volute	Activated Sludge (Extended Aeration)

(Collection Trucks)

Based on the septage removal time, transportation time and so on, the number of trucks needed to collect the design quantity of septage will be as follows.

8.5 m^3 vacuum trucks	1
4.5 m^3 vacuum trucks	2
5 m^3 dump truck	1

(Required Area for the Planned Construction Site)

The required area of the planned construction site, including the treatment facilities, management building, parking area and so on and taking future expansion into account, is approximately 1,500 square meters.

(Construction Cost)

The construction cost (PhP) is as follows. Option 1 is less expensive.

Item	Option 1	Option 2
Ⅰ. TREATMENT PLANT	44,280,736	45,561,925
Procurement of Lot	15,000,000	15,000,000
II. VACUUM TRUCKS	17,100,000	17,100,000
Total	76,380,736	77,661,925

(Operation and Maintenance Cost)

The annual operation and maintenance cost (PhP) is as follows. Option 1 is less expensive.

Item	Option 1	Option 2
Ⅰ. Treatment Operation	3,948,092	4,703,884
Ⅱ. Desludging Operation	2,362,800	2,362,800
Ⅲ. Sludge Disposal	1,055,549	1,055,549
Ⅳ. Headquarters	1,440,000	1,440,000
Total	8,806,441	9,562,234

7. Financial Plan

(Examination Cases)

The construction cost is examined for two cases, i.e. the case including cost of land, and the case not including cost of land. The source of funding for the Water District will basically be loan and own capital, and consideration will also be given to sharing of cost with central government subsidies. Concerning the loan, the Philippines Water Revolving Fund (PWRF) will be utilized for the environment development project (EDP), which will be the ODA implemented by JICA via the Development Bank of the Philippines (DBP). Also, the desludging fee is set basically assuming an extra charge of 2 PhP per cubic meter of water usage.

The basic conditions are indicated below.

Loan Terms and Conditions	
Interest per annum	**9.00 %**
Repayment period (inclusive of grace)	15 years
Grace period	3 years
Weighted Average Cost of Capital (WACC)	**9.80 %**
Loan Share	80 %
Equity Share	20 %
Estimated desludging fee (per cu.m. of water consumed)	**PhP2.00**

(Examination Results)

The results of examination are shown below.

A desludging fee of 2PhP is appropriate, however, the business will stabilize if the national government provides a subsidy of 40%.

Examination Case	Case where CWD Purchases Land		Case where Land is Provided by the City	
Demarcation (NG:LGU:WD)	0:0:100	40:0:60	0:0:100	40:0:60
Net Present Value (in thousand pesos)	**36,952**	**64,777**	**50,617**	**72,978**
Financial Internal Rate of Return	**18.0%**	**31.7%**	**23.2%**	**39.6%**
Net Present Value (NPV)				
Cost (+20%)	8,961	42,352	25,359	52,192
Revenues (-20%)	1,571	29,396	15,235	37,596
Cost (+20%), Revenues (-20%)	**-26,420**	6,971	**-10,023**	16,810
Financial Internal Rate of Return				
Cost (+20%)	11.6%	22.3%	15.7%	28.3%
Revenues (-20%)	10.2%	20.4%	14.1%	26.0%
Cost (+20%), Revenues (-20%)	**4.1%**	12.0%	**7.3%**	16.2%

8. Environmental and Social Considerations

Since the sewage and wastewater treatment sector is often regarded as exerting important environmental and social impacts, it is necessary to advance the projects upon paying ample attention to environmental and social considerations such as impacts on air, water, and soil, impacts on natural items such as ecosystems and biota, and social impacts such as involuntary resettlement and so on.

The septage treatment facilities planned here are relatively small in scale and will not exert as large an impact as sewage treatment facilities, however, it will still be necessary to pay attention to the following points in particular.

(1) Large-scale land reclamation and clearing (especially in Calamba Water District)

(2) Odor countermeasures

(3) Involuntary resettlement of residents

Moreover, when it comes to starting septage management activities in both water districts from now on, it will be necessary to obtain Environmental Sanitation Clearance (ESC) from the Center for Health Development Office (CHD). Accordingly, it will first be necessary to submit applications to the city authorities.

9. Future Measures

The items that need to be tackled from now on when it comes to advancing septage management are as follows.

(1) Establishment of dedicated departments

(2) Formulation of the project schedule

(3) Implementation design

(4) Securing of the planned construction sites

(5) Increase of water tariffs and application for subsidies from the central government

(6) EDP application

(7) Examination of sludge disposal

(8) Examination of outsourcing

(9) Implementation of monitoring

1. Outline of Project

1.1 Background

In the Philippines, sewage and septage are often released into water bodies without being treated first, and this has led to severe water contamination. Less than 10% of the population nationwide has access to sewerage systems, and the resulting annual economic loss is believed to be 78 billion pesos (according to the World Bank's 2008 report *Economic Impacts of Sanitation in the Philippines*). This economic loss includes effects on health, water resources, tourism and other such factors, and 72% of all loss can be traced to adverse effects on health. In particular, health-related economic losses stemming from early fatality among infants caused by water contamination are estimated to be 50.8 billion pesos annually.

In response to these conditions, the Government of the Philippines enacted the Clean Water Act (RA 9275) in 2004 to address environmental degradation caused by water contamination. In addition, the government has clearly expressed its commitment to environmental protection measures through its mid-term development plan (2011–16), which prioritizes development of the investment climate that encompasses the water environment infrastructure with the aim of achieving inclusive growth. Furthermore, the government established the National Sewerage and Septage Management Program (NSSMP) led by the Department of Public Works and Highways (DPWH) in 2012, and has in other ways pursued measures focusing primarily on the development of legal and institutional frameworks.

Unfortunately, these plans, laws/ordinances and so forth have not always been implemented smoothly, and environmental degradation has continued unabated, worsening to the point that urgent measures are now needed to prevent further deterioration.

Meanwhile, the Japan International Cooperation Agency (JICA) has been implementing a two-step loan scheme called Environmental Development Project (EDP) through the Development Bank of the Philippines (DBP) since 2008 with the aim of contributing toward environmental improvement efforts through promoting construction of facilities (total committed amount: 24.8 billion yen).

Among environmental improvement facilities targeted for EDP financing, those in the fields of water supply and water quality control utilize a financing program known as the Philippines Water Revolving Fund (PWRF; a guarantee fund that aims to promote private-sector funding for water and sewerage works construction) established jointly by USAID and the DBP based on a Japanese-American water initiative.

Regarding environmental improvement facilities, the DBP (which implements the EDP) has made active efforts to encourage EDP financing for recipients (water districts) with the goal of promoting septage management projects. However, in water districts targeted for funding, many septage management F/S are either nonexistent or the contents of existing F/S are insufficient, creating a bottleneck in operations and thus

obstructing financing efforts in this area.

In consideration of the factors outlined above, with the aim of promoting septage management projects through the EDP, the DBP has applied for support from JICA in basic data collection for the purpose of updating F/S and so forth in two water districts where existing F/S are available: the Calamba Water District (hereafter, "CWD") and Angeles City Water District (hereafter, "ACWD"). The relevant ordinances that are a key factor in actualizing these projects have already been approved by the city councils in both the CWD and ACWD and legal requirements and so forth needed to move forward have been fulfilled. (The relevant ordinances is shown in reference 10.1.) Furthermore, many Japanese-owned enterprises have been established in these areas, and the projects are expected to provide great benefits to these enterprises as well as members of the local communities.

Through this survey, which envisions project actualization via the EDP, it is intended to collect and confirm the basic information necessary to update F/S on the septage-management administrative side (the two water districts targeted) and then revise the F/S.

Through this survey, it is also intended to introduce septage treatment technologies through JICA's ongoing small- and medium-sized enterprise support program while deepening collaborative ties with small- and medium-sized enterprise support efforts and international yen loan programs.

Figure-1.1.1 Locations of Angeles City and Calamba City

1.2 Objectives

Through collecting and confirming the latest information from the technical, organizational, institutional, and financial aspects concerning the F/S for septage management in ACWD and CWD, this survey aims to revise

existing F/S; to contribute to the disbursement of the EDP; and to promote collaboration with schemes for assisting small and medium enterprises.

1.3 Examination Contents

(1) Confirmation of Existing F/S, etc. for Septage Management

This Survey will collect the information that is necessary to update the existing F/S for septage management. In particular, organizational systems and personnel systems, owned materials and machinery, planned capabilities, potential for land procurement, specifications of equipment for collection, treatment and disposal, and financial analysis will be examined.

(2) Careful Examination of Municipal Ordinances

The ordinances regarding septage management have already been approved by the city councils in Calamba and Angeles. The contents of these regulations will be scrutinized and analyzed for necessary information from the viewpoint of the effectiveness of the ordinances. Also, information will be collected and analyzed regarding political links between the city authorities and water districts.

(3) Survey of Septage Management in Japanese-affiliated Industrial Parks, etc

The target water districts contain industrial parks occupied by numerous Japanese-affiliated companies. Concerning the state of sludge management and septage management in the concerned industrial parks, survey will be conducted on management systems, management bodies, sludge discharge frequency and the presence/absence of septage treatment operators, etc.

(4) Clarification of Effluent Quality Standards and Treatment Methods

Effluent quality standards in the case where septage treatment facilities are installed in the target water districts will be clarified, and information will be collected and confirmed regarding the necessary septage treatment systems. This information will be used to update existing F/S, etc.

(5) Links with Schemes for Small and Medium Enterprises

The Philippine side highly regards the dewatering technologies of small and medium-sized enterprises that have been utilized in the SME assistance scheme currently implemented by JICA. While appropriately introducing these technologies, information necessary for updating existing F/S etc. including financial plans (investment costs, maintenance costs, etc. envisaged when introducing the said technologies) will be collected, and the contents will be checked.

(6) Careful Examination of Financial Plans

The water tariffs set in the existing F/S will be revised to realistic settings, and financial plans including the amount invested and maintenance costs will be scrutinized. In addition, the feasibility of cost sharing with entities apart from the water districts (city authorities or the national government) will be reviewed, and if this is feasible, outline survey and clarification will be performed. The approach to outsourcing project operations will also be examined.

(7) Confirmation of EDP-related Documents

In this survey, since it is envisaged that projects will be implemented with EDP loans based on F/S, etc. revised in this survey, information concerning the documents that the water districts will need to submit in order to apply to the DBP for loans will be collected and checked.

(8) Confirmation of Environmental and Social Considerations

Since septage treatment systems are often regarded as troublesome facilities, information concerning environmental and social matters that merit particular attention, odor prevention measures, planning for compensation, and so on will be collected. In particular, concerning the acquisition and expropriation of the planned land (whether or not to remove residents), appropriateness and important points from the viewpoint of environmental and social consideration will be confirmed, and the measures that need to be taken and costs that need to be borne by the water districts will be ascertained.

2. Outline of Calamba City

2.1 Outline

Located in the Province of Laguna in the center of Luzon, the Philippines, Calamba City is the core city of Calabarzon Region. It is situated roughly 50 kilometers from the capital Manila. The city is a famous resort area in the Philippines thanks to hot springs located south of Lake Laguna. It is also the birthplace of Jose Rizal, who is lauded as a national hero of the Philippine independence movement and is still a loved figure today.

According to the national census of 2010 (CENSUS 2010), the city's population was 389,377, however, it exceeds 500,000 in 2015 (in 2013 the figure was 507,180). Calamba is the largest city in the Province of Laguna.

The municipal area of Calamba is 14,950 hectares (149.5 square kilometers), making it the second largest city in the Province of Laguna behind San Pablo City. Land in the city is classified according to purpose of use into: Urban Redevelopment Zones, Growth Management Zones (1/2), Upland Conservation Zones, Forest Buffer Zones, and Agricultural Development Zones. Since the population is large in comparison to the city area, population density is extremely high at 2,600 people per square kilometer (2010). The populations of barangay range from a few hundred to a few thousand people per square kilometer in rural zones, tens of thousands of people per square kilometer in urban zones, and more than 70,000 in the densely populated areas containing municipal offices and commercial facilities.

Calamba is situated along the northern slopes of the dormant volcano Mount Makiling. To the north is located Cabuyao City, to the southeast is Los Banos City, to the southwest is the province of Gatangas, and to the east is Laguna de Bay, which is the largest lake in the country.

Calamba is located at the southern origin of the South Luzon Expressway, and the transport network stretches to cities in the Province of Laguna, as well as to the Province of Batangas, and the Province of Quezon in the south.

As one of the Premiere Industrial Hubs outside of Metro Manila, Calamba has numerous industrial parks that contain factories operated by Philippine, Japanese, Chinese, South Korean, European, and American corporations. The industrial parks are concentrated in peripheral barangay such as Canlubang, Milagrosa, and Punta. As may be gathered from the fact that Calamba Water District production wells are concentrated in such areas, since these industrial parks require sources of good quality water, they are located in the center of the city. These industrial parks contain factories of various sectors ranging from the food processing plants of well-known Philippine fast food and beverage makers to Japanese and South Korean electronics factories, Japanese auto makers, and American cosmetics manufacturers.

2.2 Organization

According to city classifications in the Philippines, Calamba is ranked as First Class among the top rated Highly Urbanized Cities. Incidentally, Highly Urbanized Cities refer to cities with a population of 200,000 or more and municipal revenue of 500 million PHP or more.

The following figure shows the organization chart of Calamba City Office.

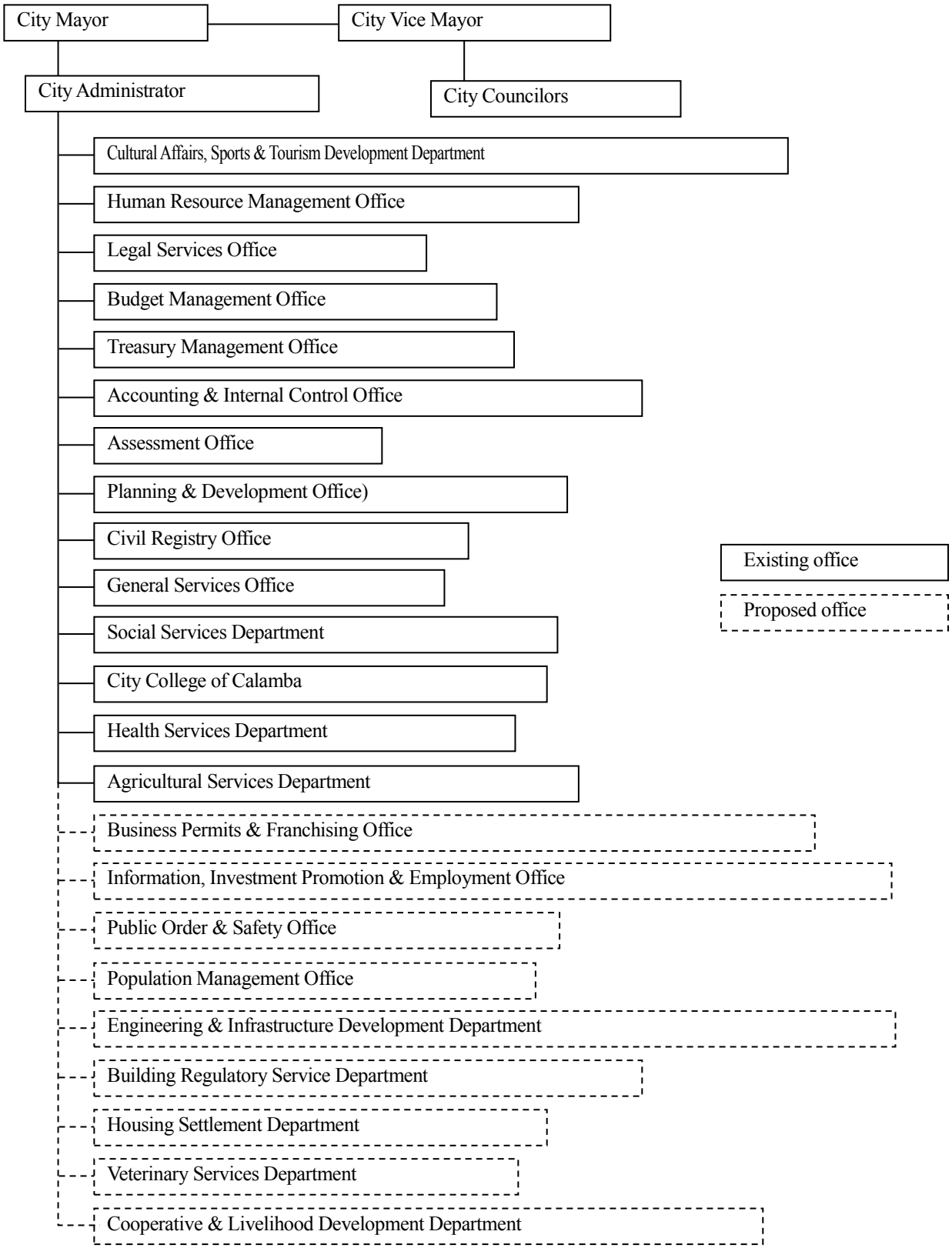

Figure-2.2.1 Calamba City Office Organization Chart

2.3 City Ordinances relevant to Septage

With respect to septage, Calamba City has enacted the "Ordinance for Establishment of a Sewage and Septage Management System and Implementation Procedure in Calamba City" (City Ordinance No.456, S-2009). In particular, Section 8 of this ordinance stipulates the design of septic tanks; Section 11 makes it obligatory to remove septage from (desludge) tanks once every 3~5 years; and Section 12 clearly states that user fees should be paid on top of the water tariff paid to Calamba Water District. In relation to this, non-users in CWD are able to receive septage removal services from CWD providing that they pay the commensurate fee.

3. Outline of Calamba Water District

3.1 Outline of Operations

The water supply system of Calamba City was started by Calamba City Office in 1926. From 1956 it was passed on to the National Waterworks And Sewage Agency (NAWASA) and came under provincial management. However, it once more came under municipal jurisdiction by Calamba City in 1964. Water was primarily sourced from spring water (the districts of Bucal and Tigbe) and groundwater and was conveyed to households along 16.4 kilometers of small-diameter transmission and distribution pipes.

In 1974, based on the Provincial Water Utilities Act of 1973 according to Presidential Decree No. 198 (PD198), Calamba Water District (CWD) inherited the Calamba City water supply system and started operation as a semi-public service entity based on an independent accounting system. On September 4, 1976, CWD received Conditional Certificate of Conformance (CCC) No. 29 from the Local Water Utilities Administration (LWUA). This certificate (CCC) is recognized to possess authorization rights and concession rights under PD198.

Calamba Water District in those days only had 15 employees and very limited equipment, however, as the working environment came to be improved under assistance from the municipal government, it acquired the capability to maintain water supply facilities and operate the system. As the number of contract holders and employees subsequently increased, the business status picked up.

The following table shows the water supply situation of CWD.

Table-3.1.1 CWD Water Supply Situation

Items		Unit	2012	2013
Active Metered Customers		Conn.	43,537	46,230
Domestic/Government		Conn.	40,659	43,346
Commercial/Industrial		Conn.	2,878	2,884
Bulk		Conn.	1	0
Average Monthly Consumption		m^3/Conn.	21.6	21.5
Water Sales		1,000PHP	303,985	318,326
Collection Rate		%	97.3	97.4
Water Source	Well	Location	42	50
	Spring	Location	1	1
Water Production Capacity		m^3/day	61,197	62,839

Water Production	m^3/day	49,650	100%	50,555	100%
Revenue Water	m^3/day	31,383	63.2	32,777	64.8
Non-Revenue Water	m^3/day	18,267	36.8	17,778	35.2
Real Leakage	m^3/day	(------)	(----)	(------)	(----)
Identified Leakage	m^3/day	(5,054)	(10.2)	(7,558)	(15.0)
Illegal Connection	m^3/day	(------)	(----)	(------)	(----)
Water Meter Error	m^3/day	(------)	(----)	(------)	(----)
Maintenance by CWD	m^3/day	(233)	(0.5)	(403)	(0.8)
Uncollectable Bill	m^3/day	(1,341)	(2.7)	(1,314)	(2.6)
Other	m^3/day	(11,639)	(23.4)	(8,503)	(16.8)
Employee	Person	323		329	

Table-3.1.2 Calamba City Barangay Information

No.	Barangay	Area (ha:0.01km^2)	Population (2010)	Population Density (persons/km^2)	Classifi-cation	Zoning Classification					
						UR	GM1	GM2	UC	FB	AD
1	Bagong Kalsada	157.8	3,306	2,095	Urban	X					
2	Banadero	190.0	7,116	3,745	Urban						X
3	Banlic	274.9	12,780	4,649	Urban						X
4	Barandal	189.3	4,625	2,443	Rural		X				
5	Poblacion B1	29.2	6,569	22,497	Urban	X					
6	Poblacion B2	17.1	8,005	46,813	Urban	X					
7	Poblacion B3	29.8	4,408	14,792	Urban	X					
8	Poblacion B4	4.5	3,237	71,933	Urban	X					
9	Poblacion B5	25.6	6,285	24,551	Urban	X					
10	Poblacion B6	42.3	2,447	5,785	Urban	X					
11	Poblacion B7	81.8	2,519	3,079	Urban	X					
12	Batino	110.5	1,249	1,130	Rural	X	X				
13	Bubuyan	196.0	1,666	850	Rural				X		
14	Bucal	265.0	11,346	4,281	Urban	X			X		X
15	Bunggo	556.6	3,809	684	Rural				X		
16	Burol	258.2	1,783	690	Rural				X		
17	Camaligan	106.5	978	918	Rural			X			
18	Canlubang	3,912.0	54,655	1,397	Rural		X	X			
19	Halang	166.7	6,829	4,097	Urban	X					X
20	Hornalan	22.0	1,397	6,350	Rural				X		
21	Kay-Anlog	272.0	2,665	980	Rural			X			
22	La Mesa	294.1	11,836	4,024	Urban	X	X		X		

23	Laguerta	314.9	1,766	5,060	Rural				X		
24	Lawa	146.6	9,169	6,254	Urban	X					
25	Lecheria	157.5	8,391	5,328	Urban	X					X
26	Lingga	45.0	5,817	12,927	Urban						X
27	Looc	179.1	14,524	8,109	Urban						X
28	Mabato	273.1	705	258	Rural				X		
29	Majada Labas	180.2	5,172	2,870	Urban		X				
30	Makiling	465.7	7,510	1,613	Rural		X	X			
31	Mapagong	320.8	4,942	1,541	Rural		X				X
32	Masili	32.1	3,585	11,168	Urban	X					
33	Maunong	399.2	2,105	527	Rural		X	X	X		
34	Mayapa	116.3	21,826	18,767	Urban		X				
35	Milagrosa	209.4	5,308	2,535	Urban		X	X			
36	Paciano Rizal	126.8	11,958	9,431	Urban			X			
37	Palingon	15.3	6,403	2,339	Urban						X
38	Palo Alto	273.7	10,628	3,883	Rural		X				
39	Pansol	528.2	10,868	2,058	Urban	X			X	X	X
40	Parian	112.0	20,248	18,079	Urban	X					X
41	Prinza	95.3	3,996	4,193	Rural	X	X				
42	Punta	331.0	3,511	1,061	Rural		X	X			
43	Puting Lupa	542.0	1,720	317	Rural			X	X	X	
44	Real	132.9	13,805	10,388	Urban	UR					
45	Saimsim	194.5	5,504	2,830	Rural		X				
46	Sampiruhan	81.0	8,144	10,054	Urban						X
47	San Cristobal	119.0	12,584	10,575	Urban	X					
48	San Jose	89.6	4,203	4,691	Urban	X					
49	San Juan	15.3	4,780	31,242	Urban	X					
50	Sirang Lupa	198.4	8,225	4,146	Urban		X				
51	Sucol	31.6	4,765	15,079	Urban	X					
52	Turbina	51.5	4,475	8,689	Urban	X					
53	Ulango	227.6	858	377	Rural				X		
54	Uwisan	78.0	2,358	3,023	Urban						X

UR: Urban Redevelopment Zone

GM1: Growth Management Zone 1

GM2: Growth Management Zone 2

UC: Upland Conservation Zone

FB: Forest Buffer Zone

AG: Agricultural Development Zone

Table-3.1.3 Production Well Particulars

Pump Station	Production Capacity (m^3/hr)	Water Conveyance Method	Elevated Tank Capacity (m^3)	Remarks
01 Crossing	158	Direct water supply		
02 Parian	158	Direct water supply		
03 Landmark	109	Direct water supply		
04 Bucal Pump/Spring	828	Via elevated water tank	1,700	
05 Villa De Calamba	72	Via elevated water tank	455	
06 Pasong Kalabaw	109	Direct water supply		
07 Real	158	Direct water supply		
08 Lawa	148	Direct water supply		
09 Laguna Hills	54	Direct water supply		
10 Sirang Lupa	72	Direct water supply		
11 Lakeview Heights	4	Direct water supply		
12 Asiacon 1	43	Via elevated water tank	151	
13 Asiacon 2	64	Via elevated water tank	151	
14 Palao 1	79	Via elevated water tank	189	
15 Palao 2	72	Via elevated water tank	189	
16 Manfil	54	Via elevated water tank	189	
17 Asiacon Phase 2	50	Via elevated water tank	189	
18 MCDC 1	69	Via elevated water tank	151	
19 MCDC 2	43	Via elevated water tank	151	
20 SCGH	22	Via elevated water tank	151	
21 Villa Palao Banlic 1	41	Via elevated water tank	189	
22 Villa Palao Banlic 2	43	Via elevated water tank	189	
23 Major Homes	9	Via elevated water tank	56	
24 North Marie	12	Direct water supply		
25 Tibagan	6	Via elevated water tank	35	
26 Ulango 1	4	Direct water supply		
27 Ulango 2	4	Direct water supply		
28 Villa La Prinza 1	14	Via elevated water tank	55	
29 Villa La Prinza 2	13	Via elevated water tank	55	

30 Aztec	11	Via elevated water tank	189	
31 Barandal 1	9	Direct water supply		
32 Barandal 2	10	Direct water supply		
33 Makiling	50	Direct water supply		
34 Tulo	50	Direct water supply		
35 Homelands	52	Direct water supply		
36 Glenwood	23	Direct water supply		
37 Turbina	4	Direct water supply		
38 Woodlands	50	Direct water supply		
39 Maunong 1	5	Via elevated water tank	75	
40 Maunong 2	4	Via elevated water tank	5	
41 Maunong 3	11	Direct water supply		
42 Bunggo 1	4	Via elevated water tank	75	
43 Bunggo 3	4	Direct water supply		
44 Bunggo 4	11	Direct water supply		
45 Villa Consolacion	4	Via elevated water tank	189	
46 Maresco	11	Via elevated water tank	25	
47 Gumamela	4	Direct water supply		
48 Punta 1	11	Direct water supply		
49 Punta 2	11	Direct water supply		
50 Punta 3	11	Direct water supply		
51 Bubuyan 1	4	Direct water supply		
52 Bubuyan 2	4	Direct water supply		
53 Majada 1	50	Direct water supply		
54 Majada 2	45	Direct water supply		
55 Southville 1	36	Direct water supply		
56 Southville 2	43	Direct water supply		
Total	2,217			

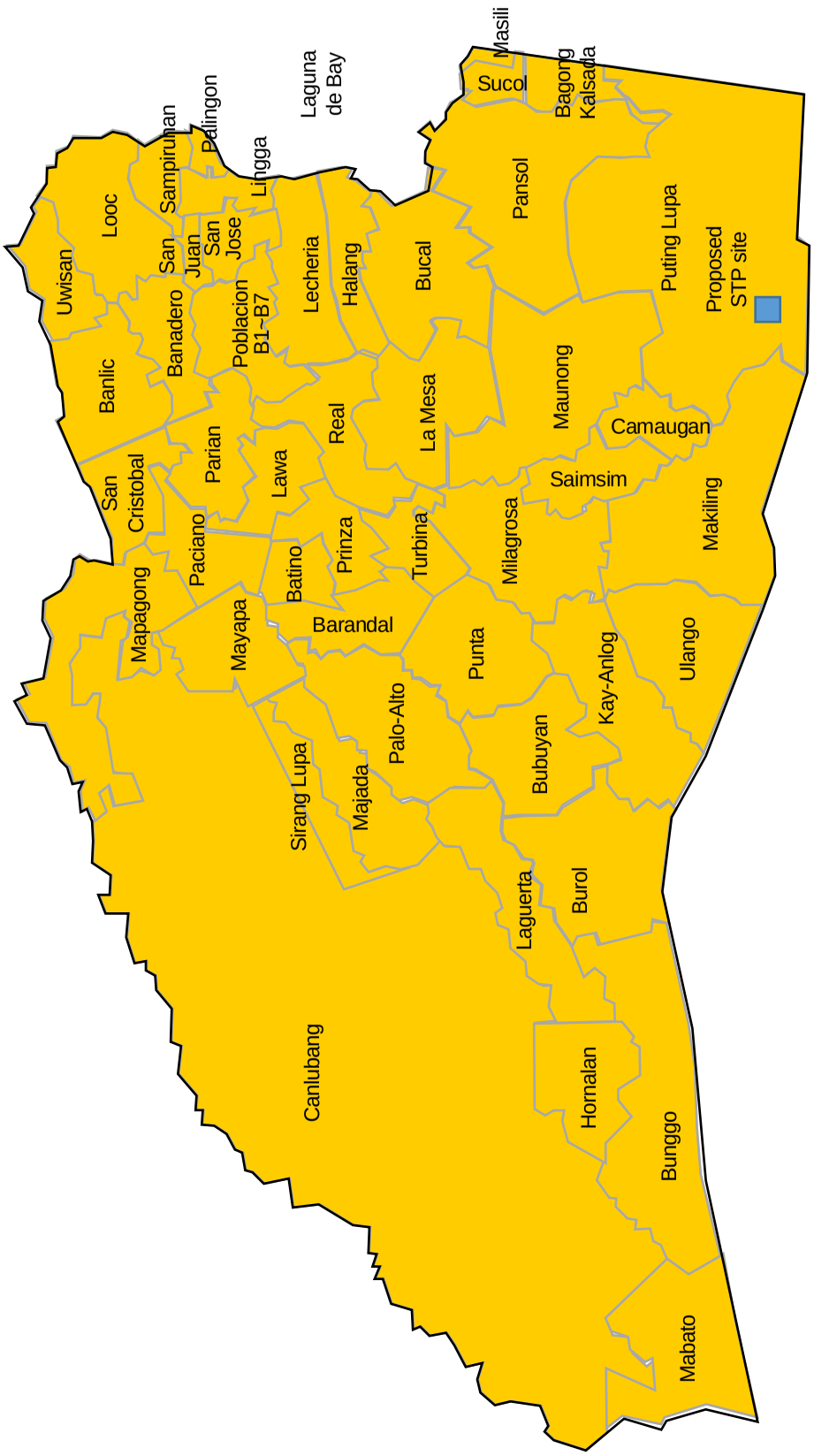

Figure-3.1.1 Map of Barangay in Calamba City

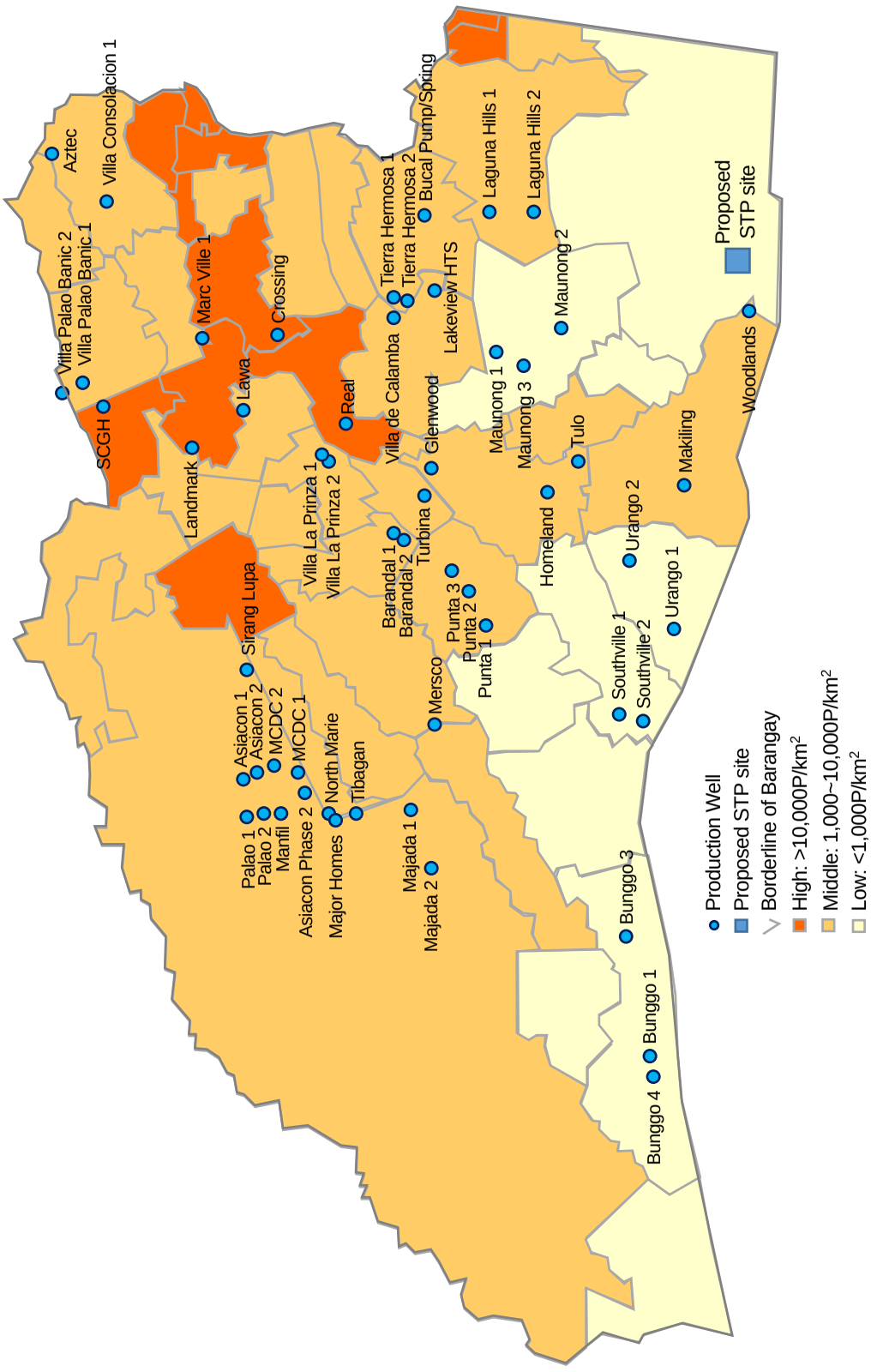

Figure-3.1.2 Population Density and Well Layout by Barangay

3.2 Organization

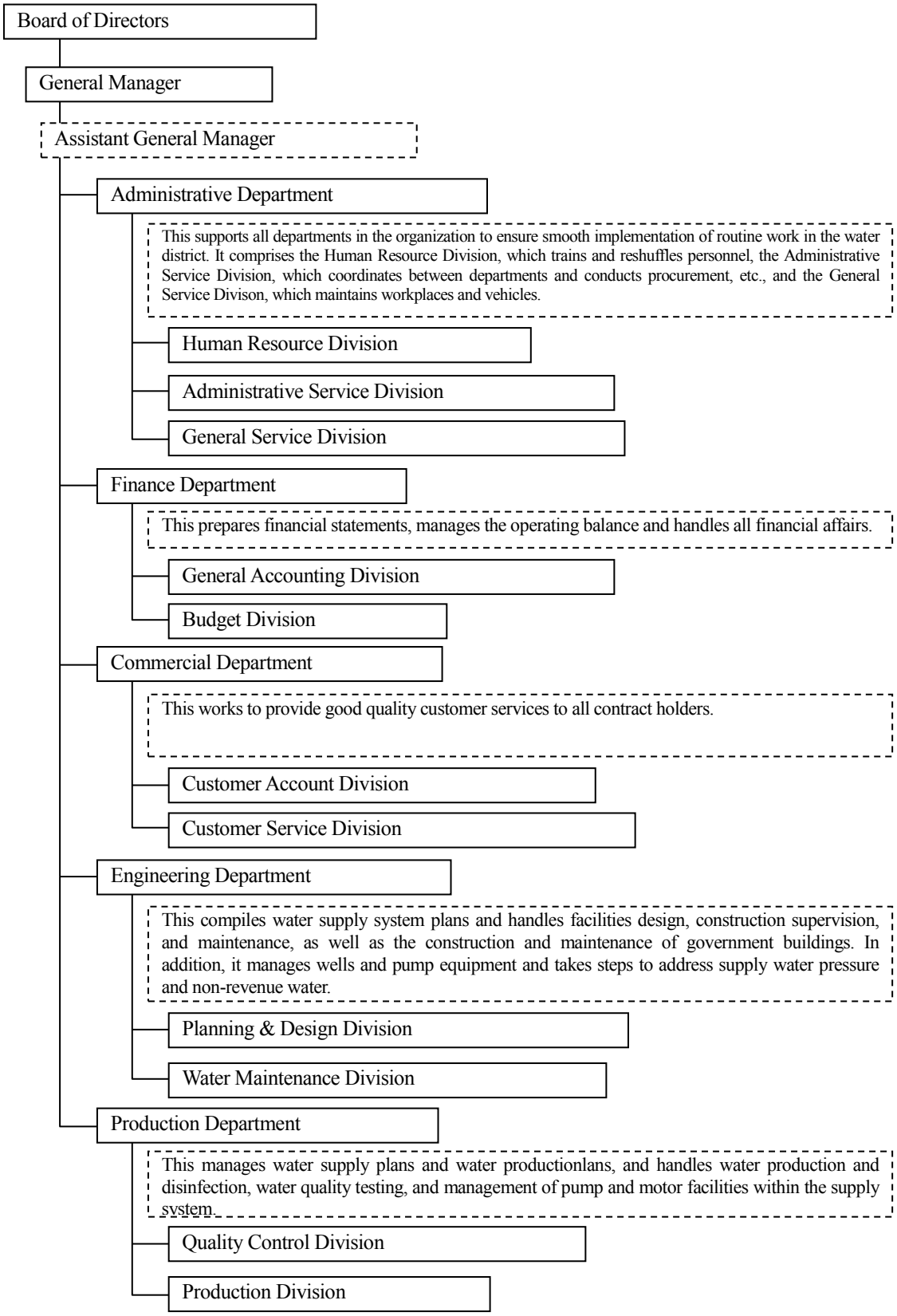

Figure-3.2.1 Calamba Water District Organization Chart

3.3 Financial Condition and Tariff Scheme

(1) Financial Condition

Table-3.3.1 Financial Data (PhP)

Item	2012	2013
1. REVENUE		
a. Operating	311,467,457	325,959,229
b. Non- Operating	3,796,889	2,698,701
TOTAL	315,264,346	328,657,930
2. EXPENSES		
a. Salaries & Wages	66,781,563	64,282,424
b. Pumping Cost (Fuel, Oil, Electric)	65,331,097	75,419,041
c. Chemical (Water Treatment)	2,657,113	2,637,351
d. Other O & M Expense	113,193,639	107,016,192
e. Depreciation Expense	31,171,775	37,669,091
f. Interest Expense	1,200,000	1,200,000
g. Others	16,478,468	14,497932
TOTAL	296,813,656	302,722,031
3. NET INCOME (LOSS)	18,450,691	29,538,898

(2) Tariff Scheme (revised July 2010)

a) Domestic/Government Use

Table-3.3.2 Water Tariffs (Domestic/Government Use)

Water Meter Diameter		Basic Tariff (PHP/10m^3)	Excess Charge (PHP/m^3)			
			11-20m^3	21-30m^3	31-40m^3	Over 41m^3
13mm	1/2”	183.00	20.30 (16.20)	24.05 (19.20)	30.80 (24.60)	36.45 (29.20)
20mm	3/4”	298.80				
25mm	1”	585.60				
40mm	1.5”	1,464.00				
50mm	2”	3,660.00				

Note: Figures in parentheses indicate tariffs in cases of water supply from wells of NHA (National Housing Authority) areas, VLP (Villa La Priniza), VPB (Villa Palac Banilic), and Major Homes.

b) Commercial/Industrial Use

Table-3.3.3 Water Tariffs (Commercial/Industrial Use)

Water Meter Diameter		Basic Tariff (PHP/10m^3)	Excess Charge (PHP/m^3)			
			11-20m^3	21-30m^3	31-40m^3	Over 41m^3
13mm	1/2”	366.00	40.60 (32.40)	48.10 (38.40)	61.60 (49.20)	72.90 (58.40)
20mm	3/4”	585.60				
25mm	1”	1,172.20				
40mm	1.5”	2,928.00				
50mm	2”	7,320.00				

Note: Figures in parentheses indicate tariffs in cases of water supply from wells of NHA (National Housing Authority) areas, VLP (Villa La Priniza), VPB (Villa Palac Banilic), and Major Homes.

4. Septage Management - Current Conditions and Future Schedule

4.1 Current Conditions of Septage Management

Currently, the water district and city authorities implement no collection and treatment of septage at all. Accordingly, there is no organization for the sewage and septic tank sector, and no vacuum trucks and other equipment are owned.

The team conducted hearings about collection and disposal by private sector enterprises, however, the local side had no information to give.

4.2 Future Schedule for Septage Management

The team conducted hearings about the currently envisaged division of roles of the city authorities and Water District when it comes to introducing septage management in the future. The results of hearings were as follows:

- Land acquisition → City
- Septage collection → Water District
- Facilities construction → Water District
- Facilities maintenance → Water District
- Sludge disposal (landfill) → Water District
- Sludge recycling → Private enterprises (contractors)

4.3 Septage Management Conditions on Japanese-Affiliated Industrial Parks

4.3.1 Survey Targets

As is indicated in Table-4.3.1, there are many industrial parks in Calamba City. The Survey Team conducted a survey of 25 Japanese-affiliated enterprises operating in these industrial parks. Incidentally, according to the hearings at Calamba City Office, since Calamba Premiere International Park (1) and Filinvest Technology Park Calamba (5) have their own sewer systems and sewage treatment facilities, meaning that enterprises do not need to have septic tanks, they were omitted from the survey.

Table-4.3.1 List of Industrial Parks

	Industrial Park	Address
1	Calamba Premiere International Park	Batino, Parian & Barandal ,Calamba City, Laguna
2	Carmelray Industrial Park I	Canlubang, Calamba City, Laguna
3	Carmelray Industrial Park II	Punta & Tulo, Calamba City, Laguna
4	Carmelray International Business Park	Canlubang, Calamba City, Laguna
5	Filinvest Technology Park Calamba	Punta, Burol & Bubuyan, Calamba City, Laguna
6	Light Industry & Science Park II	Real & La Mesa, Calamba City, Laguna
7	SMPIC Special Economic Zone	Barangay Paciano Rizal, Calamba City, Laguna
8	YTMI Realty Special Economic Zone	Brgy. Makiling, Calamba City, Laguna

4.3.2 Survey Contents

Questionnaire was implemented concerning the conditions of septic tank sludge management, management structure, management agencies, sludge removal and so on.

4.3.3 Survey Findings

Upon implementing a questionnaire survey of 25 enterprises, 11 gave responses. The following table shows the number of surveyed enterprises and number of responding enterprises in each industrial park.

Table-4.3.2 Breakdown of Responding Enterprises

	Industrial Park	Number of Surveyed Enterprise	Number of Responding Enterprise
2	Carmelray Industrial Park I	9	3
3	Carmelray Industrial Park II	7	4
4	Carmelray International Business Park	1	0

6	Light Industry & Science Park II	5	1
7	SMPIC Special Economic Zone	1	1
8	YTMI Realty Special Economic Zone	2	2
Total		25	11

According to the survey findings, leaving aside 4 Carmelray International Business Park and 8 YTMI Realty Special Economic Zone where no responses were given, the industrial parks have their own sewage treatment plants for treating wastewater. Accordingly, standards are established for wastewater discharge to the treatment plants, and discharges are managed and supervised. Moreover, some enterprises are connected to the sewage system and have also installed septic tanks; in these cases, private operators remove septage when the septic tanks become full. Desludging (septage removal) fees are paid to the private operators according to the amount of septage removed.

In 8 YTMI Realty Special Economic Zone, which is thought not to have its own sewage treatment plant, the amount of septage inside septic tanks is monitored and septage removal is consigned to private operators when tanks become full. In such cases, too, desludging fees are paid to the private operators according to the amount of septage removed. Moreover, concerning effluent quality, individually installed equipment is used to treat effluent and ensure compliance with the DENR environmental authorization.

4.3.4 Summary

Almost all industrial parks treat wastewater at their own sewage treatment plants, so there is no particular need for septage management inside septic tanks. Leaving aside 4 Carmelray International Business Park where no responses were given, even in 8 YTMI Realty Special Economic Zone, which is thought to be the only industrial park that does not have its own sewage treatment plant, septage is removed from septic tanks and effluent quality is managed by means of separately installed treatment equipment, so septage and effluent quality are appropriately managed. Meanwhile, since many of the employees of Japanese-affiliated enterprises that have located in the two cities reside in these cities, the indirect beneficial effects of the septage management program for Japanese-affiliated enterprises will be high.

5. Design Septage Quantity

5.1 Septage Collection Area

As is also the case in the existing F/S, the area where the Water District provides services as shown in Figure-5.1.1 will be targeted. In future, it will be desirable to expand the area to include all 54 barangay in the city in line with expansion of the area under Water District jurisdiction.

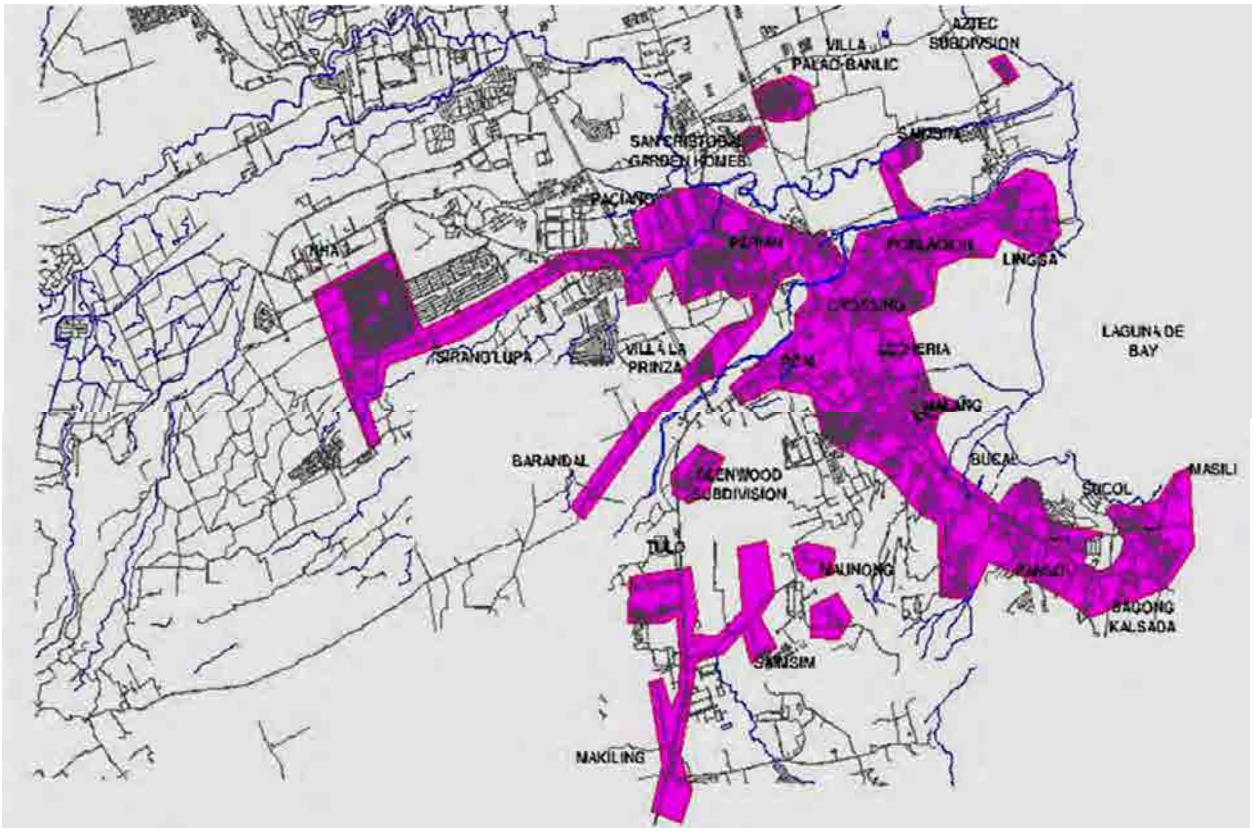

Figure-5.1.1 Target Area for Septage Collection

5.2 Population Forecast

According to Table 3-2 in the existing F/S, the population of Calamba City is as shown below. The number of households in 2007 was 72,056.

Table-5.2.1 Calamba City Population Forecast

Actual	Population Forecast			
2007	2012	2017	2022	2027
360,281	423,341	498,018	589,870	699,904

Population of the target area for septage collection was set as shown in Table-5.2.2 based on the results of population forecast in Calamba City and the existing F/S 8.1 CWD Service Area per Zone. Also, the numbers of residential customer and commercial customers were set as shown in Table 5.2.3.

Table-5.2.2 Population Forecast in the Septage Collection Area

2012	2017	2022	2027
310,001	364,685	431,946	512,521

Table-5.2.3 Forecast Number of Households in the Septage Collection Area

	2012	2017	2022	2027
Residential (Customers)	43,508	51,183	60,623	71,931
Residential (Non-Customers)	18,492	21,754	25,766	30,573
Commercial	2,447	2,879	3,410	4,046

5.3 Forecast Quantity of Septage Generation

The generated quantity of septage was forecast based on the following formula:

Quantity of septage generation (Va) = Vh1 + Vh2 +Vh3

Residential (Customers) septage generation (Vh1)

Vh1 = Number of households (Nh1) * Ownership rate (βh1) * Access rate (σh1) * Removal quantity (vh1) * Target ratio (θh1)

Residential (Non-Customers) septage generation (Vh2)

Vh2 = Number of households (Nh2) * Ownership rate (βh2) * Access rate (σh2) * Removal quantity (vh2) * Target ratio (θh2)

Commercial septage generation (Vh3)

Vh3 = Number of businesses (Nc) * Ownership rate (βc) * Access rate (σc) * Removal quantity (vc) * Target ratio (θc)

(1) Preconditions

Regarding Calamba Water District, since the quantity of septage generation has not been confirmed in the existing F/S, forecast was conducted in the Survey. In calculating the quantity of septage generation, the following parameters were set.

a) Septic tank ownership rate (β)

In light of past survey findings in Calamba City, the same values as the existing F/S were used.

Table-5.3.1 Septic Tank Ownership Rate (β)

	2012	2017	2022	2027
Residential	0.80	0.81	0.82	0.83
Commercial	1.00	1.00	1.00	1.00

b) Septic tank access rate (σ)

The access rate to residential septic tanks was set in light of past survey findings in Calamba City. As for commercial septic tanks, since there were no past survey findings, the same values as adopted in the existing F/S for Angeles City were set.

Table-5.3.2 Septic Tank Access Rate (σ)

	2012	2017	2022	2027
Residential	0.42	0.47	0.52	0.57
Commercial	0.80	0.80	0.80	0.80

c) Quantity of septage removal from septic tanks (v)

Concerning the quantity of septage removal from residential septic tanks, the same values as adopted in the existing F/S for Angeles City were newly set upon referring to the NSSMP septage removal standards, etc. The same figure as in the existing F/S was also adopted for the quantity of septage removal from commercial septic tanks.

Table-5.3.3 Quantity of Septage Removal from Septic Tanks (v(m^3))

	2012	2017	2022	2027
Residential	2.5	2.5	2.5	2.5
Commercial	5.0	5.0	5.0	5.0

d) Target ratio of septage removal (θ)

The same values as adopted in the existing F/S were used.

Table-5.3.4 Target Ratio of Septage Removal (θ)

	2012	2017	2022	2027
Residential (Customers)	1.00	1.00	1.00	1.00
Residential (Non-Customers)	0.01	0.04	0.07	0.10
Commercial	1.00	1.00	1.00	1.00

(2) Generated Quantity of Septage (Va)

The generated quantity of septage was forecast as shown in the following table.

Table-5.3.5 Generated Quantity of Septage (Va(m^3))

	2012	2017	2022	2027
Residential (Customers)	36,547	48,713	64,624	85,077
Residential (Non-Customers)	155	828	1,923	3,616
Commercial	9,788	11,515	13,638	16,182
Total	46,490	61,056	80,185	104,875

5.4 Target Year and Septage Design Quantity

The septage design quantity was forecast based on the following formula.

Septage design quantity (Vd) = Va / (Annual operating days (τ) * Collection frequency year (μ))

(1) Preconditions

In calculating the septage design quantity, the following parameters were set.

a) Annual operating days (τ)

As in the existing F/S, this was set as 240 days.

b) * Collection frequency year (μ)

Related ordinances stipulate that septage collection be carried out once every 3~5 years. Also referring to the existing F/S in Angeles City, the collection frequency was set at 5 years.

(2) Septage Design Quantity (Vd)

The septage design quantity was forecast as shown in the following table. The basis for calculation is shown in the reference materials 10.2.

Table-5.4.1 Septage Design Quantity (Vd(m^3/day))

	2012	2017	2022	2027
Residential(Customers)	30.5	40.6	53.9	70.9
Residential(Non-Customers)	0.1	0.7	1.6	3.0
Commercial	8.2	9.6	11.4	13.5
Total	38.7	50.9	66.8	87.4

(3) Target Design Year and Septage Design Quantity

a) Immediate future

The immediate target year and septage design quantity were set based on Table-5.4.1. Table-5.4.2 shows the values from this revision and the existing F/S.

Table-5.4.2 Immediate Septage Design Quantity

	Revised Plan	Existing F/S
Target year	2017	2012
Septage design quantity (m^3/d)	50	60

b) Future

The future target year and septage design quantity were set based on Table-5.4.1 and the ease of implementing the phased expansion of facilities. Table-5.4.3 shows the values from this revision and the existing F/S.

In the future, in addition to the forecast design quantity shown in Table-5.4.1, it will also be necessary to consider expansion of the septage collection area and higher frequency of septage collection. Assuming that the septage collection area is expanded to cover the entire city, the population will increase by roughly 40%; while in the case where the frequency of septage collection is increased to once every three years, the quantity of septage will increase roughly 70%, resulting in a maximum increase of 2.3 times to approximately 200 cubic meters, so particular attention will need to be paid to securing the land for future construction.

Table-5.4.3 Future Septage Design Quantity

	Revised Plan	Existing F/S
Target year	2027	2027
Septage design quantity (m^3/d)	100	100

6. Treatment Method and Cost

6.1 Planned Construction Sites

(1) Currently Planned Construction Sites

In the existing F/S, two planned construction sites are cited and compared.

Barangay Real is situated relatively close to the central urban area, while Barangay Putting Lupa is located in the mountains away from the city center. The sites are 1.3 hectares and 2.3 hectares respectively, meaning that both comfortably provide the 1.0 hectare plot required for the planned construction according to the existing FS. The sites are at altitude of 33-60 meters and 213-239 meters respectively, meaning that both have an altitude differential of at least 20 meters. Whereas the Water District would need to purchase expensive land in the case of Barangay Real, the site in Barangay Putting Lupa is scheduled to be lent by the city for free, so the Water District plans to implement construction here.

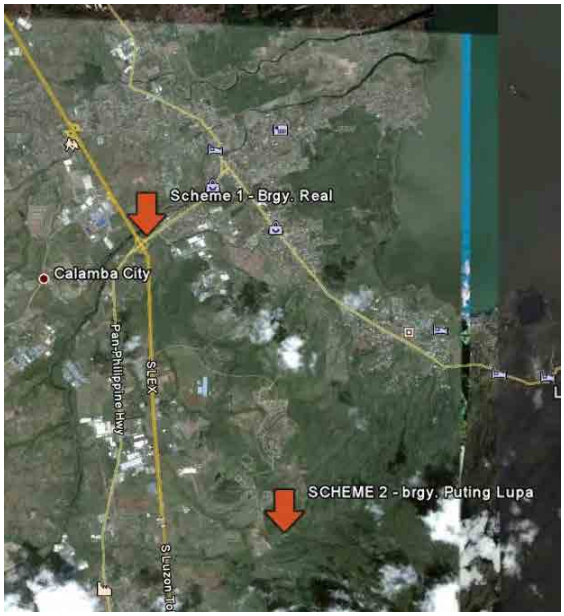

Figure-6.1.1 Candidate Construction Sites

(2) Observations on the Currently Planned Construction Site

As is shown in Photograph-6.1.1, the planned construction site is situated in a mountain area with a lot of trees and large altitude differential, so it will cost a lot to cut trees and cut and level the land. Moreover, as is shown in Photograph-6.1.2, the road leading to the planned construction site is narrow and unpaved, meaning that more expense will be incurred in road construction. Furthermore, even following construction, since it is forecast that transporting septage and sludge to and from the site would be difficult, this is deemed to be inappropriate as the planned construction site.

Photograph-6.1.1
Conditions on the Planned Construction Site

Photograph-6.1.2 Road Conditions

(3) Future Approach

As the future approach, it is desirable to request the city authorities to provide an alternative site. If this isn't possible, the option of having the Water District purchase land will also need to be examined. Since a large site area will be required if the currently planned lagoon method is adopted, this could be reduced a lot and the quality of effluent could be improved through adopting a mechanical treatment method. Accordingly, it will be necessary to carefully scrutinize the required area of land. When doing so, it will also be necessary to consider future development plans.

（Future Approach）

- Request the city authorities to provide an alternative site
- Have the Water District purchase land

6.2 Design Septage Water Quality

BOD and COD were adopted as the important items of design septage water quality. As the design water quality values, the same values as adopted in the existing F/S for Angeles City were adopted upon considering the results of past sampling analysis in Calamba City and the design water quality in the said existing F/S.

Table-6.2.1 Design Septage Quality

Important Item	Unit	Design Water Quality	Sampling Analysis Result
BOD	mg/L	6,000	5,472
COD	mg/L	20,000	15,542

6.3 Design Effluent Quality

Concerning the quality of effluent following filtrate treatment in the newly constructed facilities, as is shown in the following table, standard values were prescribed according to the water quality of the discharge destination in DENR Administrative Order No. 35.

Table-6.3.1 Effluent Quality Standards

Item	Unit	River Classification			
		CLASS A,B,SB	CLASS C	CLASS D	CLASS SC
pH	—	6.0-9.0	6.5-9.0	6.0-9.0	6.0-9.0
BOD	mg/L	30	50	120	100
COD	mg/L	60	100	200	200
TSS	mg/L	50	70	150	150
Total Coliforms	MPN/mL	3,000	10,000	—	—

Effluent from the currently planned construction site will be discharged to a Class C river. The Survey proposes that the planned construction site be changed, however, since all rivers in the city are Class C, the design effluent quality will be as follows.

Table-6.3.2 Design Effluent Quality

Item	Unit	CLASS C
pH	—	6.5-9.0
BOD	mg/L	50
COD	mg/L	100
TSS	mg/L	70
Total Coliforms	MPN/mL	10,000

6.4 Treatment Method

(1) Treatment Method in the Existing F/S

In the existing F/S, as is shown in Figure-6.4.1, the lagoon method is adopted as the treatment method. Moreover, the layout of facilities is as indicated in Figure-6.4.2, leaving room to make additional installations. Moroever, according to the existing F/S, it is anticipated that residents will need to be resettled.

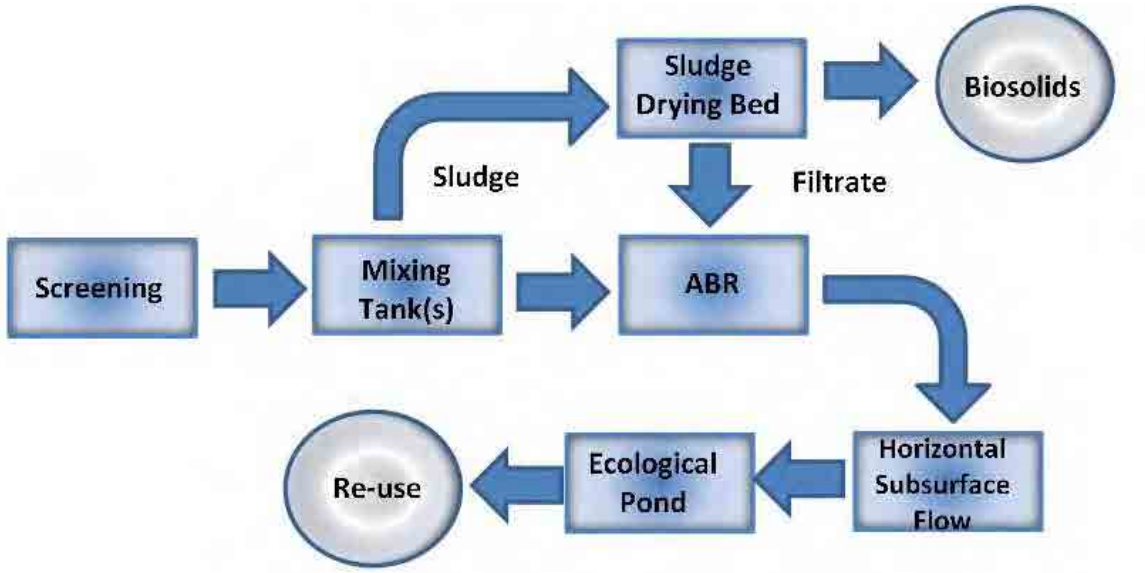

Figure-6.4.1 Treatment Process

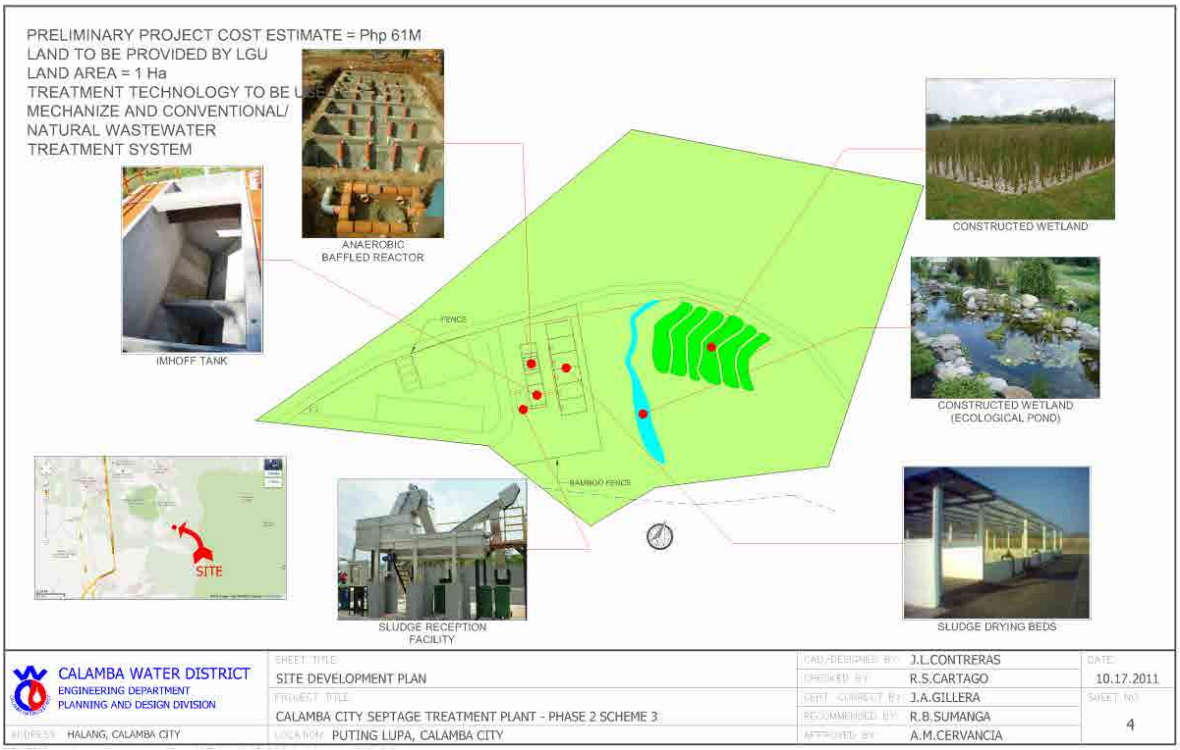

Figure-6.4.2 Layout of Treatment Facilities

(2) Examination of Treatment Method

In the current lagoon method, a large land area is required. The Survey proposes that land for a new site be acquired, however, since it is likely to be difficult to secure a large site area, the following two treatment methods were examined as a means of reducing the necessary site area and satisfying the required effluent quality. Pretreatment and mechanical dewatering are the same in both methods. The two treatment processes are shown in Figure-6.4.3 and Figure-6.4.4 respectively.

(Case 1) Pretreatment + Mechanical dewatering + Johkasou

(Case 2) Pretreatment + Mechanical dewatering + Extended aeration

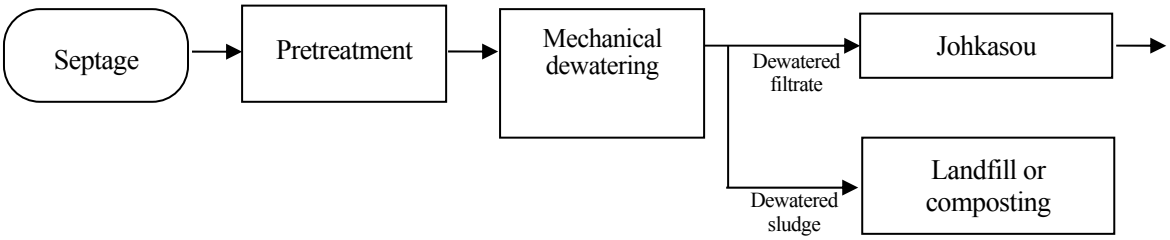

Figure-6.4.3 Treatment Process (Case 1)

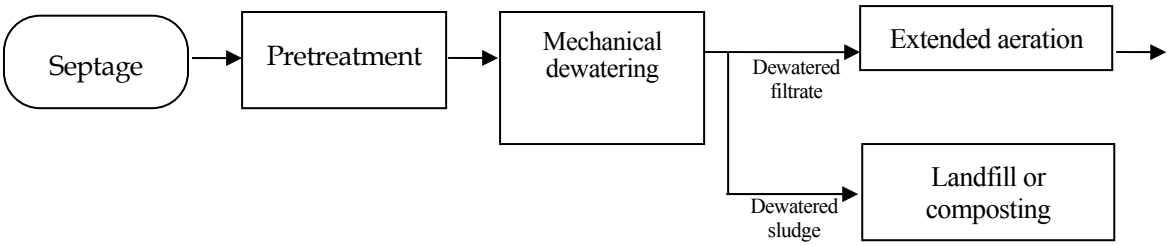

Figure-6.4.4 Treatment Process (Case 2)

(3) Equipment Specifications

a) Pretreatment

As equipment for pretreatment, the following two options were compared.

(Option a-1) Screen

(Option a-2) Septage Acceptance Unit

Option a-1 has already been implemented in Cebu City, while Option a-2 has been implemented in Metro

Manila. Option a-2 is highly systemized and fairly expensive, whereas Option a-1 is extremely simple and inexpensive. Moreover, since there have been no problems of note in Cebu City, Option a-1 is proposed in this Survey.

Photograph-6.4.1 Option a-1

Photograph-6.4.2 Option a-2

b) Mechanical dewatering

The following two types of equipment were compared for the mechanical dewatering.

(Option b-1) Volute

(Option b-2) Screw Press

Option b-1 has already been implemented in Cebu City, while Option b-2 has been implemented in Metro Manila.

Generally when the filtration unit of the dewatering machine becomes clogged, the discharge of filtrate is badly impeded and dewatering functions decline. However, in the case of the volute in Option b-1, since the filtration unit mechanically cleans itself as dewatering is performed, it is possible to conduct stable continuous dewatering without clogging. Therefore, this option is advantageous in terms of the following points. Good operating performance has also been confirmed in Cebu City.

- 24 hours fully automatic unmanned operation is possible.
- Excellent dewatering performance is possible.
- Energy and water savings can be made and noise and vibration levels are low.

Photograph-6.4.3 Option b-1

Photograph-6.4.4 Option b-2

Therefore, in the Survey, Option b-1, which enables easy maintenance and entails inexpensive lifecycle costs, is proposed.

The results of comparing lifecycle costs are shown below. In Option b-1, it is possible to greatly reduce electricity charges and water charges. Moreover, although not reflected in this comparative examination, because dewatering functions are also excellent and an additional effect can be anticipated in terms of reducing the volume of dewatered sludge and the filtrate treatment load, this will also contribute to reducing the overall cost.

Table-6.4.1 Comparison of Dewatering Machine Lifecycle Costs

	Volute	**Screw Press**
Initial Cost	**10,275,380**	**9,000,000**
Running Cost (Annual)		
Water Consumption	11,520	76,800
Electric Consumption	93,600	192,000
Polymer Consumption	288,000	288,000
Total Running Cost (annual)	393,120	556,800
Running Cost (15 years)	**5,896,800**	**8,352,000**
Total Cost	**16,172,180**	**17,352,000**

<Condition>

Capacity: $10m^3/h$

Operation: 10h/d, 240d/y

Water Consumption	$0.12m^3/h$	$0.80m^3/h$
Electric Consumption	1.95kWh	4.00kWh
Polymer Consumption	1.5kg/h	1.5kg/h

Water: $40PhP/m^3$

Electric: 20PhP/kWh

Polymer: 80PhP/kg

c) Filtrate treatment

In designing the filtrate treatment facilities, the water volume, influent quality, and effluent quality were assumed as follows. If however, the T-N value becomes more than 200 mg/L, there is a possibility that the value of the designed effluent quality of water will not be satisfied; therefore a separate examination will become necessary in that case.

Table-6.4.2 Design Conditions

Water volume	50m^3/day
Influent quality (BOD)	600mg/L
Effluent quality (BOD)	50mg/L

As the equipment for treating filtrate, the following two types were compared.

(Option c-1) Johkasou

(Option c-2) Extended aeration method

- Johkasou

The Johkasou is a treatment technology that has been uniquely developed in Japan. Johkasou tanks are installed for purifying and discharging raw sewage in households or small communities in areas not served by sewerage systems. The Johkasou is composed of three stages: septic tank, oxidation tank, and disinfecting tank, and it purifies sewage by means of sedimentation, biological oxidation, and disinfecting before discharging the treated effluent.

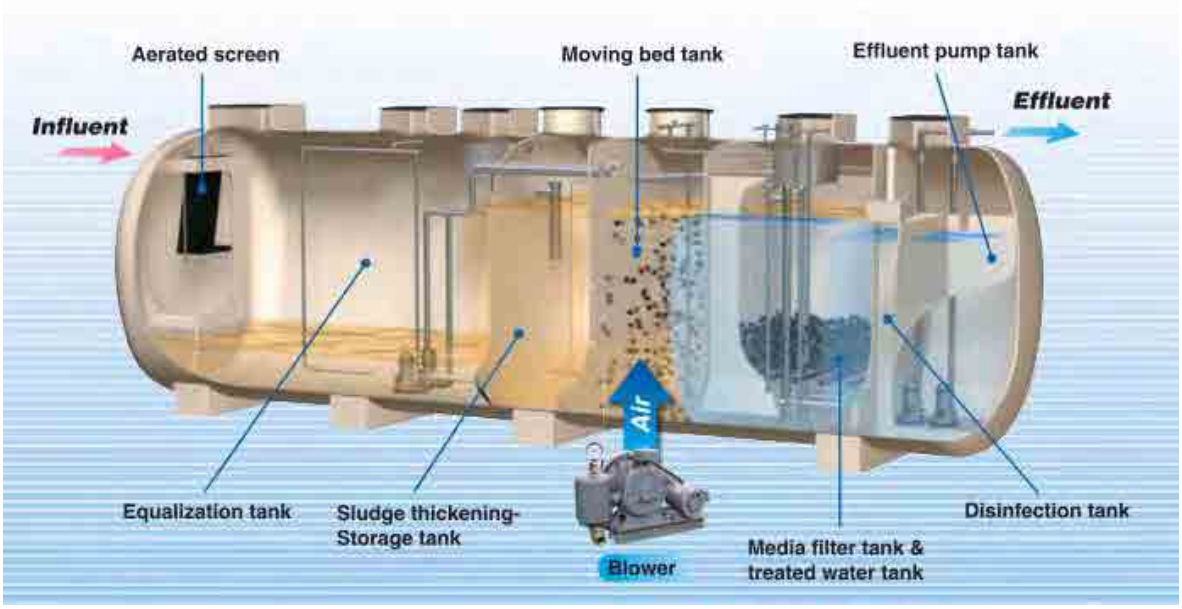

Figure-6.4.5 Cross Section of Johkasou

Specifications of the Johkasou in the case of the design conditions in Table-6.4.2 are as indicated below. The retention time is roughly 24 hours.

Table-6.4.3 Specifications of Johkasou

Unit specifications	1st: 6,100mm * φ2,050mm * H2,350mm 2nd: 6,100mm * φ2,050mm * H2,350mm 3rd : 9,950mm * φ2,050mm * H2,350mm
（Breakdown）	
Equalization tank	10,800mm
Sludge thickening-Storage tank	1,400mm
Moving bed tank	7,200mm
Media filter tank & treated water tank	1,750mm
Effluent pump tank and Disinfecting tank	1,000mm

- Extended Aeration

Extended aeration, which requires no initial sedimentation tank, is an integrated treatment method that entails conducting activated sludge treatment in a reaction tank with extended HRT, high MLSS concentration, low load conditions and long SRT, and then performing solids-liquid separation in the final sedimentation tank. Specifications of the reaction tanks and final sedimentation tank are as shown below. Incidentally, this treatment method is the same as that proposed in the existing F/S for Angeles City.

Table-6.4.4 Reaction Tank Particulars

HRT (h)	16-24
MLSS (mg/L)	3,000-4,000
Returned sludge ratio (%)	100-200
Oxygen requirement (kgO2/kgBOD)	1.4-2.2

Table-6.4.5 Final Sedimentation Tank Particulars

Sedimentation time (h)	6-12
Effective wet depth (m)	3-4
Water surface area load (m^3/m2/d)	8-12
Overflow load (m^3/m/d)	50 or less

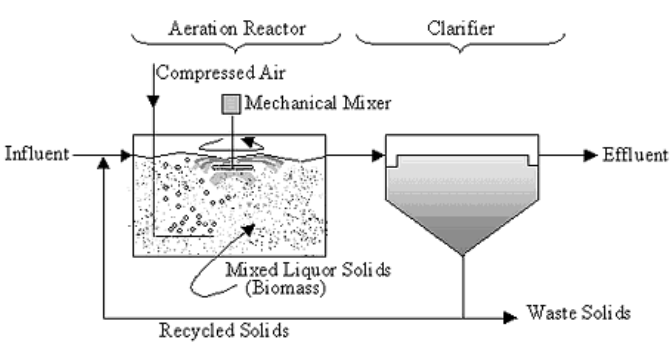

Figure-6.4.6 Extended Aeration Method

In terms of construction cost, Option c-1 is inexpensive; moreover, since this entails mechanized units, the construction works are relatively easy. Therefore, Option c-1 is proposed in this Survey.

For reference purposes, the following table shows a comparison of the Johkasou, extended aeration method, and the lagoon method that is adopted in the existing F/S.

Table-6.4.6 Comparison of Treatment Methods

Item	Johkasou	Extended Aeration Method	Lagoon Method
Construction Cost	△	△	○
Running Cost	△	△	○
Maintenance Cost	△	△	○
Effluent Quality	○	○	×
Required Area	○	○	×
Ease of Construction	○	△	△
Ease of Maintenance	○	△	△
Ease of expanding facilities	○	△	×
Overall Assessment	○	△	×

(4) Proposed Treatment Method and Equipment

In consideration of the above points, the proposed treatment method and equipment in this Survey are as shown in the following table.

Table-6.4.7 Treatment Method and Equipment

Preliminary	Dewatering	Filtrate Treatment
Screen	Volute	Johkasou

6.5 Collection Trucks

In the existing F/S, the basis for calculation is unknown, however, assuming the case where the collection area is divided into five zones, the amount of septage collection in the collection area each year is roughly the same at 50 m^3/day, and the average transportation distance to treatment facilities is 5 kilometers, it should be possible to transport septage with the number of trucks stated in the F/S so long as the daily operating time is 9.5 hours. The basis for calculation is indicated in the reference materials 10.3.

Also, one dump truck will be added for transporting the sludge that is generated in treatment.

Moreover, vacuum trucks of varying capacity will be adopted, for example, 4.5 m^3 type trucks that can gain access to narrow streets, and 8.5 m^3 type trucks that can efficiently collect septage in large quantities. Moreover, trucks will be equipped with 30~50 meters of hoses and water traps for addressing the issue of odor.

Table-6.5.1 Number of Collection Trucks

8.5 m^3 vacuum trucks	1
4.5 m^3 vacuum trucks	2
5 m^3 dump truck	1

6.6 Required Area for the Planned Construction Site

In the existing F/S, the treatment method is assumed to be the lagoon method, and the required area for facilities is approximately 2,500 square meters, rising to approximately 5,000 square meters when the facilities layout is taken into consideration.

Assuming the treatment method proposed in 6.4, the required area will be approximately 1,200 square meters. Moreover, considering the design quantity in 2027, it will be desirable to secure an area of approximately 1,500 square meters to accommodate future expansion of the treatment facilities.

Table-6.6.1 Required Area for Planned Construction Site

Pretreatment + mechanical dewatering	10 * 10 = 100 m^2
Johkasou	7.5 * 20 = 150 m^2
Building	10 * 15 = 150 m^2
Parking Area	25 * 30 = 750 m^2
Total	**1,500 m^2** (1,200 m^2)

The layout of Pretreatment + mechanical dewatering and Johkasou is indicated in the reference materials 10.4.

6.7 Cost

(1) Construction Cost

Based on 6.4, Option 1 is proposed, but costs in Option 2 were also calculated here for comparison. In addition, construction cost of Johkasou is a condition that is buried underground. Moroever, in this estimate, it is assumed that Johkasou will be constructed underground.

Table-6.7.1 Construction Cost Estimation Cases

Option	Preliminary	Dewatering	Filtrate Treatment
1	Screen	Volute	Johkasou
2	Screen	Volute	Activated Sludge (Extended Aeration)

The results of exanmination are as indicated below. The basis for calculation is indicated in the reference materials 10.5.

Table-6.7.2 Construction Cost Calculation Results (PhP)

Item	Option 1	Option 2
Ⅰ. TREATMENT PLANT	44,280,736	45,561,925
Procurement of Lot	15,000,000	15,000,000
II. VACUUM TRUCKS	17,100,000	17,100,000
Total	**76,380,736**	**77,661,925**

(2) Operation and Maintenance Cost

The results of exanmination are as indicated below. The basis for calculation is indicated in the reference materials 10.6.

Table-6.7.3 Operation and Maintenance Cost (Annual) Calculation Results (PhP)

Item	Option 1	Option 2
Ⅰ. Treatment Operation	**3,948,092**	**4,703,884**
Personnel	1,680,000	1,680,000
Power Consumption	608,160	1,389,600
Water Consumption	11,520	11,520
Chemical Consumption	341,564	341,564
Water Testing and Monitoring	714,000	714,000
Consumable Spare Parts	592,848	567,201
Ⅱ. Desludging Operation	**2,362,800**	**2,362,800**
Personnel	1,440,000	1,440,000
Fuel Consumption	580,800	580,800
Consumable Spare Parts	342,000	342,000
Ⅲ. Sludging Disposal	**1,055,549**	**1,055,549**
Personnel	240,000	240,000
Fuel Consumption	26,400	26,400
Disposal fee	789,149	789,149
Ⅳ. Headquarters	**1,440,000**	**1,440,000**
Personnel	1,440,000	1,440,000
Total	**8,806,441**	**9,562,234**

7. Financial Plan

7.1 Examination Cases

(1) Examination Conditions

a) Construction cost and sources of revenue

The construction cost is as shown in Table 6.7.2. Since it wasn't certain whether the planned construction site can be lent for free by the city or needs to be purchased by the Water District, examination was conducted on both cases. As for the sources of revenue, basically it was assumed that the Water District will bear the cost, but consideration was also given to sharing of costs with subsidies from the national government and city authorities.

The cost to be borne by the Water District will be financed by loan and own capital, and the ratio of loan will be 80%, the same as in the existing F/S. Concerning the loan, the Philippines Water Revolving Fund (PWRF) will be utilized for the environment development project (EDP), which will be the ODA implemented by JICA, and this will be implemented via the Development Bank of the Phiippines (DBP).

b) Setting of septage tariffs

For the immediate future, because septage will be collected from public water supply customers, the tariff will be levied on top of the water tariff. Concerning the amount of the extra charge, since 2PhP per cubic meter of water usage is envisaged, this was basically assumed. Concerning the forecast amount of revenue water, as in the existing F/S, increase of 1% per year was assumed.

In the case where septage is collected from parties other than public water supply customers in future, it will be desirable to levy the same charge per collection as for water supply users.

Table-7.1.1 Basic Conditions

Loan Terms and Conditions	
Interest per annum	**9.00 %**
Repayment period (inclusive of grace)	15 years
Grace period	3 years
Weighted Average Cost of Capital (WACC)	**9.80 %**
Loan Share	80 %
Equity Share	20 %
Estimated desludging fee (per cu.m. of water consumed)	**PhP2.00**

(2) Examination Cases

Examination was conducted for the following cases.

Concerning the sharing of construction cost by the national government, city authorities, and Water District, based on Table-6.7.2, the total amount including land cost was used for Case 1, and the amount with the land cost deducted was used for Case 2.

Case 1: When the planned construction site is purchased by the Water District

1-a) Desludging Fee 2.0PhP/m3, NG : LGU : WD= 0 : 0 : 100

1-b) Desludging Fee 2.0PhP/m3, NG : LGU : WD= 40 : 0 : 60

1-c) Desludging Fee 1.5PhP/m3, NG : LGU : WD= 40 : 0 : 60

1-d) Desludging Fee 1.5PhP/m3, NG : LGU : WD= 40 : 30 : 30

1-e) Desludging Fee 1.0PhP/m3, NG : LGU : WD= 40 : 30 : 30

Case 2: When the planned construction site is lent by the city at no charge

2-a) Desludging Fee 2.0PhP/ m^3, NG : LGU : WD= 0 : 0 : 100

2-b) Desludging Fee 2.0PhP/ m^3, NG : LGU : WD= 40 : 0 : 60

2-c) Desludging Fee 1.5PhP/ m^3, NG : LGU : WD= 40 : 0 : 60

2-d) Desludging Fee 1.5PhP/ m^3, NG : LGU : WD= 40 : 30 : 30

2-e) Desludging Fee 1.0PhP/ m^3, NG : LGU : WD= 40 : 30 : 30

(3) Sensitivity Analysis

Analysis was conducted for the following scenarios.

Scenario 1: Cost (+10%)

Scenario 2: Revenues (-10%)

Scenario 3: Cost (+10%), Revenues (-10%)

Scenario 4: Cost (+20%)

Scenario 5: Revenues (-20%)

Scenario 6: Cost (+20%), Revenues (-20%)

Scenario 7: Cost (+30%)

Scenario 8: Revenues (-30%)

Scenario 9: Cost (+30%), Revenues (-30%)

7.2 Examination Results

The results of exmination are shown below. The details are indicated in reference materials 10.7.

In Case 1, 2PhP is appropriate, however, the business will stabilize if the national government provides a subsidy of 40%. In the case where 1.5PhP is set, it will be desirable to have subsidies from both the national government and city authorities.

Table-7.2.1 Examination Results (Case1)

	1-a	1-b	1-c	1-d	1-e
Demarcation (NG:LGU:WD)	0:0:100	40:0:60	40:0:60	40:30:30	40:30:30
WD Principal (in thousand pesos)	76,381	45,828	45,828	22,914	22,914
Loan	61,105	36,663	36,663	18,331	18,331
Equity	15,276	9,166	9,166	4,583	4,583
Desludging Fee (PhP/ m^3)	2.00	2.00	1.50	1.50	1.00
Net Present Value (in thousand pesos)	**36,952**	**64,777**	**20,551**	**41,420**	**-2,806**
Financial Internal Rate of Return	**18.0%**	**31.7%**	**17.4%**	**37.0%**	**7.6%**
Sensitivity Tests					
Net Present Value (NPV)					
Cost (+10%)	22,957	53,564	9,338	32,294	**-11,932**
Revenues (-10%)	19,261	47,087	7,283	28,152	**-11,652**
Cost (+10%), Revenues (-10%)	**-8,909**	27,264	**-12,540**	14,590	**-25,214**
Cost (+20%)	8,961	42,352	**-1,875**	23,168	**-21,058**
Revenues (-20%)	1,571	29,396	**-5,985**	14,884	**-20,497**
Cost (+20%), Revenues (-20%)	**-26,420**	6,971	**-28,411**	**-3,368**	**-38,749**
Cost (+30%)	**-5,034**	31,139	**-13,088**	14,042	**-30,184**
Revenues (-30%)	**-16,120**	11,706	**-19,253**	1,616	**-29,342**
Cost (+30%), Revenues (-30%)	**-58,106**	**-21,933**	**-52,891**	**-25,762**	**-56,720**
Financial Internal Rate of Return					
Cost (+10%)	14.6%	26.7%	13.0%	29.7%	**0.7%**
Revenues (-10%)	14.2%	26.2%	12.6%	28.9%	**-0.1%**
Cost (+10%), Revenues (-10%)	**8.1%**	17.5%	**5.8%**	17.9%	**-9.0%**
Cost (+20%)	11.6%	22.3%	**9.2%**	23.3%	**-6.3%**
Revenues (-20%)	10.2%	20.4%	**7.4%**	20.4%	**-10.0%**
Cost (+20%), Revenues (-20%)	**4.1%**	12.0%	**-1.0%**	**7.6%**	—
Cost (+30%)	**8.9%**	18.5%	**5.6%**	17.6%	**-14.0%**
Revenues (-30%)	**5.7%**	14.2%	**1.4%**	11.0%	—
Cost (+30%), Revenues (-30%)	**-3.2%**	**2.5%**	**-13.1%**	**-9.1%**	—

In Case 2, 2PhP is appropriate. Moreover, in the case where 1.5PhP is set, it will be desirable to have subsidies from both the national government and city authorities.

Table-7.2.2 Examination Results (Case2)

	2-a	2-b	2-c	2-d	2-e
Demarcation (NG:LGU:WD)	0:0:100	40:0:60	40:0:60	40:30:30	40:30:30
WD Principal (in thousand pesos)	61,381	36,828	36,828	18,414	18,414
Loan	49,105	29,463	29,463	14,731	14,731
Equity	12,276	7,366	7,366	3,683	3,683
Desludging Fee (PhP/ m^3)	2.00	2.00	1.50	1.50	1.00
Net Present Value (in thousand pesos)	**50,617**	**72,978**	**28,751**	**45,521**	**1,294**
Financial Internal Rate of Return	**23.2%**	**39.6%**	**22.5%**	**45.9%**	**11.0%**
Sensitivity Tests					
Net Present Value (NPV)					
Cost (+10%)	37,988	62,585	18,358	36,805	**-7,422**
Revenues (-10%)	32,926	55,287	15,483	32,253	**-7,551**
Cost (+10%), Revenues (-10%)	8,854	37,924	**-1,881**	19,921	**-19,884**
Cost (+20%)	25,359	52,192	7,964	28,089	**-16,138**
Revenues (-20%)	15,235	37,596	2,214	18,985	**-16,397**
Cost (+20%), Revenues (-20%)	**-10,023**	16,810	**-18,572**	1,553	**-33,829**
Cost (+30%)	12,730	41,799	**-2,429**	19,373	**-24,854**
Revenues (-30%)	**-2,456**	19,905	**-11,054**	5,717	**-25,242**
Cost (+30%), Revenues (-30%)	**-40,343**	**-11,274**	**-42,233**	**-20,431**	**-51,391**
Financial Internal Rate of Return					
Cost (+10%)	19.2%	33.5%	17.4%	37.1%	**3.1%**
Revenues (-10%)	18.8%	32.9%	16.9%	36.2%	**2.2%**
Cost (+10%), Revenues (-10%)	11.8%	22.6%	**9.1%**	23.0%	**-7.7%**
Cost (+20%)	15.7%	28.3%	12.9%	29.4%	**-4.8%**
Revenues (-20%)	14.1%	26.0%	10.9%	26.0%	**-8.9%**
Cost (+20%), Revenues (-20%)	**7.3%**	16.2%	**1.5%**	11.0%	**-**
Cost (+30%)	12.6%	23.8%	**8.9%**	22.7%	**-13.1%**
Revenues (-30%)	**9.1%**	18.8%	**4.0%**	15.0%	**-**
Cost (+30%), Revenues (-30%)	**-0.9%**	**5.4%**	**-11.8%**	**-7.9%**	**-**

8. Environmental and Social Considerations

Since the sewage and wastewater treatment sector is often regarded as having exerting important environmental and social impacts, it is necessary to advance projects upon paying ample attention to environmental and social considerations such as impacts on air, water, and soil, impacts on natural items such as ecosystems and biota, and social impacts such as involuntary resettlement and so on.

The septage treatment facilities planned here are relatively small in scale and will not exert as large an impact as sewage treatment facilities, however, it will still be necessary to pay attention to the following points in particular.

(1) Large-scale Land Reclamation and Clearing

Especially in Calamba Water District, since the currently planned construction site will require large-scale reclamation and clearing over an area of 1 hectare or more, it will be necessary to consider the impacts on biota and the ecosystem in the case where this is actually implemented. This is another reason for examining the acquisition of an alternative site as proposed in 6.1.

(2) Odor Countermeasures

Since the quantities of septage are relatively small and the currently planned construction sites are not situated close to residences, there should be no major problems providing odor countermeasures that is addressed through considering the layout of facilities and firmly sealing the septage receiving and storage tanks.

(3) Involuntary Resettlement of Residents

The construction plan that is currently intended by Calamba Water District assumes the resettlement of residents and payment of 4.8 million PhP in monetary compensation. In the case where residents are actually relocated, CWD plans to first obtain consent from the targeted residents.

In Angeles City Water District, there are currently no plans for resettlement of residents, however, concerning acquisition of land for the planned construction site, ACWD plans to negotiate with the landowners while receiving cooperation from the city authorities. According to ACWD, this will not entail any major problems.

Moreover, when starting the septage management utility in both water districts, it will be necessary to obtain Environmental Sanitation Clearance (ESC) from the Center for Health Development Office (CHD), so it will first be necessary to make applications to the respective city authorities. The required documents for ESC application stated in the “Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage” (Department of Health, June 2008) are indicated in reference materials 10.8.

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9. Future Measures

The items that need to be addressed from now on in promoting septage management are described in the following sections.

(1) Establishment of a Specialist Department

In order to examine the items described below in (2)-(9), the most important thing is first to establish a dedicated department in charge of septage management. For the immediate future, it will be necessary to assign a manager and staff members in charge of planning, design, and maintenance, in the headquarters. After the treatment facilities have been constructed, it will be necessary to recruit additional staff to work on the collection and transportation of septage and operation and maintenance of treatment facilities. For example, it will be necessary to establish the Septage Management Division with the following staff members under the Engineering Department.

Table-9.1 Main Work Contents of the Septage Management Division

Work	Main Work Contents	Necessary Staff
Septage collection and management	Manage the septage collection trucks. Keep records in a ledger. Conduct outsourcing management.	1 member + a few support staff
Operation of septage treatment facilities, and sludge disposal	Operate the treatment facility screens, dewatering equipment, Johkasou, etc. Record and report effluent quality. Also, manage the disposal of sludge. Also, coordinate with the city authorities.	2-3 members + a few support staff
Septage planning, design, and procurement	Keep the septage ledger organized. Update septage plans and coordinate with the city authorities. Conduct basic design for expansion plans.	1 member (can also be shared with other divisions)

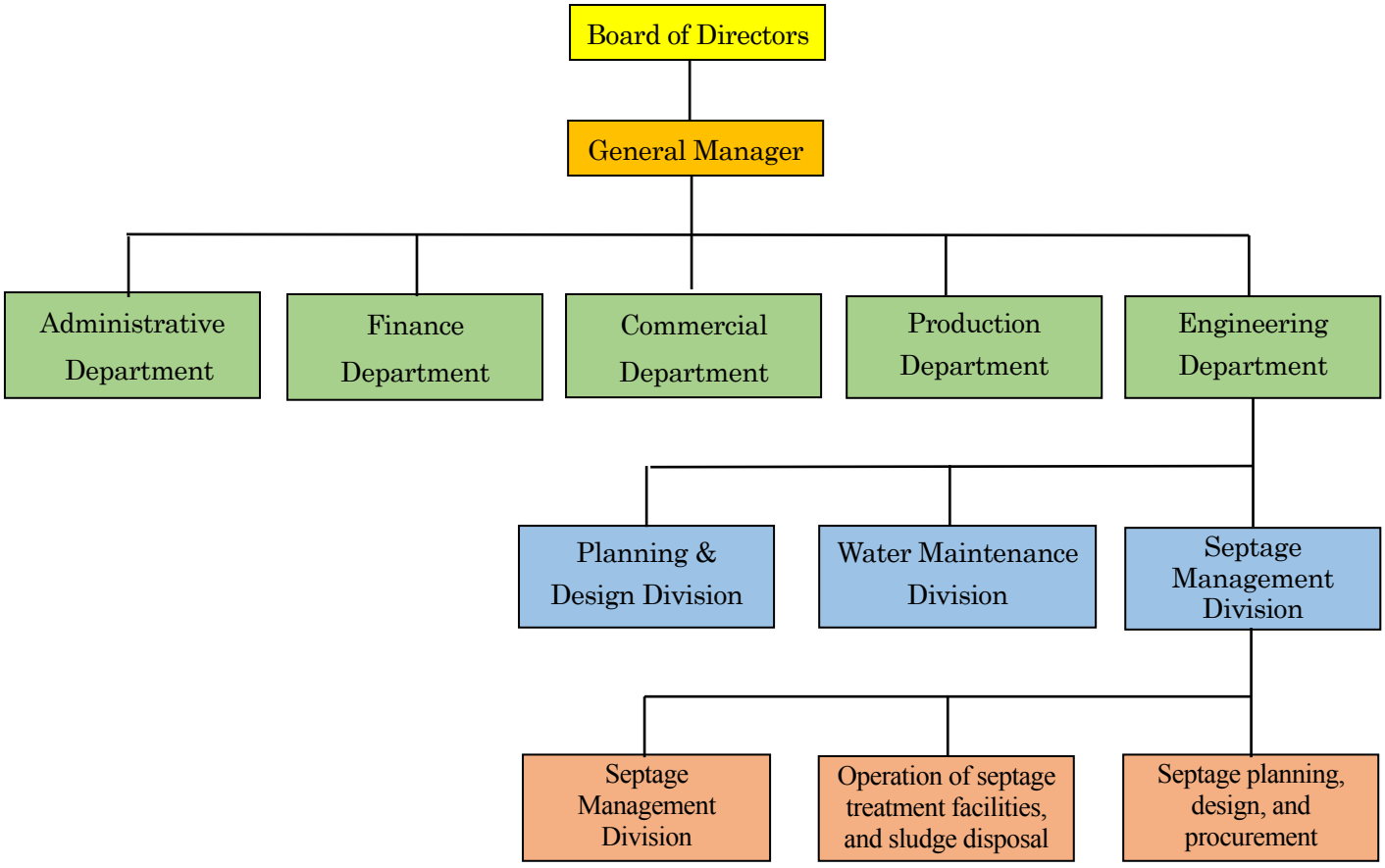


Figure-9.1 Establishment of the Septage Management Division

(2) Compilation of the Project Schedule

It will be important to compile a general project schedule that includes the securing of construction sites, design and construction of treatment facilities, raising of tariffs, and making of EDP applications.

(3) Implementation Design

It will be necessary to implement the detailed design, execution planning, and cost estimation for treatment facilities. Moreover, since the cost of vacuum trucks occupies a relatively large weight, it will be necessary to scrutinize the collection areas each year. Also, since it is important to closely manage the septage removal situation, it will be necessary to examine the method of management, for example, through grasping the areas collected based on ledgers and so on.

(4) Securing of Planned Construction Sites

Since it will take time to secure the planned construction sites, it will be necessary to cooperate with the city authorities in promptly giving explanations to the landowners and local residents. Particularly, in Calamba

Water District, the request to find an alternative site should be made to the city immediately, and if this is difficult it will be necessary to consider the option of having the Water District purchase land.

In securing the land, it will be important to secure sufficient area while taking future expansion plans into account. Moreover, because the location of planned construction sites will impact the number of vacuum trucks and distances travelled, it will be important to take these factors into account when selecting the sites.

(5) Increase of Water Tariffs and application for Subsidies from the Central Government

In order to advance the project, it will be essential to secure funding and thus to increase water tariffs. Accordingly, it will be necessary to promptly implement the procedure geared to doing this. It is planned to initially collect septage from public water supply customers, however, in the case where septage is collected from non-customers in the future, it will be desirable to set and levy the same tariff per collection as charged to public water supply customers. It will thus be necessary to conduct examination for this purpose.

For reference, the important points to remember and procedures for increasing water tariffs as stated in the LWUA Manual on Water Rates & Related Practices are indicated below.

(Reference) Important Points to Remember and Procedures for Increasing Water Tariffs

The water tariff needs to be set at an amount that covers the operating cost and other costs including all maintenance costs of the public water supply service while also taking the rate of inflation into account, and it needs to be set at an appropriate and rational level that reflects public services. The water tariff covers all users from large-scale consumers to low-income citizens, and it is necessary to set tariffs that are fair in consideration of low-income users (in the case of water connecctions with minimum diameter size of 13 mm and basic water usage of 10 m^3/month, the tariff must not exceed 5% of the average income of low-income groups in the water supply area). When increasing the water tariff, the markup must not exceed 60% of the current tariff; moreover, it is necessary to make sure that the markup doesn't exceed the users' ability to pay.

The water tariff is divided into 1) the basic tariff for covering the fixed costs necessary for improving water supply facilities (capital) and repaying loans, etc., and 2) the unit use charge corresponding to the amount used, which covers operation and maintenance costs. For large-scale users that receive water supply through large-diameter pipes, the basic tariff is set according to the amount of usage to ensure a fair cost burden.

The method for calculating water tariffs in each water district are established in the manual, thereby allowing water tariffs and new connection fees, etc. to be calculated according to the scale of water supply in each district.

When proposing tariff increases, it is deemed essential for the Water District to stage public hearings in

order to confirm appropriateness. In the public hearings, which are divided into three, preliminary hearings, main hearings, and follow-up hearings, the utility operation at the current water tariff is explained, the new water tariff (new utility operation) is proposed, and the reasons for increasing the tariff are explained.

Water tariff revisions by the Water District undergo review and approval by the LWUA based on a written resolution concerning adoption of the new water tariff by the Water District Board of Directors (BOD), minutes of the public hearings, cash-flow forecast, water usage pattern analysis, and Water District profile (designated format) that are submitted by the Water District.

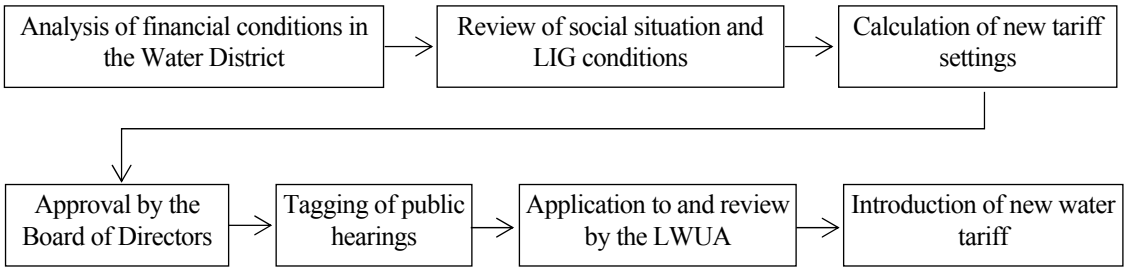


Figure-9.2 Water Tariff Revision Flow

Moroever, following revision of the NSSMP, since it appears that the central government will grant a 40% subsidy to the septage utility in addition to the sewerage utility, it will be desirable to apply for this subsidy.

(6) EDP Application

It is envisaged that the EDP will be utilized via the DBP in the project, and the documents required for making the application are as shown in reference materials 10.9. Since it is expected that a lot of time will be needed to prepare the application, it will be necessary to start work on this immediately.

(7) Examination of Sludge Disposal

It will be necessary to examine the disposal of sludge generated in the treatment facilities with a view to putting it to effective use.

In putting sludge to effective use, it will be necessary to survey needs of the destinations of effective use.

Standards about how to make effective use of sludge (compost, fertilizer, etc.) are stated in 5.5 of the "Operations Manual on the Rules and Regulations Governing Domestic Sludge and Septage," and it is necessary to satisfy these.

Table-9.2 Specifications for Fertilizers and Compost/Soil Conditioner

	Plain Organic Fertilizer	Compost/Soil Conditioner	Fortified Organic Fertilizer
Total NPK	5-7%	3-4%	8% minimum
C:N	12:1	12:1	12:1
Moisture Content	≤ 35%	≤ 35%	≤ 35%
Organic Matter	≥ 20%	≥ 20%	≥ 20%

NPK - nitrogen, phosphorous, potassium; C:N – carbon nitrogen ratio

Table-9.3 Test for Pathogens for Organic Fertilizer/Soil Conditioner

Fecal streptococci	$<5 \times 10^3$/g compost
Total coliforms	$<5 \times 10^2$/g compost
Salmonella	0
Infective parasitic	0

Table-9.4 Allowable Levels of Heavy Metals in Organic Fertilizer/Compost Soil Conditioner

Heavy Metals	mg/kg dry weight
Zn	1000
Pb	750
Cu	300
Cr	150
Ni	50
Hg	5
Cd	5

Since the sludge will have to be landfilled if it cannot be effectively used, it will be necessary to secure a landfill site. Moreover, since it costs money to transport sludge, it will also be necessary to consider the location of the landfill site.

(8) Examination of Outsourcing

Particularly in Angeles City, since private sector enterprises already collect septage, it will be desirable to examine the feasibility of outsourcing collection to them if this is likely to be less costly.

Moreover, it will also be desirable to examine the feasibility of outsourcing for sludge disposal in cases where effective utilization is possible.

(9) Implementation of Monitoring

In the Philippines, septage management is only implemented in such places as Metro Manila and Cebu, and experience is still limited. As a result, septage treatment methods have not yet been established, and it will be necessary to find the optimum treatment method based on actual performance.

For this purpose, it will be necessary to closely monitor the treatment situation at the treatment facilities that are constructed from now on. In particular, it will be important to periodically monitor the influent quality of septage, the quality of dewatered filtrate, the quality of effluent, and the water content of dewatered sludge.

It will also be important to monitor the quantity of septage that is removed from septic tanks and reflect this in the plans. Currently septage is removed once every five years, but it will also be important to set the proper septage removal frequency upon monitoring the conditions of septage discharge from septic tanks.

According to a survey implemented by Calamba city authorities, the access rate to septic tanks is low, and there are many septic tanks that do not meet structural standards for having septage outlets or the ability to remove septage. In order to improve environmental hygiene, it will be necessary to certainly remove septage, and for this reason it will be important to improve access to septic tanks. In Calamba City, based on Ordinance Article 5, it will be important to conduct medium- to long-term guidance on installing septic tanks that satisfy design standards.

10 Reference Materials

10.1 Related Ordinances

Republic of the Philippines
CITY OF CALAMBA
Province of Laguna
OFFICE OF THE SANGGUNIAN PANLUNGSOD

1st Indorsement
January 04, 2010

Respectfully forwarded to Engr. Alberto Cervancia, General Manager, Calamba Water District, copy of Resolution No. 317, series of 2009 of the Sanggunian Panlungsod, this city, embodying City Ordinance No. 09-456, for his information and guidance.

FAVIANA J. PATINIO
Sanggunian Panlungsod Secretary

11/04/10 - 11:30 am

CALAMBA WATER DISTRICT

Republic of the Philippines
CITY OF CALAMBA
Province of Laguna
OFFICE OF THE SANGGUNIAN PANLUNGSOD

EXCERPTS FROM THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIAN PANLUNGSOD OF CALAMBA HELD LAST DECEMBER 1, 2009 AT THE FUNCTION ROOM OF THE NEW CITY HALL BUILDING AT BARANGAY REAL, CITY OF CALAMBA AT 11:44 IN THE MORNING.

PRESENT:

HON. ATTY. PURSINO C. ORUGA	*City Vice-Mayor, Presiding Officer*
HON. DYAN DV. ESPIRIDION	*City Councilor*
HON. RUTH MARIANO-HERNANDEZ	*City Councilor*
HON. LUIS VERGEL G. BARORO	*City Councilor*
HON. LEEANNE P. ALDABE	*City Councilor*
HON. EDUARDO R. SILVA	*City Councilor*
HON. DENNIS R. LANZANAS	*City Councilor*
HON. JOSE MOREL D. MANAIG	*City Councilor*
HON. JOSE V. PRADAS	*City Councilor*
HON. CHRISTIAN NIÑO S. LAJARA	*City Councilor*

ABSENT:

HON. POCHOLO J. PLATON	*City Councilor*
HON. SATURNINO J. LAJARA	*City Councilor, ABC-President – O.B.*
HON. JAYNE B. RIZAL	*City Councilor, SK-President*

*** *** ***

RESOLUTION NO. 337
Series of 2009

A RESOLUTION APPROVING CITY ORDINANCE NO. 456. SERIES OF 2009.

WHEREAS, mandated by the new Clean Water Act of 2004 (RA 9275) and other existing laws and ordinances, related directly or indirectly to wastewater and septage management, the City of Calamba is establishing a sewerage and septage management system;

WHEREAS, untreated wastewater affects health by spreading diseases, making water unfit for human consumption and other uses, contaminating groundwater, threatening biodiversity, and reducing the quality of life of the citizens;

WHEREAS, most of the residences, businesses and institutions in Calamba City use septic tanks for wastewater treatment and disposal;

WHEREAS, most of the septic tanks in the city are not properly designed, constructed or regularly desludged;

WHEREAS, groundwater is the city's water source;

WHEREAS, the City is committed to the improvement, maintenance and conservation of the ecosystem and the protection of public health;

WHEREAS, the Calamba Water District (CWD), in coordination with the Local Government Unit (LGU), will be constructing Sewerage System for the affected residential units within the sixty meters (60m) distance from the water sources. The Sewage Treatment Plant will be strategically located and adequately designed/built so that groundwater contamination will be prevented;

WHEREAS, the CWD, in coordination with the LGU, will construct and operate a septage treatment plant that will regularly collect and treat the sludge of all septic tanks beyond sixty meters (60m) from the Bucal main water source and other CWD water

WHEREAS, sanitation practices in residential houses, hospitals and commercial establishment should be well monitored and supervised by the Department of Health (DOH). Strict implementation of PD 856 (Sanitation Law of the Philippines) and RA 9275 (Clean Water Act of 2004) lies predominantly with the DOH and other agencies as a collaborative effort with the LGUs.

WHEREAS, policies should be made concerning sanitation based on the "Philippine Clean Water Act of 2004" which provides, "*the state shall pursue a policy of economic growth in a manner consistent with the protection, preservation and revival of the quality of our fresh, brackish and marine waters*". To achieve this, the framework for sustainable development shall be pursued.

WHEREAS, this Ordinance should primarily apply to the abatement and control of pollution from land based sources and should enforce the civil liability and penal provisions under this Act, irrespective of the sources of pollution to maintain water quality standard;

WHEREAS, Section 7 of the Clean Water Act LLGU shall 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.

NOW, THEREFORE, on motion of Coun. LV. G. BARORO duly seconded by Coun. CN. S. Lajara , be it resolved as it is hereby resolved to approve City Ordinance No. , Series of 2009, to wit:

CITY ORDINANCE NO.
Series of 2009

AN ORDINANCE ESTABLISHING A SEWERAGE AND SEPTAGE MANAGEMENT SYSTEM IN THE CITY OF CALAMBA, SETTING GUIDELINES FOR ITS IMPLEMENTATION.

BE IT ORDAINED BY THE SANGGUNIANG PANLUNGSOD in session assembled that:

Section 1. Title. This ordinance shall be known as "An Ordinance Establishing a Sewerage and Septage Management System in the City of Calamba, setting Guidelines for its Implementation."

Section 2. This Ordinance shall apply to all buildings and structures whether public or private, residential or commercial, institutional and industrial proposed/planned or existing. However, properties or businesses that have onsite wastewater treatment facilities approved by the City Environment and Natural Resources Office (CENRO) shall be exempted from this ordinance.

Section 3. Pre-treatment for Commercial Facilities. Septage from a commercial or other non-residential facility is acceptable if the septic tank only receives wastewater typical of a household (i.e. from toilets and sinks). If the wastewater contains substances of a commercial nature such as oil or fuel residue, metals or high volumes of fats and grease, an appropriate pre-treatment program, approved by the CENRO, must be in place before the septage can be collected.

Section 4. No septic tank should be constructed within the sixty meters (60m)

Section 5. For new building constructions outside the 60m radius, there must be provision for storm drain recharge box and greywater reed bed system or its equivalent. Building permit shall be issued only by the Building Official upon compliance of applicant design on septic tank according to Revised Philippine National Plumbing Code. Proper tanks shall be sealed at the bottom, properly sized, at least two chambers and accessible for desludging.

For new structures less than twenty (20) square meters in size, a building clearance shall be issued by the barangay where the structure is to be built. For old structures, monitoring shall be done in coordination with the Assessor's Office.

Communities beyond sixty meters (60m) from the Bucal main source:

a. All existing septic tanks not meeting standard shall be corrected in accordance with the Revised National Plumbing Code.

b. All septic tanks for new construction shall conform to the new Septic tank design of the revised National Plumbing Code and regularly desludge septage as provided by law;

c. Certificate of completed desludging shall be posted in each household by CWD;

d. All septic tanks shall be desludged by an authorized desludger (CWD or private desludger);

e. New building constructions must provide for storm drain recharge box and greywater reed bed system or its equivalent;

f. Building permit shall be issued only by the Building Official upon compliance on Revised Philippine National Plumbing Code;

g. All households without connection from CWD are also required regular desludging of septic tanks as per RA 9275 Rules and Regulations;

h. New housing subdivisions with or without water connection from CWD must provide their own sewerage system and sewage treatment plant;

Section 6. This Ordinance is enacted to supplement the provisions and specifications of existing laws and ordinances related management and complement existing laws on clean water and building and plumbing regulations.

Section 7. Definition of Terms.

Baffle – 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.

Biodiversity – is the variation of life forms within a given ecosystem, biome or for the entire Earth.

Ecosystem – is a natural unit consisting of all plants, animals and micro-

CENRO – City Environment and Natural Resources Office, a department in the local government unit in-charge of environment related programs.

Chamber – an enclosed space, cavity or compartment of a septic tank.

CWD – Calamba Water District, the main provider of water and sanitation services in Calamba City.

CST - Communal Septic Tank – disposal system serving a group of dwelling units.

Desludging – the process of removing the accumulated sludge or septage from the septic tank.

Domestic Sewage – sewage containing human excrement and liquid household waste. Also called sanitary sewage.

Drain Recharge Box – a box that catches rainwater as recharge to groundwater source.

Effluent – 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.

Environment – all of the biotic and abiotic factors that act on an organism, population or ecological community and influence its survival and development.

Biotic factors – include the organisms themselves their food and their interactions
Abiotic factors – include such items as sunlight, soil, air, water, climate and pollution

Grey water – also known as sullage, is non-industrial wastewater generated from domestic processes such as dish washing, laundry and bathing. Greywater comprises 50-80% of residential wastewater.

Reed Bed System – a type of wastewater treatment which uses reed plants in treating the water.

Septage – thickened and partially treated sewage that is removed from a septic tank.

Septic Tank – 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.

Sewage – 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.

Sewerage – a comprehensive term, including all construction for collecting, transporting and pumping of sewage. Usually refers to a buried system of underground pipes.

Sewage works – a comprehensive term for pumping, treating and final disposal of effluent via a centralized treatment plan.

STP – Sewage Treatment Plant, treats sewage to the quality required by government standard before discharging to the environment.

Sludge – precipitated solid matter with a highly mineralized content produced by water and sewage treatment processes.

Subdivision – an area composed of parcel of land intended for development for housing purposes.

Treatment – any method, technique, or process designed to alter the physical, chemical, or biological and radiological character or composition of any waste or wastewater to reduce or prevent pollution.

Wastewater – waste in liquid state containing pollutants.

Section 8. General Design Construction and Maintenance Requirements of Septic Tanks.

General Requirements.

The general design, construction and maintenance requirements of septic tanks shall be in accordance with the provisions of the Revised National Plumbing Code specifically Board for Master Plumbers Board Resolution #4 of its implementing Rules and Regulations, the National Building Code of the Philippines, Sanitation Code of the Philippines and its related codes.

Section 8.1 Buildings or Structures Proposed for Construction

a. No building plan for residential dwelling units or commercial and institutional structures shall be approved unless the design of the sanitary plumbing and septic tank conforms to the specifications set herein and other pertinent regulations; alternative wastewater treatment systems shall be duly approved and endorsed by the CENRO. Further, per 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 the granting of Environmental Clearance Certificates and permit to operate.

b. It shall be the duty of the owner, administrator or contractor to inform the concerned agency 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 Building Official and a certificate of occupancy is issued.

Section 8.2 Existing Buildings or Structures

b. The cost of repair and upgrading of septic tanks shall be borne by the owners.

c. 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 determine by the City Government.

Section 9. Specification. Septic tanks shall be designed and constructed in compliance with the revised Philippine National Plumbing Code.

Section 10. Administration and Enforcement. The administration monitoring and enforcement of this ordinance for new buildings is hereby vested in the Building Official of the City Government of Calamba.

Section 11. Desludging. Septic tanks require desludging on an average of every three (3) to five (5) years following a scheduling program to be coordinated by CWD. Septic tanks shall be desludged when the sludge volume is one-third (1/3) of the total volume of the septic tank.

Section 12. User fee. All building or structure owners shall pay an amount for the desludging of their septic tanks and treatment of the septage equivalent to the following:

User fees. A user fee per cubic meter of water consumed shall charged and added to the Calamba Water District (CWD) monthly water bill to cover for loan payment and operations and maintenance of the facility. The fee may be adjusted periodically following due study and public consultations.

Section 12.1 Users of unmetered water and users with no history of billable water flow or water consumption shall have their user fee estimated by the CWD by averaging the billable flow of other households with the same number of members and toilets. For commercial establishments that have their own water source, the groundwater assessment by the CWD shall be the basis for computing the cost of desludging the septic tank.

Section 12.2 Users who have their own onsite wastewater treatment system certified by the CENRO as functioning and compliant to government effluent standards shall be exempt from paying the required user fee. The same system shall also be subject to regular monitoring and annual inspections.

Section 13. Violations and Penalties.

Section 13.1. Issuance of Non-Conformity. The CENRO/CITY HEALTH 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 CENRO.

Section 13.2 Penalties. The violator, or owner of a non-complying establishment or household, who fails to comply with the provisions of this Ordinance shall be meted the following penalties:

a. For private residential buildings

- First Offense ---------- Php1,000.00
- Second Offense ---------- Php1,500.00
- Third Offense ---------- Php2,000.00 or imprisonment

b. For hotels, apartment, banks, offices, shops, lodging houses, malls, restaurants and other commercial establishments

- First Offense ---------- Php2,000.00
- Second Offense ---------- Php2,500.00 and cease & desist order
- Third Offense ---------- Php3,000.00 and/or imprisonment plus Revocation of business permit

c. For hospitals, funeral parlors and similar operation

- First Offense ---------- Php3,000.00
- Second Offense ---------- Php3,500.00 and cease & desist order
- Third Offense ---------- Php4,000.00 and/or imprisonment plus revocation of business permit

The penalty of imprisonment shall not be less than one (1) day nor more than one (1) year , or both fine and imprisonment at the discretion of the Honorable Court. The revocation of business permit shall be effected right after the judgment of the court becomes final and executory.

For purposes of this Ordinance, three (3) months after a year the ordinance becomes effective, the tasked agency for monitoring and inspection of all septic tanks within the territorial jurisdiction of this City of Calamba, shall conduct its monitoring inspection and any found violation of this ordinance shall constitute the first offense, six (6) months after a year the ordinance becomes effective, the same agency shall monitor and inspect all septic tanks within the territorial jurisdiction of Calamba City and by reason of first inspection there is still no compliance of the provision of this ordinance, shall constitute the second offense, and nine (9) months after a year the ordinance becomes effective, the same agency shall conduct its monitoring and inspections of all septic tanks within the territorial jurisdiction of Calamba City and by reason of the first and second inspection there are still no compliance with the provision of this ordinance, shall constitute the third and final offense.

Section 14. All provisions of existing laws and ordinances are hereby supplemented and added to come up with a system that will work for the city.

Section 15. This Ordinance shall take effect upon its approval.

Section 16. Approved. December 1, 2009

*** ** ***

CERTIFIED TRUE & CORRECT:

ATTY. PURSINO C. ORUGA
City Vice-Mayor, Presiding Officer

ATTESTED BY: APPROVED BY:

10.2 Calculation of Design Septage Quantity

10.2 Calculation of Design Septage Quantity

Population

	2007	2012	2017	2022	2027
Within SCA	—	310,001	364,685	431,946	512,521
Outside SCA	—	113,340	133,333	157,924	187,383
Total	360,281	423,341	498,018	589,870	699,904
ratio	0.85	1.00	1.18	1.39	1.65

No. of Households

	2007	2012	2017	2022	2027
Within SCA					
Residential(Cusomers)	—	43,508	51,183	60,623	71,931
Residential(Non-Cusomers)	—	18,492	21,754	25,766	30,573
Commercial	—	2,447	2,879	3,410	4,046
Outside SCA					
Residential	—	22,668	26,666	31,585	37,476
Total (Residential)	72,056	84,668	99,603	117,974	139,980
Total (Residential+Commercial)	—	87,115	102,482	121,383	144,026

	2010	2011	2012
Residential(Cusomers)	42,042	42,775	43,508
Residential(Non-Cusomers)	17,869	18,181	18,492
Commercial	2,357	2402	2,447
		1.02	1.03

Ratio with Septic Tanks

	2012	2017	2022	2027
Residential	0.80	0.81	0.82	0.83
Commercial	1.00	1.00	1.00	1.00

Ratio with Accessible Septic Tanks

	2012	2017	2022	2027
Residential	0.42	0.47	0.52	0.57
Commercial	0.80	0.80	0.80	0.80

Desludged Volume (m^3)

	2012	2017	2022	2027
Residential	2.5	2.5	2.5	2.5
Commercial	5.0	5.0	5.0	5.0

Coverage Ratio

	2012	2017	2022	2027
Residential(Cusomers)	1.00	1.00	1.00	1.00
Residential(Non-Cusomers)	0.01	0.04	0.07	0.10
Commercial	1.00	1.00	1.00	1.00

Total Septage Volume (m^3)

	2012	2017	2022	2027
Residential(Cusomers)	36,547	48,713	64,624	85,077
Residential(Non-Cusomers)	155	828	1,923	3,616
Commercial	9,788	11,515	13,638	16,182
Total	46,490	61,056	80,185	104,875

	2012	2017	2022	2027
Operation Days per Year	240	240	240	240
Desludging Frequency (Years)	5	5	5	5

Design Septage Volume (m^3/day)

	2012	2017	2022	2027
Residential(Cusomers)	30.5	40.6	53.9	70.9
Residential(Non-Cusomers)	0.1	0.7	1.6	3.0
Commercial	8.2	9.6	11.4	13.5
Total	38.7	50.9	66.8	87.4

Desludging Frequency (Years)	2012	2017	2022	2027
4	48.4	63.6	83.5	109.2
3	64.6	84.8	111.4	145.7
2	96.9	127.2	167.1	218.5
1	193.7	254.4	334.1	437.0

10.3 Calculation of Number of Collection Trucks

10.3 Calculation of Number of Collection Trucks

Transfer Time (h)

	No. of STs per Trip	No. of Transfer	Transfer Time	Total
1.0m3	1	0	0.17	0.00
4.5m3	2	1	0.17	0.17
8.5m3	4	3	0.17	0.50

10min/transfer

Desludging Time (h)

	No. of Sludging	Desludging Time	Total
1.0m3	1	0.33	0.33
4.5m3	2	0.33	0.67
8.5m3	4	0.33	1.33

20min/desludging

Travel Time (h)

zone	Ave. Distance (km)	One-way Time	Round-trip Time
1	5	0.50	1.00
2	5	0.50	1.00
3	5	0.50	1.00
4	5	0.50	1.00
5	5	0.50	1.00

Speed 10km/h

Unloading Time (h)	0.50

30min/unloading

Total Time per Trip (h)

	zone1	zone2	zone3	zone4	zone5
1.0m3	1.83	1.83	1.83	1.83	1.83
4.5m3	2.33	2.33	2.33	2.33	2.33
8.5m3	3.33	3.33	3.33	3.33	3.33

Working Hours per Day	8.00

No. of Trips per Day

	zone1	zone2	zone3	zone4	zone5
1.0m3	4.36	4.36	4.36	4.36	4.36
4.5m3	3.43	3.43	3.43	3.43	3.43
8.5m3	2.40	2.40	2.40	2.40	2.40

	No. of Vacuum Trucks	Actual Capacity (m^3)
1.0m3	0	0.95
4.5m3	2	4.275
8.5m3	1	8.075

95%

Collected Volume (m3/d)

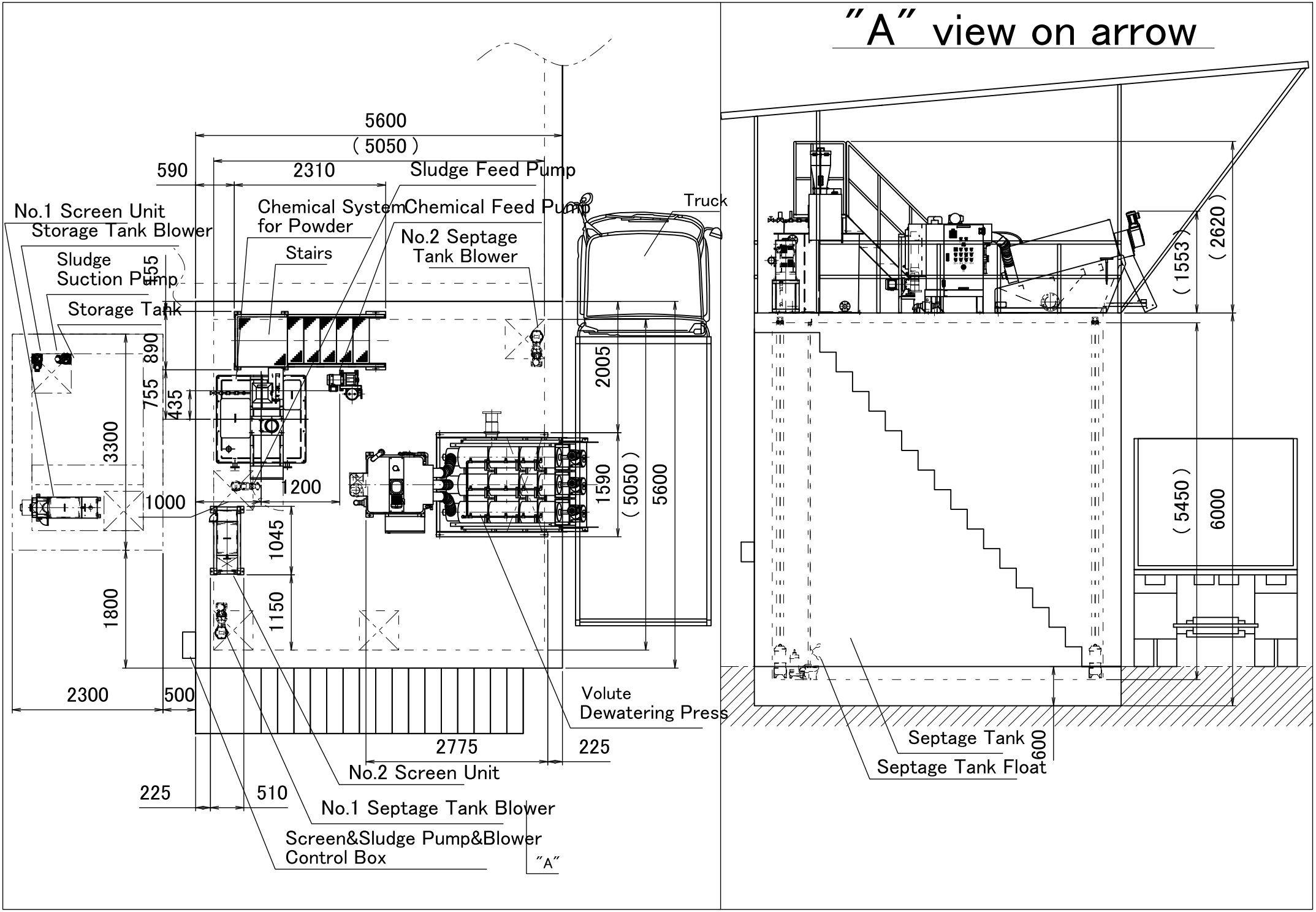
	zone1	zone2	zone3	zone4	zone5	
1.0m3	0.00	0.00	0.00	0.00	0.00	
4.5m3	29.31	29.31	29.31	29.31	29.31	
8.5m3	19.38	19.38	19.38	19.38	19.38	
Total	48.69	48.69	48.69	48.69	48.69	48.69

	No. of Vacuum Trucks	Actual Capacity (m^3)
1.0m3	0	0.95
4.5m3	4	4.275
8.5m3	2	8.075
		95%

Collected Volume (m3/d)

	zone1	zone2	zone3	zone4	zone5	
1.0m3	0.00	0.00	0.00	0.00	0.00	
4.5m3	58.63	58.63	58.63	58.63	58.63	
8.5m3	38.76	38.76	38.76	38.76	38.76	
Total	97.39	97.39	97.39	97.39	97.39	97.39

10.4 Layout of Treatment Facilities


"A" view on arrow
5600
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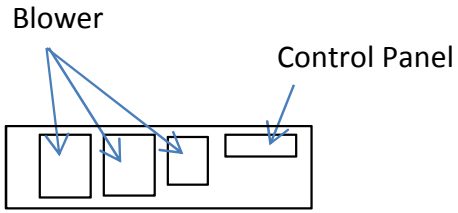
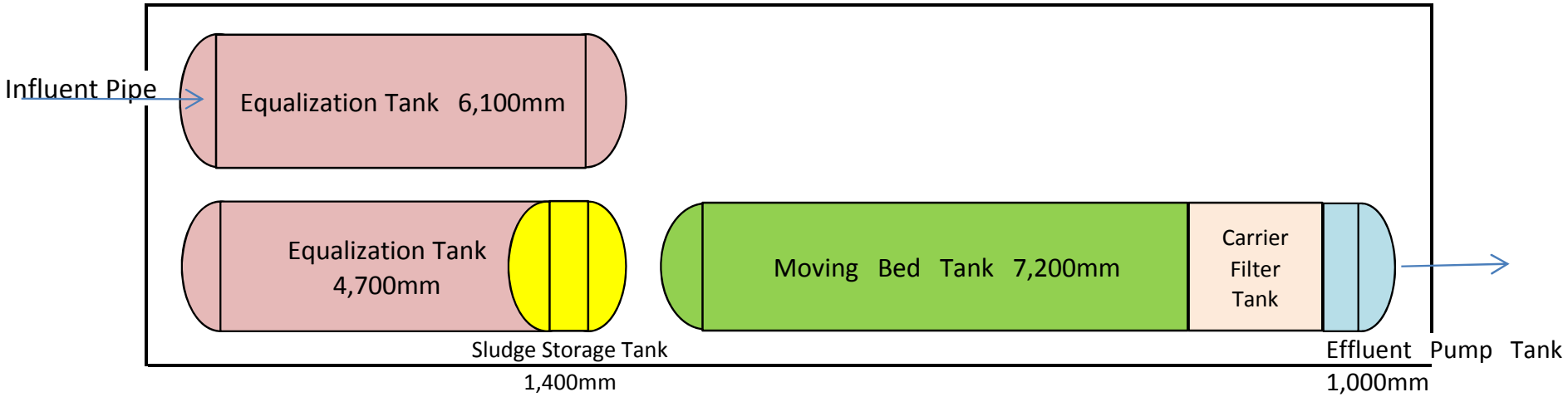
590
2310
Sludge Feed Pump
No.1 Screen Unit
Storage Tank Blower
Chemical System
for Powder
Chemical Feed Pump
Truck
No.2 Septage
Tank Blower
Stairs
Sludge
Suction Pump
Storage Tank
555
890
755
435
3300
1000
1200
1045
1150
1800
2005
1590
(5050)
5600
2300
500
2775
225
Volute
Dewatering Press
No.2 Screen Unit
225
510
No.1 Septage Tank Blower
Screen&Sludge Pump&Blower
Control Box
"A"
(1553)
(2620)
(5450)
6000
600
Septage Tank
Septage Tank Float

Johkasou ＜50m^3/day＞





10.5 Calculation of Construction Cost

(1) Option1

(2) Option2

10.5(1) Calculation of Construction Cost Option1

1PhP= 2.433 JpY

Item	Quantity	Unit Cost (JpY)	Unit Cost (PhP)	Cost (PhP)
Ⅰ. TREATMENT PLANT				
A. ENGINEERING COST ITEMS				
1. SITE DEVELOPMENT, m2	1,200		500	600,000
2. SEPTAGE TREATMENT PLANT				
2.1 Septage Receiving Tank	1	900,000	369,914	369,914
2.2 Septage Tank	1	7,200,000	2,959,309	2,959,309
2.3 Screening Unit	1	550,000	226,058	226,058
2.4 Dewatering Unit, Volute, 10m3/h capacity	1	25,000,000	10,275,380	10,275,380
2.5 Dewatering Unit Shipping Fee	1	1,400,000	575,421	575,421
2.6 Dewatering Unit Shipping Fee (17% of tariff)	1	4,250,000	1,746,815	1,746,815
2.7 Dewatering Unit Commissioning Fee	1	500,000	205,508	205,508
2.8 Screening and Dewatering Unit Installation Work	1	2,500,000	1,027,538	1,027,538
2.9 Johkasou Unit	1	10,500,000	4,315,660	4,315,660
2.10 Johkasou Unit Shipping Fee	1	1,300,000	534,320	534,320
2.11 Johkasou Unit Shipping Fee (17% of tariff)	1	1,785,000	733,662	733,662
2.12 Johkasou Unit Installation Work	1	2,500,000	1,027,538	1,027,538
2.13 Civil Works	1	8,000,000	3,288,122	3,288,122
Sub-Total A				27,885,245
Contingencies(15% of Sub-Total A)				4,182,787
Plant Cost				32,068,031
Feasibility/Environmental Studies (6% of Cons. Cost)				1,924,082
Detailed Design (5% of Const, Cost)				1,603,402
Construction Supervision (4% of Const. Cost)				1,282,721
Total Cost of A				**36,878,236**
B. NON-ENGINEERING COST ITEMS:				
1. Administration Building, m2	30		25,000	750,000
2. Motorpool (Washing Bay)	100		6,000	600,000
3. Office Equipment	1		2,000,000	2,000,000
4. Chlorine House / Chemical Storage, m2	20		25,000	500,000
5. Laboratory, m2	20		25,000	500,000
6. Building For Septage Acceptance and Dewatering, m2	30		25,000	750,000
7. Blower Room & Genset Building, m2	50		25,000	1,250,000
8. Utility Vehicle	1		700,000	700,000
Sub-Total B				7,050,000
Contingencies(5% of Sub-Total B)				352,500
Total Cost of B				**7,402,500**
TOTAL PROJECT COST				**44,280,736**
Procurement of Lot, m2	1,500		10,000	**15,000,000**
TOTAL - I				**59,280,736**
II. VACUUM TRUCKS				
8.5 m3 vacuum trucks	1		6,700,000	6,700,000
4.5 m3 vacuum trucks	2		4,200,000	8,400,000
5 m3 dump truck	1		2,000,000	2,000,000
TOTAL - II				**17,100,000**
GRAND TOTAL				**76,380,736**

10.5(2) Calculation of Construction Cost Option2

1PhP= 2.433 JpY

Item	Quantity	Unit Cost (JpY)	Unit Cost (PhP)	Cost (PhP)
Ⅰ. TREATMENT PLANT				
A. ENGINEERING COST ITEMS				
1. SITE DEVELOPMENT, m2	1,200		500	600,000
2. SEPTAGE TREATMENT PLANT				
2.1 Septage Receiving Tank	1	900,000	369,914	369,914
2.2 Septage Tank	1	7,200,000	2,959,309	2,959,309
2.3 Screening Unit	1	550,000	226,058	226,058
2.4 Dewatering Unit, Volute, 10m3/h capacity	1	25,000,000	10,275,380	10,275,380
2.5 Dewatering Unit Shipping Fee	1	1,400,000	575,421	575,421
2.6 Dewatering Unit Shipping Fee (17% of tariff)	1	4,250,000	1,746,815	1,746,815
2.7 Dewatering Unit Commissioning Fee	1	500,000	205,508	205,508
2.8 Screening and Dewatering Unit Installation Work	1	2,500,000	1,027,538	1,027,538
2.9 Extended aeration process, civil works	1	21,600,000	8,877,928	8,877,928
2.10 Blower	1	1,400,000	575,421	575,421
2.11 Sludge Pump	1	320,000	131,525	131,525
2.12 Control Panel	1	470,000	193,177	193,177
2.13 Electro-mechanical works	1	2,210,000	908,344	908,344
2.14 Instrumentation works (20% EM)	1	442,000	181,669	181,669
Sub-Total A				28,854,007
Contingencies(15% of Sub-Total A)				4,328,101
Plant Cost				33,182,109
Feasibility/Environmental Studies (6% of Cons. Cost)				1,990,927
Detailed Design (5% of Const, Cost)				1,659,105
Construction Supervision (4% of Const. Cost)				1,327,284
Total Cost of A				**38,159,425**
B. NON-ENGINEERING COST ITEMS:				
1. Administration Building, m2	30		25,000	750,000
2. Motorpool (Washing Bay)	100		6,000	600,000
3. Office Equipment	1		2,000,000	2,000,000
4. Chlorine House / Chemical Storage, m2	20		25,000	500,000
5. Laboratory, m2	20		25,000	500,000
6. Building For Septage Acceptance and Dewatering, m2	30		25,000	750,000
7. Blower Room & Genset Building, m2	50		25,000	1,250,000
8. Utility Vehicle	1		700,000	700,000
Sub-Total B				7,050,000
Contingencies(5% of Sub-Total B)				352,500
Total Cost of B				**7,402,500**
TOTAL PROJECT COST				**45,561,925**
Procurement of Lot, m2	1,500		10,000	**15,000,000**
TOTAL - I				**60,561,925**
II. VACUUM TRUCKS				
8.5 m3 vacuum trucks	1		6,700,000	6,700,000
4.5 m3 vacuum trucks	2		4,200,000	8,400,000
5 m3 dump truck	1		2,000,000	2,000,000
TOTAL - II				**17,100,000**
GRAND TOTAL				**77,661,925**

10.6 Calculation of Operation and Maintenance Cost

(1) Option1

(2) Option2

10.6(1) Calculation of Operation and Maintenance Cost Option1

Detailed Operation and Maintenance Cost

1PhP= 2.433 JpY

Item		Quantity/ Consumption per Month	Unit	Unit Rate (JpY)	Unit Rate (PhP)	Monthly Cost	Annual Cost	Sub-Total		Total
Ⅰ. Treatment Operation										
Personnel	Manager	1	no.		40,000	40,000	480,000	1,680,000	3,948,092	8,806,441
	Operator	2	no.		20,000	40,000	480,000			
	Laborer	1	no.		20,000	20,000	240,000			
	Security Guard	2	no.		20,000	40,000	480,000			
Power Consumption	Dewatering Unit	390	kWh		20	7,800	93,600	608,160		
	Johkasou Unit	2,144	kWh		20	42,880	514,560			
Water Consumption	Dewatering Unit	24	m^3		40	960	11,520	11,520		
Chemical Consumption	Dewatering Unit	300	kg		80	24,000	288,000	341,564		
	Johkasou Unit	10.86	kg	1,000	411	4,464	53,564			
Water Testing and Monitoring	pH	5	no.		200	1,000	12,000	714,000		
	BOD	15	no.		1,500	22,500	270,000			
	COD	15	no.		1,200	18,000	216,000			
	TSS	15	no.		700	10,500	126,000			
	Total Coliforms	5	no.		1,500	7,500	90,000			
Consumable Spare Parts	Dewatering Unit	1	no.	111,000	45,623	45,623	547,472	592,848		
	Johkasou Unit	1	no.	9,200	3,781	3,781	45,376			
Ⅱ. Desludging Operation										
Personnel	Driver	3	no.		20,000	60,000	720,000	1,440,000	2,362,800	
	Desludger	3	no.		20,000	60,000	720,000			
Fuel Consumption		880	L		55	48,400	580,800	580,800		
Consumable Spare Parts		1	no.		28,500	28,500	342,000	342,000		
Ⅲ. Sludging Disposal										
Personnel	Driver	1	no.		20,000	20,000	240,000	240,000	1,055,549	
Fuel Consumption		40	L		55	2,200	26,400	26,400		
Disposal fee		80	t	2,000	822	65,762	789,149	789,149		
Ⅳ. Headquarters										
Personnel	Manager	1	no.		40,000	40,000	480,000	1,440,000	1,440,000	
	Planning/Designning	2	no.		20,000	40,000	480,000			
	Manegement/office	2	no.		20,000	40,000	480,000			

10.6(2) Calculation of Operation and Maintenance Cost Option2

Detailed Operation and Maintenance Cost

1PhP= 2.433 JpY

Item		Quantity/ Consumption per Month	Unit	Unit Rate (JpY)	Unit Rate (PhP)	Monthly Cost	Annual Cost	Sub-Total		Total
Ⅰ. Treatment Operation										
Personnel	Manager	1	no.		40,000	40,000	480,000	1,680,000	4,703,884	9,562,234
	Operator	2	no.		20,000	40,000	480,000			
	Laborer	1	no.		20,000	20,000	240,000			
	Security Guard	2	no.		20,000	40,000	480,000			
Power Consumption	Dewatering Unit	390	kWh		20	7,800	93,600	1,389,600		
	Extended aeration	5,400	kWh		20	108,000	1,296,000			
Water Consumption	Dewatering Unit	24	m^3		40	960	11,520	11,520		
Chemical Consumption	Dewatering Unit	300	kg		80	24,000	288,000	341,564		
	Extended aeration	10.86	kg	1,000	411	4,464	53,564			
Water Testing and Monitoring	pH	5	no.		200	1,000	12,000	714,000		
	BOD	15	no.		1,500	22,500	270,000			
	COD	15	no.		1,200	18,000	216,000			
	TSS	15	no.		700	10,500	126,000			
	Total Coliforms	5	no.		1,500	7,500	90,000			
Consumable Spare Parts	Dewatering Unit	1	no.	111,000	45,623	45,623	547,472	567,201		
	Extended aeration	1	no.	4,000	1,644	1,644	19,729			
Ⅱ. Desludging Operation										
Personnel	Driver	3	no.		20,000	60,000	720,000	1,440,000	2,362,800	
	Desludger	3	no.		20,000	60,000	720,000			
Fuel Consumption		880	L		55	48,400	580,800	580,800		
Consumable Spare Parts		1	no.		28,500	28,500	342,000	342,000		
Ⅲ. Sludging Disposal										
Personnel	Driver	1	no.		20,000	20,000	240,000	240,000	1,055,549	
Fuel Consumption		40	L		55	2,200	26,400	26,400		
Disposal fee		80	t	2,000	822	65,762	789,149	789,149		
Ⅳ. Headquarters										
Personnel	Manager	1	no.		40,000	40,000	480,000	1,440,000	1,440,000	
	Planning/Designning	2	no.		20,000	40,000	480,000			
	Manegement/office	2	no.		20,000	40,000	480,000			

10.7 Financial Analysis

1-a) Desludging Fee 2.0PhP/m3, NG : LGU : WD= 0 : 0 : 100

1-b) Desludging Fee 2.0PhP/m3, NG : LGU : WD= 40 : 0 : 60

1-c) Desludging Fee 1.5PhP/m3, NG : LGU : WD= 40 : 0 : 60

1-d) Desludging Fee 1.5PhP/m3, NG : LGU : WD= 40 : 30 : 30

1-e) Desludging Fee 1.0PhP/m3, NG : LGU : WD= 40 : 30 : 30

2-a) Desludging Fee 2.0PhP/m3, NG : LGU : WD= 0 : 0 : 100

2-b) Desludging Fee 2.0PhP/m3, NG : LGU : WD= 40 : 0 : 60

2-c) Desludging Fee 1.5PhP/m3, NG : LGU : WD= 40 : 0 : 60

2-d) Desludging Fee 1.5PhP/m3, NG : LGU : WD= 40 : 30 : 30

2-e) Desludging Fee 1.0PhP/m3, NG : LGU : WD= 40 : 30 : 30

10.7 1-a) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**76,381**

Cost Share	Weight
National Government	0%
LGU	0%
WD	**100%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	61,105
Equity	15,276
Total	76,381

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	77,821	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	76,381								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		23,927	24,167	24,408	24,652	24,899	25,148	25,399	25,653	25,910	26,169	26,431	26,695	26,962	27,232	27,504
Projected billed water volume (m3)		11,964	12,083	12,204	12,326	12,449	12,574	12,700	12,827	12,955	13,085	13,215	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Net Revenue	-77,821	15,121	15,360	15,602	15,846	16,093	16,342	16,593	-253	17,104	17,363	17,624	17,889	18,156	18,425	18,698

Net Present Value	36,952
Financial Internal Rate of Return	17.97%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-85,603	14,240	14,480	14,721	14,965	15,212	15,461	15,712	-2,844	16,223	16,482	16,744	17,008	17,275	17,545	17,817
Revenues (-10%)	-77,821	12,728	12,944	13,161	13,381	13,603	13,827	14,053	-2,818	14,513	14,746	14,981	15,219	15,459	15,702	15,947
Cost (+10%), Revenues (-10%)	-101,167	11,848	12,063	12,280	12,500	12,722	12,946	13,172	-5,409	13,632	13,865	14,101	14,338	14,579	14,821	15,066
Cost (+20%)	-93,385	13,360	13,599	13,841	14,085	14,331	14,580	14,832	-5,434	15,342	15,601	15,863	16,127	16,394	16,664	16,936
Revenues (-20%)	-77,821	10,336	10,527	10,720	10,916	11,113	11,312	11,513	-5,384	11,922	12,129	12,338	12,550	12,763	12,979	13,197
Cost (+20%), Revenues (-20%)	-93,385	8,574	8,766	8,959	9,154	9,351	9,551	9,752	-10,565	10,160	10,368	10,577	10,788	11,002	11,218	11,435
Cost (+30%)	-101,167	12,479	12,718	12,960	13,204	13,451	13,700	13,951	-8,025	14,462	14,721	14,982	15,247	15,514	15,783	16,056
Revenues (-30%)	-77,821	7,943	8,110	8,279	8,450	8,623	8,797	8,973	-7,949	9,331	9,512	9,695	9,880	10,067	10,256	10,446
Cost (+30%), Revenues (-30%)	-101,167	5,301	5,468	5,637	5,808	5,981	6,155	6,331	-15,721	6,689	6,870	7,053	7,238	7,425	7,614	7,804
Net Present Value (NPV)																
Cost (+10%)	22,957															
Revenues (-10%)	19,261															
Cost (+10%), Revenues (-10%)	-8,909															
Cost (+20%)	8,961															
Revenues (-20%)	1,571															
Cost (+20%), Revenues (-20%)	-26,420															
Cost (+30%)	-5,034															
Revenues (-30%)	-16,120															
Cost (+30%), Revenues (-30%)	-58,106															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	14.55%															
Revenues (-10%)	14.20%															
Cost (+10%), Revenues (-10%)	8.13%															
Cost (+20%)	11.55%															
Revenues (-20%)	10.17%															
Cost (+20%), Revenues (-20%)	4.13%															
Cost (+30%)	8.86%															
Revenues (-30%)	5.74%															
Cost (+30%), Revenues (-30%)	-3.16%															

10.7 1-b) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**76,381**

Cost Share	Weight
National Government	40%
LGU	0%
WD	**60%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	36,663
Equity	9,166
Total	45,828

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	47,268	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	45,828								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		23,927	24,167	24,408	24,652	24,899	25,148	25,399	25,653	25,910	26,169	26,431	26,695	26,962	27,232	27,504
Projected billed water volume (m3)		11,964	12,083	12,204	12,326	12,449	12,574	12,700	12,827	12,955	13,085	13,215	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Net Revenue	-47,268	15,121	15,360	15,602	15,846	16,093	16,342	16,593	-253	17,104	17,363	17,624	17,889	18,156	18,425	18,698

Net Present Value	64,777
Financial Internal Rate of Return	31.70%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-51,995	14,240	14,480	14,721	14,965	15,212	15,461	15,712	-2,844	16,223	16,482	16,744	17,008	17,275	17,545	17,817
Revenues (-10%)	-47,268	12,728	12,944	13,161	13,381	13,603	13,827	14,053	-2,818	14,513	14,746	14,981	15,219	15,459	15,702	15,947
Cost (+10%), Revenues (-10%)	-61,449	11,848	12,063	12,280	12,500	12,722	12,946	13,172	-5,409	13,632	13,865	14,101	14,338	14,579	14,821	15,066
Cost (+20%)	-56,722	13,360	13,599	13,841	14,085	14,331	14,580	14,832	-5,434	15,342	15,601	15,863	16,127	16,394	16,664	16,936
Revenues (-20%)	-47,268	10,336	10,527	10,720	10,916	11,113	11,312	11,513	-5,384	11,922	12,129	12,338	12,550	12,763	12,979	13,197
Cost (+20%), Revenues (-20%)	-56,722	8,574	8,766	8,959	9,154	9,351	9,551	9,752	-10,565	10,160	10,368	10,577	10,788	11,002	11,218	11,435
Cost (+30%)	-61,449	12,479	12,718	12,960	13,204	13,451	13,700	13,951	-8,025	14,462	14,721	14,982	15,247	15,514	15,783	16,056
Revenues (-30%)	-47,268	7,943	8,110	8,279	8,450	8,623	8,797	8,973	-7,949	9,331	9,512	9,695	9,880	10,067	10,256	10,446
Cost (+30%), Revenues (-30%)	-61,449	5,301	5,468	5,637	5,808	5,981	6,155	6,331	-15,721	6,689	6,870	7,053	7,238	7,425	7,614	7,804
Net Present Value (NPV)																
Cost (+10%)	53,564															
Revenues (-10%)	47,087															
Cost (+10%), Revenues (-10%)	27,264															
Cost (+20%)	42,352															
Revenues (-20%)	29,396															
Cost (+20%), Revenues (-20%)	6,971															
Cost (+30%)	31,139															
Revenues (-30%)	11,706															
Cost (+30%), Revenues (-30%)	-21,933															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	26.66%															
Revenues (-10%)	26.15%															
Cost (+10%), Revenues (-10%)	17.49%															
Cost (+20%)	22.33%															
Revenues (-20%)	20.38%															
Cost (+20%), Revenues (-20%)	12.04%															
Cost (+30%)	18.53%															
Revenues (-30%)	14.22%															
Cost (+30%), Revenues (-30%)	2.52%															

10.7 1-c) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**76,381**

Cost Share	Weight
National Government	40%
LGU	0%
WD	**60%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	36,663
Equity	9,166
Total	45,828

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	47,268	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	45,828								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		17,946	18,125	18,306	18,489	18,674	18,861	19,050	19,240	19,432	19,627	19,823	20,021	20,222	20,424	20,628
Projected billed water volume (m3)		11,964	12,083	12,204	12,326	12,449	12,574	12,700	12,827	12,955	13,085	13,215	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Net Revenue	-47,268	9,139	9,319	9,500	9,683	9,868	10,055	10,243	-6,666	10,626	10,820	11,017	11,215	11,415	11,617	11,822

Net Present Value	20,551
Financial Internal Rate of Return	17.36%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-51,995	8,258	8,438	8,619	8,802	8,987	9,174	9,363	-9,257	9,745	9,940	10,136	10,334	10,534	10,737	10,941
Revenues (-10%)	-47,268	7,345	7,506	7,669	7,834	8,000	8,168	8,338	-8,590	8,683	8,858	9,034	9,213	9,393	9,575	9,759
Cost (+10%), Revenues (-10%)	-61,449	6,464	6,625	6,789	6,953	7,120	7,288	7,458	-11,181	7,802	7,977	8,154	8,332	8,512	8,694	8,878
Cost (+20%)	-56,722	7,378	7,557	7,739	7,922	8,107	8,293	8,482	-11,848	8,865	9,059	9,255	9,454	9,654	9,856	10,060
Revenues (-20%)	-47,268	5,550	5,694	5,839	5,985	6,133	6,282	6,433	-10,514	6,740	6,895	7,052	7,211	7,371	7,533	7,696
Cost (+20%), Revenues (-20%)	-56,722	3,789	3,932	4,077	4,224	4,372	4,521	4,672	-15,696	4,978	5,134	5,291	5,449	5,609	5,771	5,935
Cost (+30%)	-61,449	6,497	6,677	6,858	7,041	7,226	7,413	7,601	-14,438	7,984	8,178	8,375	8,573	8,773	8,975	9,180
Revenues (-30%)	-47,268	3,755	3,881	4,008	4,136	4,266	4,396	4,528	-12,438	4,796	4,932	5,070	5,208	5,349	5,490	5,633
Cost (+30%), Revenues (-30%)	-61,449	1,114	1,239	1,366	1,494	1,624	1,754	1,886	-20,210	2,154	2,290	2,428	2,567	2,707	2,848	2,991
Net Present Value (NPV)																
Cost (+10%)	9,338															
Revenues (-10%)	7,283															
Cost (+10%), Revenues (-10%)	-12,540															
Cost (+20%)	-1,875															
Revenues (-20%)	-5,985															
Cost (+20%), Revenues (-20%)	-28,411															
Cost (+30%)	-13,088															
Revenues (-30%)	-19,253															
Cost (+30%), Revenues (-30%)	-52,891															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	13.04%															
Revenues (-10%)	12.59%															
Cost (+10%), Revenues (-10%)	5.81%															
Cost (+20%)	9.18%															
Revenues (-20%)	7.37%															
Cost (+20%), Revenues (-20%)	-0.95%															
Cost (+30%)	5.63%															
Revenues (-30%)	1.35%															
Cost (+30%), Revenues (-30%)	-13.07%															

10.7 1-d) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**76,381**

Cost Share	Weight
National Government	40%
LGU	30%
WD	**30%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	18,331
Equity	4,583
Total	22,914

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	24,354	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	22,914								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		17,946	18,125	18,306	18,489	18,674	18,861	19,050	19,240	19,432	19,627	19,823	20,021	20,222	20,424	20,628
Projected billed water volume (m3)		11,964	12,083	12,204	12,326	12,449	12,574	12,700	12,827	12,955	13,085	13,215	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Net Revenue	-24,354	9,139	9,319	9,500	9,683	9,868	10,055	10,243	-6,666	10,626	10,820	11,017	11,215	11,415	11,617	11,822

Net Present Value	41,420
Financial Internal Rate of Return	37.02%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-26,790	8,258	8,438	8,619	8,802	8,987	9,174	9,363	-9,257	9,745	9,940	10,136	10,334	10,534	10,737	10,941
Revenues (-10%)	-24,354	7,345	7,506	7,669	7,834	8,000	8,168	8,338	-8,590	8,683	8,858	9,034	9,213	9,393	9,575	9,759
Cost (+10%), Revenues (-10%)	-31,660	6,464	6,625	6,789	6,953	7,120	7,288	7,458	-11,181	7,802	7,977	8,154	8,332	8,512	8,694	8,878
Cost (+20%)	-29,225	7,378	7,557	7,739	7,922	8,107	8,293	8,482	-11,848	8,865	9,059	9,255	9,454	9,654	9,856	10,060
Revenues (-20%)	-24,354	5,550	5,694	5,839	5,985	6,133	6,282	6,433	-10,514	6,740	6,895	7,052	7,211	7,371	7,533	7,696
Cost (+20%), Revenues (-20%)	-29,225	3,789	3,932	4,077	4,224	4,372	4,521	4,672	-15,696	4,978	5,134	5,291	5,449	5,609	5,771	5,935
Cost (+30%)	-31,660	6,497	6,677	6,858	7,041	7,226	7,413	7,601	-14,438	7,984	8,178	8,375	8,573	8,773	8,975	9,180
Revenues (-30%)	-24,354	3,755	3,881	4,008	4,136	4,266	4,396	4,528	-12,438	4,796	4,932	5,070	5,208	5,349	5,490	5,633
Cost (+30%), Revenues (-30%)	-31,660	1,114	1,239	1,366	1,494	1,624	1,754	1,886	-20,210	2,154	2,290	2,428	2,567	2,707	2,848	2,991
Net Present Value (NPV)																
Cost (+10%)	32,294															
Revenues (-10%)	28,152															
Cost (+10%), Revenues (-10%)	14,590															
Cost (+20%)	23,168															
Revenues (-20%)	14,884															
Cost (+20%), Revenues (-20%)	-3,368															
Cost (+30%)	14,042															
Revenues (-30%)	1,616															
Cost (+30%), Revenues (-30%)	-25,762															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	29.66%															
Revenues (-10%)	28.90%															
Cost (+10%), Revenues (-10%)	17.86%															
Cost (+20%)	23.28%															
Revenues (-20%)	20.37%															
Cost (+20%), Revenues (-20%)	7.60%															
Cost (+30%)	17.61%															
Revenues (-30%)	11.03%															
Cost (+30%), Revenues (-30%)	-9.13%															

10.7 1-e) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**76,381**

Cost Share	Weight
National Government	40%
LGU	30%
WD	**30%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	18,331
Equity	4,583
Total	22,914

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	24,354	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	22,914								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		11,964	12,083	12,204	12,326	12,449	12,574	12,700	12,827	12,955	13,085	13,215	13,348	13,481	13,616	13,752
Projected billed water volume (m3)		11,964	12,083	12,204	12,326	12,449	12,574	12,700	12,827	12,955	13,085	13,215	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Net Revenue	−24,354	3,157	3,277	3,398	3,520	3,643	3,768	3,893	−13,080	4,149	4,278	4,409	4,541	4,675	4,809	4,946

Net Present Value	−2,806
Financial Internal Rate of Return	7.60%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	−26,790	2,277	2,396	2,517	2,639	2,762	2,887	3,013	−15,670	3,268	3,397	3,528	3,660	3,794	3,929	4,065
Revenues (−10%)	−24,354	1,961	2,069	2,177	2,287	2,398	2,510	2,623	−14,362	2,853	2,970	3,087	3,206	3,326	3,448	3,570
Cost (+10%), Revenues (−10%)	−31,660	1,080	1,188	1,297	1,407	1,517	1,630	1,743	−16,953	1,972	2,089	2,207	2,326	2,446	2,567	2,690
Cost (+20%)	−29,225	1,396	1,516	1,636	1,758	1,882	2,006	2,132	−18,261	2,387	2,517	2,648	2,780	2,913	3,048	3,184
Revenues (−20%)	−24,354	765	860	957	1,055	1,153	1,253	1,353	−15,645	1,558	1,661	1,766	1,872	1,978	2,086	2,195
Cost (+20%), Revenues (−20%)	−29,225	−997	−901	−804	−707	−608	−509	−408	−20,826	−204	−100	5	110	217	325	434
Cost (+30%)	−31,660	515	635	756	878	1,001	1,126	1,251	−20,852	1,507	1,636	1,767	1,899	2,033	2,167	2,304
Revenues (−30%)	−24,354	−432	−348	−264	−178	−92	−5	83	−16,928	262	353	444	537	630	725	820
Cost (+30%), Revenues (−30%)	−31,660	−3,074	−2,990	−2,905	−2,820	−2,734	−2,647	−2,559	−24,700	−2,380	−2,289	−2,198	−2,105	−2,012	−1,917	−1,822
Net Present Value (NPV)																
Cost (+10%)	−11,932															
Revenues (−10%)	−11,652															
Cost (+10%), Revenues (−10%)	−25,214															
Cost (+20%)	−21,058															
Revenues (−20%)	−20,497															
Cost (+20%), Revenues (−20%)	−38,749															
Cost (+30%)	−30,184															
Revenues (−30%)	−29,342															
Cost (+30%), Revenues (−30%)	−56,720															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	0.66%															
Revenues (−10%)	−0.10%															
Cost (+10%), Revenues (−10%)	−9.04%															
Cost (+20%)	−6.33%															
Revenues (−20%)	−10.03%															
Cost (+20%), Revenues (−20%)	#NUM!															
Cost (+30%)	−14.00%															
Revenues (−30%)	#NUM!															
Cost (+30%), Revenues (−30%)	#NUM!															

10.7 2-a) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**61,381**

Cost Share	Weight
National Government	0%
LGU	0%
WD	**100%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	49,105
Equity	12,276
Total	61,381

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	62,821	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	61,381								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		23,928	24,167	24,409	24,653	24,900	25,149	25,400	25,654	25,911	26,170	26,431	26,696	26,963	27,232	27,505
Projected billed water volume (m3)		11,964	12,084	12,204	12,327	12,450	12,574	12,700	12,827	12,955	13,085	13,216	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Net Revenue	-62,821	15,122	15,361	15,603	15,847	16,093	16,342	16,594	-252	17,104	17,363	17,625	17,889	18,156	18,426	18,698

Net Present Value	50,617
Financial Internal Rate of Return	23.19%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-69,103	14,241	14,480	14,722	14,966	15,212	15,461	15,713	-2,843	16,224	16,483	16,744	17,009	17,276	17,545	17,818
Revenues (-10%)	-62,821	12,729	12,944	13,162	13,381	13,603	13,827	14,054	-2,818	14,513	14,746	14,982	15,220	15,460	15,703	15,948
Cost (+10%), Revenues (-10%)	-81,667	11,848	12,063	12,281	12,501	12,723	12,947	13,173	-5,408	13,632	13,866	14,101	14,339	14,579	14,822	15,067
Cost (+20%)	-75,385	13,360	13,600	13,841	14,085	14,332	14,581	14,832	-5,434	15,343	15,602	15,864	16,128	16,395	16,665	16,937
Revenues (-20%)	-62,821	10,336	10,527	10,721	10,916	11,113	11,312	11,514	-5,383	11,922	12,129	12,339	12,550	12,764	12,979	13,197
Cost (+20%), Revenues (-20%)	-75,385	8,575	8,766	8,959	9,155	9,352	9,551	9,752	-10,564	10,161	10,368	10,577	10,789	11,002	11,218	11,436
Cost (+30%)	-81,667	12,480	12,719	12,961	13,205	13,451	13,700	13,952	-8,024	14,462	14,721	14,983	15,247	15,514	15,784	16,056
Revenues (-30%)	-62,821	7,943	8,111	8,280	8,451	8,623	8,798	8,974	-7,949	9,331	9,512	9,696	9,881	10,067	10,256	10,447
Cost (+30%), Revenues (-30%)	-81,667	5,301	5,469	5,638	5,809	5,981	6,156	6,332	-15,721	6,689	6,870	7,054	7,239	7,425	7,614	7,805
Net Present Value (NPV)																
Cost (+10%)	37,988															
Revenues (-10%)	32,926															
Cost (+10%), Revenues (-10%)	8,854															
Cost (+20%)	25,359															
Revenues (-20%)	15,235															
Cost (+20%), Revenues (-20%)	-10,023															
Cost (+30%)	12,730															
Revenues (-30%)	-2,456															
Cost (+30%), Revenues (-30%)	-40,343															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	19.19%															
Revenues (-10%)	18.78%															
Cost (+10%), Revenues (-10%)	11.78%															
Cost (+20%)	15.71%															
Revenues (-20%)	14.12%															
Cost (+20%), Revenues (-20%)	7.25%															
Cost (+30%)	12.62%															
Revenues (-30%)	9.07%															
Cost (+30%), Revenues (-30%)	-0.87%															

10.7 2-b) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**61,381**

Cost Share	Weight
National Government	40%
LGU	0%
WD	**60%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	29,463
Equity	7,366
Total	36,828

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	38,268	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	36,828								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		23,928	24,167	24,409	24,653	24,900	25,149	25,400	25,654	25,911	26,170	26,431	26,696	26,963	27,232	27,505
Projected billed water volume (m3)		11,964	12,084	12,204	12,327	12,450	12,574	12,700	12,827	12,955	13,085	13,216	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Net Revenue	-38,268	15,122	15,361	15,603	15,847	16,093	16,342	16,594	-252	17,104	17,363	17,625	17,889	18,156	18,426	18,698

Net Present Value	72,978
Financial Internal Rate of Return	39.56%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-42,095	14,241	14,480	14,722	14,966	15,212	15,461	15,713	-2,843	16,224	16,483	16,744	17,009	17,276	17,545	17,818
Revenues (-10%)	-38,268	12,729	12,944	13,162	13,381	13,603	13,827	14,054	-2,818	14,513	14,746	14,982	15,220	15,460	15,703	15,948
Cost (+10%), Revenues (-10%)	-49,749	11,848	12,063	12,281	12,501	12,723	12,947	13,173	-5,408	13,632	13,866	14,101	14,339	14,579	14,822	15,067
Cost (+20%)	-45,922	13,360	13,600	13,841	14,085	14,332	14,581	14,832	-5,434	15,343	15,602	15,864	16,128	16,395	16,665	16,937
Revenues (-20%)	-38,268	10,336	10,527	10,721	10,916	11,113	11,312	11,514	-5,383	11,922	12,129	12,339	12,550	12,764	12,979	13,197
Cost (+20%), Revenues (-20%)	-45,922	8,575	8,766	8,959	9,155	9,352	9,551	9,752	-10,564	10,161	10,368	10,577	10,789	11,002	11,218	11,436
Cost (+30%)	-49,749	12,480	12,719	12,961	13,205	13,451	13,700	13,952	-8,024	14,462	14,721	14,983	15,247	15,514	15,784	16,056
Revenues (-30%)	-38,268	7,943	8,111	8,280	8,451	8,623	8,798	8,974	-7,949	9,331	9,512	9,696	9,881	10,067	10,256	10,447
Cost (+30%), Revenues (-30%)	-49,749	5,301	5,469	5,638	5,809	5,981	6,156	6,332	-15,721	6,689	6,870	7,054	7,239	7,425	7,614	7,805
Net Present Value (NPV)																
Cost (+10%)	62,585															
Revenues (-10%)	55,287															
Cost (+10%), Revenues (-10%)	37,924															
Cost (+20%)	52,192															
Revenues (-20%)	37,596															
Cost (+20%), Revenues (-20%)	16,810															
Cost (+30%)	41,799															
Revenues (-30%)	19,905															
Cost (+30%), Revenues (-30%)	-11,274															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	33.51%															
Revenues (-10%)	32.89%															
Cost (+10%), Revenues (-10%)	22.59%															
Cost (+20%)	28.34%															
Revenues (-20%)	26.02%															
Cost (+20%), Revenues (-20%)	16.24%															
Cost (+30%)	23.84%															
Revenues (-30%)	18.78%															
Cost (+30%), Revenues (-30%)	5.36%															

10.7 2-c) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**61,381**

Cost Share	Weight
National Government	40%
LGU	0%
WD	**60%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	29,463
Equity	7,366
Total	36,828

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	38,268	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	36,828								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		17,946	18,125	18,307	18,490	18,675	18,861	19,050	19,241	19,433	19,627	19,824	20,022	20,222	20,424	20,628
Projected billed water volume (m3)		11,964	12,084	12,204	12,327	12,450	12,574	12,700	12,827	12,955	13,085	13,216	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Net Revenue	-38,268	9,140	9,319	9,500	9,683	9,868	10,055	10,244	-6,666	10,627	10,821	11,017	11,215	11,416	11,618	11,822

Net Present Value	28,751
Financial Internal Rate of Return	22.46%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-42,095	8,259	8,438	8,620	8,803	8,988	9,174	9,363	-9,257	9,746	9,940	10,136	10,335	10,535	10,737	10,941
Revenues (-10%)	-38,268	7,345	7,506	7,670	7,834	8,001	8,169	8,339	-8,590	8,683	8,858	9,035	9,213	9,393	9,575	9,759
Cost (+10%), Revenues (-10%)	-49,749	6,464	6,626	6,789	6,954	7,120	7,288	7,458	-11,181	7,803	7,977	8,154	8,333	8,513	8,695	8,879
Cost (+20%)	-45,922	7,378	7,558	7,739	7,922	8,107	8,294	8,482	-11,847	8,865	9,060	9,256	9,454	9,654	9,856	10,061
Revenues (-20%)	-38,268	5,550	5,694	5,839	5,985	6,133	6,283	6,434	-10,514	6,740	6,895	7,052	7,211	7,371	7,533	7,696
Cost (+20%), Revenues (-20%)	-45,922	3,789	3,933	4,078	4,224	4,372	4,521	4,672	-15,695	4,979	5,134	5,291	5,450	5,610	5,772	5,935
Cost (+30%)	-49,749	6,498	6,677	6,858	7,041	7,226	7,413	7,602	-14,438	7,985	8,179	8,375	8,573	8,774	8,976	9,180
Revenues (-30%)	-38,268	3,756	3,881	4,008	4,136	4,266	4,397	4,529	-12,438	4,797	4,933	5,070	5,209	5,349	5,491	5,633
Cost (+30%), Revenues (-30%)	-49,749	1,114	1,239	1,366	1,494	1,624	1,755	1,887	-20,210	2,155	2,291	2,428	2,567	2,707	2,849	2,992
Net Present Value (NPV)																
Cost (+10%)	18,358															
Revenues (-10%)	15,483															
Cost (+10%), Revenues (-10%)	-1,881															
Cost (+20%)	7,964															
Revenues (-20%)	2,214															
Cost (+20%), Revenues (-20%)	-18,572															
Cost (+30%)	-2,429															
Revenues (-30%)	-11,054															
Cost (+30%), Revenues (-30%)	-42,233															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	17.41%															
Revenues (-10%)	16.89%															
Cost (+10%), Revenues (-10%)	9.09%															
Cost (+20%)	12.94%															
Revenues (-20%)	10.87%															
Cost (+20%), Revenues (-20%)	1.46%															
Cost (+30%)	8.88%															
Revenues (-30%)	4.04%															
Cost (+30%), Revenues (-30%)	-11.84%															

10.7 2-d) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**61,381**

Cost Share	Weight
National Government	40%
LGU	30%
WD	**30%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	14,731
Equity	3,683
Total	18,414

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	19,854	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	18,414								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		17,946	18,125	18,307	18,490	18,675	18,861	19,050	19,241	19,433	19,627	19,824	20,022	20,222	20,424	20,628
Projected billed water volume (m3)		11,964	12,084	12,204	12,327	12,450	12,574	12,700	12,827	12,955	13,085	13,216	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Net Revenue	-19,854	9,140	9,319	9,500	9,683	9,868	10,055	10,244	-6,666	10,627	10,821	11,017	11,215	11,416	11,618	11,822

Net Present Value	45,521
Financial Internal Rate of Return	45.90%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	-21,840	8,259	8,438	8,620	8,803	8,988	9,174	9,363	-9,257	9,746	9,940	10,136	10,335	10,535	10,737	10,941
Revenues (-10%)	-19,854	7,345	7,506	7,670	7,834	8,001	8,169	8,339	-8,590	8,683	8,858	9,035	9,213	9,393	9,575	9,759
Cost (+10%), Revenues (-10%)	-25,810	6,464	6,626	6,789	6,954	7,120	7,288	7,458	-11,181	7,803	7,977	8,154	8,333	8,513	8,695	8,879
Cost (+20%)	-23,825	7,378	7,558	7,739	7,922	8,107	8,294	8,482	-11,847	8,865	9,060	9,256	9,454	9,654	9,856	10,061
Revenues (-20%)	-19,854	5,550	5,694	5,839	5,985	6,133	6,283	6,434	-10,514	6,740	6,895	7,052	7,211	7,371	7,533	7,696
Cost (+20%), Revenues (-20%)	-23,825	3,789	3,933	4,078	4,224	4,372	4,521	4,672	-15,695	4,979	5,134	5,291	5,450	5,610	5,772	5,935
Cost (+30%)	-25,810	6,498	6,677	6,858	7,041	7,226	7,413	7,602	-14,438	7,985	8,179	8,375	8,573	8,774	8,976	9,180
Revenues (-30%)	-19,854	3,756	3,881	4,008	4,136	4,266	4,397	4,529	-12,438	4,797	4,933	5,070	5,209	5,349	5,491	5,633
Cost (+30%), Revenues (-30%)	-25,810	1,114	1,239	1,366	1,494	1,624	1,755	1,887	-20,210	2,155	2,291	2,428	2,567	2,707	2,849	2,992
Net Present Value (NPV)																
Cost (+10%)	36,805															
Revenues (-10%)	32,253															
Cost (+10%), Revenues (-10%)	19,921															
Cost (+20%)	28,089															
Revenues (-20%)	18,985															
Cost (+20%), Revenues (-20%)	1,553															
Cost (+30%)	19,373															
Revenues (-30%)	5,717															
Cost (+30%), Revenues (-30%)	-20,431															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	37.06%															
Revenues (-10%)	36.16%															
Cost (+10%), Revenues (-10%)	22.96%															
Cost (+20%)	29.44%															
Revenues (-20%)	25.98%															
Cost (+20%), Revenues (-20%)	11.01%															
Cost (+30%)	22.71%															
Revenues (-30%)	14.99%															
Cost (+30%), Revenues (-30%)	-7.86%															

10.7 2-e) Financial Analysis

Financial Evaluation

In thousand pesos

Investment Cost	**61,381**

Cost Share	Weight
National Government	40%
LGU	30%
WD	**30%**

Fund Source	Weight	Cost of Capital
Loan	80%	9%
Equity	20%	13%
WACC	**9.80%**	

Fund Source	**Amout**
Loan	14,731
Equity	3,683
Total	18,414

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Costs	19,854	8,806	8,806	8,806	8,806	8,806	8,806	8,806	25,906	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Investment Cost	18,414								17,100							
Operations and Maintenance	1,440	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806	8,806
Revenue (Desludging Fee)		11,964	12,084	12,204	12,327	12,450	12,574	12,700	12,827	12,955	13,085	13,216	13,348	13,481	13,616	13,752
Projected billed water volume (m3)		11,964	12,084	12,204	12,327	12,450	12,574	12,700	12,827	12,955	13,085	13,216	13,348	13,481	13,616	13,752
Estimated cost per cu.m.		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Net Revenue	−19,854	3,158	3,277	3,398	3,520	3,643	3,768	3,894	−13,079	4,149	4,278	4,409	4,541	4,675	4,810	4,946

Net Present Value	1,294
Financial Internal Rate of Return	11.01%

Sensitivity Analysis

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Net Revenue																
Cost (+10%)	−21,840	2,277	2,397	2,517	2,639	2,763	2,887	3,013	−15,670	3,268	3,398	3,529	3,661	3,794	3,929	4,065
Revenues (−10%)	−19,854	1,961	2,069	2,178	2,287	2,398	2,510	2,624	−14,362	2,853	2,970	3,088	3,207	3,327	3,448	3,571
Cost (+10%), Revenues (−10%)	−25,810	1,081	1,188	1,297	1,407	1,518	1,630	1,743	−16,953	1,973	2,089	2,207	2,326	2,446	2,567	2,690
Cost (+20%)	−23,825	1,396	1,516	1,637	1,759	1,882	2,007	2,132	−18,261	2,388	2,517	2,648	2,780	2,914	3,048	3,185
Revenues (−20%)	−19,854	765	860	957	1,055	1,153	1,253	1,354	−15,645	1,558	1,661	1,766	1,872	1,979	2,086	2,195
Cost (+20%), Revenues (−20%)	−23,825	−997	−901	−804	−707	−608	−508	−408	−20,826	−203	−100	5	111	217	325	434
Cost (+30%)	−25,810	516	635	756	878	1,001	1,126	1,252	−20,851	1,507	1,636	1,767	1,899	2,033	2,168	2,304
Revenues (−30%)	−19,854	−432	−348	−263	−178	−92	−4	84	−16,928	262	353	445	537	630	725	820
Cost (+30%), Revenues (−30%)	−25,810	−3,074	−2,990	−2,905	−2,820	−2,734	−2,646	−2,558	−24,699	−2,380	−2,289	−2,197	−2,105	−2,011	−1,917	−1,822
Net Present Value (NPV)																
Cost (+10%)	−7,422															
Revenues (−10%)	−7,551															
Cost (+10%), Revenues (−10%)	−19,884															
Cost (+20%)	−16,138															
Revenues (−20%)	−16,397															
Cost (+20%), Revenues (−20%)	−33,829															
Cost (+30%)	−24,854															
Revenues (−30%)	−25,242															
Cost (+30%), Revenues (−30%)	−51,391															
Financial Internal Rate of Return (FIRR)																
Cost (+10%)	3.06%															
Revenues (−10%)	2.19%															
Cost (+10%), Revenues (−10%)	−7.70%															
Cost (+20%)	−4.78%															
Revenues (−20%)	−8.85%															
Cost (+20%), Revenues (−20%)	#NUM!															
Cost (+30%)	−13.14%															
Revenues (−30%)	#NUM!															
Cost (+30%), Revenues (−30%)	#NUM!															

10.8 ESC Application Documents

Annex E: Environmental Sanitation Clearance Application Form

Application No. _____

Date:

To: Mayor _____

Attention: City/Municipal Health Officer: _____

Dear Sir/Madam:

I would like to apply for an Environmental Sanitation Clearance. Please see the attached documents to support my application.

Business Name: _____
Owner/Manager:_____
Address:_____
_____
Description of Business:_____
_____

I hereby certify that the statements made in this application and the attachments are given/submitted under pain of PERJURY/FALSIFICATION OF OFFICIAL DOCUMENTS against the applicant if warranted.

IN WITNESS WHEREOF, I have hereunto set my hand this _____day of _____ in _____.

_____
Applicant

SUBSCRIBED AND SWORN to before me, in _____, this ____ day of _____, Applicant exhibiting to me his/her Community Tax Certificate No. _____issued at _____on _____.

WITNESS MY HAND AND SEAL the same date and place above stated.

_____
Notary Public

Complete the checklist on the following pages and submit this form with the required attachments.

Notice to Applicants: The checklist below is a list of the attachments required to apply for an Environmental Sanitation Clearance. Please complete the checklist for either stationary or mobile service provider and attach the required documents to your application.

Checklist for Stationary Service Provider

__ Basic project information
__ Site information (including neighboring parcels with land ownership information and information on wells and drinking water intakes)
__ Project rationale/objective
__ Project type and area covered
__ Operational processes
__ Plans and specifications (including site plan for septage treatment facilities including all treatment and disposal components)
__ Description of existing environment
  __ Topography
  __ Hydrology (including information on surface waters like streams, lakes, coastal water resources)
  __ Geological condition
__ Brief discussion on environmental and health impacts
__ Brief discussion on mitigating/control measures
__ Occupational and health safety measures
__ Monitoring and evaluation plan
__ Design report and detailed plans and specifications for domestic septage, sludge treatment and disposal facilities signed and sealed by licensed civil or sanitary engineer
__ Target market of septage pumping activities including planned volume per month
__ Staffing plan indicating number of employees, job descriptions, and organizational chart
__ Business plan indicating anticipated costs of providing services and expected revenues from grants, loans, and tariffs

Checklist for Mobile Service Provider

__ Proponent information and contact details
__ Scope of activities
__ Area covered
__ Method of collection
__ Type of vehicles and equipment
__ Occupational and health safety measures
__ Staffing plan
__ Mitigating/Control measures
__ Maps that provide the following details:
  __ Service area indicating residential, commercial, industrial and agricultural lands with major routes for septage hauling indicated
  __ Location of proposed septage treatment and disposal sites
__ Target market of septage pumping activities including planned volume per month
__ Make and model of septage pumping trucks
__ Staffing plan indicating number of employees, job descriptions, and organizational chart
__ Business plan indicating anticipated costs of providing services and expected revenues from grants, loans, and tariffs.

10.9 EDP Application Documents

GENERAL CHECKLIST OF REQUIREMENTS

For Environmental Projects (Air and Water Pollution Control, Cleaner Production, Clean Alternative Fuel, etc.)		
1.	Letter of Intent	
2.	Company Information / Profile	
3.	Feasibility Study or Project Brief or Project Description, including flowchart of production process / facilities	
4.	Detailed breakdown of estimated costs and components of the project	
5.	Amount of loan requested and project timetable	
6.	Description of proposed pollution prevention / control facilities / equipment with their respective specifications and costs	
7.	Projected environmental and socio-economic benefits of the project	
8.	Presentation of environmental self-monitoring system, personal protection equipment and their costs	
9.	Layout drawings of the project and its components	
10.	EIA Report (Environmental Impact Statement, or Initial Environmental Examination Report, or Initial Environmental Examination Checklist)	
11.	Environmental Compliance Certificate / Certificate of Non-Coverage	
12.	Accreditation Certificate of Pollution Control Officer from DENR	
13.	Permit to Operate Pollution Control Devices from DENR	
14.	Hazardous Waste Registration	

SPECIFIC CHECKLIST OF REQUIREMENTS PER PROJECT TYPE

Septage/Sewage/Wastewater Treatment Project (including installation/rehabilitation of pipeline, lift stations and other relative equipment/facilities)		
1.	Design Capacity (existing and projected) a. No. of service connections - classified as residential, commercial or industrial b. Volume of water consumed (in m^3/day) c. Volume of wastewater generated (in m^3/day) d. Length of pipeline to be installed/replaced (in meters) e. No. of lift stations, manholes	
2.	Description of Proposed Treatment Process/Technology - pre-, main and post-treatment including sludge handling a. List of equipment and machineries (including capacity) b. Pollution prevention/control facilities (i.e. odor)	
3.	Site Description a. Land and floor areas b. Geography and Topography c. Zoning classification d. Distance to/classification of nearest body of water/discharge point (i.e. creek, river) e. Availability of water supply (i.e. water district, municipal water system)	
4.	Laboratory Results (plant/discharge point, when available) - existing (without the project), expected (with the project) a. Water quality/wastewater parameters (in mg/L) - BOD, COD, TSS, Oil & grease, pH	
5.	LGU Ordinance/Memorandum of Agreement	
6.	Proposed Tipping Fee (if the operator/owner will allow private desludgers to use the facility)	

Acquisition of Desludging Trucks		
1.	No. and capacity of desludging trucks	
2.	Quotation or Pro-forma Invoice from Supplier	
3.	Certificate of Conformity from Manufacturer or Supplier	
4.	Proposed Route (no. of trips/day, no. of kilometers/trip)	
5.	Fuel and Maintenance Costs	
6.	LTO Registration, Insurance, when available	