

# **ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN**

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Methane Recovery and Power Generation Project

Ref. No. 5979-0030

CPA-37 Methane Recovery and Combustion with Renewable Energy Generation from Anaerobic Animal Manure Management Systems under the Land Bank of the Philippines' Carbon Finance Support Facility

**June 2019**

## LIST OF ACRONYMS

BOD	Biological Oxygen Demand
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFSF	Carbon Finance Support Facility
CMR	Compliance Monitoring Report
CPA	Component Project Activity
DENR	Department of Environment and Natural Resources
DNA	Designated National Authority
DP	Discharge Permit
ECC	Environmental Compliance Certificate
EMB	Environmental Management Bureau
EPMD	Environmental Program and Management Department
ESMP	Environmental and Social Management Plan
ESSF	Environmental and Social Safeguards Framework
INEC	Ilocos Norte Electric Cooperative
LBP	Land Bank of the Philippines
MOA	Memorandum of Agreement
MRF	Methane Recovery Facility
MSDS	Materials Safety Data Sheet
PCO	Pollution Control Officer
P.D.	Presidential Decree
PoA	Program of Activity
PPE	Personal Protective Equipment
PTO	Permit to Operate
R.A.	Republic Act
SMR	Self-Monitoring Report
SPA	Subproject Agreement
TSD	Treatment, Storage, Disposal
TSS	Total Suspended Solids
WWTF	Water Treatment Facility

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B	Evacuation Plan
C	Health and Safety Risk Management Plan

## **PURPOSE OF THE DOCUMENT**

This Environmental and Social Management Plan (ESMP) is prepared as part of the requirements of the Safeguards Framework for Clean Development Mechanism (CDM) projects implemented under the Carbon Finance Support Facility (CFSF) of the Land Bank of the Philippines (LBP). The Environmental and Social Safeguards Framework (ESSF) was developed to ensure the establishment of protection, compliance, and mitigation measures for relevant environmental and social aspects of projects under the CDM program which covers the Methane Recovery and Power Generation Project of CPA 37 (Pig Farm).

### **Scope**

Since the Methane Recovery and Power Generation Project is a key component of CPA 37's wastewater treatment facility (WWTF) – which handles the primary waste (manure) the pig farm produces – this ESMP will cover the operations of the entire pig farm described herein, highlighting the management of impacts attributable to or associated with the Project.

## 1 PROJECT SUMMARY

The Methane Recovery and Power Generation Project of CPA 37 is an initiative developed under LANDBANK's CFSF. Its goal is to capture greenhouse gases, particularly methane from piggery wastewaters that would otherwise dissipate into the atmosphere, and convert them into electrical energy.

### 1.1 Proponent Profile

Proponent: CPA 37  
Business Address: Tupi, South Cotabato, Philippines  
Project Site: Tupi, South Cotabato, Philippines

Project Type: Livestock Project  
Philippine Standard  
Industrial Classification: 0145 - Hog Farming

#### Contact Persons

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## 1.2 The Pig Farm

CPA 37 operates under Environmental Compliance Certificate (ECC) No. ECC-R12-1608-0011. It is licensed to house a total of 20,000 heads. The Farm occupies an area measuring roughly 151,607 m<sup>2</sup>.

Water for pig production and general farm activities are mainly sourced from two to four deep wells within and without the property. It is largely powered through a grid by South Cotabato II Electric Cooperative, Inc. (SOCOTECO II), but will soon also utilize electricity from biogas generated through the Project. Figure 1 shows the site layout of the Farm.



Figure 1. Site layout of CPA 37

### 1.3 Project Description

The Project covers the installation operation of an anaerobic digester system and its ancillary facilities, including post-treatment wastewater lagoons and a biogas-fueled electricity generation system. The biodigester and the power generation unit are collectively referred to herein as methane recovery facility (MRF).

#### 1.3.1 Components and Design

CPA 37's wastewater treatment process features three treatment phases:

- *Pre-Treatment*, which involves mechanical removal of indigestible materials and large digestible particles in wastewaters prior to entering the reactors;
- *Anaerobic digestion*, or the disintegration of biodegradable materials in the wastewaters through biological processes facilitated by microbes which thrive in the conditions promoted by the reactor; and
- *Post-Treatment* of biogas, effluent, and sludge, the by-products of anaerobic digestion.

The WWTF mainly consists of a sand trap, a covered earthen lagoon (biodigester), and two earthen clarifying lagoons (see Fig 2). The MRF basically consists of a biogas-fueled generator set.



Figure 2. Wastewater treatment facility of CPA 37

Wet digestion is likely employed. Anaerobic process is likely mesophilic, occurring at around 30-40 °C. At this temperature range, the ideal retention time is 30-40 days.

The anaerobic digester was intended to accommodate wastes generated by the maximum number of pigs the farm could house (20,000 heads) and capture enough biogas to run the Project's facilities with a net energy requirement of zero. Once the construction of the WWTF is completed, an assessment of the system's performance will be undertaken to determine operational parameters and outputs. Results will be presented in the



succeeding version of this ESMP. The design and layout of the WWTFs are in the construction plans in Appendix A.

### 1.3.2 Operation

Wastewaters are collected in underfloor pits that are emptied via pull-plug systems. They flow through concrete channels above or underground through a sand trap prior to entering the biodigester. Stirring inside the fermentation chamber is passive, facilitated by the current produced by the inflow and outflow of feedstock.

Partially treated wastewaters exit the biodigester through pipes that lead to a series of two open lagoons for clarification and storage (indefinitely).

Captured biogas in the biodigesters is refined in a gas conditioning system and then propelled into an engine that uses it to generate electricity used to power the farm.

Sludge is removed from the anaerobic lagoon through gravity release pipes and is piled onto a concrete bed for drying. Dried sludge will be used as soil amendment.

Figure 1 illustrates the current processes involved and the Project components employed in the wastewater treatment and power generation process in CPA 37.

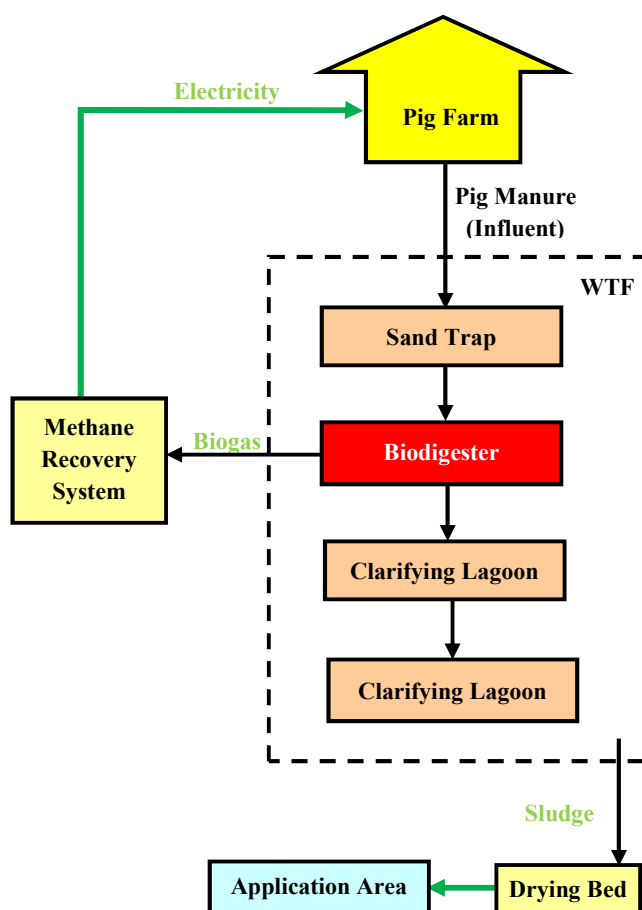


Figure 3. Wastewater treatment and power generation process in CPA 37

## 1.4 **Project Site (Existing Environmental Conditions)**

CPA 37 is located in Tupi, South Cotabato. South Cotabato is in the southern portion of the island of Mindanao in the Philippines.

### 1.4.1 **Land Classification and Use**

The site of CPA 37 is classified as agroindustrial. Wide pineapple plantations surround the property.

### 1.4.2 **Climate**

Köppen-Geiger system classifies the climate in Tupi as Tropical rainforest (Af).<sup>1</sup> There is no pronounced dry season in the area and it receives rain all year round. Tupi has an average annual temperature of 25.4 °C and an average annual rainfall of 1584 mm.<sup>1</sup> Tupi has a cool microclimate owing to its altitude.

### 1.4.3 **Topography and Soil**

The Farm is situated on a rolling terrain. Ground elevation inside the property ranges from about 75 m to 110 m asl. Slopes reach up to 20°.

Soil in the farm is sandy / sandy loam characterized by moderate drainage and slow to moderate permeability.<sup>2</sup> Erosion of the top soil is common during rainy seasons.

### 1.4.4 **Water Resources**

The landscape of the property features a number of gulleys and natural ditches through which rainwater and sediments flow down into the surrounding lower grounds.

A creek about 1.5 km southwest downslope of the Farm seems to be the closest recipient of runoff that may come from the Farm.

The Farm's main source of water are the deep wells within and without its premises.

### 1.4.5 **Natural Hazards**

Tupi has low susceptibility to typhoons and earthquakes. However, the gulleys and dains within the property makes its at risk to intermittent flooding, especially during rainy seasons.

### 1.4.6 **People and Communities**

There are a few sporadically situated houses within the 500-m radius of the Farm. There is however a small community of around 20 households situated just beside one of the property's perimeter wall. Immediate community subsists through farming and employment in food production industries in the area.

## **2 ENVIRONMENTAL MANAGEMENT**

### **2.1 Impacts**

#### **2.1.1 Positive Impacts**

##### *Environment*

The primary treatment of pig wastes of CPA 37 is accomplished mainly through the Project's facilities. Anaerobic digestion helps ensure that the Farm's effluents meet regulatory quality standards. Foul odors emanating from stored effluents are significantly abated, improving working conditions for workers and the general environment for the Farm's neighboring communities and livestock.

By providing a mechanism to capture methane and using it as a renewable source of energy, the Project is helping lower the Farm's overall carbon footprint – through preventing release of greenhouse gases into the atmosphere and decreasing its consumption of conventional fuels (for power).

##### *Economy*

Using biogas-generated electricity lessens the Farm's reliance on the grid, translating to savings for the piggery business. Sludge on site eliminates the need to purchase fertilizer for the Farm's vegetation. Selling it as soil amendment presents an opportunity to generate additional income. Further savings may also be gained from reusing treated effluent.

Moreover, having been being registered as a component project activity (CPA) in the CDM Program, CPA 37 has an opportunity to earn monetary incentives by selling carbon credits to World Bank. It may also opt to trade its carbon credits in the wider carbon market after the Program.

Lastly, CPA 37 provides employment opportunities to residents of Tupi and even to people from the other regions in Mindanao. It also generates significant revenue for the local government.

#### **2.1.2 Negative Impacts**

Certain aspects of the Pig Farm's and the Project's operations inevitably result in potential harm to the environment, including generation wastewaters; hazardous and non-hazardous wastes; air pollutants; foul odors, noise, dust and other nuisance; and depletion of natural resources, especially freshwater / groundwater. These pose inherent risks of variable degrees to environmental quality and natural ecosystems and health and safety of workers, communities, and livestock.

##### *A. Wastewater Generation*

Wastewaters saturated with dissolved manure and feed materials are primarily generated from raising pigs through intensive farming methods.

##### *B. Solid Wastes Generation*

Pig manure, sludge from wastewater treatment, and carcasses make up the bulk of solid wastes generated in the Farm.

C. *Hazardous Wastes Generation*

Generation of potentially hazardous wastes mainly result from veterinary activities and use of various chemicals for cleaning and for maintenance of machineries. Biological materials from diseased pigs also pose significant risks to the health of workers and livestock.

D. *Generation of Air Pollutants*

Emissions from diesel- and biogas- fueled generator sets which supplement the grid for the Farm's power requirements are the main sources of air pollutants in the Farm.

E. *Risks to Environmental Quality*

- ▮ Pollution. The inadvertent release to the environment (through breaches and leaks) of the wastes listed above, especially of nutrient-rich materials, may cause serious damage to the quality of affected soil and aquatic resources.

The project site features natural and constructed slopes and drains that make it vulnerable to flashfloods and significant erosion caused by heavy rains and runoffs. These may result in siltation of watercourses in the surrounding lower ground. Long periods of heavy rainfall could overtop open wastewater lagoons and wash off improperly contained sludge piles. Strong winds may also damage WWTF and MRF causing release of pollutants.

- ▮ Global warming. Large amount of biogas, mostly composed of potent greenhouse gases, are produced during the anaerobic decomposition pig manure and other organic compounds. If allowed to escape to the atmosphere, these gases will contribute to the furthering of the deteriorating effects of global warming. Use of power from the grid consumes non-renewable fuels which generate greenhouse gases when processed for electricity production.
- ▮ Resource depletion. Intensive farming demands for significant volume of freshwater. Neglectful sourcing and use of water in the Farm could deplete water resources.

F. *Health and Safety (Methane Recovery Facility)*

Biogas is a mixture of gases produced during anaerobic digestion. It is mainly composed of methane and carbon dioxide, but other gases (nitrogen, hydrogen, hydrogen sulphide, ammonia, etc.) may also be present at lower concentrations.

- ▮ Fire and Explosion. The MRF presents a major fire and explosion hazard in the farm owing to the high concentrations of biogas (primarily consists of methane which is highly flammable and combustible) that it is designed to capture and process. Risk of explosion is elevated in areas where biogas is compressed for storage.
- ▮ Asphyxiation and Poisoning. Methane and carbon dioxide are asphyxiants, substances that cause suffocation by displacing oxygen in the ambient air. Furthermore, carbon dioxide and hydrogen sulfide are considered poisonous when inhaled at high concentrations. In the farm, risks of asphyxiation and gas poisoning are high in the areas associated with the MRF and in confined spaces and poorly ventilated areas where fugitive biogas may collect.

- ↪ Infection and Infestation. Handling and processing of manure, wastewaters, and sludge expose workers to various pathogens and parasites.

#### G. *Health and Safety (General Operations)*

Various elements and situations in the Farm could compromise the health and safety of workers and livestock. The comfort and convenience of surrounding communities may also be affected by impacts not contained by the Farm's boundaries.

- ↪ Odor, Noise, Dust. Foul odors are typically emitted from manure drains and storage and unclean pig houses. Loud noises may be produced by pigs (especially during feeding) and farm machines. Dust is generated from handling feeds and other dusty materials and by movement of vehicles on unsealed roads.
- ↪ Pests and vermin. Pests and vermin are attracted to foul odors and sources of food in the Farm (improperly disposed biodegradable wastes and inadequately contained food and feed materials).
- ↪ Diseases and Injuries. Livestock, pathological materials, and excretions likely harbor harmful organisms. Various injuries could result from accidents, particularly when handling pigs, operating machineries, and using toxic substances.

## 2.2 **Due Diligence**

CPA 37 hereby commits to undertake due diligence in its dealings and operations through compliance with relevant regulatory safeguards and implementation of the environmental management and monitoring plan in Table 3 and of other relevant provisions herein.

### 2.2.1 **Legal Framework**

CPA 37 operates in the context of laws prescribing the regulatory safeguards in Tables 1 and 2.

**Table 1.** Environmental documents and statutory requirements regulating the operation of CPA 37

DOCUMENT	PARTICULARS / STATUS	
Environmental Compliance Certificate (ECC)	Reference No.	ECC-R10-1608-0011
	Issuing Agency	EMB Region 12
	Date of Issuance	September 9, 2016
	Valid Until	- no expiration -
	Conditions	<ul style="list-style-type: none"> <li>• area of operation: 151,517 m<sup>2</sup></li> <li>• maximum population: 20,000 heads</li> <li>• creation of MMT and EMF</li> </ul>
Discharge Permit (DP)	Reference No.	AVAILABLE AND UP TO DATE
	Issuing Agency	EMB Region 12
	Date of Issuance	February 2019
	Valid Until	February 2020
	Conditions	•
Permit to Operate (PTO) Air Pollution Source Control Installations	Reference No.	AVAILABLE AND UP TO DATE
	Issuing Agency	EMB Region 12
	Date of Issuance	February 2019
	Valid Until	February 2024
	Conditions	<ul style="list-style-type: none"> <li>- For the following equipment:</li> <li>• (1 unit) biogas genset</li> <li>• (1 unit) diesel-fueled genset</li> </ul>
Water Permit	Reference No.	<For application>
	Issuing Agency	National Water Resources Board
	Date of Issuance	-
	Valid Until	- no expiration -
	Conditions	(P.D. 1067 Water Code)
Hazardous Waste Generator ID	Registration No.	M-GR-R12-63-00775
	Approving Agency	EMB Region 12
	Date of Approval	March 18, 2019
	Valid Until	- no expiration -
	Conditions	<ul style="list-style-type: none"> <li>• used industrial oil, sludge (I101)</li> <li>• pathological or infectious wastes (M501)</li> <li>• pharmaceuticals and drugs (M503)</li> <li>• special wastes (M507)</li> </ul>
PCO (Pollution Control Officer) Accreditation Certificate	Accreditation No.	2018-R12-0166
	Issuing Agency	EMB Region 12
	Date of Issuance	September 10, 2018
	Valid Until	September 10, 2021

EMB      Environmental Management Bureau  
 EMF      Environmental Monitoring Fund  
 MMT      Multipartite monitoring team  
 P.D.      Presidential Decree  
 SMR      Self-Monitoring Report

**Table 2.** Permits ensuring the safety of CPA 37's facilities and operation

DOCUMENT	PARTICULARS	
Business Permit	Permit No.	AVAILABLE AND UP TO DATE
	Issuing Agency	Office of the Mayor - Municipality of Tupi
	Date of Issuance	January 2019
	Valid Until	December 31, 2019
	Prerequisites	compliance with the requirements of the following: <ul style="list-style-type: none"> <li>• Building Permit</li> <li>• Occupancy Permit</li> <li>• Zoning Clearance</li> <li>• Sanitary / Health Certificate</li> <li>• Fire Safety Inspection Certificate</li> </ul>
Zoning Clearance	Registration No.	AVAILABLE AND UP TO DATE
	Approving Agency	--
	Date of Approval	--
Fire Clearance	Reference No.	AVAILABLE AND UP TO DATE
	Issuing Agency	Bureau of Fire Protection Regional Office 12
	Date of Issuance	January 2019
	Valid Until	December 31, 2019
	Prerequisites	• compliance with R.A. 9514 (Revised Fire Code)
Sanitary Permit	Permit No.	AVAILABLE AND UP TO DATE
	Issuing Agency	Municipal Health Office – Municipality of Tupi
	Date of Issuance	January 2019
	Valid Until	December 31, 2019
	Prerequisites	• compliance with P.D. 522 ('Sanitation Requirements'), P.D. 856 (Code on Sanitation), and pertinent local ordinances

ENRO Environment and Natural Resources Office  
P.D. Presidential Decree  
R.A. Republic Act

### 2.2.2 Environmental Management and Monitoring Plan

Table 3 presents the measures CPA 37 is implementing and intends to implement to address the environmental risks and impacts identified in Section 2.1.2. Adequate training will be given to concerned employees to ensure that the content of this environmental management plan will be properly carried out.

Table 3. Environmental Management and Monitoring Plan of CPA 37

IMPACT	SOURCE / ACTIVITY	MEASURES	STATUS			MONITORING METHOD	FREQUENCY	PARAMETER / INDICATOR	RESPONSIBLE ENTITY	REPORTING TO	Cost^, Php
			Existing / Current Practice	To be Implemented / Under Construction	Adoption Under Review						
A. Wastewater											
a.1 generation of wastewater	pig raising	water conservation strategies	✓			quantify wastewater production	monthly	volume of wastewater produced	PCO	Operations Manager > reported in SMR	(Project cost)
		treatment of wastewater in WWTF	✓								
a.2 generation of domestic wastewater	general farm activities	water conservation strategies	✓			check siphoning and hauling records	every 5 years	volume of sewage hauled	PCO	Operations Manager > reported in SMR	-
		lined sewage septic tanks		✓							
		sewage disposal to treatment plant		✓							
B. Solid Waste											
b.1 generation of manure, sludge	pig raising, feed wastage, WTF	minimize feed wastage - automated feeding system	✓			quantify (dried) sludge produced	annually	amount of sludge produced	Maintenance	PCO > reported in SMR	(Project cost)
		treatment of manure in WWTF	✓								
b.2 generation of (non-infectious) carcasses, blood	injuries, adverse environmental conditions, etc.	observe sound pig raising practices and biosecurity measures	✓			weigh disposed materials	daily	weight of materials disposed	Maintenance	PCO > reported in SMR	-
		regular inspection and preventive maintenance of equipment regulating pig environment	✓								
		carcass, pathological materials disposal through burial	✓								
b.3 generation of general solid wastes	general farm activities	waste segregation	✓			weigh solid wastes disposed of (recyclables and residuals)	every hauling	weight / details on wastes generated, stored, and disposed of	Maintenance	PCO > reported in SMR	(cost of hauling and dumping)
		adequate collection bins, proper storage	✓								
		reuse, recycling / selling of recyclables	✓								
		residuals hauled to the sanitary landfill	✓								
		composting	✓								
C. Hazardous Materials											
c.1 generation of hazardous, toxic wastes	facilities' operation and maintenance	monitors resource usage to avoid expiration of chemicals	✓			quantify each type of hazardous waste produced / stored and disposed of (check hazardous waste manifests)	every hauling and disposal	quantity of each hazardous waste type stored and disposed	Maintenance	PCO > reported in SMR	(cost of disposal through TSD)
		disposal through accredited TSD		✓							
		reusing, recycling (for various construction and maintenance activities)	✓								
c.2 generation of infectious, pathological wastes, carcasses	veterinary activities, infections, outbreaks	disposal through burial	✓								
D. Air Pollution											
d.1 generation of air pollutants	vehicles, stand-by generator sets (fossil fuel combustion)	operates equipent according to manufacturer's instruction	✓			review inspection and maintenance record	quarterly	number and details of machinery issues noted	PCO	Operations Manager	(cost of maintenance, including salaries)
		regular inspection and preventive maintenance of equipment	✓								
E. Risk of Environmental Degradation											
e.1 surface water and groundwater quality degradation, disruption of soil properties, contamination	e.1.1 wastewater collection, transport, treatment, disposal	WWTF constructed with durable materials	✓			effluent sampling and testing by an EMB-accredited laboratory	quarterly - more frequently during rainy seasons	effluent quality indicators: BOD, TSS, ammonia, phosphate (must meet standards for Class C effluent)	PCO	Operations Manager > reported in SMR	(cost of maintenance, including salaries)
		operates WWTF as prescribed	✓								
		regular inspection and preventive maintenance of WWTF	✓								
		adequate rainwater and wastewater separation		✓							
		adequate groundwater and wastewater separation	✓								
		establish vegetation (filter strips) around lagoons		✓							
		has and implements contingency response plan	✓								
	e.1.2 sludge management, storage, leachate	regular inspection and preventive maintenance of drying bed	✓			review inspection and maintenance record	monthly - more frequent during rainy seasons	number and details of leak / breach incidents	Maintenance	PCO	-
		adequate separation of storage from surface/groundwater		✓							
		establish vegetation (filter strips) around drying bed and storage		✓							
		has and implements contingency response plan	✓								
	e.1.3 pathological wastes, carcass disposal, leachate	disposal through burial	✓			review inspection and maintenance record	monthly - more frequent during rainy season	number and details of leak / breach incidents	Maintenance	PCO	-
		create diversion banks, drains around disposal site		✓							
		establish vegetation (filter strips) around disposal site		✓							
		has and implements contingency response plan	✓								
	e.1.4 handling, transport, storage, disposal of hazardous and infectious materials	use materials according to registered use / manufacturer's instruction	✓			review inspection and maintenance record	weekly	number and details of leak / breach incidents	PCO	Operations Manager	(cost of signage cost)
		MSDS available and consulted		✓							(cost for TSD disposal)
		proper and secured storage	✓								
		spill kits available		✓							
		appropriate signage, warnings in place	✓								



		regular inspection of storage, disposal facilities	✓														
		has and implements contingency response plan	✓														
		adequate training on handling hazardous materials		✓													
		e.1.5 natural hazards	adequate runoff channels		✓								review inspection and maintenance record	monthly - more frequently during rainy seasons	details of inspection report	Maintenance	PCO
	slope protection measures		✓														
e.2 (release of GHGs)	e.2.1 anaerobic digestion, biogas collection and utilization, fugitive biogas	plant / maintain vegetation along / on sloping areas	✓			review inspection and maintenance record	monthly	number and details of leak / breach incidents (odor detection)	Maintenance	Operations Manager	(cost of maintenance, including salaries)						
		biogas sequestered using biodigester	✓														
		MRF constructed with durable materials	✓														
		operate MRF as prescribed		✓													
		regular inspection and preventive maintenance of MRF	✓														
		has and implements contingency response plan	✓														
	has flare		✓														
e.2.2 use of electricity from grid	energy conservation strategies	✓			review billing statement	monthly	kWh consumption	Maintenance	Operations Manager >reported in SMR	-							
	uses renewable fuel (biogas from MRF)	✓															
e.3 groundwater depletion	pig raising, general farm activities	water conservation strategies	✓			quantify volume of freshwater consumption	monthly	volume of freshwater consumed	PCO	Operations Manager >reported in SMR	(flow meter cost)						
		effluent recycling		✓													
		rainwater harvesting			✓												
F. Health and Safety – Anaerobic Digester System																	
f.1 explosion, fire hazard	biogas collection, storage, combustion	WWTF-MRF constructed with durable materials	✓			review inspection and maintenance records, incident reports, complaints register	monthly	number and details of explosion, fire incidents	Maintenance	Operations Manager	(signage cost)						
		operates WWTF-MRF according to design		✓							(cost of fire protection equipment)						
		regular monitoring of pressure within the MRF system	✓								(cost of maintenance, including salaries)						
		regular inspection and preventive maintenance of MRF	✓														
		restricts access to MRF		✓													
		prohibits ignition sources near MRF	✓														
		‘no smoking’ policy / designated smoking area	✓														
		appropriate signage, warnings in place	✓														
		fire protection equipment on site	✓														
adequate training on biogas safety		✓															
f.2 asphyxiation, poisoning	biogas	appropriate signage, warnings in place		✓		review incident reports	monthly	number and details of asphyxiation, poisoning incidents	Maintenance	Operations Manager	(cost of PPE)						
		adequate training on biogas safety		✓							(signage cost)						
		pull-plug system for draining and desludging WWTF	✓														
		use of appropriate PPE		✓													
f.3 infection, infestation	wastewater, sludge	appropriate signage, warnings in place		✓		review incident reports	monthly	number and details of infection, infestation incidents	Maintenance	Operations Manager	(cost of PPE)						
		adequate training on handling infectious materials		✓		review results of health checks	annually				(cost of employees’ health checks)						
		uses appropriate PPE		✓													
		G. Health and Safety – General Farm Operations															
g.1 odor - nuisance, discomfort, health issues	g.1.1 pig houses, manure	regular cleaning, disinfection	✓			review complaints register	every two weeks - more frequent during typhoon (windy) season	number and details of odor complaints	PCO	Operations Manager	(cost of cleaning materials)						
		tunnel ventilated buildings	✓								(cost of seedlings)						
		plant / maintain buffer trees / vegetation	✓								(cost of PPE)						
		uses appropriate PPE		✓								(cost of maintenance)					
	g.1.2 WTF, effluent, MRF	employs biodigester (traps odor and biogas)	✓														
		adequate retention time of wastewaters in the biodigester		✓													
		regular inspection and preventive maintenance of WWTF-MRF	✓														
		prevent overtopping, spillage	✓														
		plant / maintain buffer trees / vegetation	✓														
		uses appropriate PPE		✓													
	g.1.3 decomposing materials (sludge and organic solids)	sludge pile is well aerated, prevent waterlogging		✓													
		uses appropriate PPE		✓													
	g.1.4 decomposing materials (placental materials and carcasses)	disposal through burial	✓														
		prevent leachate leakage		✓													
		uses of appropriate PPE		✓													
g.2 noise - nuisance, discomfort	g.2.1 pigs	automated feeding system	✓			review complaints register	monthly	number and details of noise complaint	PCO	Operations Manager	(cost of PPE)						
		uses appropriate PPE		✓							(cost of seedlings)						
		adequate spatial buffer from surrounding communities	✓									(cost of maintenance)					
		plant / maintain buffer trees / vegetation	✓														
	g.2.2 vehicles, machineries	operates equipment according to manufacturer’s instruction	✓														
		limits operation during day time	✓														
		regular inspection and preventive maintenance of machineries	✓														

		noise reduction equipment	✓								
		uses appropriate PPE		✓							
g.3 dust - nuisance, discomfort, health issues	g.2.1 pig houses, feed handling	automated feeding system	✓			review complaints register	quarterly - more frequent during typhoon (windy) season	number and details of dust complaints	Team Leaders	PCO	-
		tunnel ventilated buildings	✓								
		uses appropriate PPE		✓							
	g.2.2 composting areas, dried compost handling	limit dust-generating activities during day time, low wind movement	✓								
		uses of appropriate PPE		✓							
	g.2.3 vehicles, machineries	sealing of unpaved roads		✓							
		limits vehicular speed on unsealed roads	✓								
		limit dust-generating activities during day time	✓								
	uses of appropriate PPE		✓								
g.4 pest and vermin proliferation / infestation - nuisance, health issues	decomposing materials, sources of odors	observes good housekeeping practices	✓			review inspection results records and complaints register	monthly - more frequent during rainy season	number and details of incidents, complaints	Team Leaders	PCO	(cost of pest control)
		odor control measures	✓								
		pest, vermin control measures	✓								
g.5 health hazards, (risk of) contracting infectious diseases, sustaining injuries, livestock outbreak	handling, transport, storage of hazardous and infectious materials, movement of carrier pests and vermin, handling of ill pigs	adequate training on handling of hazardous, infectious materials		✓		review incident reports, inspection records and complaints register, results of employees' regular health checks	monthly	number and details of illness, injury incidents, complaints	PCO	Operations Manager	(cost of PPE)
		uses appropriate equipment (including PPE) for handling, storage of hazardous and infectious materials		✓							(cost of supplies for biosecurity)
		enforce, observe biosecurity, health and safety protocols	✓								
		pest and vermin control measures	✓								
g.6 drowning hazard	open ponds, lagoons, tanks	restricted access to WWTF		✓		review incident reports	monthly	number and details of drowning incidents	Maintenance	Operations Manager	(cost of signage)
		appropriate signage and warnings		✓							

BOD    Biological Oxygen Demand  
 MSDS    Materials Safety Data Sheet  
 PCO    Pollution Control Officer  
 PPE    Personal Protective Equipment  
 SMR    Self-Monitoring Report  
 TSD    Treatment, Storage, Disposal  
 TSS    Total Suspended Solids

^    Indicative cost

### 2.2.3 Contingency Response

The following is an overview of the Farm's current preparation and plan of action in response to certain emergency incidents (see also Appendix B):

- a. Fire
  - Administration buildings, employees' quarters, and pig buildings are equipped with fire extinguishers.
- b. Earthquake
  - The open grounds around the farm may serve as evacuation areas for when an earthquake occurs.
- c. Outbreak
  - The Farm's veterinarian / animal specialist is immediately notified to assess the situation and give instructions for the workers to carry out.
- d. Power outage
  - Standby diesel and biogas-fueled generators are able to supply the farm's electricity needs.
- e. Health emergencies
  - First aid kits and medicines are available on site for minor health issues. Farm personnel have access to vehicles that can be used for transporting cases that may be needing more advanced medical care

Emergency services can be accessed in the town proper of Tupi after about a 5 to 10-min drive.

The Farms communication line is accessible to all workers. In the event that any of the listed emergencies occur, farm personnel are to report to the team leader of each production area or to their immediate supervisors. These, in turn, will alerting the proper authorities and emergency services near the property.

### 2.2.4 Occupational Health and Safety

CPA 37's risk management plan for general occupational health and safety issues associated with work in the Farm is presented in Appendix C. Health complaints and accidents will be recorded in a register and will serve as indicators of the plans effectiveness, together with results of workers' annual health check-ups.

## 2.3 Monitoring, Reporting and Auditing

The Proponent will perform the monitoring plan in Table 3 and conduct regular inspection of its facilities not only for internal purposes but also to satisfy the requirements of the Environmental Management Bureau (EMB) for periodic self-monitoring reports (SMR) and compliance monitoring reports (CMR). Furthermore, assessments will also be initiated during or immediately after incidents that may have compromised the integrity of the Farm's facilities, especially of the MRF and WTF, and caused release of pollutants in the

environment. A registry of such incidents and other environmental emergencies and accidents will be maintained in the Farm and its details reported in the SMR.

SMRs and CMRs will contain the results of audits on the Farm's environmental performance in terms of resource utilization, waste management, regulatory compliance, and fulfillment of environmental commitments among others. Copies of these documents will be tendered to EMB quarterly and semi-annually, respectively, as well as to LBP-EPMD (Environmental Program and Management Department) for its reference and review.

The Pollution Control Officer (PCO) has been tasked to ensure that the Farm is compliant with pertinent environmental regulations, including those listed in Table 1 and is performing its environmental commitments, including the implementation of this ESMP.

During the implementation of the CDM Program, LBP-EPMD will conduct monitoring activities in the farm at least twice a year to help the Proponent execute, identify gaps in, and improve and update this management plan.

### 3 SOCIAL DUE DILIGENCE

#### 3.1 Consultation and Participation

Stakeholders of the project have been identified and invited by the proponent, together with LBP-EPMD, through letters and notices to the consultative meeting held on March 20, 2016 (2 PM) in Tupi. The meeting was attended by at least 44 individuals from various institutions, including local officials, and residents of communities near the project site.

All relevant information, especially those that pertain to the Project's environmental and social impacts, was communicated to the stakeholders. The issues and queries they raised were all satisfactorily addressed by the proponent and other presenters.

#### 3.2 Grievance Redress Mechanism

CPA 37's PCO is hereby designated as the main contact person for grievances, feedbacks, and queries related to the project. He is to ensure that the details of complaints and the actions made to address the same will be recorded completely and truthfully in a register. Such information shall be part of the regular monitoring report for the project and will be made available to relevant stakeholders.

The Proponent will make reasonable effort to settle any concern at the project level. Should its attempts be unsuccessful, issues will be raised to the following third party institutions for arbitration and possible resolution:

- Office of the Barangay Chairman  
Complaints shall be entertained in the *barangay* where the farms are situated. The *barangay* office concerned will facilitate the negotiation process and LBP-EPMD will ensure that the complainant is properly represented.
- Municipal Office  
Should no agreement be reached at the *barangay* level, the matter will be elevated to a municipal government office. Depending on the nature of the complaint, grievances may be addressed to the Municipal Health Office, Agriculturist Office, Environment and Natural Resources Office, or other relevant municipal agencies.
- LBP  
LBP through EPMD will take part on the resolution process only after the aggravated party has gone through the previous levels and finds the decisions rendered there unacceptable. EPMD will coordinate with the proponent to ensure that issues regarding the latter's project are resolved to the best interest of the complainant.

To further ensure the proponent's accountability, contact details of the Farm's management and LPB-EPMD shall be provided to stakeholders during consultations and through postings at public notice boards and at CPA 37's feedmill facility's main gate. For this Project, the following will serve as grievance administrators:

- Prudencio E. Calado III  
Head/Assistant Vice President, LBP-EPMD  
Telephone No.: (632) 405-7339  
Fax No.: (632) 528-8484

### 3.3 **Information Disclosure**

This ESMP and other relevant information regarding the project will be published in LANDBANKS's website where it can be readily accessed by the public. Printed copies of this document will be submitted to EMB Region 12 in LANDBANK's library (1598 M.H. Del Pilar cor Dr. J. Quintos St., Malate, Manila, Philippines), and in the World Bank InfoShop.

### 3.4 **Equal Opportunity**

CPA 37 is an equal opportunity employer, not regarding gender, age, disability, and ethnicity in evaluating and hiring potential employees. Presently, its workforce is composed of about 16 individuals. Various farm tasks, including animal handling, are performed by males and females alike.

### 3.5 **Resettlement**

The Project is located inside the premises of CPA 37, a private property. No individual was displaced for nor were there any indigenous peoples affected by the establishment of the Farm and the Project.

### 3.6 **Others**

Employees of CPA 37 receive standard basic salaries at the minimum, 13th month pay, and other regular statutory benefits, in addition to free food and lodging at the Farm for stay-in workers.

#### **4 ESMP REVIEW AND UPDATING**

This ESMP shall be reviewed annually and will be updated subject to the results of the semiannual monitoring activities conducted by CPA 37 and LBP-EPMD. Reviews may be done more frequently or earlier than schedule, especially after events resulting in significant adverse effect to the environment.

## **5 INSTITUTIONAL ARRANGEMENTS**

### **5.1 The Proponent**

CPA 37 will be responsible in all the aspects of the project, including the implementation of this ESMP. It will shoulder all costs associated with the construction and operation of the project, internal monitoring activities, and meeting various statutory requirements. Specifically, it shall / it shall cause the accomplishment of the following:

- exercise environmental and social due diligence in implementing the project
- incorporate sound practices in environmental, health, and safety management
- comply with relevant national and local laws and satisfy regulatory obligations
- perform diligent environmental and system monitoring
- prepare and submit on schedule accurate monitoring reports to EMB and LBP
- cooperate with the LBP and other regulatory agencies by providing assistance and correct and relevant information regarding the project and its environmental performance for reference, review, and monitoring purposes
- promote transparency by maintaining open lines of communication with project stakeholders and giving them access to relevant information
- initiate resolution of conflicts that may arise as a result of the project's operation

The Proponent, in close coordination with LBP, shall implement the Project in accordance with LBP's ESSF and to the agreed activities and timelines stipulated in the memorandum of agreement (MOA) and subproject agreement (SPA) between the said entities.

### **5.2 LANDBANK**

LBP shall serve as the financial and technical intermediary for the CDM Program of Activity (PoA) under which the project of CPA 37 is being implemented. It shall provide the proponent carbon and investment finance assistance for the installation of an anaerobic wastewater treatment facility equipped with a biodigester and methane-fueled power generator. Moreover, it shall act as the entity in charge of project validation and verification activities, and of collation of relevant information and monitoring data for the undertakings mentioned. Specifically, LANDBANK, through EPMD, shall:

- make available financing facilities to the proponent, subject to existing lending policies of LBP
- coordinate and facilitate communications and transactions between the proponent and World Bank or other carbon buyers, designated operational entity, and when necessary, with other project partners
- administer the agreements (MOA, SPA) forged between LBP and the proponent
- provide technical support and relevant trainings to farm owners and personnel in partnership with other institutions
- ensure compliance of the project and its proponent with the rules governing PoAs and with its commitments in the MOA and SPA
- ensure compliance of the project and its proponent with relevant standards and regulations and environmental commitments by conducting onsite monitoring and evaluation and desk reviews
- provide assistance to the Proponent in complying with statutory requirements for the project



- ensure the Project's sustainability by monitoring the long-term implementation of the safeguards specified in this ESMP and its environmental performance in general
- gather, collate, and review pertinent information and documents (including safeguard instruments, reports, and permits and clearances) concerning the Project
- participate in conflict resolution initiated by the Proponent
- prepare and submit monitoring reports to World Bank regularly
- satisfy its obligations under the Emissions Reduction Purchase Agreement between LBP and World Bank

LBP shall assist the proponent in its implementation of the project in accordance with LBP's Safeguards Framework and the agreed activities and timelines stipulated in the MOA and SPA.

### 5.3 **Department of Environment and Natural Resources**

DENR is the primary government institution mandated to manage and protect the Philippines' environment and natural resources. It is also the Designated National Authority (DNA) of the CDM Program in the Philippines. As DNA, its main role is to review and endorse PoAs to the United Nations Framework Convention on Climate Change.

#### 5.3.1 **Environmental Management Bureau**

Through the EMB, DENR sanctions and regulates the activities of the project by means of various legal instruments. EMB also leads (whether or not as part of a multi-partite monitoring team) the periodic monitoring of the project's compliance and impacts, including the fulfillment of the commitments stated in this ESMP. Prior to construction, EMB was the agency tasked to review and evaluate the environmental soundness of the project and authorize its establishment through the issuance of an Environmental Compliance Certificate.

### 5.4 **Municipal Government**

The municipal government of Tupi licenses the operation of CPA 37 through the issuance of a business permit. This permit is only given to businesses able to satisfy its prerequisites – building and occupancy permits, zoning clearance, sanitary permit, and fire clearance among others.

Agencies and offices of the municipal government of Tupi will also, if necessary, lead / facilitate the resolution of complaints arising from the Farm and the Project's operations.

### 5.5 **World Bank**

The World Bank is the main carbon buyer of the project, but will also serve as an advisor to LBP in carrying out the latter's responsibilities as the coordinating and managing entity for CDM projects. The Bank will conduct regular monitoring, audits, and appraisals on the Project's safeguards performance against its established policies, as well as provide technical guidance to LBP and to the proponent.

## **6 SUB-PROJECT ACCOUNTABILITY**

In line with Section 3.02 on *Sub-Project Development and Operation by the Sub-Project Entity*, Item (q) of the Sub-Project Purchase Agreement (SPA) signed by the Farm Management, the Sub-Project Entity (Farm Management) agrees and undertakes to:

- (q) implement and operate the Sub-Project in compliance with the World bank Operational Policies, including without limitation and as applicable, the Environmental Management Plan, Resettlement Plan, Indigenous Peoples Plan, and any other requirement resulting from the application of the World Bank Operational Policies.

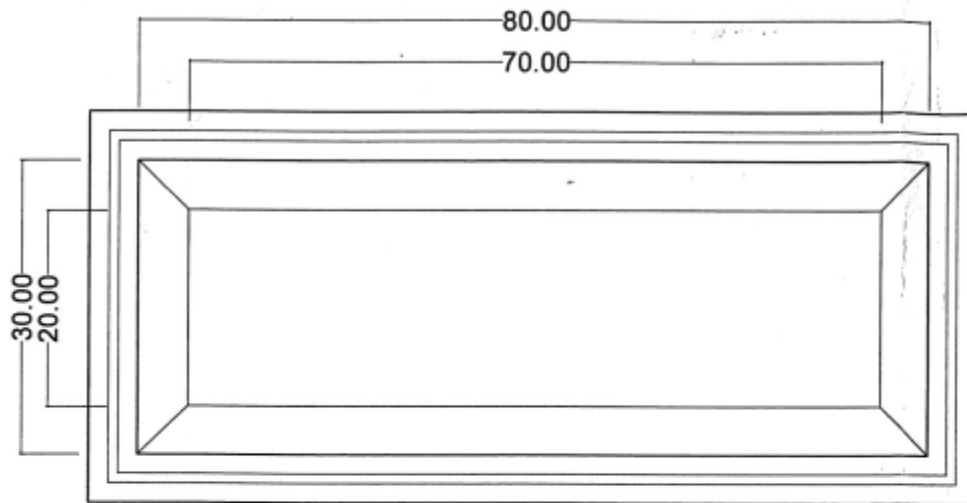
Having signed the SPA, the Farm Management is accountable to comply with the commitments stated in this document.

## **REFERENCES**

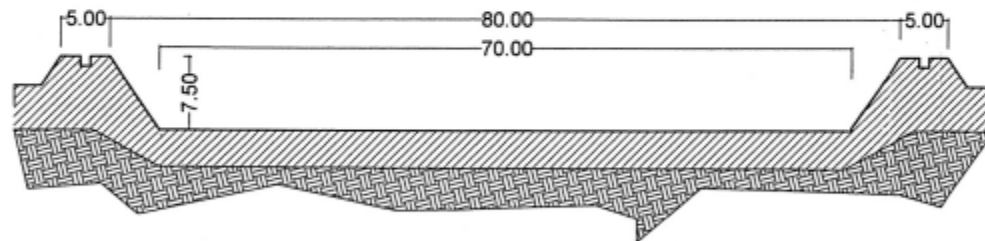
- 1 [en.climate-data.org](http://en.climate-data.org)
- 2 [bmp.philrice.gov.ph](http://bmp.philrice.gov.ph)

## **APPENDICES**

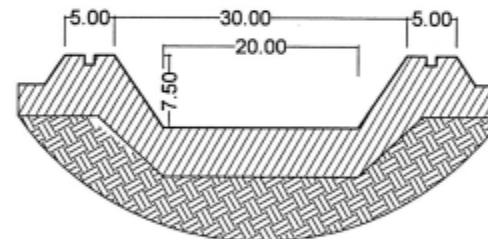
- A Project Design, Plan and Specifications
- B Evacuation Plan
- C Health and Safety Risk Management Plan



1 PLAN  
A 02 SCALE: NTS



2 LONGITUDINAL SECTION  
A 02 SCALE: NTS



3 CROSS SECTION  
A 02 SCALE: NTS



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DATE ISSUED :

DATE REVISION :

DATE ISSUED :

DATE REVISION :

PROJECT LOCATION

TUPU, SOUTH COTABATO

REVISION

SHEET CONTENTS

DIGESTER LAGOON

DATE

SHEET NO.

DAR-1

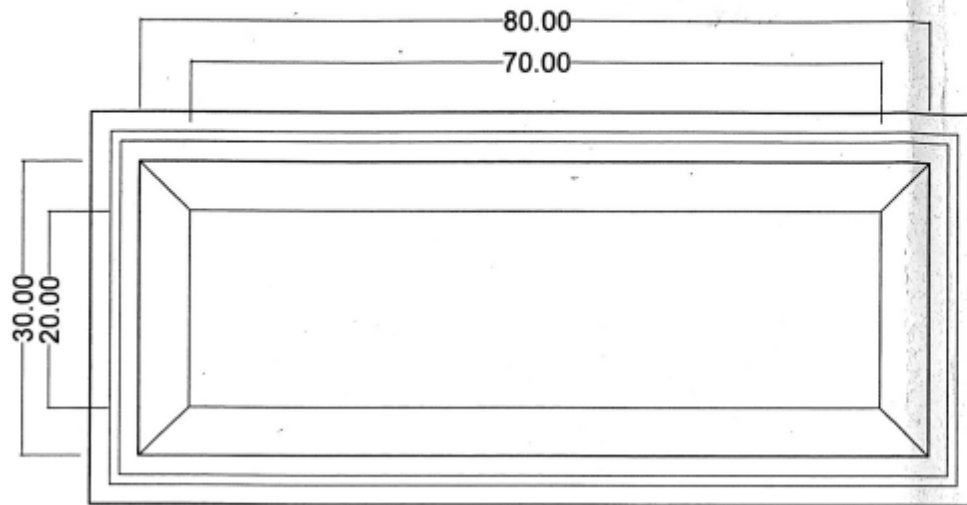
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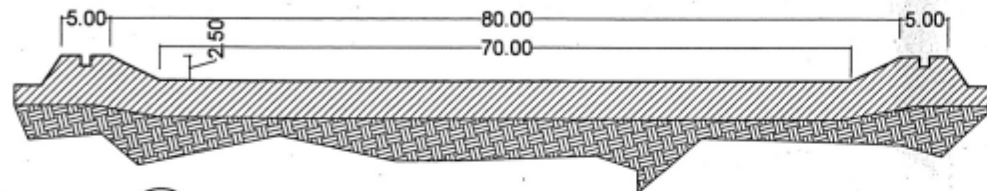
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PROJECT APPROVAL

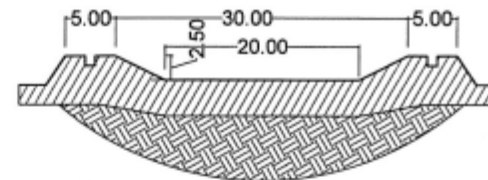
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1 PLAN  
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2 LONGITUDINAL SECTION  
SCALE: NTS



3 CROSS SECTION  
SCALE: NTS



Qrics CORPORATION  
Rampasay Avenue, Tuguegarao City, Cagayan, Philippines 5010

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DATE ISSUED

DATE ISSUED: 1/1/2011  
DATE ISSUED: 1/1/2011  
DATE ISSUED: 1/1/2011

PROJECT LOCATION

TUGUEGARAO, SOUTH COTABATO

REVISION

DATE ISSUED

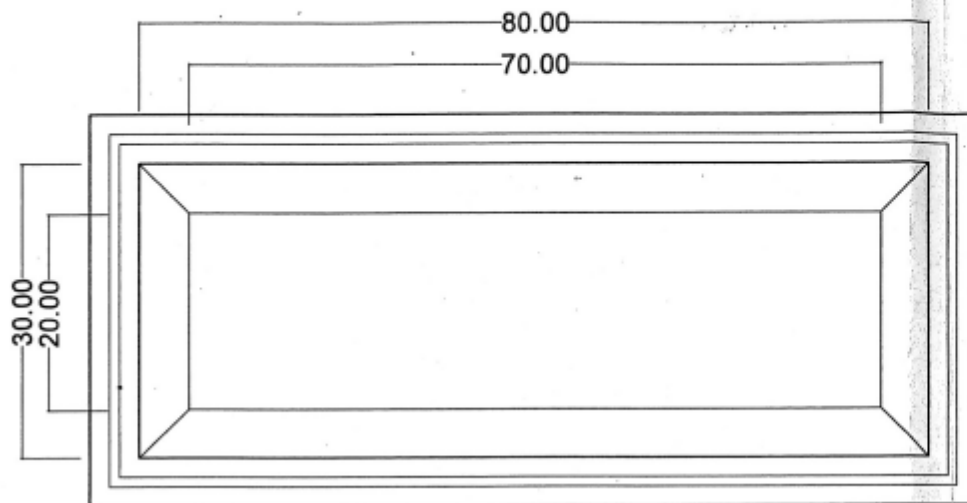
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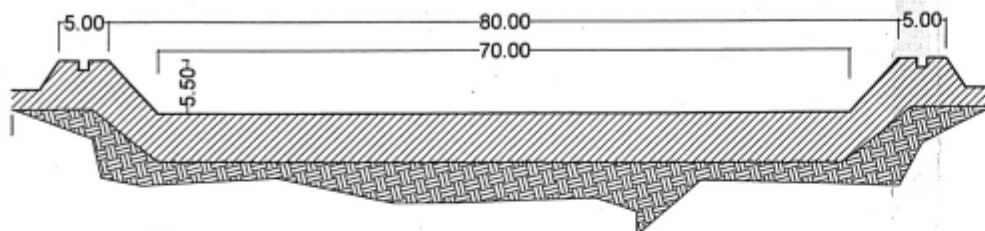
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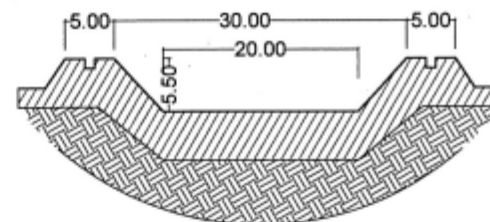
PROJECT NO.



1 PLAN  
A 02 SCALE: NTS



2 LONGITUDINAL SECTION  
A 02 SCALE: NTS



3 CROSS SECTION  
A 02 SCALE: NTS



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ONE DRAWING

FIG. NO. 1  
DATE DRAWN: 1  
PLATE NO. 1

PROJECT/LOCATION  
TUPI, SOUTH COTABATO

REVISION

SHEET CONTENTS

CLARIFYING LAGOON

OWNER

SHEET NO.  
DAR-3

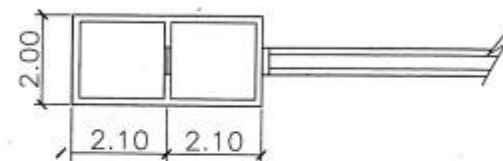
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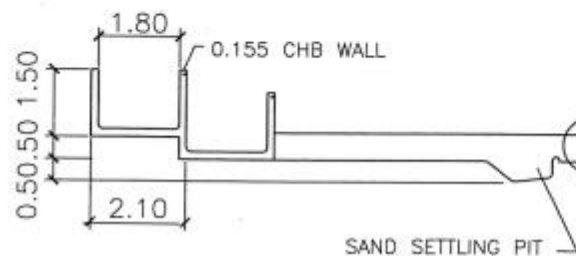
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ENGINEER APPROVAL

PROJECT NO.



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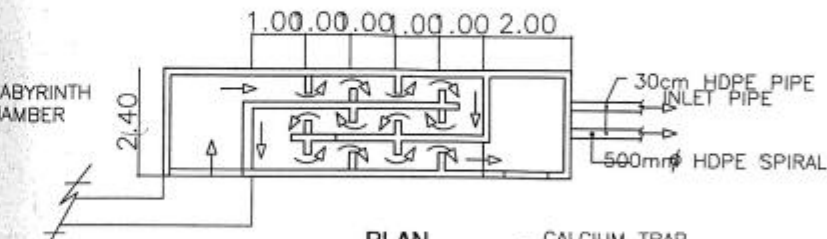


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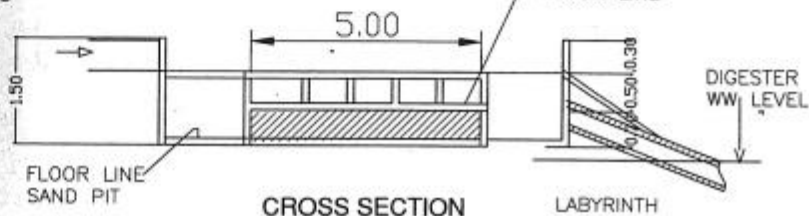


CANAL CROSS SECTION

# DOUBLE MANURE PIT WITH LABYRINTH TYPE CALCIUM TRAP



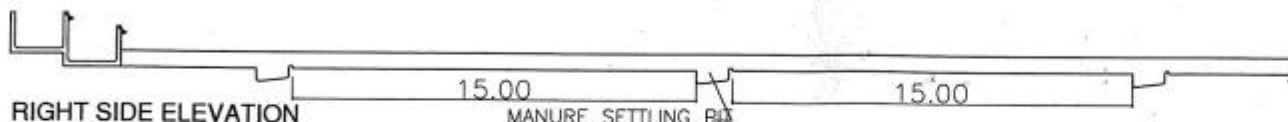
PLAN



CROSS SECTION



PLAN - MIXING TANK & CONNECTING CANAL



RIGHT SIDE ELEVATION



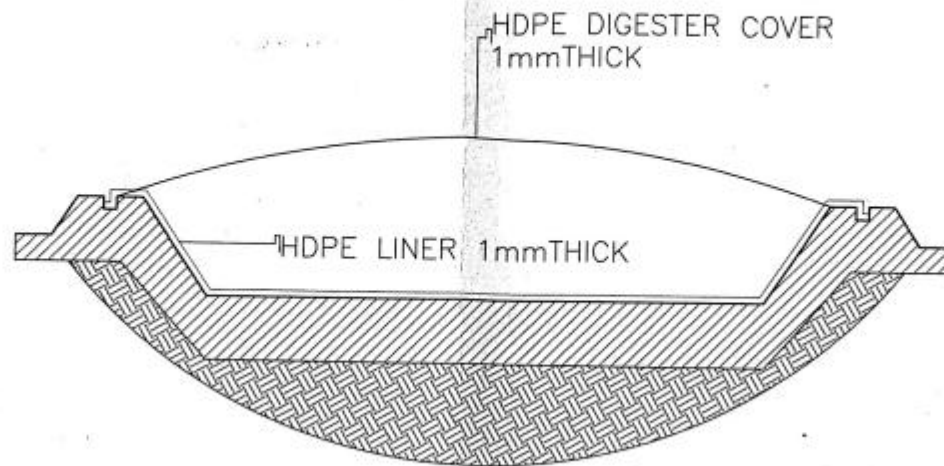
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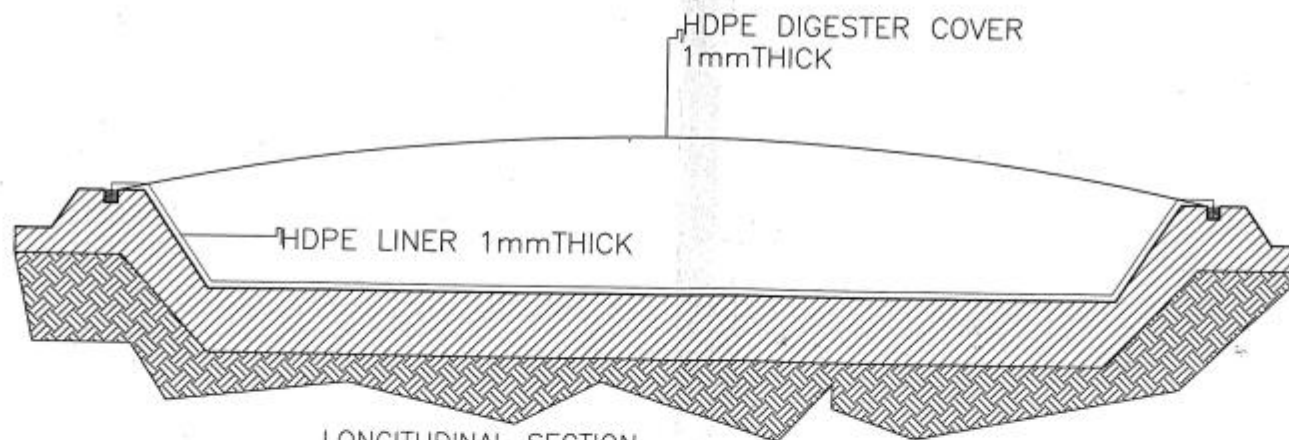
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TUPU, SOUTH COTABATO

CLIENT:  
DIGESTER LAGOON  
DETAILS

DESIGNER:  
DAR-4



CROSS SECTION



LONGITUDINAL SECTION



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DATE ISSUED

DATE ISSUED

PROJECT LOCATION

TUPI, SOUTH COTABATO

REVISION

DATE ISSUED

DIGESTER LAGOON  
DETAILS

DATE

DATE

DAR-5

DATE ISSUED

CHECKED BY

DATE

OWNER APPROVAL

PROJECT NO.



## APPENDIX B

### Site Evacuation Plan



#### **CPA 37 Point Persons:**

Operations Manage: <name> <contact details>

PCO: <name> <contact details>

Biodigester / Genset Maintenance Team: <name> <contact details>

#### **Local Emergency Contact Details:**

**911** Provincial Incident Response Management (PIRM)

BUREAU OF FIRE PROTECTION - TUPI **822 0122**

TUPI POLICE **226 2802**

POLOMOLOK MUNICIPAL HOSPITAL: **225 6014**

SOCOTECO **822-0097**

APPENDIX C

Health and Safety Risks Management Plan of CPA 37

Hazard	Possible Harm	Source / Cause	Prevention / Minimization*	Person/s Responsible
physical				
noise	discomfort, hearing damage	pig squeals	- wear appropriate PPE (ear protection)	Farm Personnel
		running machineries and vehicles	- install noise-control devices when applicable - regular equipment inspection and maintenance - equipment housed in enclosed structure, if applicable - schedule shifting duties - install signage and warnings - wear appropriate PPE (ear protection)	Team Leader Farm Personnel
vibration	discomfort, ergonomic and nerve injuries, fatigue	running machineries	- ensure all loose equipment are securely placed - perform regular equipment inspection and maintenance - install signage and warnings	Team Leader Farm Personnel
electricity	shock, electrocution, burns	faulty machineries and power lines	- get services of a licensed electrician - consult equipment manual - perform regular equipment inspection and maintenance	Maintenance Farm Personnel
		improper use (or servicing) of electrical equipment	- restrict access to equipment - install signage and warnings - train staff (consult equipment manual) - wear appropriate PPE	
heat	burns	running machineries (hot surfaces, vapors, liquids)	- use insulation where possible - install machine guards - install signage and warnings - wear appropriate PPE (such as long sleeved shirts)	Maintenance Farm Personnel
	discomfort, heat exhaustion, heat stroke	working in enclosed spaces with limited ventilation	- adequate hydration and rest breaks	Lead Man
dust	irritation, respiratory distress / diseases	feeds, ambient dust	- calm work pacing to avoid exciting the pigs - thorough cleaning of indoor spaces - PPEs (mask)	Farm Personnel
poor lighting	eye strain, can't see hazards	unlit / inadequately lit areas	- install light sources - carry portable light sources - work during daytime whenever possible	Team Leader Farm Personnel
chemical				
harmful gases, dust, vapors (inhalation)	discomfort (odor), asphyxiation, poisoning, respiratory distress / diseases	degrading organic wastes	- observe measures for odor control - install signage and warning labels - train staff (on handling hazardous substances and wastes and working in confined spaces; review MSDS / product information sheets) - wear appropriate PPE (mask) - ensure first aid kits are readily available	PCO Team Leader Farm Personnel
		hazardous substances (cleaning and pest control chemicals, veterinary medicines, fuels, hazardous wastes, etc.)		
		fuel burning (machineries, vehicles)	- perform regular equipment inspection and maintenance	Maintenance
		fugitive gases	- perform regular inspection and maintenance of biogas system	Maintenance
hazardous substances (contact, ingestion)	irritation, burns, poisoning, skin problems	hazardous substances (cleaning and pest control chemicals, veterinary medicines, fuels, hazardous wastes, etc.)	- use proper labeling, containers, and storage - restrict access to chemical and hazardous waste storage - train staff (handling hazardous substances and wastes; review MSDS / product information sheets) - only competent staff should administer veterinary medicines - ensure first aid kits are readily available - PPEs (gloves, eye glasses)	PCO Team Leader
biological				
pathogens / infectious agents, toxins and other products	various infectious diseases, parasites, irritation	pathological materials / tissues	- observe proper disposal of animal and veterinary wastes - implement quarantine measures - good housekeeping practices (disinfection) - practice hygienic practices (especially hand hygiene) - perform workers' regular health examination - train staff (on animal handling, proper waste handling and disposal) - wear appropriate PPE (gloves, mask, goggles)	PCO Veterinarians Team Leader
		sick animals		
		animal excretions and fluids		
		manure (wastewaters)		
		sludge		
		veterinary wastes (especially sharps)		
		potential disease carriers (objects, people, dust)		
		insects, pests, vermin	- proper disposal of odorous wastes - good housekeeping practices - implement pest control measures	Farm Personnel
ergonomic				
ergonomic stress	ergonomic injuries	repetitive actions, forceful exertions, sustained awkward posture	- use aid of appropriate equipment for lifting/moving heavy objects - use of proper lifting techniques - implement buddy system at work - ensure job rotation / adequate rest (in between tasks)	Team Leader Farm Personnel
		improper use of equipment	- train staff (consult manuals)	Team Leader Farm Personnel
		use of faulty equipment	- repair or replace equipment	Team Leader
other accidents and contingencies				
slips, trips, falls	injuries, wounds, contusions	spills (slips)	- maintenance of walkways - daily safety briefings and regular trainings - barricading of work areas - wearing of appropriate PPE	Maintenance Farm Personnel
		various objects, debris (trips)		
		heights, slips (falls)		
entanglement	injuries, wounds, strangulation	machineries	- install machine guards - tie back long hair - wear long sleeve shirts	Farm Personnel

			<ul style="list-style-type: none"> <li>- avoid wearing loose-fitting clothes and personal accessories</li> <li>- regular equipment inspection and maintenance</li> </ul>	
blows, punctures	injuries, wounds, contusions	pig handling	<ul style="list-style-type: none"> <li>- use animal restraints</li> <li>- ensure enough space to maneuver</li> <li>- train staff (animal handling techniques)</li> <li>- wear appropriate PPE (boots, gloves, etc.)</li> </ul>	Team Leader Farm Personnel
sharps	sharps injuries, wounds	veterinary activities, waste handling	<ul style="list-style-type: none"> <li>- ensure only trained personnel conduct veterinary activities</li> <li>- wear appropriate PPE (gloves, goggles)</li> </ul>	Team Leader Farm Personnel
fires	burns	faulty electrical systems, explosions, fugitive gases, accidental ignition	<ul style="list-style-type: none"> <li>- comply with requirements and regulations of fire authorities</li> <li>- provide adequate and proper (multipurpose) fire protection equipment</li> <li>- designate smoking areas away from digester, gas tanks, and electrical equipment and storage of combustible materials (compost, sludge, chemicals)</li> <li>- regular clearing of vegetation near farm structures</li> <li>- install signage and warnings</li> <li>- train staff (on contingency plan and proper equipment use)</li> <li>- perform regular inspection and maintenance of electrical systems and equipment</li> </ul>	Maintenance
blast	blast injuries	excessive pressure in biodigester, fugitive gases, contained gases in confined spaces, fires	<ul style="list-style-type: none"> <li>- keep sources of heat, including machineries, at a safe distance from biogas facility</li> <li>- prohibit smoking and use of cellphones around biogas system and gas storage facilities</li> <li>- perform regular inspection and maintenance of MRF</li> <li>- install signage and warnings</li> </ul>	Maintenance

\* Shaded rows / items applicable for Anaerobic Digestion System