

**ANNEX V: Environment and Social Management Plan
of Ananda Agriculture Farms Pvt. Ltd.**

This Environmental and Social Management Plan (ESMP) has been developed for proposed large biogas construction and operation sub-project at Ananda Agriculture Farms Pvt, Ltd., Amduwa-5, Sunsari in order to mitigate the likely environmental impacts predicted during Environmental Screening. The screening process indicated that the sub-project intervention will not require any land acquisition as well as displacement of inhabitants. Similarly, as the project itself reduces wastes and use of waste in order to produce energy, the significant negative impacts are not envisaged. However, the screening process indicated negligible impacts during construction and operation phase. The overall impact caused by the sub-project intervention was classified as “Category C” with minimal environmental impact and hence there is no need of conduction of further environmental or social assessment. Nevertheless, in order to reduce or mitigate thus identified adverse impacts, “Environmental and Social Management Plan (ESMP)” was recommended to prepare prior to project implementation.

Some of the impacts caused by the sub-project are: health and safety issues of construction workers, possible ground water contamination due to leakage from substrate and slurry storage, workers health during slurry handling, foul smell and increased noise level due to operation of generator. The possible mitigation measures have been proposed in this ESMP and shall be implemented by the contractor/Construction Company and developer. In addition, the monitoring as mentioned in this ESMP shall also be performed accordingly. The likely impacts not identified during screening as well as in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.

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1. Introduction

The farm will establish in Amduwa VDC-5, Sunsari. The total land area is 33862 sq. m. (5 Bigha) and there are currently 17 water buffalo (12 big and 5 small) with 7 cows (5 big and 2 small). From available 606 kg per day of dung, the detail feasibility recommends construction of 50m³ biogas plant. The proposed design technology is floating drum model biogas plant. Thus generated biogas is proposed to be used in the form of electricity and cooking gas. The project is under evaluation for AEPC/SREP support.

2. Description of Project and Location

The project is located at Amduwa VDC-5, Sunsari. The coordinate of the sub-project site is 26°26'08.84"N, 87°12'29.47"E with altitude of 66 m.

The figure provided below illustrates the sub-project location as well as environmental setting near the sub-project site.



Figure 1: Google Earth Map

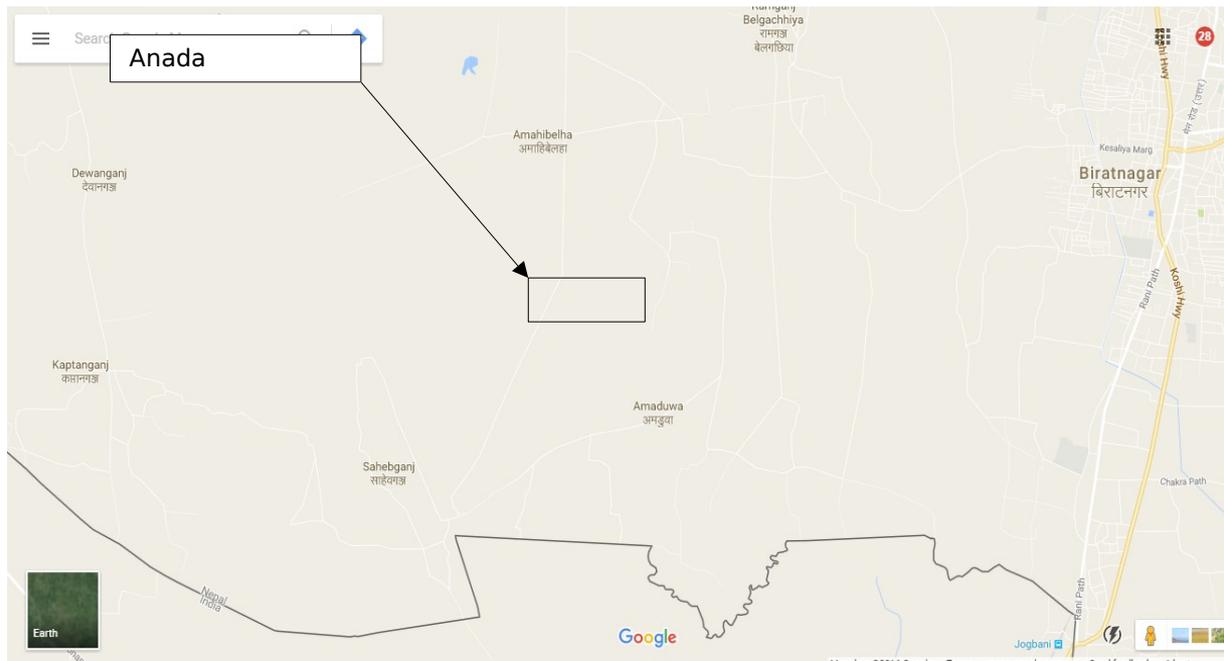
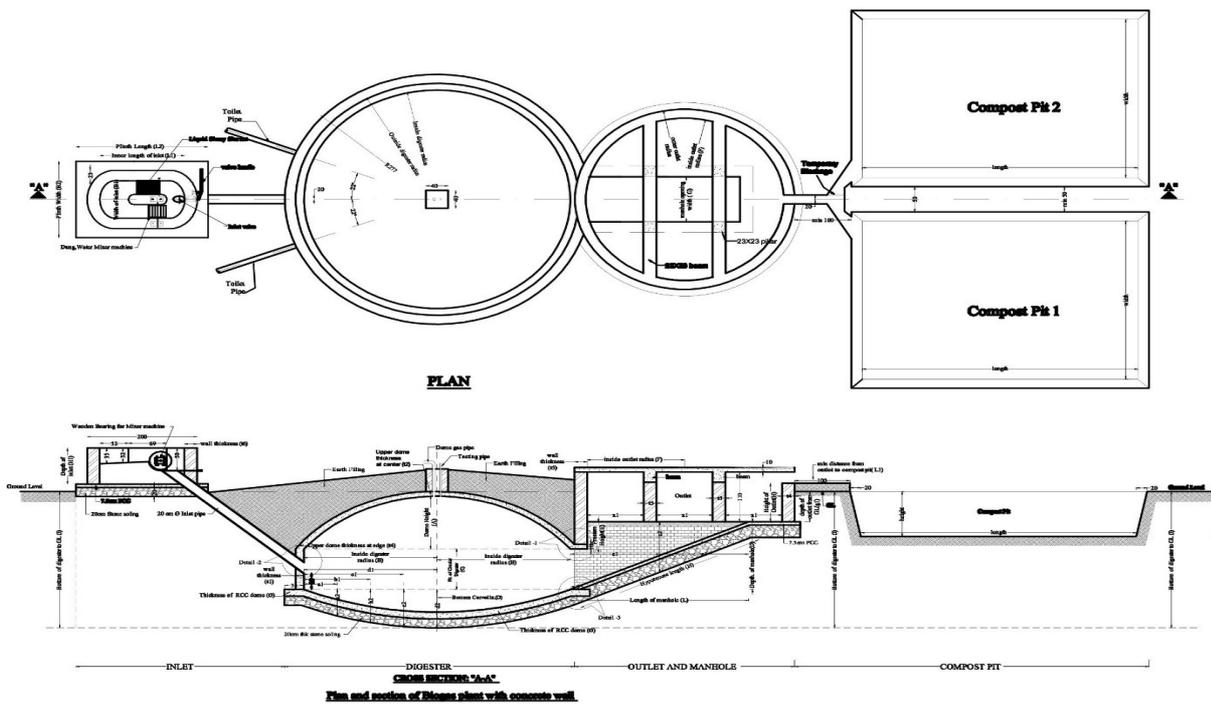


Figure 2: sub-project Location Map

The proposed plant is 50m³ single unit modified GGC 2047 model digester (33.3 m³ digester volume and 16.7m³ gas storage volume) with 10.9 m³/ day of biogas production per day. The generated biogas will be used only for electricity generation. 5 kVA biogas generators will generate maximum of 18 kwhr of electrical output each day.

The major works that will be carried out during construction are excavation of earthwork for digester, cement aggregate works and civil construction work. A generator will be installed in order to generate electricity from biogas. Once after the construction completion, 273 kg of dung along with 333 litres of dilution water (606 kg of feedstock) will be fed into the digester daily. A total of 606 litres liquid slurry will be generated each day.

50 m³ Modified GGC 2047 biogas plants Civil Drawing is given below.



3. Relevancy of preparing ESMP

This Environmental and Social Management Plan (ESMP) has been done for the proposed sub-project in order to mitigate the likely environmental impacts predicted during environmental and social screening. Any land acquisition or displacement of inhabitations will not be involved in this sub-project. The significant negative impacts are not predicted since the sub-project itself reduces wastes and converts into useful renewable energy. However, negligible impacts identified and might prevail during construction and operation phase. This sub-project is classified as “**Category C**”, with minimum environmental/social impacts and hence there is no need of conduction of further environmental or social assessment. This Environmental and Social Management Plan has been prepared in order to reduce thus identified adverse impacts prior to project implementation.

4. Environmental and Social Baseline

The project location is situated in the Terai region of Nepal. The topography is flat land with altitude of about 66 m above sea level. Regarding climatic condition, as it is situated in Terai region, sub-tropical climate with hotter summer and mild winter with occasional cold wave (during winter) prevails in the sub-project area. The land use pattern of proposed sub-project vicinity is agricultural land with sparse settlement. While, most of the total land area owned by the developer is used for fodder plantation.

The farm is spread over 33862 sq. m. (5 Bigha) of land with potential for land expansion. The farm has allocated around 237m² of land which is sufficient for construction of biogas plant including compost pit. The ground conditions are favorable to build a biogas plant. A flat land has been prepared adjacent to the farm to construct biogas plant. Farm has potential for large biogas plant. The nearest settlement from the plant site is more than 500 meter away. Hence, there will not be any significant negative affect to neighboring settlement. Since the farm is accessible from the major market points, sourcing of the construction materials will not be a

major issue unless any external occurrences cause delay. No any remarkable water sources like rivers and streams are observed within 200m periphery of the subproject location.

The sub-project location is dominated by Tharu, Musalman, Gurung and Yadav. The settlement pattern is sparse. An all weather road exists to reach the sub-project location at distance of about 9 km from Biratnagar.

The current status of respiratory diseases of the community is not documented however, in rural areas of Nepal, the respiratory diseases are caused mainly because of burning of traditional energy sources especially firewood and cow dung cake. The major diseases that the community are commonly suffered are diarrhea, dysentery, flues and in some cases cholera too and are mostly transmitted because of unhygienic condition and through disease vectors like flies and mosquitoes.

5. Environmental and Social Impacts

The following beneficial as well as adverse impacts have been envisaged due to implementation of proposed large biogas subproject.

5.1 Beneficial Impacts

Considering the benefit to the nearby community, there seems no any direct advantage to nearby population however, management of the organic waste within the farm obviously reduce the foul odor which is the nuisance to nearby locality. During construction phase, there would be few numbers of employment opportunities. Nevertheless, the sub-project will be present itself as a show case waste to energy subproject.

5.2 GHG emission reduction as beneficial impact

Cow manure is rich in organic substances so significant quantity of methane is released to the atmosphere during manure storage with anaerobic condition inside the dump. Methane is highly potent greenhouse gas than CO₂ with global warming potential 28- 36 over 100 year's time period. The installation of biogas plant will directly reduce the emissions of methane gas from cattle manure heaps. In addition, the biogas will also replace diesel currently used in diesel generator that is being consumed in the farm thereby further contributing in greenhouse gas reduction.

5.3 Adverse Impacts

There will be no any significant adverse impact to the surrounding community and environment by the implementation of the proposed project. However, during construction and operation phase, minor impacts have been predicted and provided as below:

5.3.1 Construction Phase

- **Construction related accidents:** There are several processes which will be involved in the site during its construction. Excavation work, use of machineries and civil construction work etc. could lead accidents, but would be exceptional. It is projected that some 18 skilled and unskilled human resources will be involved in construction process for about 1 month. The impact is envisaged as site specific, low in magnitude, short term in duration limited to one month construction period and construction workers as receptor.

- **Respiratory problems due to dusty environment:** During construction phase, there will be intermittent movements for transport vehicles for transporting construction materials and can lead to generate dusts. Similarly, during excavation of digester and outlets, such impact could be visible. However the impact is envisaged to be a low in magnitude, short term duration and construction workers as receptor.
- **Increased noise due to construction activity:** The increased noise may be experienced due to vehicular movement and construction activities such as loading and unloading of construction materials and other construction activities. This will mainly affect construction workers (18 numbers of workers) and partly to resident living (2 households) close to the construction site. The impact will remain for short duration i.e. construction period only and magnitude is projected to be low.
- **Issues related to excavated material:** The size of the biogas plant proposed is 50m³. During construction phase, a total of about 280m³ of muck soil is predicted to be generated from various excavation work like excavation of digester, outlet and compost pit. The haphazard disposal and storage of excavated material may cause sedimentation in nearby agricultural field during rainy season. Apart from this, the stockpiling of excavated material may degrade the aesthetics of the subproject vicinity. However, the impact is assessed as site specific, low in magnitude, short term in duration.

5.3.2 Operation Phase

- **Health and safety issue due to haphazard disposal and mismanagement of digested slurry:** 606 kg of digester slurry will be generated each day from the plant. If the slurry is not well managed and disposed haphazardly in and around subproject site, this could establish favorable breeding environment for disease vectors.. In addition, the aesthetics of the site would also be decreased due to such unmanaged disposal. This can affect farm workers as well as local resident living in near vicinity. The impact will be area specific, with moderate magnitude and for long term duration
- **Foul odour from substrate storage area and outlet of plant:** If not properly managed, the slurry can generate foul odors which can be nuisance to farm workers (about 40 farm workers) as well as local residents (2 households) who lives nearby to subproject area. But such foul odour would be prevalent only if the slurry is not properly digested. However, the designated compost pits will be installed in order to collect all slurries passed from outlet. The magnitude is expected to be low, long term in duration and farm workers as the main receptor.
- **Ground water intrusion of slurry due to seepage and leakage from substrate storing area, digester and outlet:** The seepage of water from manure and slurry can pollute downstream water sources decreasing its quality with increasing nitrogen level and organic matter content. The case could be more prominent in case of toilet attached plants. This can affect not only workers but also people living nearby who rely on same source of water. Since the water source is upstream the magnitude can be moderate with long term impact and farm workers and local resident as the main receptor
- **Occupational health and safety issues including accidents associated with firing and explosion:** The biogas is highly flammable. The open firing or electrical shorts can cause huge fire and explosion. Also, many mechanical and electrical devices such as generators, tractors, pumps will be in use during the operation which could lead to fire or accidents. The impact is envisaged as site specific, low in magnitude, occasional but the risk is long term in duration, farm workers as receptor.

- **Increased noise level from operation of generator:** Biogas Generator will be used for electricity generation from biogas. It can generate loud noise and can be nuisance to people residing within farm and nearby residents. The impact is envisaged as site specific, low in magnitude, long term in duration, farm workers as receptor.

6. Mitigation Measures

The environmental mitigation measures with their time of action and responsibility are prescribed in the following matrix:

Regarding alternatives, the detailed design recommends modified GGC 2047 model biogas plant from wide range of technologies like floating drum type model, up-flow sludge blanket, CSTR etc.. There are different ways of management of digested slurry like composting, screw press for producing dry manure instantly, disposal of post digested without using it as manure etc. In this subproject, a composting is proposed for producing dry manure from liquid slurry in designated two compost pits. The implementation of below mentioned mitigation measures shall be strictly done during specified time.

Environment and Social Mitigation Plan

S.N.	Environmental/Social Impacts	Mitigation Measures	Time of Action	Estimated Mitigation Cost (NRs.)	Responsibility
1.0 Construction Phase					
1.1	Construction related accidents	The construction premises shall be barricaded	During construction phase	-	Construction Company
		Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	During construction phase	-	Construction Company
		Provision of First Aid Kits at construction site	During construction phase	Minor	Construction Company/ Sub-project Developer
1.2	Respiratory problem due to dusty environment/vehicular emission in construction site	Spraying of water during excavation and vehicular use to reduce dust re-suspension	During construction phase	-	Construction Company/ Sub-project Developer
1.3	Increased noise due to construction activity	Work will be conducted from 8:00 AM-6:00 PM. If additional times are needed, local residents will be informed prior to do so.	During construction phase	-	Construction Company/ Sub-project Developer
1.4	Issues related to excavated material	The excavated soil/muck shall be used for land development and filling within subproject vicinity	Prior to operation phase	-	Construction Company/ Sub-project Developer
2.0 Operation Phase					
2.1	Health and safety issue due to haphazard disposal and mismanagement of digested slurry	Storage of digested slurry in designated compost pit to prevent haphazard disposal	During operation phase	-	Sub-project Developer
		Use of personal protective equipments during slurry handling process	During operation phase	5,000	Sub-project Developer
2.2	Foul odour from substrate storage area and outlet of plant	Avoid storing substrate as far as possible	During operation phase	-	Sub-project Developer
		Appropriate amount of daily feeding shall be done for	During operation phase	-	Sub-project Developer

S.N.	Environmental/Social Impacts	Mitigation Measures	Time of Action	Estimated Mitigation Cost (NRs.)	Responsibility
		complete digestion of slurry.	Phase		
		Storage of dry manure/compost and wet slurry in closed yard/structure	During operation Phase	-	Sub-project Developer
2.3	Ground water intrusion of slurry due to seepage and leakage from substrate storing area , digester and slurry storage for producing dry manure	Proper sealing of base of storage area as well as digester and outlet/ manure storage area with sealing material or concrete casting	During Construction Phase	Already included in construction cost	Construction Company/Sub-project Developer
2.4	Spreading of diseases due to increased disease vectors, flies, mosquitoes etc	Avoid formation of ditches and haphazard slurry disposal; storage of digested slurry in designated compost pits	During Operation phase	-	Sub-project Developer
2.5	Occupational health and safety issues including accidents associated with firing and explosion	Strictly avoid naked flames near digester	During operation phase	-	Sub-project Developer
		Awareness building of workers on safety practices	During operation phase	-	Construction company
2.6	Increased noise level from operation of generator	Provision of generator shed	During operation phase	-	Construction Company

7. Monitoring

It is also necessary to monitor to ascertain implementation of mitigation measures mentioned as well as to perform impact monitoring to figure out the impacts of the project. The monitoring plan is provided in the table below.

Environmental and Social Monitoring Plan

S.N.	Indicators	Methods	Frequency/Time	Place	Monitoring Authority	Monitoring Cost (NRs.)
<i>1.1 Construction Phase</i>						
1.1.1	The construction premises shall be barricaded	Direct Observation	During construction	Sub-project Site	Sub-project Developer	-
1.1.2	Provision of personal protective equipments (PPEs) like helmets, boots, gloves, etc for construction workers	Direct Observation	During construction	Sub-project Site	Sub-project Developer	-
1.1.3	Provision of First Aid Kits at construction site	Direct Observation	Once prior to start of construction	Sub-project site	Sub-project Developer	-
1.1.4	Spraying of water to reduce dust re-suspension	Records/Photographs	During construction	Sub-project site	Sub-project Developer	-
1.1.5	Compliance of construction activities performed only in designated time (8:00 to 6:00)	Interview with locals	During construction	Sub-project site	Sub-project Developer	-
1.1.6	Management of excavated materials; used for land development	Direct Observation	During construction	Sub-project site	Sub-project Developer	-
<i>1.2 Operation Phase</i>						
1.2.1	Provision of composting pit	Direct observation/ Photographs/records	During construction	Sub-project site	Sub-project Developer	-
1.2.2	Provision of personal protective equipments (PPEs) during operation	Direct observation/ Photographs	Once prior to operation	Sub-project site	Sub-project Developer	-
1.2.3	Avoid storing substrate as far as possible	Direct observation	Bi-weekly	Sub-project site	Sub-project Developer	-
1.2.4	Proper sealing of base of storage area as well as digester and outlet manure	Record of specification of constructed plant	During construction	Sub-project site	Sub-project Developer	-

S.N.	Indicators	Methods	Frequency/Time	Place	Monitoring Authority	Monitoring Cost (NRs.)
	storage area with sealing material or concrete casting					
1.2.5	Storage of compost and wet slurry in designated area	Direct observation	Bi-weekly	Sub-project site	Sub-project Developer/Site manager	-
1.2.6	Avoid naked flames near digester	Direct observation	Daily	Sub-project site	Sub-project Developer/Site manager	-
1.2.7	Build awareness of workers on safety practices	Direct observation/ verification of training conducted by technology provider and/or construction company	Once prior to operation	Sub-project site	Sub-project Developer	-
1.2.8	Provision of generator shed	Direct observation	Once prior to operation	Sub-project site	Sub-project Developer	-

Most of the mitigation costs are covered within total construction cost and others required minor costs. The monitoring part is assigned to developer and will require one human resource which will be assigned to existing subproject staff and other costs are minor.

8. Conclusion and recommendation

The above mentioned mitigation measures shall strictly be implemented by the responsible individuals as mentioned in this ESMP. In addition, the monitoring as mentioned in this ESMP shall also be performed accordingly. The likely impacts not identified in this ESMP, if perceived during construction and/or operation phase shall also be avoided or mitigated by the Construction Company and/or developer.