

Junajil K'anjel

“Improving the Quality of Life through Corn and Pig Production”

San Miguel, Toledo, Belize

Environmental Management Plan

June 2015

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1 Project Background

Junajil K'anjel is a group of San Miguel residents; formed since 2008 with Humana support, and legally registered in January 2014. The Junajil K'anjel (Working Together) group consists of 14 members, 4 hard working men, 6 dedicated women - 3 of which are single parents, and 4 energetic youths. Our mission is to enhance the economic livelihood of community members, engage youths in meaningful activities, promote the sustainable use of our natural resources and build cooperation among members and others stakeholders. The group will be using individual family parcels to do the pig production. Each household controls land of two to five acres on which homes are located.

Each of the 6 participating households will be provided with either a 16' x 16' or a 16' x 24' pig rearing shed capable of housing one or two breeding sows respectively. Water tanks on stands will be used to store water from a variety of sources, including rain water and the village water system, to ensure adequate water for the operations. A biogas system will be installed to remove and utilize solid and liquid wastes that will later be used as organic fertilizer.

Another nearby, but not adjacent, 30 acre piece of land will be used to grow food crops such as corn, cassava, bananas, yams, etc. Tree crops will be used as natural buffers, to help control erosion, and to increase biodiversity. This will provide food for the pigs and some crops to sell as well. Composted manure from the pig operations will be used to enhance the soil quality and increase growth on this farm. Various nitrogen-fixing plants will be planted along contour lines to improve soil nutrition and stability while reducing the possibility of erosion. Organic waste from agricultural products will be composted along with the residue of the biogas digesters and used for organic fertilizer on the 30 acre plot or sold locally.

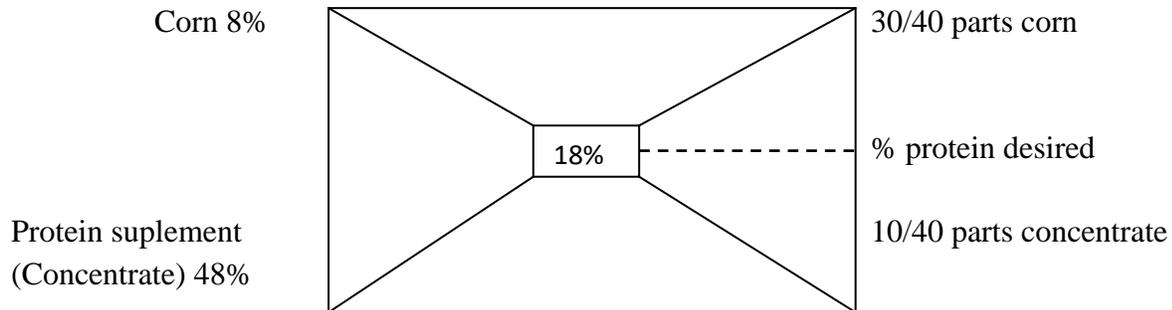
2 Expected Environmental Impacts

There are several potential negative environmental impacts associated with pork production when it is not properly managed. Most impacts stem from the management and disposal of faecal matter. This is a direct impact that is seen in the form of excess soil enrichment (and plant death) and eutrophication of affected water bodies. Additionally there is generation of unpleasant and overpowering odour; health problems in cases of poor sanitation; and land use change and loss of biodiversity. Potential indirect impacts include contribution to climate change as pork production results in the emission of greenhouse gases primarily in the form of methane and nitrous oxide, which are generated by the biological activity that breaks down manure during decomposition. This project is designed in such a way as to avoid said impacts, and instead turning the manure into valuable production resources – biogas and compost.

3 Main activities and expected environmental impacts

- 3.1 **Planting corn/ staple foods** – The 30 acres of land to be used for planting has been under cultivation for the last 10 years using the Maya system of rotational planting that interchanges seasonal crops such as corn, beans, pumpkin, and root crops such as cassava and yam. The land is left fallow for three to five years after it has been used for two seasons and allows for replenishment of nutrients. No negative impact is expected during the land preparation as members will clean the field manually with machetes and no burning will be done.
- 3.2 **Reaping corn** – Corn harvesting will be done manually so no negative impact is expected. All stalks and harvest residue will be composted and used for soil enhancement.
- 3.3 **Preparing pig feed** – A portion of the feed for the pigs will be produced from the raw materials grown by the group. Members will attend training in feed preparation that will be delivered by the Extension Services of the Ministry of Agriculture in Toledo. Any feed preparation residue will be composted so no adverse impacts are expected.
- 3.4 **Constructing pig pens** – Individual pig pens will be constructed on the premises of six households. The areas where the pens will be located are on gently sloping ground with inclines of less than 10%. This is advantageous for the cleaning and waste disposal as it will allow for easy drainage into the biodigester. Pens will be of two basic floor plans; one that is 16' x 16' and the other that is 16' x 24'. The sites to be used are adjacent to the individual homes. Group members, under the supervision of an experienced builder, will construct the pen. Youth member from the group will be involved in accordance with existing laws of Belize and any signed conventions. No negative impact is expected, taken the construction activities follow good environmental and health and safety practices.
- 3.5 **Selecting breeders** – No negative impact is expected.
- 3.6 **Installation of the individual Biodigesters** - The installation of the bio-digesters will require the excavation of a small area approximately five feet wide by ten feet long by four feet deep. The impact on the immediate environment will be minimal but is essential in ensuring the proper functioning of the digesters.
- 3.7 **Feeding pigs** – Pigs will be fed a combination of commercial feeds and locally grown supplemental feeds.
 - a. Use of feed bins so feed is not wasted.

- b. Measurement of commercial and supplementary feed amounts will be done according to a guideline developed by the Ministry and Agriculture and the group, based on size of pigs.
- c. Supplemental feeding will be done based on a Pearson's Square (example below) to ensure that there is a balanced diet.
- d. Provide legumes to make up 17-25% of daily intake



3.8 **Maintaining the pig pen and pigs** – The pens will be cleaned twice a day to avoid pigs contracting diseases and other infections. Group members will attend training in production best practices so pigs can be kept as healthy as possible. Self-watering systems will be used to ensure pigs have adequate drinking water supply. The pigs will be sprayed regularly with water to ensure that they are keep cool. Rain water will be collected in rain vats during rainy season for use during the dry season. No negative impact is expected as this is a component of the compost production plan.

3.9 **Slaughtering** – In the Maya culture approximately 90% of the slaughtered pig is utilized. It is estimated that from a 100 pound (on the hoof) pig, between 10 and 20 pounds will be offal that cannot be utilized. Any unutilized by-products from slaughtering will be buried under four feet of earth on the thirty acres of land. This is not expected to be more than approximately fifty pounds per month. No negative impact expected.

3.10 **Marketing pork meat** – A license will be obtained from the health department. After six months, the pigs will be slaughtered and marketed locally or sold to the direct market. Pork meat will be stored in refrigerators to keep fresh.

4 Mitigation Measures

4.1 Water management

Since the amount and quantity of available water varies from place to place and time to time, it is hard to generalize about water efficiency strategies. These strategies,

however, are necessary in both rearing and processing. Local farmers and processors may need to work closely with neighbors and water authorities to ensure that they are not exceeding withdrawal capacities or wasting the extracted water. Using a two pond system for waste water management, the first pond should be very shallow, allowing maximum surface area to interact with the oxygen in the air.

4.2 Waste treatment system

It is important to dispose of pig waste (composted solids, as well as liquids) well away from all waterways, whether permanent or temporary. There are no permanent waterways on or near the sites, but three sites do have temporary waterways created by runoff during the rainy season.

Attention will be given to the positive environmental impacts of sustainable pig farming, especially when pig production is part of agro-silvo-pastoral systems or organic farming systems where outdoor production is integrated with crop rotation. The residue from the biodigesters will be used as natural soil enhancement for crop production.

4.3 Biodigesters.

Primary waste treatment will be low cost biodigesters and will follow the instructions set out in the Biodigester Manual that is an annex to this document. Residue from the digesters will be used as organic fertilizer for corn, beans and vegetable production.

4.4 Best Practices – some notes

- Pigs are omnivorous and can eat meat and plants.
- Pigs are a monogastric animal, which means they have a single stomach similar to humans.
- Pigs require a diet that is balanced and includes protein, energy and minerals.
- Grains, most commonly corn, are the chief source of carbohydrates for calories and energy in pig rations.
- Grains alone are deficient in needed protein, vitamins and minerals. A 14 to 15 percent protein level is adequate for the entire growing period.
- Pigs require plenty of clean, fresh water every day. A sow with young will need
- 20 - 30 liters of water a day.
- Feed pigs from 1 - 3lbs twice each day. Feed them from a dry trough and a wet trough, as appropriate.
- Minimize soy based feeds, use local legumes, or a locally made concentrate if purchasing. Legumes should be no more than 25% of daily diet.
- Control of pests and parasites.

5 Monitoring Program

Indicator	Response	
	Yes	No
1. Pen floor has the required slope to allow for proper drainage?		
2. Drains are adequate for the removal of liquid and semisolid waste		
3. Adequate quantities of water are available for rehydration, cooling and cleaning		
4. A feeding schedule is prepared at the beginning of the week		
5. A feeding regime has been developed for all the animals in the pen		
6. A person is assigned to the daily feeding and cleaning		
7. Pens are cleaned daily		
8. Growth rates are monitored and recorded		
9. Pigs are checked regularly for symptoms of the more prevalent illnesses.		
10. Veterinary services are secured on a monthly basis		
11. Biodigester is monitored on a daily basis		
12. Biodigester is maintained according to the schedule provided in the manual		
13. Residue from the biodigester is properly composted or disposed of		
14. Pigs are slaughtered in accordance with the existing regulation and with permission from the proper authorities		
15. Offal and unutilized by-products are properly disposed of		

6 Lines of Responsibility:

The project will train members of the group in the proper handling and maintenance of pigs. The first line of response on any matter will be the members who are trained and responsible for the individual pens. The final authority is the president of the group, Ms. Norvela Chubb, or any person that is properly delegated to undertake a particular activity.

7 Cost estimates and sources of funds:

Proper care and cleanliness are central to the success of the project. Sick and infirm pigs will not grow well and cannot be sold. Hence, a clean environment with proper feeding regimes is important. It is essential that proper waste disposal is done to ensure a clean area for the pigs. Proper storage for feeds is also an important component. The cost of these have been

built into the project budget.

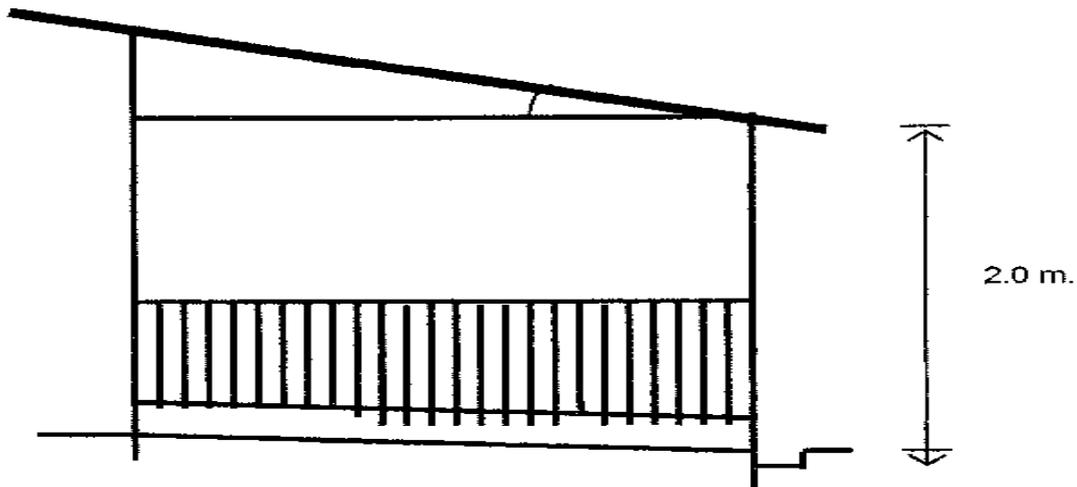
Item / Activity	Units	Total
Biodigesters (complete)	6	\$6,600.00
Pen construction (materials)	6	\$42,200.00
Pen construction (labour – in kind)	6	\$20,500.00
Cleaning and maintenance equipment	6	\$16,200.00
Total		\$85,500.00

Summary table on environmental impacts and their management

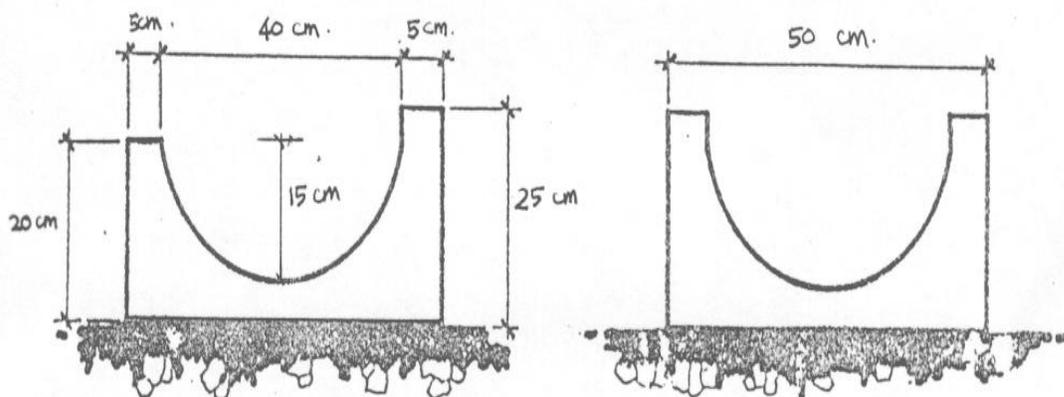
Activity	Impact	Indicator	Response/Mitigation Measure	Responsibility
Planting Corn/staples food	- Land clearing	- Already cleared (10 yrs)	- Larger branches removed and leaf litter left as mulch	All members
Harvesting agricultural products	-	-	-	All members
Processing pig feed	-Generation of bi-products	-Accumulation of half ton of agricultural bi-products	Composting	All members
Construction of pig pen/storage room	-Land clearing -Child labor	-Land is cleared -Checking credentials	Employ only adults	Project Coordinator
Building biodigester waste disposal system	- Land clearing - Child labor	-Land is cleared -Checking credentials	Employ only adults	Project Coordinator
Operating compost	- Scent	Compost being full	Use of Effective Microorganisms Empty compost on a regular basis	Selected group of members
Feeding pigs	-Excess nutrients in waste	-Excess feeding	Measuring adequate levels of feed per meal	Project Coordinator
Maintenance of pig pens	-Washing pig pens	- Unclean pens; generation of scent	-Clean the pens twice daily	Household members
Slaughtering	-Offal	-Slaughtering one pig	-Burying in proper location and depth -Proper disposal of offal	All members

8 Additional Information

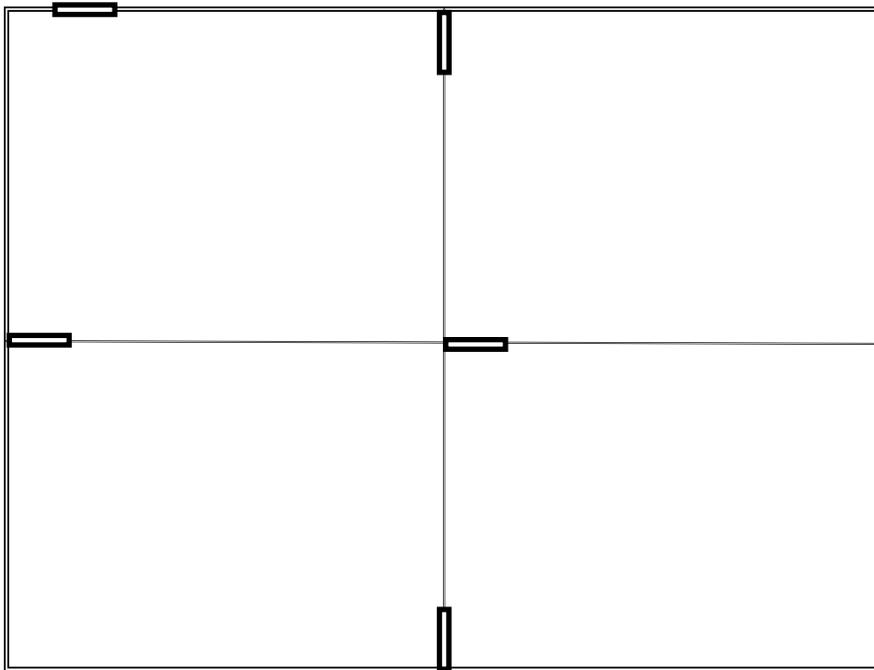
Three designs will be used for the pens that will be placed on the individual properties. A total of six pens are to be built following three different, but similar designs. All three designs will have a sloping roof with a concrete floor and block walls four feet high. A drain will be built around the perimeter of each pen to channel the runoff from cleaning into the biodigester. The floor plan will be one of the three shown below depending on whether it is a one sow, two sow or one sow with boar unit. The boar services will be shared by the entire group but will be housed by one member.



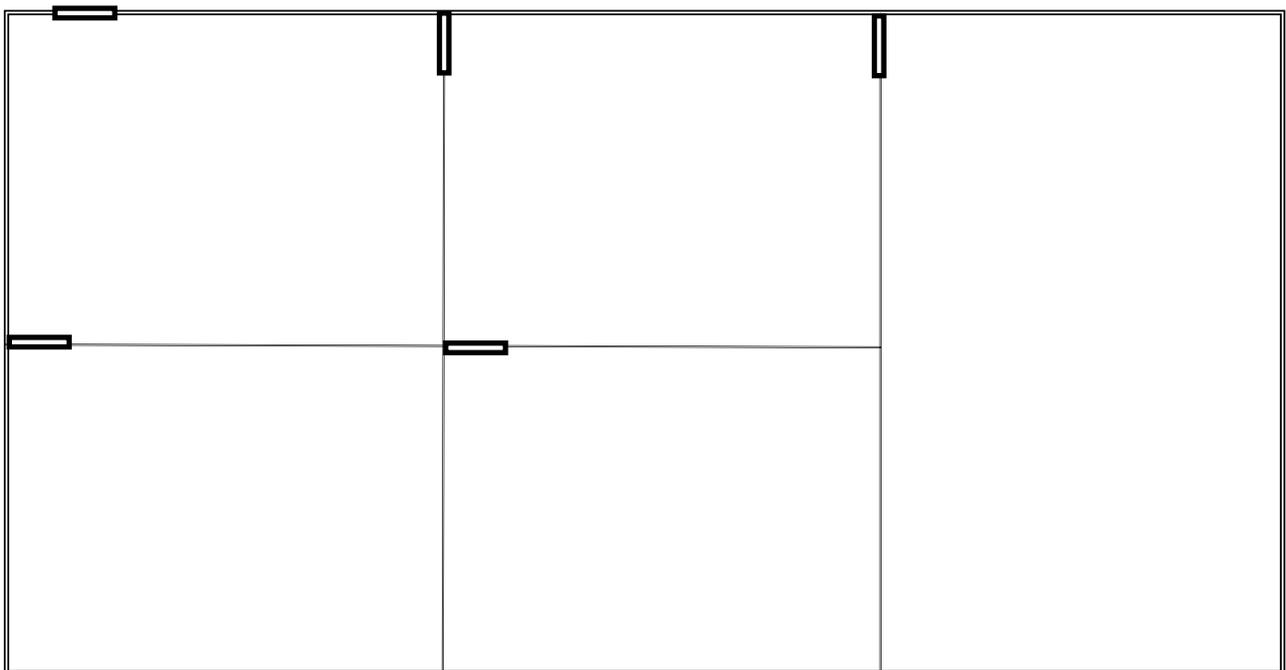
Roof and siding design



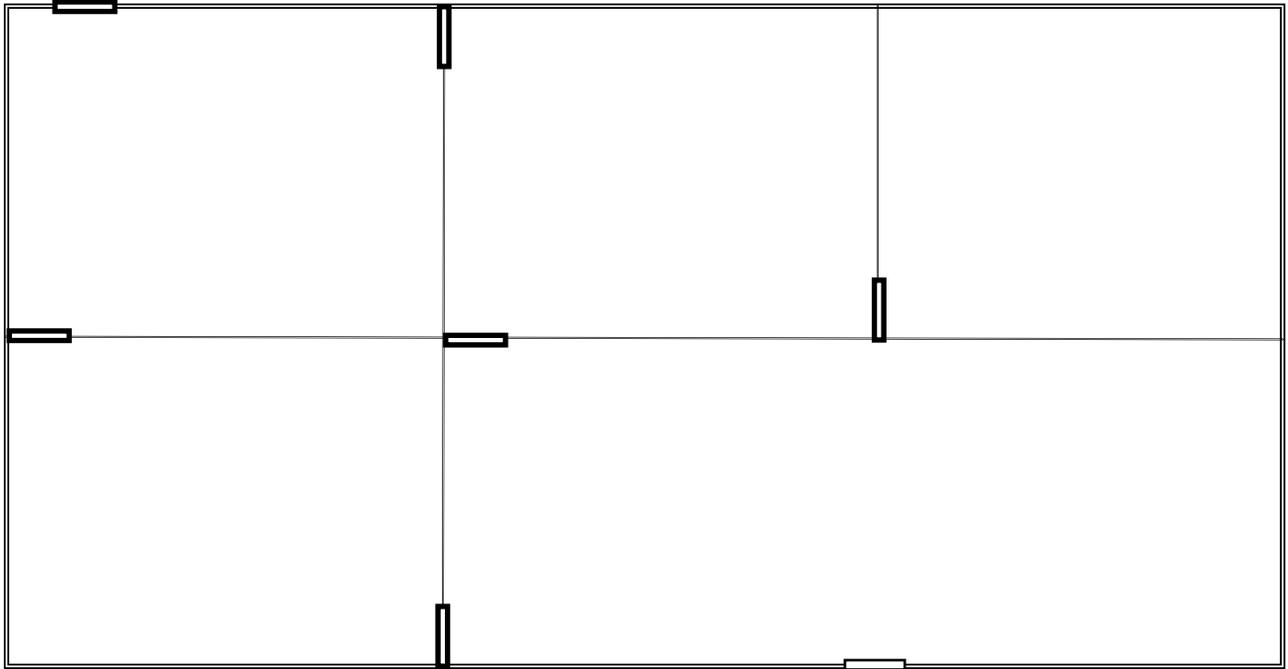
Feeding trough design



Floor plan for one sow unit



Floor plan for one sow unit with space for a boar



Floor plan for two sow unit