ISSN 1818-5614

Waste management survey report and waste management manual for Barakau Village, Central Province, PNG

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IWP-Pacific Technical Report (International Waters Project) no. 26

Global Environment Facility

United Nations Development Programme

Pacific Regional Environment Programme

SPREP IRC Cataloguing-in-Publication Data

Lovai, Narua

Waste management survey report and waste management manual for Barakau village, Central province, Papua New Guinea / by Narua Lovai. – Apia. Samoa : SPREP, 2006.

38 p. ; 29 cm. - *(IWP-Pacific Technical report, ISSN 1818-5614 ; no.26).*

ISBN: 978-982-04-0346-8

1. Waste disposal – Law and legislation – Papua New Guinea. 2. Waste management – Conservation of natural resources – Papua New Guinea. 3. Waste reduction – Environmental impacts - Papua New Guinea 4. Waste management – Handbooks, manuals - Papua New Guinea. I. International Waters Project (IWP). II. Secretariat of the Pacific Regional Environment Programme (SPREP). III. Title. IV. Series.

363.728 8

This report (originally written in December 2004) was produced by SPREP's International Waters Project, which is implementing the Strategic Action Programme for the International Waters of the Pacific Small Island Developing States, with funding from the Global Environment Facility. This study was funded by the International Waters Project.

The views expressed in this report are not necessarily those of the publisher.

Cover design by SPREP's Publication Unit
Editing and layout: Mark Smaalders

Printed by: Marfleet Printing Co. Ltd., Apia, Samoa

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Contents

Acronyms

BA	Bagava section
BE	Bay Entry section
BS	Bay Side section
DH	Dere Hua section
IWP	International Waters Project
IWP PNG	International Waters Project PNG
KD	Kida section
ME	Middle East section
PPA	participatory problem analysis

Acknowledgements

The IWP PNG team would like to convey its sincere gratitude to the youth members of Barakau Village who participated as interviewers in the survey. Thanks are also extended to the Councilor Mr. Kala Madu, members of the Local Project Management Committee and the people of Barakau for their hospitality and support.

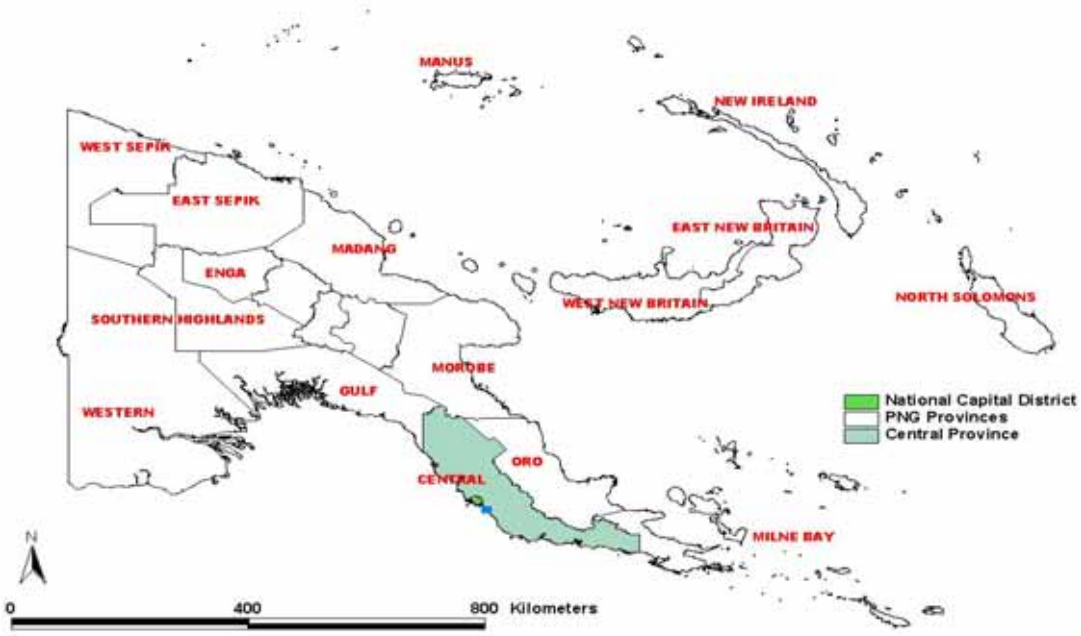

Figure 1: Map of Papua New Guinea

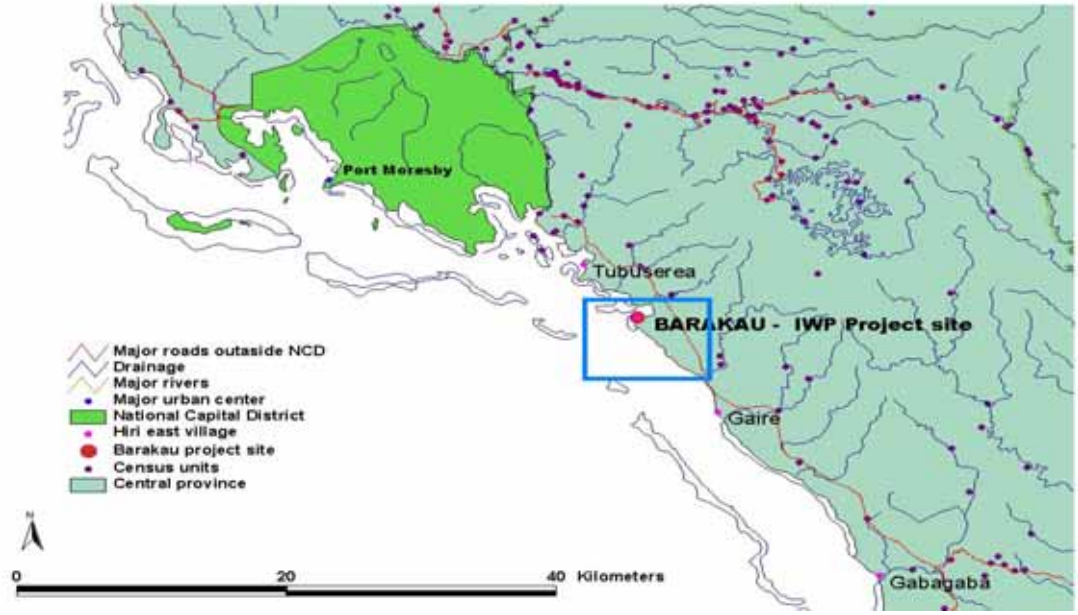

Figure 2: Location of Barakau village

1 Introduction

International waters comprise one of four focal areas of the Global Environment Facility (GEF). The GEF was created in 1994 to fund programmes aimed at achieving global environmental benefits in four focal areas: biodiversity, climate change, international waters and ozone layer depletion.

International waters include oceans, large marine ecosystems, enclosed or semi-enclosed seas and estuaries as well as rivers, lakes, groundwater systems, and wetlands with trans-boundary drainage basins or common borders involving two or more countries. The ecosystems and habitats associated with these waters are essential parts of the system.

The Pacific region International Waters Project (IWP) is a 7-year, USD 12 million initiative concerned with management and conservation of marine, coastal and freshwater resources in the Pacific islands region. The project includes two components: an Integrated Coastal and Watershed Management (ICWM) component, and an Oceanic Fisheries Management component (the latter has been managed as a separate project). It is financed by GEF under its International Waters Programme. The ICWM component is implemented by the United Nations Development Programme (UNDP) and executed by the Secretariat of the Pacific Regional Environment Programme (SPREP), in conjunction with the governments of the 14 independent Pacific Island countries: Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. The ICWM component of the project has a 7-year phase of pilot activities, which started in 2000 and will conclude at the end of 2006.

The primary objective of IWP's IWCM component is to "address root causes of the degradation of international waters in coastal regions through a programme focused on improved integrated coastal and watershed management". It requires action at the community level to address priority environmental concerns relating to: marine protected areas, sustainable coastal fisheries projects, protection of freshwater resources and community-based waste reduction. Implementation of the IWCM component in PNG is the responsibility of IWP-PNG, which is located within the Department of Environment and Conservation. At the conclusion of the assessment of the PNG's priority environmental concerns, the IWP focal areas were ranked in terms of severity as follows: waste management, protection of freshwater quality and sustainable coastal fisheries.

1.1 Barakau village pilot project

Due to funding constraints it was decided that the pilot project would be located in the Central Province (see Fig. 1). When invitations were requested for expressions of interest to host the pilot project, the public in the Central Province was advised that those intending to apply should ensure the environmental issues in their respective villages are relevant to the focal areas and preferably in the same order of importance. Barakau was among the sixty villages that responded. Barakau was chosen as the host site for a number of reasons: (i) the relatively easy access from Port Moresby, (ii) its manageable population size, (iii) environmental issues that are relevant to the IWP focal areas and (iv) the degree of understanding of these environmental concerns by the people and their apparent preparedness to address them.

Barakau (see Fig. 2) is a coastal Motuan village situated about 40km southeast of Port Moresby; it is accessible by road and can be reached from the capital in about half an hour. It has a population of 1500 people. About 40 % of the houses are built over the sea. This is a traditional Motuan practice, which today has serious negative waste management implications.

In the Expression of Interest form submitted for Barakau Village and the subsequent follow up meetings, improper waste disposal and its health and environmental effects were highlighted. Most people agreed that as a community, there appeared to be a lack of concern for the

environment; people did not really care how waste material was disposed off. Existing regulations relating to waste management were not adhered to and there was overwhelming support for the project to come into the community and help remedy matters.

To determine how the project could assist in improving village waste management, it was decided that a survey should be carried out to determine what types of waste are being produced and how they are handled. This report will explain how the survey was conducted, discuss the results obtained, and propose several possible remedies.

2 Data collection and compilation

A survey questionnaire was formulated in English and translated into Pure Motu (both English and Motu versions are included as Appendix 1.0). It was decided that village youth would be trained to conduct the survey. This would enhance their knowledge of the project and waste management issues in the village and teach them how to carry out interview-based surveys. Two training sessions were conducted before they carried out the surveys in the six sections of the village. The training sessions were held on two days, in the evenings from 1930 hours to 2130 hours.

The sessions were run by the Project Facilitators; Mick Raga and Helen Havora. Each session consisted of a general overview of the baseline data collection phase, the use of questionnaire-based surveys as a means of gathering information, interviewing techniques and data recording. This was followed by role plays in small groups where one participant served as the interviewer using the actual survey questionnaire while the rest of the group responded as interviewees from a household. The session concluded with clarification on any related issues.

The survey was planned to run over a fortnight but a number of church activities and three deaths in the village forced an extension by another two weeks. The entire duration of the survey was therefore from 20 May to 21 June, 2004. During this period guidance and support was provided by the Project Facilitators. A list of the surveyors is attached as Appendix 2.0.

Barakau village (Fig. 3.0) is divided into six sections: Bagava, Dere Hua, Middle East, Kida, Bay Entry and Bay Side (see Fig. 4). Each house was assigned a code and all survey results were registered and evaluated accordingly.

Figure 3: Sketch map of Barakau Village

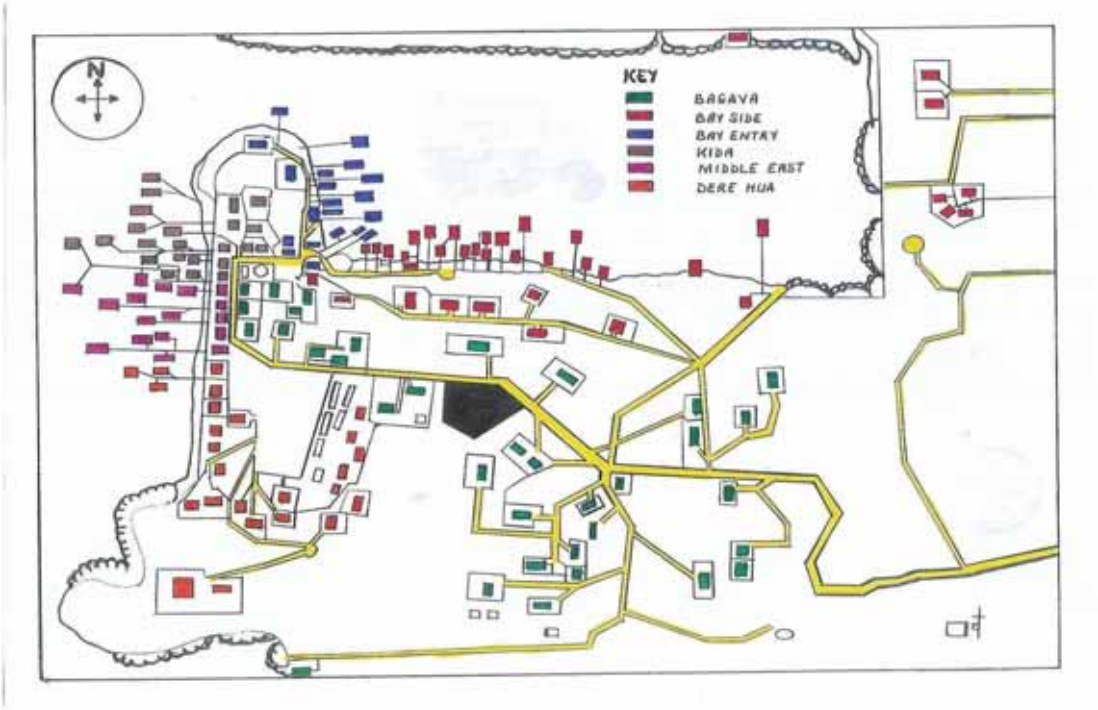

Figure 4: Sketch map highlighting the six sections comprising Barakau Village

The data were compiled and summarized in a series of tables by one of the Project Facilitators, Mrs. Helen Havora. These summary tables are explained in the following sections. Table 1 shows the population breakdown for all the households covered by the survey.

Table 1: Population distribution by age and sex for each section of Barakau Village

	No. of Households	No. of Occupants									
		Adults		Children							
SECTION				0-5yrs		6-12yrs		13-18yrs		>19yrs	
		M	F	M	F	M	F	M	F	M	F
Bagava (BA)	36	78	72	34	26	34	29	7	16	28	18
Derehua (DH)	24	53	52	16	14	21	14	15	14	9	19
Middle East (ME)	17	35	35	11	9	13	13	10	10	5	5
Kida (KD)	21	73	61	13	9	23	25	14	18	14	8
Bay Entry (BE)	22	63	56	13	14	30	14	18	8	9	3
Bay Side (BS)	39	81	64	16	13	30	19	13	13	11	6
Subtotals		383	340	103	85	151	114	77	79	76	59
Village total	159	1467 (participants in survey)									

Note that of the 159 households in the village, only 143 households participated in the survey; therefore, 1,467 is not an accurate population count. The approximate total population, extrapolating from average household size, would be around 1500 people. Some heads of households were reluctant to take part in the survey for the following reasons: disagreement with the involvement of the youth as survey interviewers, refusal to disclose information about how they handle their waste, and the belief that waste management with the project is

unnecessary because the people already know what to do but are simply unorganized and irresponsible.

3 Discussion of data

The main waste types covered in the questionnaire were household waste, human waste, animal waste and hazardous substances. The methods of disposal appear to be influenced by a number of factors including education and awareness, location of residences and cultural considerations.

3.1 Current waste disposal practices

Household waste

In general household waste management on land within residential premises is not an issue, except where houses are located close together. With land-based houses organic waste is either given to pigs or buried in a backyard pit while combustible inorganic waste is either piled into a heap and burnt or buried in a pit. However, several houses near the beachfront dispose of their household waste into the sea especially at night when the tide is in. With over-the-sea houses, organic waste is again fed to the pigs but whatever is left over — and all inorganic waste — is tossed into the sea.

Human waste

The types and locations of toilets used by households are shown in Table 2. Up to seventy percent of the population (i.e. approximately 1000 people) use over-the-sea drop toilets. All the houses over the sea are located too close to the shoreline and this practice can be offensive to those who are not accustomed to it, especially during low tide. In addition, most of residents in beachfront houses use over-the-sea drop toilets. Two of the land-based houses have direct-to-sea flush toilets, eleven have septic tanks and forty-two have pit latrines. However, most of the pit latrines are poorly designed and constructed, resulting unpleasant odors and attracting disease-transmitting flies.

Table 2: Type and location of toilets used by households

Section	Households with toilets				Households without toilets				Shared toilets		
	Yes	Septic	Pit latrine	Sea latrine	None	Sea	Land	Shared	Yes	No.	No. households with access
Middle East	9			9	2			2	8	1	15
Kida	16	2	2	12	5		1	4	14	2	20
Bay Entry	18	1		17	4			4	9	9	20
Derehua	10	4	4	2	6	1		5	5	5	25
Bagava	26	1	25		10	3		7	16	10	27
Bay Side	34	3	11	20	2			2	14	20	30
Total	113	11	42	60	29	4	1	24	66	47	137
Proportion	80%	10%	38%	53%	20%			69%			

Notes: 1) 80% of Barakau households have toilet, 50% of which are shared.
2) 53% of the toilets are built over the sea.
3) 20% of households do not have toilets, 69% of these use other household toilets and 17% go elsewhere.

Some villagers have pointed out that flushing away of waste matter from houses near the main beachfront during high tide is very effective, but concerns were raised over the situation with the Bay Side houses and the flushing capacity of the bay's waters. Fishermen from the village are used to seeing floating fecal matter on the mangrove, bay and reef waters. While it is obviously unpleasant they have become used to it and most of them use the same method of disposal anyway.

Figure 5: Main beachfront showing toilets and pig pens along the shoreline

Figure 6: Over-the-sea houses in the Bay Side section

Animal waste

The types of domesticated animals in the village, including those raised for food (e.g. pigs and chickens) are shown in Table 3. The main contributors to improper waste disposal are dogs and pigs. With dogs, the removal of faeces in public areas will have to be addressed. There is an existing ban on free ranging pigs in the village, however some seem to be getting out and wandering about on a regular basis so enforcement needs to be improved. Over half of the pig pens owned by over-the-sea households and households on the beachfront are located over the sea or the shoreline. These pigs and pens are regularly cleaned using sea water.

Hazardous waste

This category includes waste oil and fuel, old batteries, certain chemicals such as paints and solvents as well as tires, tubes and scrap metal. Some households are using Godio Hill as a dump site, especially for old vehicles and other solid waste (see Table 4). Not many people are aware of this and on inspection it was found to be overgrown with grass and other vegetation. Most of the households store these materials on their premises but unfortunately some of the items are discarded into the sea, as it is more convenient.

3.2 Environmental impacts due to current waste disposal practises

During the participatory problem analysis (PPA) sessions, most people expressed concern regarding the decline in general cleanliness of the village over the last five years. A large proportion of the land-based households continue to keep their immediate premises clean, but some of these households are dumping their accumulated rubbish into the sea. All household waste from houses over the sea ends up in the sea. Most of the plastic bags and containers are carried out into the reefs or wind up in the mangrove areas. All kinds of substances can end up in the sea as a result of the ignorant, deliberate and direct disposal of waste material.

The direct disposal of human waste from individual over-the-sea household toilets is deplorable especially when the houses are very close to the shore and to each other. The incoming tide can also deposit the fecal matter on the beach giving rise to odour and flies. Whatever is carried away by the outgoing tide into the open sea or into the mangrove areas disintegrates or is consumed by fish and other marine organisms. The shoreline water needs to be tested for its level of fecal coliforms and nutrients because of the volume of the material that is discharged and complaints of skin infections, especially by children who swim in the sea, under or beside the houses.

Pig feces are also washed into the sea and contribute to organic pollution and nutrient build-up in the nearshore waters. Other potentially disease-causing microorganisms are also discharged into the sea, although it is not known whether these organisms can survive in the sea and be transmitted to other humans or marine organisms.

According to verbal DEC and village reports, a number of a algal blooms have occurred in the Bay Side area during occasions when tidal movements failed to flush out the accumulated organic material. This will become more frequent if additional houses are built over the sea and the current methods of waste disposal continue.

Table 3: Animals — domesticated and reared for human consumption.

Section	Own animals		Type								How/where kept					
	Yes	No	Pigs	Dogs	Cat	Chicken	Ducks	Bird	Cuscus	Wallaby	FR	Cage	Pens	Sea	Land	SB
Middle East	8	3	8	16	3			1	1	1	19	3	6	3	3	
Kida	6	15	26	16	1						17		21	10	1	2
Bay Entry	20	2	66	32	6						39		18	14		1
Derehua	6	10	19	20	6	2					28		10	4		3
Bagava	28	8	47	55	19	15	3				92		21	3	14	
Bay Side	25	12	33	66	2	3					71		25	4	5	4
Total no. / %	93/65%	50/35%	199	205	37	20	3	1	1	1	266	3	101	38/53%	23/32%	10/14%

Notes: FR = free ranging. S/B = shoreline/beach. 65 % of Barakau households own animals; of the 199 pigs, only 1 is totally free ranging. Households that have more than one pig build one big pen to cater for them; 53% of pig pens are built over the sea.

Table 4: Disposal of scrap metal, tyres and other hazardous waste.

Section	Old Vehicle/ Parts in Residential Premises						Dinghy		Outboard Motor		Service (per year)				Own Vehicle	PMV	Service (per year)				Common Disposal Pit		
	Yes	Duration (years)				No	Yes	No	Yes	No	No	1	2	>3			No	1	2	>3	Yes	No	Loca-tion
		<1	1	2	>3																		
Middle East	1			1		10	5	5	6	5	1	3	1	1	3	1				4		11	
Kida	7				7	14	7	14	6	15	1		3	2	6	1			4	3		21	
Bay Entry	8	1	1	1	5	14	8	14	11	11	2	4	4	1	6	1	1	2		3		22	
Derehua	7	1			6	9	7	9	6	10	1		1	4	4	3				7	1	15	Godio Hill
Bagava	15	1	1	1	12	21	15	21	10	26	1		3	3	14	4	1	3		14	1	35	Godio Hill
Bay Side	13				13	24	13	24	11	26	1	1	1	3	3	2	1	1		3	1	36	
Total	51	3	2	3	43	92	55	87	50	93	7	8	13	14	36	12	3	6	4	34	3	140	
%	36					64	39	61	35	65	14	16	26	28	25	8	6	13	8	71	1	99	

Notes: 1) 36% of Barakau households store solid/hazardous waste; 74% own a dingy and an outboard motor; 70% service their motors while 14% don't; 33% own a vehicle; 92% are serviced and 8% don't service; 99% are not aware of a common disposal pit in the village.

3.3 Community views on improved waste disposal

In general, while the people would openly agree that direct disposal into the sea should be discouraged, they continue to do so, both because it is more convenient than other options, and because they believe that somehow the sea will take care of the waste and they will not be harmed in any way.

Most people attending the PPA sessions were in favor of setting up a common dump site for the disposal of inorganic material. Burial of organic matter not fed to pigs was highlighted, as well as abolishment of toilets over the sea, and of pig pens either on the shoreline or over the sea.

The priority activities to be addressed appear to be:

- identification of a location of a common dump site;
- construction of the dumpsite;
- construction of pit toilets over land for houses over the sea and those land-based houses currently without toilets;
- organized collection and disposal of household garbage from houses over the sea;
- collection and sale of recyclable material;
- promotion of composting of organic waste; and
- relocation of pigs pens away from the sea.

3.4 Obstacles to realising behaviour change

There appears to be an increasing lack of concern for the well-being of the community and people are more preoccupied with meeting their daily needs. The sense of communal welfare and the need to support each other for the good of the community has to be restored. The people need to be reminded of the detrimental effects of improper waste disposal and their responsibility towards the environment in they live in, which provides food and other essential resources. This can be achieved through water quality and health surveys, shoreline clean-up activities and education and awareness on taking care of the environment.

It is clear that a substantial reduction in the volume of waste discharged into the sea can be achieved if new residential construction over the sea is stopped and current over-the-sea household owners are encouraged to shift their houses onto land. This will mean that land subdivision will have to be facilitated, particularly as several disputes over land have occurred recently. There have been calls for the village land to be surveyed and divided into residential allotments through a committee comprising the Village Court Magistrate, Councillor and clan representatives.

A number of over-the-sea householders are full-time fishermen who have pointed out that living in this way is more convenient for them because of the easy access to fishing grounds and security for their dinghies, outboard motors and fishing nets. In addition, most of the people still fear sorcery by the inland Koiari people, and would rather continue living over the sea.

Those who for one reason of another choose to live in over-the-sea houses must carry out their communal responsibility by using land-based toilets and properly disposing of their household waste. The latter will require a waste collection and disposal system through which the waste can be disposed of into a common dumpsite.

Table 5: Household views on waste management

Comments	Middle East	Kida	Bay Entry	Derehua	Bagava	Bay Side	Total
1. Rubbish dump be identified/established.	11	10	20	8	23	26	98
2. No toilets over the sea, pigpens to be built away from the beachfront and homes	8	7	3	5	22	6	51
3. Keep informing progress/activities of IWP PNG	4	4	4	4	7	7	30
4. Start new village cemetery on Godio Hill	3	3	4	3	12	5	30
5. Waste management plan and practices to be established	3	3	4	2	6	5	23
6. Central place for recycling waste for bulk sale	3	2	1	2	10	4	22
7. Village should organize a collection system and dump the rubbish at Six Mile	2	3	2	3	8	3	21
8. Each household to purchase a rubbish bin	4	2	3	3	6	2	20
9. Free ranging pigs be penalized – laws to be enforced	4	2	3	3	6	2	20
10. Own disposal pit for each household	1	1	2	2	10	1	17
11. Proper rainwater storage system near village	1	2	2	2	5	3	15
12. Littering penalty/fine be established	3	2	2	2	3	2	14
13. Improve drainage system		2	1	1	3	5	12
14. More awareness on waste management and its effect on lives	3	2	1	1	3	1	11
15. Proper enclosures/cages for animal keeping	2	1	1	2	2	2	10
16. Project activities are explained/implemented	1	2	1	1	2	2	9
17. Improve village wharf	1	1	1	1	1	1	6
18. Need for clean water	1	1	1	1	1	1	6
19. Septic methods utilized/introduced at LLG	1	1	1			1	4

4 Recommendations

Based on evaluation of the collected survey information, the following actions should be taken in order to improve waste management in Barakau village, and minimize the associated health and environmental impacts.

1. A suitable location, which will serve as the communal dumpsite for non-recyclable inorganic waste, should be identified as a matter of urgency.
2. A feasible waste collection and disposal system should be established immediately.
3. A suitable pit latrine design should be selected and assistance should be sought for the construction of a number of demonstration toilets in strategic locations throughout the village.
4. Waste separation should be encouraged and each waste type should be disposed of in an appropriate manner.
5. The sale of recyclable material to buyers in Port Moresby should be organised.
6. Composting of organic waste should be encouraged.
7. Direct disposal of human and pig feces into the sea should be discouraged.
8. Pigpens should be located well away from the sea.
9. Existing waste management regulations and their enforcement should be reviewed and amended as soon as possible.
10. A variety of awareness activities — targeting different age, gender and interest groups within the village — should be carried out to encourage proper and responsible disposal of waste.

5 Conclusion

The general poor state of cleanliness of the village and the continued use of over-the-sea drop toilets are clear indications that the majority of the people of Barakau are not convinced about the negative health and environmental impacts of improper waste disposal. In addition, although local regulations relating to waste disposal exist, they are simply not being enforced. The mere location of houses over the sea also encourages people to simply discard their waste into the sea. The absence of a collection and disposal system is another contributing factor.

In order to improve the situation, the people must make an effort to dispose of various types of waste in a responsible manner. The existing regulations should be reviewed and amended to improve monitoring and enforcement. A common dumpsite needs to be established, accompanied by a feasible collection and disposal system. Land-based pit latrines should be encouraged and construction of over-the-sea residences should be stopped immediately. Allocation of land for residences and long-term village planning, taking into consideration population growth and provision of water and sanitation services, will have to be seriously and urgently addressed by the community.

6 References

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Niu, L and Tongia, S. 2004. Nukuhetulu household survey and waste characterisation study analysis. IWP Tonga Technical Report Number 5 (draft).

Appendix 1: Survey questionnaire

Household Waste Management Survey - English

1. Name of Head of Household

_____

_____

2. Number of Occupants

2.1 Adults **Male** ☐

2.2 **Female** ☐

2.3 Children	**Ages (yrs)**	**0.5**	**6-12**	**13-18**	**>19**
	Male	☐	☐	☐	☐
	Female	☐	☐	☐	☐

3.0 Types of Waste and Methods of Disposal (Indicate method of disposal)

3.1 General Household Waste

(a) **Organic (vegetable peelings, fish, guts, etc.)**

_____

_____

(b) **Inorganic**

i. Plastic bags and containers

_____

_____

ii. Metal cans

_____

_____

(c) **Shower water (laundry/bathing)**

_____

_____

(d) **Kitchen wash water**

_____

_____

3.2 Human Waste

3.2.1 Does this household have a toilet?

YES **NO**

(a) **If Yes, what type?**

i. Septic ☐

ii. Pit Latrine ☐

(b) **Do you share toilets? YES NO**

(c) **If Yes, how many households are involved?**

_____

_____

(d) **If No, where do you dispose off human waste?**

1. **Over the sea** ☐
2. **On land** ☐

3.3 Animal Waste

(a) **Do you look after animals? If Yes, what and how many?**

_____

_____

(b) **Are the animals free-ranging or inside an enclosure?**

_____

_____

(c) **If free-ranging, indicate location.**

_____

_____

a. Hazardous Waste

(a) **Indicate method of disposal:**

i. Old household/garden chemicals & poisons

_____

_____

ii. Old medicines

_____

_____

iii. Small dry cell batteries

_____

_____

iv. Oil – spill/containers

_____

_____

v. Paint – spill/containers

_____

_____

vi. Vehicle batteries

_____

_____

(b) **Do you have any old vehicle(s)/parts within your residential premises?**

YES **NO**

i. If Yes, how long has it been there?

_____

_____

(c) **Do you own a dingy and outboard motor?**
Indicate if more than one

YES **NO**

i. If Yes, how many times a year is it serviced and where?

_____

_____

(d) **Do you have a vehicle?**

YES **NO**

i. If Yes, indicated if more than one.

_____

ii. Is it a PMV or personal use?

_____

iii. How many times a year is it serviced and where?

_____

_____

3.5 Other Solid Waste

(a) **What methods are used for the disposal of the following:**

1. Metals (aluminum cans, old vehicles, appliances, equipment etc.)

_____

ii. Paper (newspaper, writing paper, magazines, books, cardboard boxes, food & drink wrappers etc.)

_____

_____

iii. Cosmetic (cement, ceramics, tiles etc.)

_____

iv. Glass (bottles, jars, windows, mirrors etc.)

_____

v. Textiles (torn old rags/clothes, curtains, carpets etc.)

_____

3.6 Does the village have a common disposal pit?

YES NO

(a) **If Yes, how many and where are they located**.

_____

3.7 Other Comments *Existing rules-traditional/modern)

Household Waste Management Survey - Pure Motu

1.0 Ruma biaguna ladana

_____

_____

2.0 Ruma Taunimanimadia

2.1 Badadia Maruane ☐

2.2

Hahine ☐

2.3 Maragidia Ages (yrs) **0.5** **6-12** **13-18** **>19**

Maruane	☐	☐	☐	☐
Hahine	☐	☐	☐	☐

3.0 Types of Waste and Methods of Disposal (Indicate method of disposal)

3.1 Asi edia gaukara gaudia

(e) **Organic (Aniani kopidia, gwarume bogadia, etc.)**

_____

_____

(f) **Inorganic**

i. Plastic bags and containers

_____

_____

ii. Auri, tini

_____

_____

(g) **Shower water (hurihuri ranudia/digu ranudia)**

_____

_____

(h) **Kitchen wash water**

_____

_____

Human Waste – Tage, Mei

3.3.1 Ina ruma na mai mei rumana?

YES NO

(e) **Bema mai gauna neganai?**

i. Septic ☐

ii. Pit Latrine ☐

(f) **Haida ida meiruma tamonai omeimu?** **YES NO**

(g) **Bema oibe neganai, ruma hida?**

_____

_____

(h) **Bema lasi neganai, edeseni ai omeimu?**

i. Davarai ☐

ii. Tanoai ☐

3.4 Animal Waste

(d) **Sisia/Boroma/Kito/Kokoroku/Manu/Vaura onarimu? Dahaka onarimu bona hida onarimu?**

_____

_____

(e) **Ini ubuubu gaudia e loa kavamu eiava magu ai?**

_____

_____

(f) **Bema magu ai neganai, ede seni ai.**

_____

_____

a. Hazardous Waste

(e) **Ede onegedia tomamu:**

i. Old household/garden chemicals & poisons

_____

_____

ii. Muramura gaudia

_____

_____

iii. Batere maragidia, dikadia.

_____
_____

iv. Oil – Spill/containers

_____
_____

v. Paint – spill/containers

_____
_____

vi. Motuka bateredia

_____
_____

(f) **Emu ruma badina motuka dikadia eiava kohudia dikadia mimia?**

YES NO

i. Bema oibe neganai, lagani hida vada emia?

_____
_____
_____

(g) **Mai emu posi eiava kurupela?**
Indicate if more than one

YES NO

i. Bema oibe geganai nega hida service olaohaiam lagani tamona lalonai?

_____
_____
_____

(h) **Mai emu motuka?**

YES NO

i. Bema oibe neganai, hida?

_____
_____

ii. Passengers oudamu eiava sibomu emu gui gauna?

_____
_____

iii. Lagani tamona lalonai nega hida service olaohaimu?

3.6 Momoru aukadia haida

(b) **Edeseni o negemu:**

i. Metals (aluminum cans, old vehicles, appliances, equipment etc.)

_____
_____

ii. Paper (newspaper, writing paper, magazines, books, cardboard boxes, food & drink wrappers etc.)

_____
_____

iii. Cosmetic (cement, ceramics, tiles etc.)

_____
_____
_____

iv. Glass (bottles, jars, windows, mirrors etc.)

_____
_____

v. Textiles (torn old rags/clothes, curtains, carpets etc.)

_____
_____

3.7 Hanua mai momoru nege gabuna?

YES **NO**

(b) **Bema oibe negani edeseni ai?**

_____
_____

3.8 Ma mai hereva haida.

Appendix 2: List of interviewers

	Name	Sex	Age
1	Sibo Asi	F	31
2	Maria Lohia	F	21
3	Hereva Nanadai	M	22
4	Peter Valahu	M	32
5	Joe Tai	M	32
6	Gima Valavu	F	31
7	Manau Vagi	M	25
8	Dickson Nua	M	33
9	Baroa Vagudi	M	26
10	Tony Koipiri	M	29
11	Maimu Iubu	F	30
12	Zealous Nanai	M	35
13	Boga Koko	F	29
14	Maimu Vagi	F	24
15	Sam Aisi	M	42
16	Heni Aisi	F	36
17	Koia J Tau	F	40
18	Rita Marava	F	18
19	Lois Nanai	F	35
20	Raka Uhau	M	32
21	Iamo Budo	F	21

Appendix 3: Establishment of a common village dumpsite

Purpose

To provide a common site where garbage from the village area can be discarded in a manner that minimises or avoids environmental and health problems.

Factors to consider

Location

Should not be on disputed land or in areas where arguments may develop. Also should not be within catchments where drinking water sources are located. It should be within reasonable walking distance, but not so close to the village that odour and flies become problematic.

Collection and disposal

Individual households

Will individual households be responsible for transportation of the garbage to the dump?

Is this possible for all households?

Common collection and disposal system

Alternatively, should there be a common collection and disposal system?

Who will collect the garbage from each household?

How will the waste be transported to the dumpsite?

Will collection and disposal be done voluntarily?

Should payment be made for collection and transportation? If so, how should this be arranged? Should each household be levied a certain amount monthly for the services rendered?

Design and maintenance

The dumpsite must require minimum maintenance so this can be done by the village people. It must be designed to minimize odour, vector and water contamination.

Who will ensure proper disposal of waste at the dumpsite and carry out regular maintenance?

Appendix 4: Handling of recyclable material

Purpose

To promote the collection, reuse and sale of all recyclable material in order to improve village cleanliness and minimize environmental degradation.

Factors to consider

Separation, collection and storage

Separation from other household waste

Collection from wherever they are found

Storage in household premises or common village holding area

Reuse of certain material

Use of material for various applications.

Sale of other recyclable material

Location of buyer

Sale price

Volume generated in the village, per household or as a community

Should households deliver the stuff to the buyer? If so, do they have the capacity?

Should the buyer be invited to come to the village at predesignated times?

Should there be a common collection facility from which all the material can be taken to the buyer? Perhaps the money from these can be used for garbage collection and disposal expenses in the village.

Appendix 5: Waste management manual

A Overview of waste management procedures

Introduction

Human beings produce a variety of waste, which can be classified into two groups: organic and inorganic. Organic waste is biodegradable and generally decomposes fairly rapidly, while inorganic waste decomposes much more slowly. Both types of waste have to be handled and disposed of properly to minimize negative health and environmental impacts.

This short manual describes the Barakau Village Waste Management Strategy. The strategy outlines what the people of Barakau village — with the assistance of IWP PNG — have agreed to do in relation to the various types of waste generated in the village. The approach is basic and straightforward but requires committed and consistent effort from individuals, households and the community in order to achieve the ultimate goal: of a clean and healthy village. A procedural outline of the strategy is given in Section 2.

Human waste

Direct disposal of human waste into the sea, especially from houses built on stilts over the sea, is common in most Central Province coastal villages including Barakau. Disposal of sewage into the sea is common in most coastal towns and cities throughout the world, and this is possible with minimum adverse impact, but only if the sewage is treated prior to disposal, and then disposed of at an appropriate distance and depth offshore.

Direct introduction of human faeces into the nearshore environment (as occurs at Barakau, where houses are clustered together close to the shoreline, with toilets that introduce untreated waste directly into the sea) can lead to concentrations of pathogenic microorganisms and organic nutrients. This can lead to skin and gastrointestinal infections among swimmers and fishermen, food poisoning from eating contaminated fish, or algal blooms that can damage fish and other marine life. An increasing number of people are now building their houses on land with pit or septic toilets, and this is gradually reducing the amount of human waste directly entering the sea; this trend should be encouraged.

Houses over the sea. Each house should have a land-based toilet for use by the occupants, which should be used both day and night.

Houses on low-lying, poorly drained land. Where the water table is high and the land is normally inundated during heavy rainfall, the use of pit latrines is not advisable. Other toilet designs — such as wheelie bins and septic toilets — can be used but this depends on each household. Occupants of these households should have access to a septic tank toilet or a pit latrine built on higher ground.

Houses on higher well drained land. Each household should have a pit toilet or a better alternative. Section 7 describes the construction of a ventilated improved pit (VIP) toilet.

Household waste

Every household should practise waste reduction, reuse and recycling. Household waste should be separated (see Section 3) into organic and inorganic waste. The organic waste should be buried in a compost pit, placed on a banana circle or fed to the pigs. Section 5 (English) and Section 6 (Motu) show the use of a banana circle as a beneficial disposal method for household organic waste. The inorganic waste can be reused, recycled or taken to the village waste dump. This method of separation and handling will reduce the amount of rubbish that ends up in the dump site. Section 4 shows how common material coming from households should be

separated into the different waste categories. Waste material taken to the dump site must be securely disposed of in the designated area to prevent rubbish from being scattered.

Direct disposal of organic waste into the sea will result in increased nutrient levels, while disposal of inorganic material into the sea can disrupt the biophysical functions of reef, mangrove and other marine ecosystems.

Pigpens

Most of the over-the-sea houses, and those along the shoreline, have pigpens located either over the sea or along the beach. Pig faeces are discharged directly into the sea, or indirectly when the pigs and the pens are washed and cleansed with sea water. This contributes to the pollution of the nearshore waters, in combination with directly discharged human and household organic waste.

Hazardous waste

Hazardous waste — such as used vehicle batteries and waste oil — should not be directly discharged or disposed of into the environment, as they contain substances that are harmful to the environment. The acid in the batteries should be diluted with water, and the lead fragments recovered and reused or sold to a recycling facility. Waste oil should be stored in a drum and sold to road construction companies.

B Procedural outline of the waste management strategy

Human Waste

Do not discharge human waste directly into the sea.

All drop toilets along the beach and over the sea should be dismantled.

Direct flush toilets into the sea should be converted into septic tank discharges.

Every house should have access to at least a septic toilet or a pit toilet.

Household Waste

Separate all waste into the different waste groups.

Give organic waste to pigs and/or dispose of in burial pits or banana circles.

Make use of or sell reusable and recyclable material.

Dispose of all non-reusable and non-recyclable material in the village dump site.

Pigpen Waste

Shift all over-the-sea and shoreline pigpens further inland.

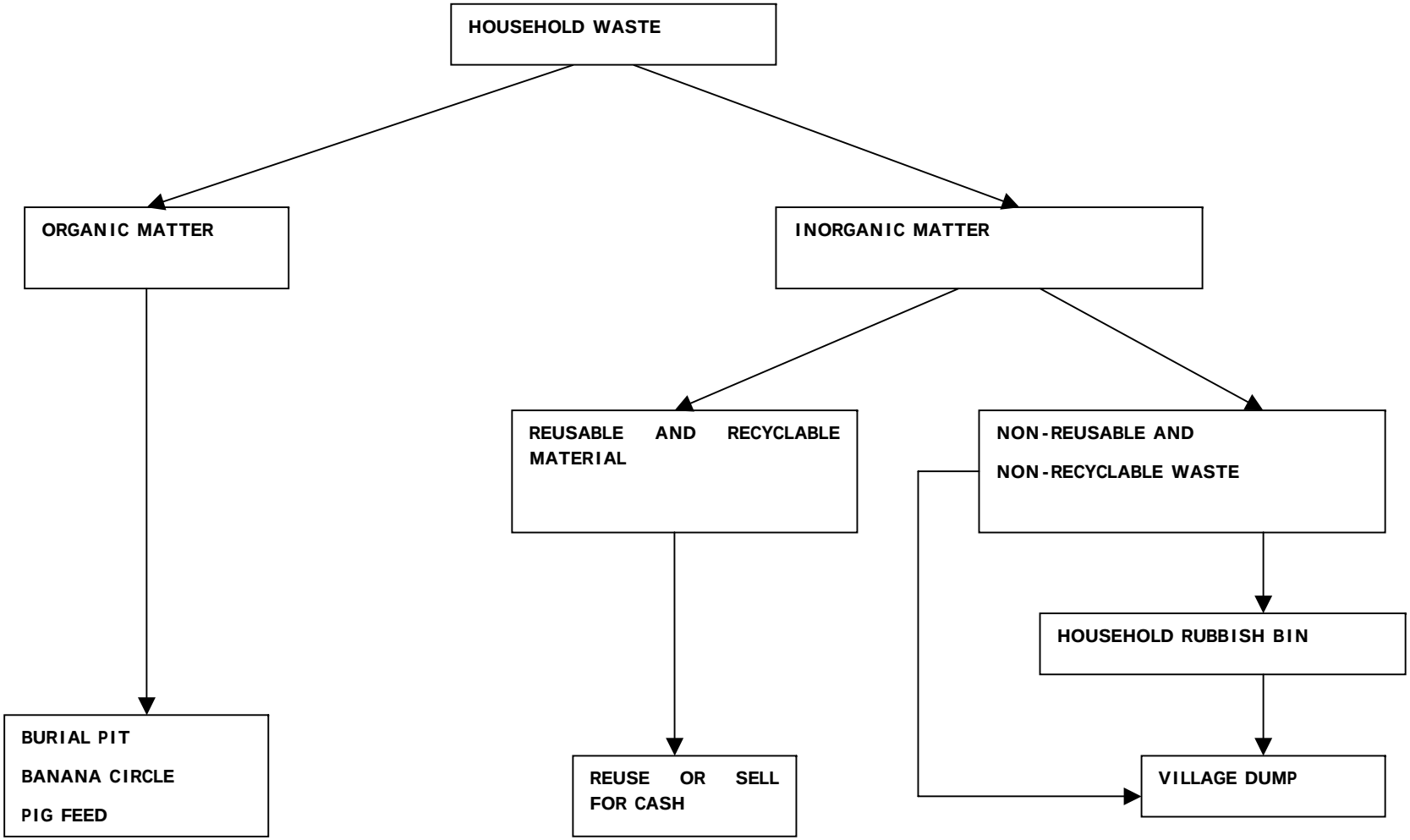
Hazardous Waste

Old car batteries should be diluted with water and dismantled for reusable parts prior to disposal at the dump site.

Waste oil should be stored in drums and sold to road construction companies.

C Household waste management strategy

Waste reduction through composting of organic matter, reuse and recycling of appropriate inorganic material and proper disposal of non-reusable and non-recyclable waste



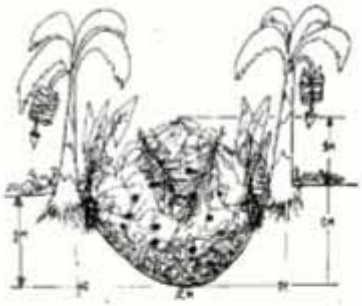
D Classification of common items into the different waste groups shown in Section 2

Organic waste	**Inorganic waste**		
	Reusable	**Recyclable**	**Non-reusable and non-recyclable**
Vegetable peelings	Undamaged plastic containers	Soft drink cans	Damaged plastic containers
Leftover food	Undamaged used tires	SP beer bottles	Damaged plastic bags
Fish scales and guts	Undamaged plastic bags	SP cans	Damaged tires
		Plastic soft drink containers	Empty tins
		Other plastic containers of non-toxic matter	Broken glass
		Copper wire	Old rags
		Lead	Damaged plastic items
		Old newspapers	Paper that is too hard to use in the toilet.
			Old vehicles and non-reusable parts
			Damaged electrical appliances

E Disposal of household organic waste into a banana circle

1. DIG A CIRCULAR PIT 1M DEEP AND 2M WIDE

2. PLACE AT THE BOTTOM CARDBOARD, OLD MATS OR COCONUT FRONDS



3. DISPOSE OFF ALL HOUSEHOLD ORGANIC WASTE ALONG WITH CUT GRASS, DEAD FOLIAGE OR HEDGE CUTTINGS INTO THE PIT

4. PLANT SIX BANANA OR PAWPAW SEEDLINGS AROUND THE PERIMETER

5. KEEP THE ORGANIC WASTE AND THE PLANTS WATERED AT ALL TIMES AND MAKE SURE PIGS DO NOT DESTROY THE CIRCLE. OVER TIME YOU SHOULD HAVE HEALTHY AND DELICIOUS BANANAS OR PAWPAWS FOR CONSUMPTION OR SALE IN THE VILLAGE MARKET. *Note that all dimensions and numbers given here can be halved.*

F Dui hado dalana ta ani momoru enegedia namonamo dalana ta emui ruma badidiai

1. GURI BA GEIA LABABANA MITA RUA ENA DOBI MITA TAMONA

2. KADIBODI, NIU RAURAU EIAVA GEDA DIKANA TA GURI AI BA TAHOA

3. ANI ANI KOPIDIA O DUHIMU GAUDIA BONA MOMOA TANO AI BAELA GAUDIA GURI AI BA NEGEDIA RANU DIKADIA AI BA DAIRIDIA (DISI/DABUA HURI RANUDIA DIKADIA)

4 GURI ISE NAI DUI HUEDIA HITU BA HADODIA HEGEGE

5.

INI AINIANI MOMORUDIA GURI AI ONEGE GAUDIA NA NEGA IBOUDIAI RANU DIKADIA MEREKI O HURIMU GAUDIA GURI AI BA BUBU DOBI EMU DUI O HADO GAUDIA EDIA VARA NA BE NAMO HEREAMU BONA ANIDIA DANU NANAMO HEHEREA.

G Construction of a ventilated improved pit (VIP) latrine

The VIP toilet is basically an improved version of the conventional pit toilet. It provides a complete cover for the pit and a vent pipe through which odor from the pit can be removed through the natural cyclic motion of warm and cool air. In addition, flies that enter the toilet will be trapped in the pit and the vent pipe. The VIP latrine therefore eliminates the well known, annoying nuisances of odour and flies typically associated with conventional pit toilets.

i) Preparation of the toilet pit

1. Select a site that has a low water table and is not flooded routinely after a heavy downpour.
2. Excavate the pit, which must be at least 1 × 1 metre and 1.5 metres deep.
3. Reinforce the sides with bamboo or wooden poles or off-cut timber. This will constitute the pit reinforcement structure.

ii) Assembling the pit cover

4. The essential features of the pit cover are holes for the seat and a vent pipe. You can buy a prefabricated cover or assemble one using timber, concrete, or a combination of both. The seat can be prefabricated or built into the cover. Make sure the hole for the vent pipe will be outside of the superstructure when the latter is placed on the pit cover.
5. Make sure the pit cover is secured to the top of the pit reinforcement structure described in Part A, step (3).
6. Make sure the seat has a cover.

iii) Construction of the superstructure

7. Having allowed for the vent pipe in Part B, step (1), the superstructure can be built of just about any material but taking into consideration strength, durability and cost.
8. Place the vent pipe onto the pit cover and connect it to the superstructure. Paint it black and cover the top with fly wire. Ideally, all other exposed spaces in the superstructure should also be blocked off with fly wire.