

The way ahead: an assessment of  
waste problems for the Buada  
community, and strategies toward  
community waste reduction in Nauru

By IWP-Nauru and Alice Leney

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## Abbreviations and Acronyms

<b>ADAB</b>	Australian Development Assistance Bureau (succeeded by AusAID)
<b>AusAID</b>	Australian Agency for International Development
<b>DET</b>	
<b>GEF</b>	Global Environment Facility
<b>GIS</b>	Geographical Information System
<b>HDPE</b>	
<b>IOM</b>	International Organisation of Migration
<b>IWPN</b>	International Waters Program Nauru
<b>Kg/p/wk</b>	Kilograms per person per week
<b>MSW</b>	Municipal Solid Waste (in this report meaning household solid waste)
<b>NC</b>	National Coordinator of IWP Nauru
<b>NECC</b>	National Environmental Coordinating Committee (local equivalent to IWP National Task Force – NTF)
<b>NPC</b>	Nauru Phosphate Corporation
<b>NRC</b>	Nauru Rehabilitation Corporation
<b>NRDFS</b>	Nauru Rehabilitation and Development Feasibility Study (Sept. 1994)
<b>PCU</b>	Project Coordination Unit of IWP/SPREP (based in Samoa)
<b>PDT</b>	Project Development Team
<b>RON</b>	Republic Of Nauru
<b>SPREP</b>	South Pacific Regional Environment Programme
<b>UNDP</b>	United Nations Development Program

## Executive Summary

This report is the result of a visit to Nauru of 21 days from 14<sup>th</sup> November to 5<sup>th</sup> Dec 2003. In May 2003 Buada Community had been chosen as the International Waters Programme Pilot Project, to implement a community-based waste reduction pilot project. There were two main areas of interest for this visit: to identify the baseline situation regarding waste in Buada Community, and to determine the current situation on Nauru with regard to the legal and institutional responsibility for dealing with community waste. Thus this report is divided into two parts: Part A details work associated specifically with the Buada Pilot Area, and Part B details applicable legislation, and the current situation regarding who is doing what in terms of waste collection on Nauru.

The original Strategic Action Plan (SAP) for the IW in the Pacific Islands Region clearly stated that there were information gaps in data on<sup>1</sup>:

- Current and projected waste volumes;
- Sources, pathways and impacts of pollution on waters.

This document contains information that goes some way to addressing those information gaps in relation to freshwater sources on Nauru Island.

### Part A: Buada Community's current waste problems

#### Household waste survey

There was a complete lack of site specific data regarding actual household waste generation rates and composition on Nauru. Some previous literature had alluded to rates of around 500kg/yr/person, (1.3kg/day) but those figures were based on countries with similar per capita incomes, and those incomes were for Nauru of 15 years ago. The situation today is very different. In order to have some suitable data to work with, a waste survey was conducted, using a representative selection of households in Buada community, which resulted in about 17% of the population having its garbage weighed and sorted for a week. Materials were sorted in to 28 different categories to give a clear picture of materials in the household waste stream. Results were that average daily waste was around 0.17kg/person/day, an order of magnitude lower than previous estimates. Also clear was that some materials present in the waste stream that are easily recycled, principally aluminium drink cans, do not enter the household waste stream for behavioural reasons. However, a full analysis of recyclable materials was conducted, and about a quarter of the waste is recyclable – by weight – and about a third if measured by volume. Recyclable was taken to mean those items that could be expected to exist in sufficient quantity and have a ready market in Brisbane, as a benchmark. Glass was not counted as recyclable as it is very heavy and difficult to handle in a small island situation, but it is readily reusable on island as, for example, aggregate substitute. Steel cans can also be recycled, but the market value is very low, and the initial issues of importing into Australia, for example, materials very likely to contain food remains meant that for the purposes of this survey they were excluded from the recyclable category. Of note was the high weight of steel cans, and disposable nappies – 12%. Also number 6 plastics – Styrofoam types – comprised a large volume if not weight.

To facilitate further work in this area, four members of the Buada Community were trained in how to conduct a Household Waste Survey, so that in future they can measure their own progress. Certificates were provided at the end of the weeks training.

Also, for the purposes of creating a baseline of information, any point sources of pollution resulting from wastes of any sort that was occurring inside the Buada Watershed was mapped. To this end, wrecked cars – 112 of them – a cadmium wastes dump, the municipal rubbish tip, mining equipment debris, and the Refugee Camp were all included in the survey.

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<sup>1</sup> Strategic Action Program for International Waters in the Pacific Islands Region, 1998: Table 5 page 39

## **Implementing Change**

A set of implementation plans has been provided in this report, and these compliment actual discussions that took place on a daily basis with key community members. The author spent many hours on daily with community members, and within the pilot area. Plans are provided for discrete elements that can be 'mixed and matched' dependant on available resources – both human and financial - to create a comprehensive plan. The elements provided must be themselves broken into sub-tasks; but to commence on detailed planning for implementation before the community makes decisions on where to start would be jumping the gun somewhat. In this light, there are no specific timeframes attached to the plans. This will come later. The Buada Community are a highly motivated and well-informed group of people who will have little trouble implementing this program outlined if they are assisted with the means to do so. They have already demonstrated a remarkable degree of self-motivation and activity, having already instigated community kitchen gardens amongst other things. Actual implementation will depend very much on resources available. The community itself – like most of Nauru – is suffering a slow economic collapse that is drawing down its household financial and physical capital. But this community has human capital in abundance, and is very well placed to implement the sort of low-cost solutions that the IWP project design envisages.

The plan elements recommended for implementation by this report fall under the general group headings below:

- **Public Awareness**
- **Utilise Organic wastes**
- **Extract resources from waste stream**
- **Compost toilets**
- **Household Waste Water**
- **Reverse Garbage Truck**
- **Scrap Metals**
- **Inorganic liquid wastes**
- **Rubbish Dump**

## **Part B: Legislation**

In the field of relevant legislation, there is little of substance that exists to deal with waste on Nauru. The only piece of legislation that would appear to specifically mention waste is a Litter Act, which is not enforced, and un-enforceable in practical terms as it provides for a fixed fine of \$300 for littering. Institutionally, the organisation doing most to address the Municipal Solid Waste issue, the Nauru Rehabilitation Corporation (NRC), does not appear to be specifically charged with the task. However, The NRC operates a very well run waste collection, with a well-motivated workforce and very well maintained equipment. This operation is a credit to the NRC managers who are struggling with difficult and adverse circumstances. The Buada Community is fortunate that two key members of the NRC team are active community members. There is a real need for legislative models to be made available to the Government to assist them in developing suitable frameworks to commence serious resource recovery from the waste stream. With the economy in crisis it is even more important to avoid loosing potential resources and income flows. A legislative review is in the IWP work plan, and this essential activity is marked down for August to October 2002.

## **Recycling**

There is some recycling of non-ferrous metals on Nauru, but it is at a very low level. There is potential to generate significant recycling activity, especially in the non-ferrous metals and PET plastic areas, but in order to really encourage recycling some institutional framework would be of great assistance to assist with collection processes. There is great potential to deal with some of the industrial waste, but realistically this work needs be done on a regional basis with other nearby small island states due to the high steel content of the waste and the low value and bulk shipping requirements of economic steel recycling.

### **Existing dump site**

The current dumpsite is located in an area that is certain to be adversely impacting Nauru's largest freshwater aquifer. It is uncontained and essentially uncontrolled. A new location, away from water sources, needs to be identified soon and an engineered dumpsite constructed. Building new dumpsites is of course an expensive business, especially when the economy and the government is cash strapped. However, this may prove sound economics when it is a large portion of the country's fresh water is at stake. Also, the quantities of materials ending up in a new dump need to be reduced in future, in order to maximise the value of the dump.

### **Recommendations**

- Ensure that every house has a Wheelie Bin for rubbish collection.
- Commence with developing a slogan – in the Nauruan language – for the protection of Buada Lagoon
- Define the area for protection within the ring road around the lagoon.
- Commence collecting recyclable materials: aluminium, and PET and HDPE plastics.
- Utilise potential water recycling sources from houses.
- Trial a home-made compost toilet alongside a commercial unit for comparison and development of local generic design.
- Set up a 'Reverse Garbage Truck': a place where excess materials and household goods can be exchanged between the community members
- Remove and process car wrecks.
- Commence a campaign to get a new, properly contained landfill constructed away from the aquifer and the Buada Community.

### **Conclusion**

The Buada community provide an excellent starting point to develop a comprehensive waste management system that views waste as a resource, and one that can be implemented nationally in Nauru. The information in this report, and the implementation pathways indicated, which have been produced in consultation with key community members, clearly shows the way ahead.



# 1 Introduction

## 1.1 Nauru Background<sup>2</sup>

The Republic of Nauru is a small isolated Central Pacific island lying some 26 miles south of the Equator at 166°55' East. Nauru is some 2,500 miles from Sydney, 2,600 from Honolulu and 3,000 miles from Tokyo. The total area of the island is 2,158 hectares.

Nauru, a raised atoll with a surrounding reef which is exposed at low tide, has a circumference of 12 miles and an area of just over 8 square miles. From a narrow coastal belt where most of the population reside, a plateau rises to some 70m above sea-level at its highest point. The plateau covers approximately four fifths of the land area, and contains valuable deposits of rock phosphate.

The weather is generally hot and humid tempered by occasional sea breezes, with a variable annual rainfall which averages 200cm (80 inches). Its vegetation on unmined lands includes coconut palms, the forest Tomano, figs, almonds, mangoes, wild cherry, pandanus and many smaller species.

The total population of Nauru numbers 10,065<sup>3</sup> people, of which around 6,800 are indigenous Nauruans. The remainder are temporary residents made up of expatriate contract workers and a sizable Chinese community.

## 1.2 Recent history of Nauru

Nauru existed as an independent island society until it was annexed by Germany in 1888 as part of the Marshall Islands Protectorate. In 1900 a British company discovered phosphate on the island and negotiated with Germany for mining rights. In November 1914 Nauru was seized by Australian troops and remained in British control until 1921. At the end of the war, when the German colonies were detached, a League of Nations C Class Mandate was granted to Australia, New Zealand and Great Britain. The three countries provided for an Administration and set up the British Phosphate Commissioners (BPC) to run the phosphate industry.

In 1940 Nauru was occupied by the Japanese and 1200 Nauruans were deported to Chuuk (Truk), in the Caroline Islands. Only 700 survivors returned after brutal treatment at the hands of the Japanese military. In 1947 the island was placed under United Nations Trusteeship and Australia resumed administration on behalf of the three partner governments: Australia, New Zealand and Great Britain.

Nauru became an independent republic on 31 January 1968.

## 1.3 Mining and its Effects

Over the past century, Nauru has generated wealth quite out of proportion to its size. The source of this wealth is high-grade phosphate rock, which has been mined since 1907. The phosphate rock on Nauru is among the highest grade in the world, with a typical percentage of 80% phosphate of lime. Rates of extraction were 0.5 to .75 million tonnes per annum. The Nauru Phosphate Corporation supplied phosphate to Australia and New Zealand, and small amounts to Korea, the Philippines and Indonesia.

The phosphate on Nauru has been laid down over millions of years in coral beds, which have risen above sea-level and subsided a number of times over millennia and which now lie atop cliffs rising 50 metres above sea-level. The phosphate has been laid down in between areas of coral so that when it is removed, tall coral pinnacles remain.

The Nauru Phosphate Corporation, a statutory corporation of the Republic, took over mining activities in June 1970, following Independence. In addition to mining phosphate, the NPC also performs community services such as the running of Nauru's desalination plant, which provides fresh water that

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<sup>2</sup> Source: Air Nauru [www.airnauru.com.au](http://www.airnauru.com.au)

<sup>3</sup> Nauru Bureau of Statistics, 2002 Census Data Sheet

previously had to be shipped from Australia. The island is fully electrified, power being supplied by diesel generators maintained by the Nauru Phosphate Corporation. There are over 12 miles of sealed road, consisting of a ring road and a road to Buada Lagoon some distance inland and the phosphate workings. A small narrow gauge railway serves the phosphate workings.

A wholly owned statutory corporation of the Republic, the Bank of Nauru provides banking services.

## **1.4 Current Situation**

Nauru is currently undergoing an economic crisis, which has severely impacted some basic infrastructure. Phosphate mining is operating at a very reduced level, with about 200,000 tonnes expected to be produced in 2003. Around 500,000 tonnes a year are required to keep the operation profitable. Some income comes from fishing licences, but in the main the economy is very short of cash. The Bank Of Nauru has no cash in the bank, and is unable to exchange money. Nauru Phosphate Corporation and government workers are paid infrequently, about 50% of the usual schedule, and then payments are only for a two-week period. Food stamps redeemable at some stores can be obtained, at a \$100 voucher per month. There was no petrol for sale during most of the time of this report, which was not unusual, and at these times the government operates a free bus service for workers so that they can get to work. Petrol shortages have been common for the last two years. Diesel vehicles are still on the road, and diesel is freely available at about \$1.05 per litre. Virtually all private petrol cars are parked, and if the situation persists, no doubt many of those vehicles will become moribund. Most houses have cars parked in their immediate environs, and many of those are wrecks.

When paid, workers are paid cash, but any overtime owed is generally paid as a cheque in the Bank of Nauru. Money cannot be drawn from the bank. Cheques can be cashed at certain businesses, but at a typical discount of 300%. Electricity bills can be paid by cheque, but electricity appears to be free again after a period when users were billed. In the past, electricity was free, and housing was provided free for Nauruans. The telephone system now only works between Yarren Govt. Offices and as far as the NPC offices to the north, and the Menen to the east, perhaps 5km of the south western quarter of the coastal strip. Most of the island is without telephones. Two public internet facilities exist, one in Yarren at RONTEL, and one at the Aiwo Civic Centre, Cenpac. The Government supermarket in the Civic Centre is virtually empty of any goods.

In general, it would appear that people are living off their existing wealth.

## **1.5 International Waters Program (IWP) Pilot Project<sup>4</sup>**

The objective of the coastal component of the IWP is specifically to address root causes of the degradation of international waters in coastal regions ‘through a program focused on improved integrated coastal and watershed management’. This is to be achieved through action at the community level to address priority environmental concerns within participating countries relating to:

- Marine and freshwater quality;
- Habitat modification and degradation; and
- Unsustainable use of living marine resources.

To address these concerns, the IWP has support the establishment of one pilot project or demonstration project in each of the 14 participating countries. Each pilot project will seek to strengthen capacity and provide lessons for best practice and appropriate methodologies for sustainable resource management and conservation in four focal areas relating to one or more of the following areas:

- Marine protected areas;
- Sustainable coastal fisheries;
- Protection of freshwater resources; and/or
- Community-based waste reduction.

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<sup>4</sup> Extracted from Stakeholder Consultations on Waste Issues in Nauru: IWP Stakeholder Briefing Workshop, Allan Bose & IWP PCU, December 2002

The focus on each pilot project is to promote increased community involvement and responsibility for local resource management and conservation initiatives. A pilot project is intended to be a small-scale issues-based project designed to demonstrate best practices and methodologies offering the greatest potential for replication across the region in future follow-up projects.

Implementation of the IWP in Nauru commenced in February 2002 with the signing of Memorandum of Understanding (MoU) between the Government of Nauru and SPREP. The MoU guides implementation of the IWP in each country and describes the obligations of the Government of Nauru and SPREP.

A pilot project under the IWP could have related to a variety of areas such as the preservation and conservation of freshwater resources, waste, fisheries and/or marine protected areas (MPA). To ease assessment and comparison of competing projects, it was proposed that one or more broad focal areas be selected as the target of an IWP pilot project.

The selection of a focal area for Nauru was achieved through a review of:

- Priority environmental concerns<sup>5</sup>(PEC) ; and
- Past, present and planned environmental activities.

The review of PEC for Nauru was conducted in August 2002 using existing documents that described key environmental problems and activities.

The review observed that the environmental concern most commonly noted in Nauru was waste management (or lack thereof). It noted that few activities had been undertaken in Nauru to address waste problems. The review therefore recommended that the focus of an IWP pilot project be community-based waste management. The recommendation was accepted by the National Environment Coordinating Committee (NECC) in early September 2002.

Before identifying a community to host a pilot project on community-based waste management, representatives from the Nauru community were invited to participate in activities to identify:

- Waste-related problems that might be addressed under an IWP pilot project; and
- Possible ideas for a pilot project to be implemented under the IWP at the local community or district level.

The activities were conducted during a one-day IWP briefing workshop and subsequent community consultations that were conducted in Nauru. The workshop was hosted by the IWP Lead Agency, the Department of Economic Development on Friday 29 November 2002<sup>6</sup>.

## **1.6 Scope of this Report: Terms of Reference (ToR)**

The author of this report was engaged to assist the IWP Nauru National Coordinator to:

- Review the profile of waste issues of Nauru specifically in relation to the community site of Buada;
- Consider the responsibilities for waste management in Nauru (legislation, policies, statutory bodies, etc) by literature review, consultation with key government and community stakeholders, including through problem analysis and other PRA exercises with particular reference to the Buada community;

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<sup>5</sup> Project Coordination Unit, SPREP 2002. Summary of Priority Environmental Concerns for Nauru. Report prepared by the Project Coordination Unit, International Waters Programme, SPREP and IWP National Coordinator, Nauru, for the International Waters Programme, August 2002.

<sup>6</sup> Stakeholder consultations on waste issues in Nauru: IWP stakeholder briefing workshop, December 2002; Allan Boase, Community Waste Management Specialist Golders Associates Pty Ltd.

- Assess the Buada community problem analysis and project mapping exercise for waste and waste management issues;
- Describe community options for addressing waste issues in Buada;
- Identify responsibilities and potential institutional arrangements for addressing waste issues in Buada; and
- Develop a Work Plan with community stakeholders for addressing Buada community waste issues.

## 1.7 Outline of Tasks Conducted

This report is the result of a three-week visit to Nauru between November 14<sup>th</sup> and December 5<sup>th</sup> 2003. This report is essentially of two parts: one assessing the current institutional arrangements for dealing with waste in Nauru, and the other concerning the Buada community Pilot Area: the existing situation regarding waste, and strategies to tackle these problems in the future.

The community consultations workshop report of December 2002 came to the conclusion that:

‘The waste composition for Nauru, both in general and for the communities interested in the pilot project are not currently well defined. Estimates from a reference report (Baines 1994) are out of date, given recent trends in consumption in Nauru...The success of any community-based waste management project in Nauru will rely on a comprehensive waste survey for the selected community.’<sup>7</sup>

As a consequence of that situation, the author conducted a household waste audit during his visit with 10% of Buada households. During this audit, four members of the Buada Community Committee were instructed in the methodology and materials knowledge required to repeat this exercise at a later date, in order to measure the community’s success in waste minimisation. This instruction required daily presence at the waste separation session. Also, the author reviewed available information regarding any activities or materials present in Buada Watershed that might be either polluting or have potential to pollute the water resources of the Buada Community.

It should be noted that the author is not a hydrologist, and the watershed area has not been specifically defined by a hydrologist. Also, the movement of surface waters across previously mined pinnacle areas is some thing that is not clear, given the very uneven nature of the land surface and the very porous nature of the limestone coral rock. However, given that limitation, and the mapping information available, assumptions as to the watershed area have been made. It is also worthy of note that much of the Buada Community sits on top of Nauru’s largest aquifer.

Information regarding the institutional situation of waste collection and regulation was obtained by reviewing literature provided by the NC Nauru, the Department of Justice, and interviews with people concerned in MSW management.

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<sup>7</sup> page 7, Stakeholder Consultations on Waste Issues in Nauru: IWP Stakeholder Briefing Workshop, Allan Bose & IWP PCU, December 2002

# Part A : IWP Community-Based Waste Reduction Project

## 2 Buada Community Pilot Project

### 2.1 Buada Watershed

The IWP Pilot Area of Buada had not been specifically defined prior to the development of this report. There is a government defined district of Buada; however, as the IWP is concerned with the issue of waste inasmuch as it impacts water sources, the Buada Watershed has been accepted as a *de facto* definition of the Pilot Project area by this author. The housing and infrastructure that exist within the government-defined District also exist within the watershed.

Government District is in white, with an outline of the watershed area in yellow. This map is for general representation purposes only and should not be regarded as a hydrological map. However, the ground image utilised<sup>8</sup> does indicate the general lie of the land. Roads are in black. Most inland roads except that around the lagoon are unpaved.

### 2.2 History of the Buada Community and the IWP Pilot Project

In the latter part of 2002, the community of Buada, Nauru's only inland village, with a lagoon at its centre, decided to take concrete steps to address the deepening economic crisis. Independently of the IWP they formed a committee of fifteen people from the community, and drew up a constitution with the aim of tackling the crisis around them and promoting self-reliance and sustainable development. The community erected a large billboard at the place where the road for the coast reaches the lagoon (see Appendix III) urging people to grow their own food, clean up the rubbish, and increase their self-sufficiency.

In September 2002 the IWP steering committee, the National Environmental Coordinating Committee (NECC) selected waste as the IWP focal area for Nauru, and the IWP in Nauru commenced the advertising for expressions of interest from communities willing to be considered as the focus of a Community-Based Waste Reduction Pilot Project. In November of 2002, the IWP conducted a workshop to inform prospective communities of the nature of the project, and analyse the issues concerning waste that the community at large saw as the problem. The full Expressions of Interest process was conducted during the first four months of 2003, with the Buada community being selected for the project in May 2003.

### 2.3 Waste issues identified by Buada Community

The following had been identified as priority waste issues by members of the Buada Community in the months leading up to the commencement in May 2003 of the Pilot Project in their community:

- Dump site selection;
- Rubbish dump leachates polluting lagoon;
- Backyard dumping;
- Septic clear out;
- Car dumping around lagoon area;
- Dumping on roads, especially cans/bottles/diapers etc;
- Oily groundwater;
- Water contamination from phosphate;
- Disposal of animal carcasses;
- Lagoon pollution;
- Small pig pens around/near houses;

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<sup>8</sup> Nauru GIS CD, © Nauru Rehabilitation Corporation. Use by kind permission of NRC

- Bush/backyard mechanics, and the uncontrolled dumping of waste oil;
- Rubbish burning;
- Scrap metal from old motors; and
- Use of water.

Residents have also been aware of the issue of the cadmium levels, the cadmium slimes dump, and whether these were a health risk. Mostly these issues were exposed during the workshop on 29<sup>th</sup> November 2002.

Manfred Depaune, Chair of the Buada Community Committee, in a meeting on 5<sup>th</sup> Dec 2002, also stated that the lagoon area is polluted with household waste, batteries and leachates from the tip. Dempsey Detanamo, a Buada resident and manager of waste collection at Nauru Rehabilitation Corporation (NRC), was consulted at a meeting on Friday 6<sup>th</sup> Dec 2002. His main concern was the impact of hydrocarbons on coastal aquifer, which was limiting its use for non-potable purposes such as showers and toilet flushing, both conventional practices in this area. Dempsey was quite concerned that leachates from the landfill were flowing into Buada Lagoon and these leachates created odour problems for houses on the southern slopes of this catchment.

### 3 Baseline information Collected as of October 2003

#### 3.1 Community output relating to waste

A workshop held at Buada Chapel Hall, Buada District, between the 16<sup>th</sup> to the 20<sup>th</sup> of June 2003 provided most of the information collected so far from Buada Community regarding their attitudes to waste. Data from this workshop, in the form of sheets produced by teams, and sheets produced by young people between the ages of 11 and 14, were provided to the author. These sheets indicate a very clear understanding of several essential points:

- Littering is not a good practise;
- Rubbish lying around is unhealthy as well as unsightly;
- The innumerable car wrecks are a pollution problem;
- Allowing oil – and other liquid wastes – to soak into the ground is very detrimental to the ground water, and then for the users of wells; and that compromises a resource for future use;
- That there is a prevalent culture of accepting the waste situation, even though there is a clear understanding that it is no good to carry on in that way: social pressure is not sufficient to modify behaviour, but one senses a large degree of frustration on the part of these young people that the current situation is socially acceptable; and
- They need more wheelie bins.

Some extracts from this information are included in Appendix III.

It is clear from this information, from the information detailed prior to the selection of Buada as the Pilot Community, and from subsequent discussions with community members over the three weeks – and many hours – spent in Buada, that the people on the whole have a very good grasp of the waste issues facing them. Any program to improve the situation must start from this point, and **not** start from the assumption that people do not realise that all this garbage lying around the place – in its various forms – is a problem. Motivation to tackle the problem must be a singularly important element of any attempts to address the issues of waste.

Feelings of institutional impotence preventing the individual from helping themselves are strong. The demise of some government services has affected everyone, especially in a society where the government has for the last thirty years provided free housing, water, electricity, education, and virtually guaranteed employment.

#### 3.2 Hydrological and Mapping Information Concerning Buada

An extensive study of Nauru was conducted as apart of the Nauru Rehabilitation and Development Feasibility Study of 1994 (NRDFS). A hydrologist by name of Jacobson conducted studies in both 1987<sup>9</sup> and 1994<sup>10</sup> with the groundwater resources of Nauru as a primary focus. A Hydrological map was included in the NRDFS, and that is reproduced below for reference, as Map 1. Bore holes and depth probes were used to try and determine the size of the ground water resources. It can be seen from the map that Buada contains Nauru's largest freshwater resource, as an aquifer. Tony Falkland tested the freshwater resources at Buada and at coastal wells in late 2002, and his results were that the freshwater resources were within WHO Guidelines for salinity in drinking water<sup>11</sup>. In the same communication he states that he has not tested for bacterial contamination, and recommends that this be

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<sup>9</sup> Jacobson, G. and Hill, P.J. (1987). *Hydrogeology and Groundwater Resources of Nauru: Preliminary Results of Investigation. Professional Opinion, Commission of Inquiry.*

<sup>10</sup> Jacobson G. (1994). *Groundwater For Irrigation and Water Supply Needs, Report as part of The Nauru-Australia Rehabilitation Study, AIDAB. 3pp. Also see: Ghassemi, F., Jakeman, A.J., and Jacobson, G. (1990). Mathematical modelling of sea water intrusion, Nauru Island. Hydrological Processes, vol. 4, pp 269-281.*

<sup>11</sup> Email from Tony Falkland to Joseph Cain, Sec. for Economic Development, 5/11/02.

done to establish the potential utility of the resource. A WHO Mission Report of Dr. Ian Wallis of October 2001 recommends a thorough study of groundwater to determine safe yields during times of drought, and water quality. Nauru was in severe drought from 1998 to 2001.

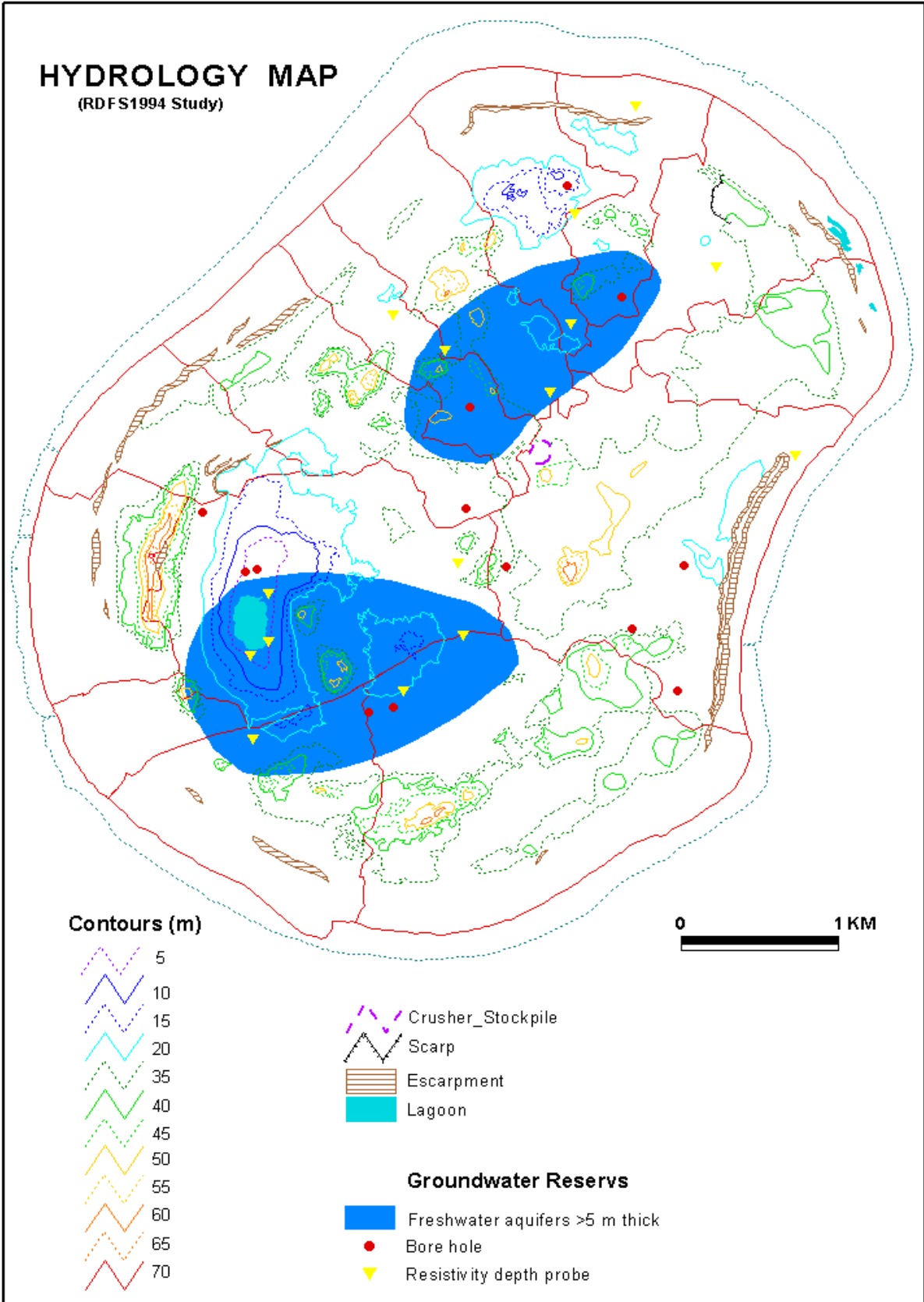
Given that the desalination plant at the Nauru Phosphate Corporation (NPC) has only just recommenced operation, and it is aged and unlikely to be operational for many more years; and given the cost of importing water, it is very likely that sooner or later the aquifers will be tapped more systematically.

The conclusion of the hydrologist Jacobsen regarding the nature of the Buada Aquifer and lagoon, was that the lagoon was a 'Perched' water body<sup>12</sup>: 'This body of water is defined as a "perched water table", which means it is a small body of water perched **above**, and not connected to the groundwater which underlies the island as a whole.' There are many wells amongst the housing at Buada, some are illustrated on Map 2 (though this map does not claim to include all wells by any means). Some wells were observed by the author to be very shallow. It may be that some of the shallow wells are tapping into the 'perched' water, whilst the deeper wells dug by the government are reaching the aquifer. This last is speculation, but needs looking into. The comments of some young people who attended the workshop at Buada in July indicate that some of them may be living in houses using contaminated wells. It may also be the case that some wells have been colonised by a type of bacteria that results in the well water smelling of rotten eggs, a common problem in Tarawa, Kiribati.

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<sup>12</sup> Nauru Rehabilitation and Development Feasibility Study, from 'Nauru GIS CD'; section 4.2.3 Environment Component Report, Part A.





## **4 Household Waste Survey**

### **4.1 Collecting the waste**

A survey of the household waste stream of a representative selection of Buada households was held between Saturday 22<sup>nd</sup> November and Monday 1<sup>st</sup> December. Eleven households took part, as the Community had advised the garbologist that there were 110 households in Buada, so eleven would be a sample of 10%. Eight garbage bags were given out on the Saturday morning, and all the houses visited by the garbologist and two Committee members. The householders were asked to put each day's household rubbish into a single bag, starting that morning. Bags would be picked up each day at about 9.30 am, except on Sundays, as it was not appropriate. The survey finished Monday morning, effectively amounting to eight days, to allow a better picture of a week's rubbish output. Also, this approach allowed some 'settling down' at the start of the survey, as participants may take a day or two to adjust to the survey routine.

### **4.2 Methodology**

The bags were numbered as they were collected each morning, according to household. On arrival at the sorting station, they were weighed and noted. The number of children and adults in each household had previously been noted. Bags were then picked at random, with two or three bags tipped out together so that it was not known which rubbish came from which house to keep some privacy. The materials were sorted into the following categories:

eight different types of plastic; six different types of metals; rubber; shoes; disposable nappies; glass bottles; plate glass; fabrics; alkaline batteries; Tetrapak; organics; five different types of paper product; leather; lead-acid batteries; household consumer and electrical items; ceramics; other mixed odds. A total of twenty eight different categories of materials were found. Some materials, such as copper and brass, were on the recording sheets, but were not found.

The materials were sorted into category on a concrete slab, and then after all the bags had been sorted, each category of materials was weighed and bagged. Some materials had very low weights, and ideally a separate small scale could have been used. However, by amalgamating all the materials over a week, the low weights became greater and were easier to measure. Estimates were made for some materials of very low weight; aluminium cans were counted and weight calculated, as they are such a valuable component of the waste stream, and of virtual uniform size – 375ml, or 17.2g

All bagged materials were kept - some on a toddy platform to keep away the dogs and pigs – and were reweighed at the end of the week to check weights so as to minimise collective weighing errors. The week's materials were then shown to the Buada Committee on Monday evening, so that they would have a clear idea of how much garbage 10% of their community households would make in a week. Simple arithmetic shows that ten times this amount would be a week's worth for the whole community, and then fifty times that would be a year's household rubbish. Such a graphic illustration is very useful to grasp the scale of the problem.

### 4.3 Overall Results

Data is outlined in the tables below. Totals are for one week, adjusted. Full tables of raw data are in Appendix I. Numbers are rounded. The essential elements from these data are listed below:

- Household waste generation is **62 kg/capita/year**;
- The lowest rate of waste production was 0.69 kg/p/wk which is 99g/person/day;
- The highest rate was house No.10 at 6.04 kg/p/wk which is 863g/person/day;
- That is 114 kgs/day for Buada community;
- 41,600 kgs/year total for Buada community;
- Approximately 7,300 garbage bags per year;
- Total collected as weighed at end of survey = 206 kgs;
- Variance in measurement: +or- 3%;
- A total of 117 people were surveyed: 57 Adults and 60 Children; and
- Of a 2002 census population of 673 they comprise 17% of Buada population.

Raw data treated crudely indicates the waste production rate is 1.66 kgs/person/week. However, it was clear from the data and the actual daily survey that some waste was not produced within the last two days, so if these anomalous data are excluded, and provision is taken for missed days and new calculations are made, then a figure for household waste generation is: 59.8kg/person/year, or 1.15 kgs/person/week, or 164g/person/day.

Looking at the figures, this is a realistic average for waste production in the home in Buada. The highest house rate is significantly higher than the others, and it was clear during the survey that not all the rubbish provided for the survey from that house was made that day. (Raw data is available at Appendix I). The house producing high waste rates did contribute to the survey in adding to volume for defining the materials in the waste stream, as the waste was still very representative of the household waste stream. The lowest rate of waste production was house No. 2 at 0.69 kg/p/wk which is 99g/person/day. The highest rate was house No.10 at 6.04 kg/p/wk which is 863g/person/day.

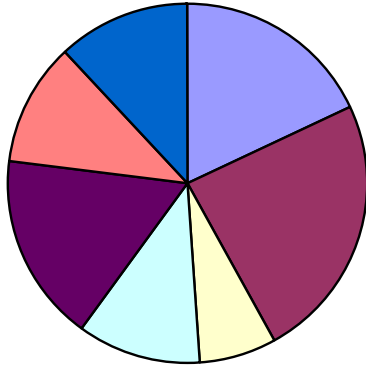
If we accept a rate of 0.17 kgs/person/day, which is a rounded up figure to give a conservative larger estimate, and multiply this by 673 people = 114 kgs/day for Buada population. Multiply by 365, and we get 41,600 kgs/year for Buada; close to 42 tonnes. The waste collected in the survey fitted into 36 garbage bags and amounted to 206 kgs of waste. That would make about 7,300 garbage bags per year for Buada Household Waste production. (Note that these figures are only for materials that would be put out in garbage bins for collection, and 'Garbage Bag' is an imprecise – yet useful- measure!)

### 4.4 Results by materials breakdown

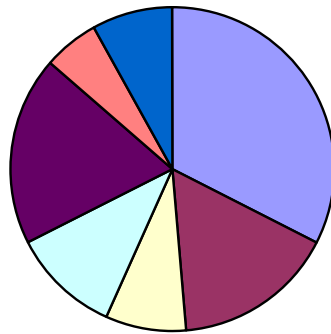
Materials breakdown can be seen below. Materials marked **R** are either already being recycled or may be worth looking at to recycle in quantity. Cardboard cartons are readily recyclable, but not present in the household waste stream in Nauru in the quantities required. These would best be sourced via commercial outlets. Thin cardboard is present in some quantity. These comments do not address the economics of recycling, which are very dependant on factors not under investigation in this report. Aluminium cans are already being recycled in Nauru, and PET plastic bottles – No.1 – are present in quantity, and easily recycled. Experience of Tarawa, Kiribati, where this sort of analysis has been done, indicates that the economic framework set through legislation (for example Container Deposit systems) is crucial in determining viability of different materials for recycling.

Figures have been rounded. Volume figures are estimated from actual amounts produced during the survey, and should be considered as indicative only, as volumes were not scientifically measured.

**4.4.1 Total Household Garbage  
by Weight**

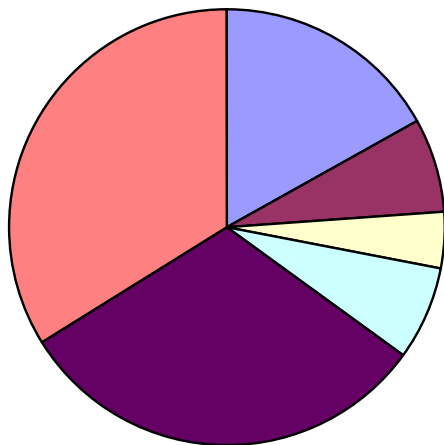


**4.4.2 Total Household Garbage  
by Volume**



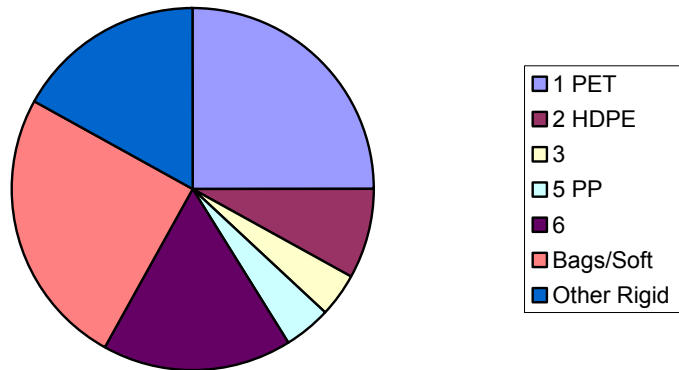
- Plastics
- Metals
- Paper
- Organics
- Other
- Glass
- Nappies

**4.4.3 Plastics: by weight**

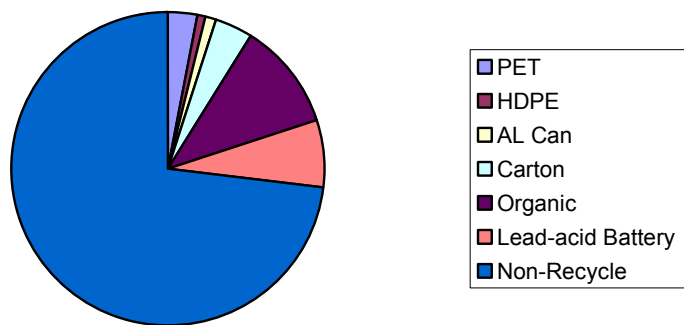


- 1 PET
- 2 HDPE
- 5 PP
- 6
- Bags/Soft
- Other Rigid

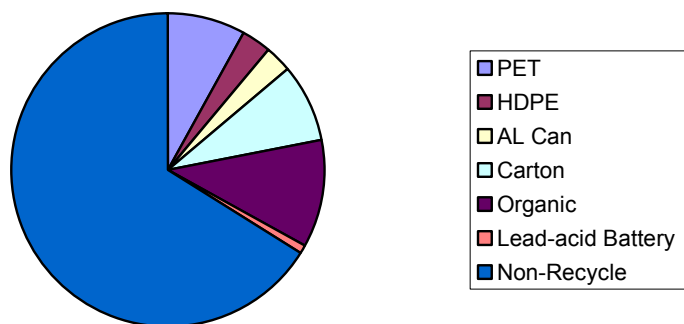
#### 4.4.4 Plastics: by volume



#### 4.4.5 Recyclable: by weight



#### 4.4.6 Recyclable: by volume



## Tables 4.1 to 4.5

Of significant note is that plastics are a very high proportion of the waste at 18%, (about one third by volume) and that PET bottles are a significant part of that volume. No.6 plastic is meat trays, Styrofoam takeaway food boxes and disposable plates, and that too is significant in volume. Also plastic bags and wrappers are great in both number and volume. 'Rigid plastic' includes mostly small plastic items like old pens, odd small household items, and pieces of unmarked packaging. But in this survey it also included some large items such as toys.

Tin cans for food are also significant at over 18% of the total. A comment made by one of the trainee garbologists was that this was because many people were eating from tins because of the constant power blackouts, and nearly everyone had an electric cooker. Disposable nappies are very significant too, at 12% of the total.

**Table 4.1 Household waste production during survey**

House Number	1	2	3	4	5	6	7	8	9	10	11
Adults	4	6	5	7	9	4	5	5	2	8	2
Children	6	4	2	5	8	13	5	6	3	4	4
Total Weight	16.7	6.9	7.8	16.2	27.1	13.9	16.2	10.8	16.6	82.8 anomaly	6.8

**Table 4.2 Plastics by number type and generic group**

Plastic Type no. 18% by wt	1 R PET	2 R HDPE	3	4	5 PP	6	Bags Inc. soft plastics	Other Rigid Plastic
Total kg	6.5	2.4	0.3	0.1	1.6	2.6	11.6	12.5
37.6	<b>3 bags</b>	<b>1 bag</b>			<b>½ bag</b>	<b>2 bags</b>	<b>3 bags</b>	<b>2 bags</b>
% by wt	17%	7%	0.1%	N/A	4%	7%	31%	34%
% by vol	25%	8%	4%		4%	17%	25%	17%

**Table 4.3 All metals by material**

Metals 24% by weight	Al Can R	Al foil	Stainless Steel	Steel Can R	Other steel R
Total kg	2.3	0.7	1	38.1	6.9
	<b>1 bag</b>			<b>4 bags</b>	

**Table 4.4 Paper products by type**

Paper Product 7% by wt.	White Paper	Thin board R	Carton I carton full	Magazine	Other Inc. books
Total kg	0.7	6.7	2.2	1.1	0.7
		<b>2 bags</b>			

**Table 4.5 Common items usually present in quantity**

Common Items 36% by wt.	Nappies 12%	Glass 11%	Alkaline Battery	Tetrapak	Organics R 11%
Total kg	24	23.2	3.0	1.1	23.4
	<b>3 bags</b>				<b>4 bags</b>

**Table 4.6 Other items**

Others 15%	Other Mixed odds	Lead-Acid Battery R	Household Electrical/Consumer
Total kg	4.3	14.9	6.9
	<b>1 bag</b>		

## 4.5 Training of Buada Garbologists

During the course of the survey, four of the Buada Community Committee volunteered to assist. Over the course of the survey all were trained in identifying materials in the waste stream, their recyclability, and how to sort materials to groups and record the data. All four performed very well, and could competently conduct a further survey at a later date to measure progress in reducing waste. Also, because the exercise was repeated over several days, this was more effective than a formal one-day workshop. At the end of the survey, the trainees were tested by themselves conducting the sorting, whilst the author observed and provided guidance when required. By this process, a far greater insight into the Buada household waste stream was gained by the community.

There was a request from the community Project Development Team (PDT) that those participating in the survey be given some tangible recognition of their week-long workshop in practical garbology, so as a result each of the four participating trainee Garbologists were presented with a certificate at a dinner on the evening of December 3<sup>rd</sup> 2003.

## 5 Identification of Point sources of Pollution

Watershed protection is a crucial component of the IWP. Thus an attempt was made to identify any relevant information relating to all possible point sources of pollution within the Buada watershed. This required a review of available written literature, and detailed questioning of Buada residents, as well as field visits to suspect sites.

### 5.1 Car Wreck survey

One of the most obvious sources of pollution to the waters of Buada is the large number of wrecked vehicles that are in the area. Cars no longer suitable for use on the road and other discarded vehicles are increasingly a serious problem globally, and particularly in small islands. Buada is no exception. It can be expected that, on average, each vehicle contains approximately 5 litres of oil, plus perhaps two litres of other toxic fluids, such as brake and clutch fluid, gear oils, and automatic transmission fluids<sup>13</sup>. In order to determine the scale of the problem that appeared from casual observation to be important, a survey of the Buada Community housing area was conducted on Saturday 29<sup>th</sup> of November 2003. Large scale maps were printed from available Geographic Information System (GIS) data, and used as data input sheets. The author in conjunction with a fruit fly bait station dispersion program that was carried out by community volunteers that day conducted the actual survey. The fruit fly program required a systematic coverage of the housing area and immediate environs, on foot. The survey took six hours to cover the area.

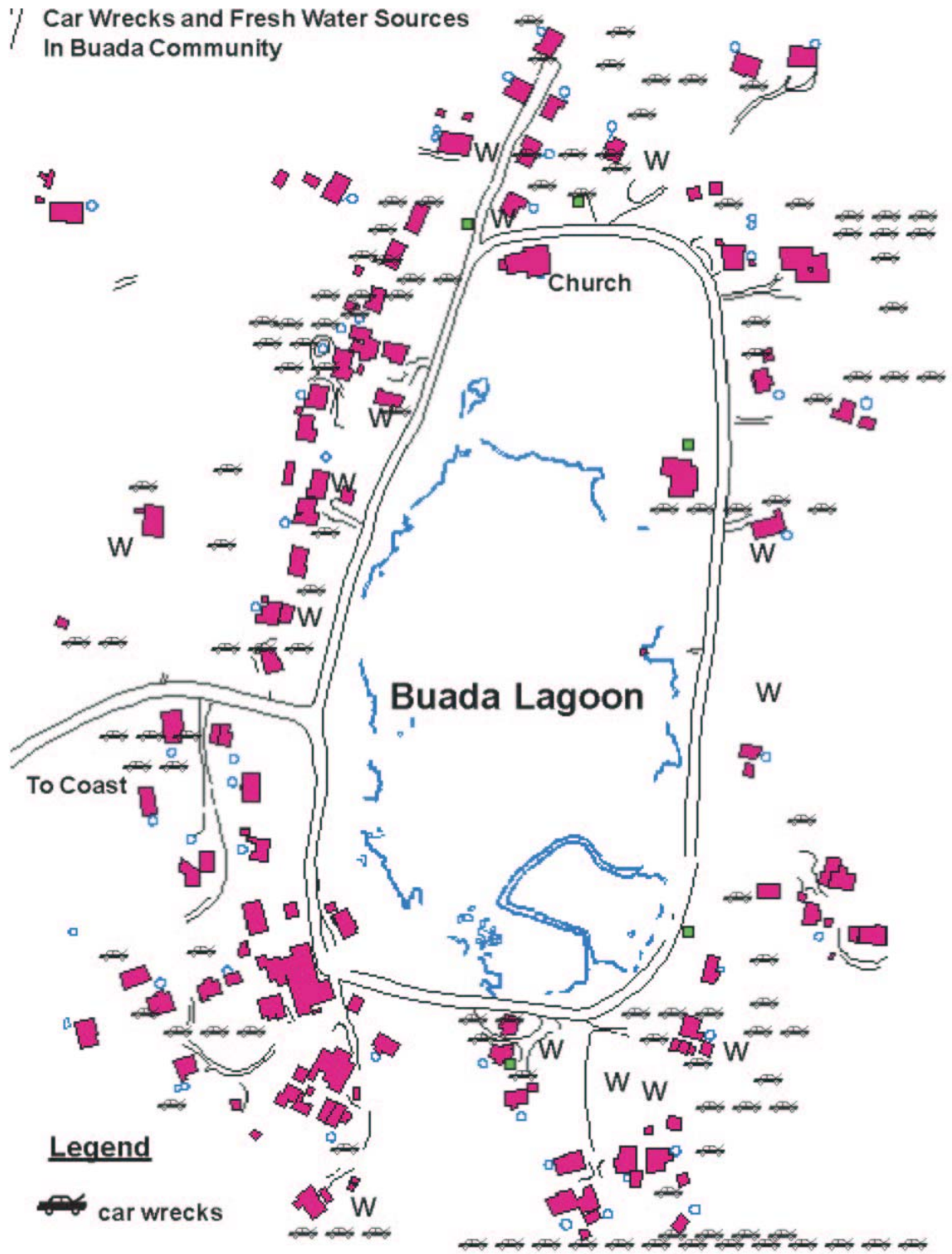
The results can be seen in **Map 2**. One hundred and twelve vehicles were identified. That amounts to more than one per household. Most are on the map, but some were identified off the map area. Vehicles within about 30m of the map boundary are included. It should be noted that because of scale and electronic map marking issues, vehicles may not be exactly where the cars on the map appear to be. However, the map gives a good representation, with most cases being within 20m of the map mark. The raw data sheets, marked with a pen, remain with the IWP Nauru NC, and give a very precise location of vehicles mapped.

Two piles of discarded lead-acid batteries were found during this survey, in undergrowth locations. One of these piles composed of sixteen batteries, some of a large truck type of 100 to 120 amp/hrs size. This single pile could easily contain over 200 kgs of lead, which is lying in the open, uncontained, within 30m of the lagoon.

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<sup>13</sup> Author's personal experience in automotive maintenance procedures.

Map 2





## 5.2 Cadmium source<sup>14</sup>

A source of filter sludges very high in cadmium is located high along the edge of the watershed to the North West of the lagoon. Cadmium is heavy metal which is well documented as having many adverse health effects above certain levels.<sup>15</sup> This material was collected from filters used when a certain product of Phosphate was being sold to the Japanese market. The Japanese required a low cadmium content, and Nauru phosphates are very high in cadmium. To provide a suitable product, the mined cadmium was heated to a much higher temperature than usually used for drying. This temperature was so high that the process actually burned the cadmium out of the phosphate. The cadmium ended up in the scrubber dusts, and there was wetted with seawater for removal. The resulting sludges were dumped into a pit adjacent to the railway line and to the east of the north end of Command Ridge. This activity lasted for several years, and ceased around about 1990. Information relating to the cadmium is available in the NRDFS report of 1994. That report states:

‘Analyses of cadmium levels in the slimes dam, undertaken on samples collected only a couple of years after the last cadmium rich sludge had been deposited, revealed a highest level of 544,000 ppb (Blake, 1992). This is about a quarter of the cadmium level of the waste at the time it was pumped into the slimes dam. How is the difference to be explained? If there has been a movement of cadmium out of the slimes dam, then where has it gone? Is this cadmium in a chemical form, which is readily taken up by plants, or is it in a form, which is not readily soluble and, so, does not move easily through the environment? Answers to these important questions are not available. Further research is needed to find answers.’<sup>16</sup>

The NRDFS study also stated that it was known that cadmium was chemically fixed in alkaline soils<sup>17</sup>. Discussions with the agronomist who is training the refugees in the refugee camp how to make gardens indicated that the soil was very alkaline, as he said that he had tested the soil and found it to be so<sup>18</sup>.

It would appear that no further research has been done. However, the author and members of the Buada community visited the Cadmium slimes dump on Tuesday the 25<sup>th</sup> November 2003. The dump is in a pit that appears to be closed on all sides. GIS data states it to be 0.66 hectares in size.<sup>19</sup> One side of the pit is provided by the railway line embankment; in fact the railway is between the dump and the lagoon. Much undergrowth was in evidence: the remains of the tipping ramp can be seen overgrown. Next to the pit was a large Tomano tree that the locals said could not be more than 15 years old as the area was bare during the dumping period. The tree was estimated 7 – 9 metres high. The author and a community member descended through the undergrowth to the floor of the pit. The floor was very flat, with some vegetation, but not a lot. The ‘soil’ in the bottom was damp but firm – in spite of recent heavy rain – but very dark, with almost the consistency of very old, deep, rust. Casual observation of the situation would suggest that water must drain through the material very easily. Also, as the slimes are so flat, the materials must have been very fluid when dumped. The bush plants surrounding the pit do not appear to have been adversely impacted by the presence of the cadmium. To the North is a stand of large Casuarina trees. Nauru soils typically have about ten times as much cadmium than is average for other parts of the world.

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<sup>14</sup> See also Blake, C., 1991. A study of heavy metals in marine organisms and sediment from the island of Nauru, Central Pacific. Unpublished report submitted in partial fulfilment of the requirements for the degree of B.App.Sci., University of New England, Northern Rivers, Australia. Blake, C., 1992. Environmental distribution of heavy metals on Nauru, Central Pacific, and possible relationships to human health. Unpublished report submitted in partial fulfilment of the requirements for the degree of B.App.Sci.(Hons), University of New England, Northern Rivers, Australia.

<sup>15</sup> [www.who.org](http://www.who.org)

<sup>16</sup> Nauru Rehabilitation and Development Feasibility Study, from ‘Nauru GIS CD’; section 3.1.2 Environment Component Report, Part A.

<sup>17</sup> *ibid*

<sup>18</sup> Pers comm. Mr. Mir Frahmand, IOM Liaison Officer, Nauru IOM Refugee Camp, 3 December 2003.

<sup>19</sup> Nauru GIS CD, 94 Mining History layer.

The NRDFS recommends testing the Buada Lagoon sediments to see if cadmium pollution is a problem. No information was available to see if this has been done. This should be done to help determine what is happening with this cadmium deposit.

### **5.3 Nauru Rubbish Tip**

The main Nauru rubbish tip is situated inside Buada Watershed, at the head of a gully to the south of the lagoon. Rubbish is dumped in a largely unregulated manner, and there does not appear to be any engineered containment. The base of the dump was not accessible as the base is in an area of mined pinnacles, which is very difficult country to walk across. Whilst the dump can be clearly seen to be 'upstream' of the Buada Lagoon, the presence of the intervening mined pinnacle area also means that it is difficult for water to run across it. The water body that is most likely at risk of this uncontained dump is likely the Buada Aquifer, which is Nauru's largest body of fresh water. (See Map 1) Clearly, an engineered landfill is required for Nauru, one that is not on top of an aquifer. The current dump also appears to have very limited application of soil cover at suitable intervals.

The NRDFS of 1994 has this to say regarding pollution of ground water by the rubbish dump:<sup>20</sup>

'The current system of MSW disposal provides no protection of the groundwater resource which underlies the landfill. Jacobson's hydro geological report for the rehabilitation study (1994:1) identifies 4-5m thick fresh groundwater layer in two zones on the island. As described by Jacobson in his technical presentation on 1.7.94, there is a potentially exploitable zone which circumscribes these two deeper zones and covers approximately 50% of the island area'.

'The extent to which this groundwater would be contaminated by the landfill may be approximate as follows. The groundwater flows in radial directions from the centre of the island (Jacobson pers comm, 1994). During periods of plentiful rain, this radial flow would divert leachate, which had percolated into the groundwater system in a direction away from the zone of potentially exploitable groundwater by advection. That is, leachate would flow beneath the coastal fringe and out through the reef to be diluted by the highly buffered seawater. During extended drought periods, where percolation to the groundwater had slowed considerably or even ceased, there would be the possibility for dispersion processes to occur. The presence of large fissures would facilitate rapid dispersion rates and leachate contaminants may migrate into the exploitable zone.'

### **5.4 Refugee Camp**

#### **5.4.1 Location of the camp**

Analysis of GIS data and a contour map borrowed from the Lands Survey Office had showed that the refugee camp was inside the Buada watershed. Hydrological data also showed that the camp was sitting right above the Buada Aquifer, the largest aquifer on Nauru. Thus, the refuge camp was an issue for the Buada Pilot Project in that it has the potential to affect the water bodies that the project seeks to protect.

On 2<sup>nd</sup> December the author and the National Coordinator (NC) met with the head of the International Organisation of Migration (IOM) mission, Si Winter, which runs the camp. A presentation was made using computer GIS data representations to indicate the relative locations of the aquifer, the camp, and the Buada watershed. Discussion then ensued regarding the waste generated from the camp.

Mr. Winter explained that originally, human liquid waste had been stored in holding tanks, and then trucked several times a day to the NPC coastal area where it had been pumped into the ocean through the sewage system. This system has been replaced by a sewage system that treats the waste before allowing excess water to trickle out into the pinnacles next to the camp. There were about 250 refugees

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<sup>20</sup> Nauru Rehabilitation and Development Feasibility Study, from 'Nauru GIS CD'; Environment Component Report, Part B section 2.2.2

in the camp, with about 220 staff also there on a daily basis. Around 500 people in total, although staff live off site in the hotel. This system had been installed after advice from consultants, and was regularly serviced by the installer. The system was set up so that the liquid produced could be taken away in a tanker and used on suitable land as fertilizer, which is not currently the case.

#### **5.4.2 Camp refuse**

The issue of recycling was discussed. The author had already noted that the camp produced a large quantity of PET water bottles; Mr. Winter responded that each person involved in the camp drank an average of 6 bottles of water per day. That would be around 3,000 a day total, or over a million a year. This is a quantity that is easily recyclable, and could complement efforts to capture PET from Buada's waste stream. One 600ml bottle (the size used at IOM) with no cap weighs 24g. Thus 1 million bottles = 24,000kg, or potentially in the order of 20 tonnes per year of PET (worth \$300/tonne in Brisbane). The camp produces few aluminium cans, but a large number of cardboard boxes, which could either be pressed, packed and shipped for recycling, or some can be used locally for banana circles and small gardens. In this instance, cardboard is laid on the ground and wetted with water. Larger stones can be placed around the edge, with a layer of smaller stones on inside. Soil is then put on top of this to make small garden beds. The cardboard acts to retain moisture in these fast-draining soils. This technique has also been used in the camp nursery. The camp also uses paper plates, after previously using Styrofoam, and plastic knives and forks. A large quantity of this material is visible in the dump, and it is also very mobile as a source of litter.

#### **5.4.3 Camp waste water**

The next day, 3<sup>rd</sup> December, the trained garbologists from Buada, the NC and the author visited IOM refugee camp, guided by Mir Frahmand, an Afghani agronomist. The camp is on a plateau of unmined material that used to be the sports ground. In area it is approximately two football fields. The camp has gardens that have been created by the refugees, where pawpaw, cassava, kumara, banana, ochry spinach are grown. Compost making was undertaken in a system of five bins, turned once a week initially, then every three weeks, so that in twelve weeks they get good compost. These activities are very complimentary to the work conducted by the Buada community in the area of organic resources. It has three waste water streams:

- *Grey water* from the kitchen goes through a large grease trap and water goes over the edge of the plateau in a fairly rudimentary system;
- *Grey water* wash-house water goes out through a similar system, without the grease trap and ;
- *Blackwater* sewage treatment goes through a system of about ten tanks: Biofilters, clarifiers, sludge thickening, storage; then excess water runs out into the pinnacles, over the edge of the plateau. The sludge tank is still filling.

This water could be recovered and used for irrigation of some plants, which would in effect treat the water. If the plant crop was not directly useful, it could be used to make some compost materials along the lines of silage making. At the moment it is potentially a source of contamination to the aquifer as the ground is so porous. The camp plateau is at the 25 m contour, with heights reaching 27m on the plateau. The water is going over the edge of the plateau, and the area immediately surrounding the plateau is at the 20m contour. Thus any water going down maybe going through 20m of coral and phosphate. It may of course be seeping down cracks into the aquifer. Whether this waste water flow is contaminating the aquifer is a question the author of this report is neither qualified nor equipped to answer. However, given the usual steps to protect underground water sources in atoll environments, it is a question that would deserve further study, and a precautionary approach would be wise.

The camp management is very open to the idea of capturing the waste water resource, and prepared to materially assist good proposals to deal with this. This is an area where Buada Community could potentially capture a very useful resource, or at least some of it.

## 5.5 Nauru Phosphate Corporation Machinery Dumps

Areas where disused and broken mining equipment and company vehicles can be found are at two locations on the west side of the Buada watershed. One is to the north of the road to the coast, to the west of the railway line as it skirts the side of Command Ridge; and the other is opposite, to the south of the road to the coast. These dumps contain various items of old vehicles and mining machines. The main pollution sources here are likely to be lead from batteries, and oils contained within machines and engines. These dumps are used as a resource by the NPC mechanics, but there is no containment, or attempt to be systematic about what is there. Equipment is dumped along the sides of the tracks.

## 5.6 Nauru Phosphate Corporation Workshops

The NPC has a large workshop area at the head of the railway line, where phosphate is loaded onto the train cars. The workshops have been at this location since the 1960s. The workshops are about 200m from the loader, and are big enough to drive very large mining equipment into them. Lots of disused, wrecked machinery can be seen lying around outside. Ground oil contamination around the diesel fuel pump has permanently discoloured the ground. In the workshop area, the ground is black from oil; also, where the railway track enters the workshop for train maintenance there is much soaked oil in the ground evident. A pile of 200 litre drums was observed to be very rotten and spilling what appeared to be old bitumen onto the ground. Lots of old machinery is observable in the surrounding bush.

This area, whilst in the Buada watershed, and clearly leaking much hydrocarbon-based liquids into the ground, is not over an aquifer. It is also separated from the Buada lagoon by a large area of pinnacles from previous mining, and some higher country. Thus it may not pose an immediate threat to the Buada water bodies; nevertheless, attention to prevent hydrocarbons leaking into the soil and the coral rock of Nauru would be a useful course of action to take.

## 5.7 Backyard Rubbish Burning

On the evening of the 19<sup>th</sup> November the author met with 20 members of the Buada community at Manfred Depaune's house. The group proceeded to a nearby bonfire, already noted by the author, where household rubbish is regularly burnt. The author indicated the topographical position of the fireplace, and its potential to pollute the water body of the lagoon:

- Lagoon only 20 metres away;
- Lagoon downhill of fireplace;
- Track of surface water flows around the immediate surroundings – visible from heavy rain a few nights before;
- Clear spread of light rubbish items downhill of the fire site; and
- The piling of rubbish on a daily basis prior to burning allows plenty of time for pigs and dogs to root around and spread the rubbish.

The group then looked at what the process of burning the rubbish does. The author indicated the ash under the unburnt materials as an extremely mobile form of pollution, being light and soluble. Ash can contain heavy metals, and also chemicals produced in the burning process. Chlorinated compounds, such as PVC, when burnt with organic compounds at temperatures around 700 – 900 degrees centigrade will produce organochlorins belonging to the families of Dioxins and Furans. Dioxins are subject to the UN Stockholm Treaty of 2002 (commonly called the POPs Treaty – Persistent Organic Pollutants), which is promoting worldwide elimination of these chemicals. Dioxins are extremely toxic, and have a range of very unpleasant effects on human and environmental health. Items identified in the burnt rubbish included PVC and old alkaline cell batteries, many of which may still contain mercury along with other heavy metals, especially the cheaper varieties from Asia.

This was discussed, along with the theme that whilst burning rubbish might look like it is getting rid of the problem, it is really only hiding it. In fact, it is turning the pollution into a highly mobile form. With a body of water so close, that body will become polluted easily by this activity. The fact that the

group only had to walk 20 metres to find a suitable site for demonstrating this problem is indicative in itself of the widespread nature of this practise.

## **6 Other Activities During the Visit**

### **6.1 Community Relationship with Consultant**

The author provided community assistance by supplying to each household participating in the survey with a copy of the waste handbook 'Rubbish No More'. He also supplied a copy of 'Energy From Nature' to the committee, detailing renewable energy options, and also containing a design for a compost toilet. Daily contact with members of the community allowed regular access by community members to the author's knowledge base: information on POPs chemicals, Zero Waste strategies and renewable energies was supplied to complement the directly waste related information. A solar powered hand torch was also donated to the community to indicate options to minimise pollution from alkaline cell batteries.

An engineering drawing for the construction of a recycling collection point was supplied to Community members who work for the NRC. Three wool sacks, to go inside a collection point, were also provided, along with a picture of a similar collection point in Tarawa, Kiribati.

The community in return were extremely helpful to the consultant, supplying transport, assistance and information regarding local pollution hot spots, as well as accompaniment on field trips, on a daily basis. Lunch with community members occurred on several occasions, as well as some after hours socialising, all helping to cement interactions.

Assistance during the day-long car wreck survey was also invaluable, as it would not be realistic for a visitor to go alone over community members' lands without someone local in attendance.

In all, the Buada community prove to be a well informed, highly motivated group of people, who were extremely welcoming and forthcoming to the visitor in their midst.

### **6.2 Building a Banana Circle**

On the evening of the 18<sup>th</sup> November the author visited Buada Community at a pre arranged event to demonstrate the construction of a Banana Circle as a simple way of utilising organic materials produced on a daily basis, such as from sweeping up around the house. Over thirty people attended the demonstration.

A hole was dug about 2m across and 1m deep. Cardboard boxes were flattened and spread around the insides of the hole. Any organic materials immediately available was then piled into the hole, and watered, the pile built up to about 1m above ground. Banana suckers were then planted around the edge of the hole, 4 in all, in holes with a bit of compost to help give them a start. These plants were also watered. In time, the organic materials in the hole decompose, and feed the bananas. Papaya is also suitable for planting around the edge. The consultant encouraged the community to experiment with the concept and see if other plants could do well around the edge in a Nauruan environment.

### **6.3 Household Waste Water**

One of the Buada Committee member's houses was also used as a demonstration for simple reuse of household waste water. The kitchen sink drain pipe on Mrs. Kareen Karl's house had been blocked for some time, and the water spilled out onto the ground. A piece of pipe, found lying on an old Land Rover in her back yard, was cut and modified so that the sink waste water could be collected into a bucket. This could then be used to water vegetables within 5 m of the sink. This particular house is on the side of a hill, and the garden is above the sink; but many houses would have gardens below the sink, and a piece of pipe – or a hose - can be used to directly water the gardens. In these times of

austerity for many Nauruan families, the ability to grow one’s own vegetables is an important addition to the economic wellbeing of a household.

## 6.4 Media exposure in Nauru during the visit

All media work was conducted with the full knowledge, assistance and encouragement of the NC. The author recorded a television interview with a Nauru Television presenter in the NTV studio. He supplied some brief background material, and some indication of suitable questions, to NTV prior to recording. In the interview, the author outlined the work of the IWP in the Pacific of developing pilot waste projects with the community (sticking to the waste issue as time was limited) and spoke in general terms about the waste problem in the Pacific Islands, why it was important to address it, and how enthusiastic the Nauru Pilot Project community members were at Buada. The author also wrote a piece concerning the waste survey and the Pilot Project for submission by the NC to the Nauru Bulletin.

## 7 Implementing Solutions To the Waste Problems

### 7.1 Community identified waste problems revisited

The problems below are those that at the outset of the project the Buada Community considered to be of priority in the area of waste. They are presented again here, with an outline of solutions available. Necessary planning required to implement those solutions is detailed below.

**Table 7.1. Community Identified Waste Problems.**

<b>Problem</b>	<b>Solution</b>
Dump site selection.	Move Rubbish Dump to new location.
Rubbish dump leachates polluting lagoon.	New Dump outside watershed. Build engineered dump that does not allow leachates to escape untreated.
Backyard dumping.	Ensure regular waste collections. Publicity program to use waste collection. A wheelie bin for every house.
Septic clear out.	Improved collection from septic tanks. Compost Toilets.
Car dumping around lagoon area.	Remove wrecks; establish no dump policy in the community for cars; extract resources from wrecks and remove remains.
Dumping on roads, especially cans/bottles/diapers, etc. Dumping particularly bad on road to dump site.	Littering: generate community pride of place (make this socially unacceptable behaviour) <ul style="list-style-type: none"> <li>● Grade access road to dump more regularly.</li> <li>● Create Waste Transfer Stations incorporating recycling.</li> </ul>
Oily groundwater.	Commence collection and export of waste oils for processing. Publicity campaign to prevent dumping of waste oils on the ground.
Disposal of animal carcasses.	Bury dead animals.
Lagoon pollution.	Create protected area around lagoon, starting within the ring road.
Small pig pens around/near houses.	‘Pig Tractors’ – movable pig pens.
Bush/backyard mechanics.	Remove car wrecks, batteries, old oil collection.



Rubbish burning.	Don't Burn Rubbish! Public awareness work on the dangers of burning rubbish.
Small scrap metal from old motors.	Strip aluminium parts for scrap value.
Use of water.	Reuse grey water on gardens.

Many of these issues are in fact related; what is required is a plan for implementing some of these solutions. Also, it should be clear from the report above that the issues are wider than these in some areas, particularly with regard to impact on water resources.

## 7.2 Elements of an Implementation Plan for Buada

The implementation plan indicated below has been broken into several components. The situation on Nauru is such that quite simple things in some areas may be hard to achieve, whilst the situation may well precipitate activities in other areas that might be harder to initiate normally (collection of non-ferrous scrap metal for example). These plans are also interrelated: for example use of household waste water complements efforts to utilise organic wastes productively; collection of waste oils should operate in tandem with removal of car wrecks, especially if they end up at the topside dump, still within the watershed and on top the aquifer. Some items have already commenced, such as identifying wrecks, and building the first banana circles.

Public awareness of, and complementary to, efforts to tackle the waste issues are essential. However, any work must commence at the current – general – understanding of the community, and particularly of the community leaders. Such a program should not start at the lowest common denominator, as the people it is most essential to reach will be already beyond that stage, and they are the ones who will really make the big difference in the early stages. These are the 'Early Adopters' who will lead their community. Fortunately, these individuals have already assumed leadership of their community by creating the Buada Community association that applied to host the IWP pilot project in the first place. There is clearly a good understanding within the community of many of the issues that must be addressed. There is no need to start from the point that teaches the community that waste is a problem. Rather, it is how to tackle these problems through implementing solutions.

These plans are simply expressed; each stage can usually be developed into several subsections. However, to do that meaningfully, this process must be conducted with the community members: these are not tasks that can be imposed, but effort that must be initiated because the community wants to do so and understands the need to do so. These planning groups are not laid out in particular order for implementation: the community could start with Household Waste Water or Public Awareness activities if they so decided. However, if they were tackled in an order similar to the table below, this would likely produce the most logical way of approach to many of the issues. Sub groups need to be implemented in the order presented. Following these tables outlining planning stages, two of the sections have been expanded on by way of example. These examples show how the community and the IWP acting together can bring about the desired change. Wherever possible, start with easy tasks first, and gain the experience and confidence to tackle the harder ones. This may not always be possible given the order in which things need be done, but is a useful rule of thumb when working together as a team.

All these groups detailed below were discussed at length with community members, and presented to the PDT meeting on December 3<sup>rd</sup> 2003. The Reverse Garbage Truck was in particular discussed at some length, with the author using examples from his own local community where such a system operates well. This same concept is also common amongst progressive councils, for example New Zealand produces a Recycling Directory for exchange of industrial quantise of waste materials that may be useful to others<sup>21</sup>. In Buada, the Reverse Garbage Truck concept started to become reality when the trainee garbologists started taking things home they found in the garbage, and also when we noticed that the pile of odd shoes – mostly thongs – would decrease overnight as people came to look for a spare shoe!

<sup>21</sup> Recycling operators of New Zealand [www.ronz.org.nz](http://www.ronz.org.nz)

## Implementation Tables

### 7.2.1 Public Awareness

	Phases of Implementation			
	1st	2nd	3rd	4th
Develop Slogan for Community efforts.				
Agree to protect inside the lagoon ring road.				
Clean up litter and fireplaces inside ring road.				
Put up signboards.				
Create information handouts.				
Set up Picnic Area by lagoon.				
Control litter.				
Designate an Information Officer.				
Develop the FM Radio Station proposal.				

### 7.2.2 Utilise Organic wastes

	1st	2nd	3rd	4th
Build Banana Circles.				
Compost heaps: development/experiment.				
Experiment with composting Kimbies.				
Full organic wastes recovery.				

### 7.2.3 Extract resources from waste stream

	1st	2nd	3rd	4th
Agree to commence a recycling system.				
feeding into NRC waste collections.				
Collect aluminium cans.				
Collect PET(No. 1 plastic)				
Collect HDPE (No.2 plastic)				

### 7.2.4 Compost toilets

	1st	2nd	3rd	4th
Build trial unit.				
Install and test commercial unit.				
Develop local design as a result of testing.				
Expand number of units.				



### 7.2.5 Household Waste Water

	1st	2nd	3rd
Conduct simple household water use audit.			
Identify areas of savings.			
Reuse household water waste stream.			

### 7.2.6 'Reverse Garbage Truck', (RGT)

	1st	2nd	3rd	4th
Find a place for RGT.				
Person in charge RGT.				
Collect glass bottles.				
Collect old building materials/pipes.				
Collect old clothes.				
Collect old consumer items.				

### 7.2.7 Scrap Metals

	1st	2nd	3rd	4th
Identify car wrecks.				
Discuss issues with owners of wrecks.				
Non-ferrous metals collection.				
Remove unwanted car wrecks.				

### 7.2.8 Inorganic liquid wastes

	1st	2nd	3rd
Identify non-organic liquid wastes.			
Waste Oil collection.			
Remove liquid wastes to outside of watershed (NPC?).			

### 7.2.9 Rubbish Dump

	1st	2nd	3rd	4th
Ask authorities for new to dump location.				
Conduct campaign to get new dumpsite.				
location, in engineered landfill.				
Get old dump covered with soil.				
and graded to keep water off.				
New rubbish dump away from Buada's waters.				

## 7.3 Steps of Implementation

How do these plans become reality, and who takes on which role? These elements detailed above must now be worked through by the PDT and the NC Nauru to agree the specific tasks that need to be undertaken. This can only be realistically be done in Nauru, and must be done in conjunction with clear

commitments regarding availability of financial and physical and human resources of both IWP Nauru and the Buada Community.

To assist this process, below are a set of recommendations that will help take the process forward. These recommendations should be taken as being in order of both priority and ease of implementation.

### 7.3.1 Recommendations

1. Ensure that every house has a Wheelie Bin for rubbish collection (see section on waste collection). Cost will be of the order of A\$70 per new bin once the next shipment arrives. Currently only about half the houses have a Wheelie Bin. This has the potential to dramatically decrease litter from broken garbage bags, and backyard burning.
2. Commence with developing a slogan – in the Nauruan language – for the protection of Buada Lagoon. The lagoon is a focal point of the community, and developing a slogan for the project that focuses on the Lagoon makes it a lot easier for the people who live there to understand why they might engage with this project. Also, during the process of developing the slogan, a *de facto* consensus will be attained by virtue of the fact that a slogan is agreed. If this step cannot be completed successfully, it is unlikely that other steps will receive much community support. A suitable slogan should be no more than four words. Paint the slogan on the Wheelie Bins.
3. Having achieved a slogan which identifies the Lagoon as the object of efforts to protect the water, define the area within the ring road around the lagoon. This will probably require some kind of physical markers, for example white posts, a low fence, or whatever. This will also require close consultation with the two houses that are inside the ring road. A Picnic Area might be set up at the side of the lagoon, and at this place a sign board should be put up to inform the public of the efforts of the Buada Community, why they are doing it, and ‘Don’t Drop Your Rubbish Here!!’. Of course a few litter bins would be needed, along with a schedule for emptying them.
4. Commence collecting recyclable materials: aluminium, and PET and HDPE plastics. A collection Point for Aluminium cans and PET bottles can be simply made. The NRC already collects aluminium cans, and has a crusher. PET bottles can be recovered in quantity from the IOM Refugee camp, and this source should be tapped to kick-start the recycling.
5. Utilise potential water recycling sources from houses. Use this in conjunction with efforts to utilise organic wastes. The community already operates kitchen gardens. Encourage the ‘Green Fingers’ people to experiment with compost, waste water, and banana circles.
6. Trial a home-made compost toilet alongside a commercial unit. Once someone has built a unit from the designs provided, and it is in operation, the IWP could purchase a commercial compost toilet. Improvements to the home built one may result from using the commercial unit. Commercial units are likely to be too expensive for most people; however, the advantages of a compost toilet are many: No Black Water to deal with; no water required; a resource is produced that can be used for, at a minimum, planting fruit trees and the like; it works when the power is off; it doesn’t smell bad because the power is off and one cannot flush it!
7. Reverse Garbage Truck: this is a place where excess materials and household goods can be exchanged and disposed off amongst the community members. During the Waste Survey, several household items in the waste stream were recovered and put back into use; and shoes in particular were a common item that went around again. Old building materials, particularly steel and pipes, can be very useful in programs such as recovering the waste water for gardens. A place needs to be found to operate this, and a keen person put in charge. Initially, it might be open Saturday mornings for exchange, deposit and removal of items.
8. Car wrecks can be removed with the assistance of the Department of Works and Community Services; ideally, a program to remove waste oils and recover valuable items, such as useful parts,

and especially non-ferrous metals, would be in place alongside removal. This program would best be conducted with the participation of those members of the community who are mechanics.

9. The Rubbish Dump needs moving. Once the community and its efforts are well established, they might launch a campaign to get a new dumpsite arranged, and a proper engineered landfill provided by the government. This is in the Nauru Rehabilitation Study plan. If the community can achieve this kind of result, they will have become very much a force to be reckoned with.

## **7.4 Measuring Progress**

### **7.4.1 Recovered/Recycled materials**

Materials recovered from the waste stream, whether reused or recycled, will be easy to measure and a good indicator of success. With the information supplied from the Household Waste Survey, proportions recovered can be seen. With members of the community trained to conduct similar surveys, the community can measure its success in efforts at waste reduction. Any materials shipped for recycling are of course easily measured at shipping.

### **7.4.2 The Buada Lagoon**

The lagoon is currently a very green piece of water, with floating rubbish caught in the grass along its shores, and a noticeable lack of birdlife. During the author's visit, he saw dead fish floating in it every day. It clearly was once a very beautiful place, and is still pleasing to the eye – if you don't look too closely. Improvement in the waters of the lagoon will surely indicate improvement in the lives of the community that surrounds it. When the children of Buada will happily swim in the waters on a hot afternoon, when the people will sit under the shade of its trees, along its banks, because that is a pleasant place to be on that same afternoon, then this will be the best indicator of the success of their efforts.

## **Part B: Institutional Issues Concerning Waste on Nauru**

### **8 Current Situation Regarding Waste Collection on Nauru**

#### **8.1 Description of waste management by NRC**

Mr. Depsey Detanamo, the Waste Manager of the Nauru Rehabilitation Corporation took the author on a tour of the current MSW collection system on 18<sup>th</sup> November. Depsey is also a Buada Community resident, and a member of the PDT. He is highly motivated on the waste issue, and thirsty for information and new ideas.

NRC collects garbage from households around Nauru on a twice-weekly basis. Rubbish is collected from Wheelie bins that are put out on the roadside, and picked up using a dedicated truck with a bin lifter. This lifter is externally operated: the driver stops and the lifter operator gets out of the truck and operates the hydraulic controls on the side of the truck; the bin is picked up, tipped into the top of the truck, and the bin put back on the ground. This process can take place very quickly, as was observed. The truck also has a built in compactor. Some days the collection truck goes around the inner roads other than the main island ring road. NRC also picks up Green Waste from tree lopping, clearing etc. on a weekly basis, and this is processed through a large shredder, which is towed to the dumpsite on topside where it is chipped onto a large existing pile. This material is to be used for land rehabilitation.

Buada has a rubbish collection once a week, but only from Wheelie Bins. The collectors do not pick up garbage bags as these are frequently broken open by marauding pigs and dogs.

#### **8.2 Wheelie Bins**

There are two sets of wheelie bins in Nauru: One set was purchased 8 years ago (with coloured lids, Second hand, still commonly seen around Nauru and in daily use, of 'Waste Master' brand. Another set was purchased new, about 300 in a container load, 'Solo' brand bins. These have not stood up to the local conditions so well, and many have been broken.

A new shipment of bins is expected in the first quarter of 2004. This will be sold to the public, and the expected price is around A\$70.

Some people complained that the garbage collectors throw them down after emptying, but the author did not observe this activity when observing the lifter in operation, even though the workers were unaware that they were being observed.

#### **8.3 Nauru Rubbish Dump**

The author visited the Rubbish Dump on topside (above Buada lagoon, to the south) with Dempsey to check the current situation. The rubbish dump is at a height of about 38m above sea-level, and within the Buada catchment. Clearly seen was:

- the pile of organic chippings;
- much fly tipping on the approach road;
- scavengers (people) searching over the dump;
- large construction tyres that had been placed along road to stop people fly tipping on the road. Seems that quite a lot of the fly tipping is caused by the poor road access to the dump discouraging people from driving down it;
- a sign near a pile of old cars says 'Temporary Wrecked Car Stockyard';
- no engineered containment of dumped wastes;
- encroachment of dumping area in a haphazard manner on the surrounding environs;
- no control over which materials are dumped;

- An old incinerator that was used for hospital and some other wastes, but is now overgrown. What happened to the ash previously produced from it? It has been unused for about ten years. During a site visit on November 27<sup>th</sup>, it was reported by Manfred and Nelson that the ash used to be piled up around the incinerator. Inspection revealed no obvious signs of an ash pile, except perhaps at the base of the chimneystack.

## **8.4 Problems Identified with current system**

- Houses that have no Wheelie bins get no collection of rubbish.
- No new Wheelie bins are likely to be available until March at the very earliest (awaiting AUSAID funds release)
- Uncontrolled dumping over quite a wide area.
- The boundaries of the tip area not clearly defined.
- The management of the tip area is not clearly delineated.
- Poor access road results in fly tipping before dump.
- The dump site is above Buada lagoon depression: is it polluting that body of water?
- The dump site is on top Nauru's largest aquifer.

## **8.5 Positive elements of current situation**

- There is a dumping area.
- There is a well-motivated and well-managed waste collection team.
- There is a specific car dump area.
- Waste collection machinery is very well maintained.
- The Waste Manager and his workers are keen to accept new ideas.
- The Waste Manager is prepared to adapt the system to suit improvements.
- There are more wheelie bins in the plans for the future.

## **8.6 Other Waste Collections**

The NPC collects waste from its workers' housing in the area known as The Location; rubbish collected is taken to the same dump that NRC uses on Topside. The Department of Works and Community Services does collect wrecked vehicles sometimes. Wrecked vehicles are dumped at the 'Temporary Wrecked Car Stockyard' adjacent to the dump. Also, the department works with NPC on occasion by providing a truck that the NPC loads with waste using its front-end loader.

# **9 Legislation**

## **9.1 Overview**

The National Environmental Management Strategy (NEMS) document<sup>22</sup>, states: "Inadequacy, or non enforcement of environmental legislation, and the need for integration of existing legislation for environmental management and protection are major constraints to the promotion of environmentally sustainable development in Nauru." It would appear that existing legislation is either out of date, irrelevant, unenforced, unenforceable (the litter act).

The only piece of legislation that seems to specifically deal with waste is the Litter Prohibition Act 1983, providing for \$300 fines for anyone who litters, sees someone else litter and does not report it, or

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<sup>22</sup> The National Environmental Management Strategy (NEMS) document, produced by the Department of Island Development and SPREP in 1998, section 4.3.4:

is the parent of a child who litters. A copy of this act was provided during a meeting with the chief secretary of the Department of Justice, Mr. Denzil Seneviratne; this remains on file with the Nauru NC.

Other areas where waste is actually dealt with by legal entities, but not specified in their governing legal frameworks were investigated. The Act governing the Nauru Rehabilitation Corporation does not specify dealing with waste in its objectives, even though it is the *de facto* waste collection body for most of Nauruans. A copy of the index of the Act governing the setting up of the Nauru Island Council (NIC) in 1992 was available, but not the act itself. The NIC used to collect household waste. The index to sections indicated that the only area that might contain any reference to waste would be in that detailing the ability of the NIC to create by-laws under the Act. The Nauru Island Council had ceased to function at the time of this report.

Mr. Seneviratne indicated that a legislative environmental review that incorporated some possible new draft legislation, or examples thereof, concerning waste, would be very useful to the Department of Justice, as well as the country.

## **9.2 Applicable laws**

### **9.2.1 The Nauru Rehabilitation Corporation Act (1997)**

This legislation establishes the Nauru Rehabilitation Corporation, which has the responsibility for coordinating, promoting, carrying-out, managing and participating in, rehabilitation works in Nauru.

### **9.2.2 The Litter Prohibition Act (1983).**

This Act is clearly unenforced, and given that it is a fixed fine of \$300 (not 'up to') for not only littering, but seeing someone litter, or being the parent of a littering child, it would clearly be unenforceable in the current situation.

### **9.2.3 The Nauru Island Act (1992).**

The Nauru Island Act created the NIC, which has ceased to function.

It is fair to comment that no effective legal framework exists to address waste issues on Nauru.

## **10 Local Government**

### **10.1 History**

In the early 1930s the Nauru Local Government Council (NLGC) replaced the Council of Chiefs, a largely hereditary body with no power, and became the driving force for local self-government and independence. The NLGC was divested of all power in 1992, under the Nauru Local Government Council Dissolution Act (1992). The NLGC was dissolved to arrest spiraling debt that was occurring under its administration and in preparation for the prospects for a non-phosphate economy on Nauru within the following 15 years. Under the NLGC it was estimated that debt amounting to between AUD\$60,000 and AUD\$90,000 for each Nauruan had accumulated. The NLGC was supplemented by an interim body, the Nauru Council, consisting of the Cabinet with the President as Minister-in-charge. A new body, the Nauru Island Council was also established in 1992, under the Nauru Island Council Act, was established to take responsibility for local government affairs<sup>23</sup>.

### **10.2 Nauru Island Council**

Established by Act in 1992, to provide services including waste disposal, promotion of cultural activities, landscaping and improvement of urban environment and coordination of other public bodies.

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<sup>23</sup> extracted from IWP PCU First Country Report, 2002. This reference also applies to some information in the succeeding paragraphs of this section.

Schedule 1 of the Act refers to environmental control, protection and conservation of flora and fauna, and bio-aesthetic planning. The NIC has ceased to function due to reasons that were not completely clear to the author of this report. It would appear that the NIC no longer had any money to function. Its responsibilities in the area of waste management have been shouldered by the NRC.

## **11 National Government**

### **11.1 The Department of Economic Development**

The Department, formerly the Department of Island Development and Industry (IDI), is the focal Department for environment management and planning in Nauru. It is responsible for all non-phosphate related and alternative industries in Nauru. Its mandate covers energy, agriculture, livestock development, lands and surveys, the Government printer, and tourism. The Department is also indirectly responsible for the Bank of Nauru and the Nauru Phosphate Corporation. It is also responsible for the implementation of the Nauru-Australia Co-operation Rehabilitation and Development Feasibility Study, the formulation work for which was completed in 1994. The President is the Minister responsible for Economic Development.

### **11.2 Environment Unit**

IDI established an Environment Unit in 1995. The Unit is the point of contact for national, regional and international relations on environmental issues in Nauru. The IWP NC operates out of the Environment Unit office and is responsible to the Secretary for Economic Development, Mr. Joseph Cain.

### **11.3 Department of Works and Community Services**

The Department is responsible for the management of Nauru's urban environment. It has responsibility for the provision and maintenance of government and public buildings and appears to have some responsibility for waste disposal. It is also responsible for the maintenance of roads and drainage and the provision of services within buildings. The Secretary for Works and Community Services (WCS) is Mr. Anthony Garabwan. Unfortunately, the author was unable to meet with Mr. Garabwan, despite several attempts to arrange a meeting, as he was on leave at the time of the visit. WCS does work with the NPC to remove some wastes: NPC provides the front-end loader, and WCS provides the truck to remove the waste. Many people are aware that WCS can remove car wrecks as they have the truck with a crane fitted to do so. An outline of some relevant WCS activities is outlined below:

- WCS is responsible for pumping sewerage sludge from household cess pits into trucks and emptying it into a sewage system that pumps the waste over the reef shelf into the sea;
- WCS also collects solid waste from all government offices, schools and hospital;
- WCS is involved in solid waste collection from the wider community, of material such as derelict vehicles, whereas NRC collects domestic waste through Wheelie Bins;
- WCS is involved in delivery of freshwater (desalinated water) in trucks to households, government and schools; and
- Civil Division is responsible for sewerage; road maintenance and labouring work.

### **11.4 Department of Justice**

The administration and enforcement of legislation is the responsibility of the Department of Justice. It also has secondary responsibilities for environmental health through monitoring environmental health activities implemented by the Department of Health and Medical Services.

## **12 Nauru Rehabilitation Corporation (NRC)**

### **12.1 Official Functions of NRC**

The NRC is the main agency dealing with household waste, especially as far as the Buada community is concerned. The functions of the Corporation include:

- To coordinate, promote, partake in, identify, initiate and carry-out projects for the rehabilitation and development of worked out phosphate lands and un-worked phosphate lands as directed by the Minister;
- To implement government policy with regard to the rehabilitation and development of the worked out phosphate lands of Nauru;
- To perform and promote such other activities in relation to the rehabilitation and development as the Minister may direct, either alone or in conjunction with Australia in furtherance of the policies and objects of the Nacos Agreement (The Compact Settlement made between the republic of Nauru and the Commonwealth of Australia, August 1993) and the Development Cooperation Agreement; and
- To manage and administer the moneys and assets of the Corporation.

A Board of Directors, consisting of seven members, directs the work of the Corporation. The responsible Minister is the President.

### **12.2 Current Activities**

- NRC employs around 30 people who are involved in: waste collection, the Engineering Unit, and including a GIS officer. The Waste Manager, and the Engineering Manager are both members of the IWP PDT, which is a major plus for the IWP Project.
- NRC collects garbage from households around Nauru on a twice-weekly basis. Rubbish is collected from Wheelie bins that are put out on the roadside, and picked up using a dedicated truck with a bin lifter (externally operated: the driver stops and the assistant gets out of the truck to operate the lifter). The truck also has a built in compactor. Some days the collection truck goes around the inner roads other than the main ring road. NRC also picks up Green Waste from tree lopping, clearing etc., on a weekly basis, and this is processed through a large shredder, which is towed to the dumpsite on topside where it is chipped onto a large existing pile. This material is to be used for land rehabilitation.
- Land Use Plan Public Awareness Program – some attempts appear to be underway to promote the concept of a ‘Land Bank’, as the fractured nature of land ownership, and the many landowners, means that it is only by amalgamating land blocks can meaningful, coordinated development be bought about.
- Under the Australia- Nauru settlement, AusAID provides a budget each year for the above activities. Sometimes the government borrows the allocation for other purposes.

### **12.3 Waste Collection Equipment**

The author visited the NRC workshop with Dempsey Detenamo, the Waste Manager. Equipment included a truck (bought new 3 years ago) with a wheelie bin lifter and compactor; one open flat bed truck with 500mm drop down sides; one large Green Waste chipper with its own diesel power plant; one small chipper of landscape gardener size. Also, one small single-phase press for pressing aluminium cans. Some cans already pressed, approx half a ton. Cans are collected from casual collection in the course of normal garbage collections. Also, there was a pile of cardboard boxes, flattened, the beginnings of a cardboard recycling system. All equipment was very well maintained and in excellent order, especially considering some of the difficulties faced by NRC.



The workshop was very clean and tidy. The workforce appeared to be well motivated. Clearly a good, well run operation overall.

## **13 Current Recycling In Nauru**

### **13.1 Overview**

Nauru has two operations running at a very low level recycling aluminium drink cans. The problems with collection are typical, but especially acute in Nauru where there are only three bars, and they are all quite small. Also, little beer is drunk at home; most beer is consumed at public places in the open, and the cans usually discarded at the site of consumption. Thus, cans attract a high cost of recovery, not to mention the added problems of sellers trying to defraud the purchaser by adding weight to cans. Clearly a large quantity of PET plastic bottles exists to be recycled, especially with the output from the refugee camp. All these containers would have arrived in Nauru in a cardboard box, along with many other items of food and drink. Cardboard cartons are best sourced from wholesalers and retail commercial outlets.

All these problems are readily addressed by container deposit type collection mechanisms, where each can or bottle has a redeemable value, and is purchased by unit, with thus no incentive for the seller to load up the can weight. Plenty of potential exists to increase recycling on Nauru, and the Buada Community Pilot Project provides a great opportunity to develop suitable collection systems for the island.

### **13.2 Private Sector**

There does exist a private operation that collects non-ferrous metals on Nauru. The owner is a Mr. Michael Rolind<sup>24</sup> and his yard is opposite the NPC entrance at the foot of the north end of the Aiwo bridge. The author visited Mr. Rolind on 4<sup>th</sup> December, and observed that he had approximately a third of a container full of crushed aluminium cans. He explained that he ships a 20ft container every one to two years, and usually increases the weight to the 20 tonne limit by including other non-ferrous scrap metals. He has a press, a medium size 3-phase unit that produces a block of about 30cms cube. He also had some aluminium can 'bricks' that had been pressed in a press the same as the one currently at the NRC workshop. He had purchased these from someone else, already pressed. He explained that he obtains the cans from either the dump, or bush places where people have drinking parties, or some from people who bring them in for purchase. However, he has run into the problem of cans bought by weight being 'loaded up' with small stones etc. to increase price. He is currently trying to sell his press if he can find a buyer.

### **13.3 Nauru Rehabilitation Corporation**

NRC has a small can crusher which is unsuitable for PET cans, but better than nothing. The management at NRC is very open to recycling other materials, and this author has supplied the manager with information regarding markets, prices, and suitable simple equipment to help make this a reality on Nauru.

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<sup>24</sup> Michael Rolind, non-ferrous metals recycler, Aiwo, Nauru; fax/tel 444 3726

## **13.4 Summary and Recommendations**

With key NRC waste management people on the PDT, the IWP project has an opportunity to assist in the implementation of a model waste collection system in Buada, which could easily spread to other parts of Nauru. Assistance with the development of modern economic tools to encourage effective waste management, minimisation, and resource recovery would be far preferential to traditional fine and dump approaches. Penalty-based methods clearly will not work in such a small community. Nauru is not Singapore. Economic carrots, combined with sustained public campaigns and good practical examples are far more valuable in a situation such as Nauru.

The IWP should seek to actively research and promote models that have proven to be successful in other parts of the world. Perhaps, models of and approaches to effective waste management that IWP should be looking at are those that have an extensive public education campaigns and ones that does not necessarily involve the penalty system as a better deterrent to litter. However with the existing economic models such as Extended Producer Responsibility and Product Stewardship (where large multinational companies who perceive some sort of economic loss) effective waste management approach would be difficult to establish in Nauru because of its size.

## Useful Reference Materials

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# Appendix I

## Data Sheet Buada Community Garbage Survey, 22 Nov to 1 Dec 2003, Nauru Island

### Household waste generated

#### House Number

Date/day	1 Humble	2 Kareen	3 Cindy	4 Nelson	5 Ruth	6 Ritchie	7 Credence	8 Robin	9 Rosalie	10 Keffery	11 Dempsey
Adults	4	6	5	7	9	4	5	5	2	8	2
Children	6	4	2	5	8	13	5	6	3	4	4
Sun/23	0.5	0 no bag	0.5	0 no bag	3.8	6.0	7.0	0 no bag	3.5	An 5.5	0 no bag
Mon/24	3.0	1.5	0.8	1.3	5.7	1.2	5.5	1.1	6.2	An 5	1.3
Tues/25	1.2	1.3	1.0	1.6	0.7	1.1	0.7	1.6	0.3	An 7.8	0.8
Wed/26	2.6	0.4	1.1	3.8	5.1 4.1 1.0	1.1	0.5	0 no bag	3.3	An 14.9 7.9+ 7.0	0.8
Thurs/27	3.5	0.6	2.5	1.4	4.0	1.3	1.3	3.5	0.5	An 34.1 10.3+10.2 +13.6	0.5
Fri/28	1.4	0.4	0 no bag	0.9	6.2	1.0	0 no bag	4.6	1.5	An 11.7 6.9+4.8	0.4
Sat/29	2.4	2.2	1.5	4.9	0 no bag	1.1	1.2 0.6+ 0.6	0 no bag	1.3	2.3	2.3
Sun/30 no collection											
Mon/1	2.1	0.5	0.4	2.3	1.6	1.1	0	0	0	1.5	0.7
Total Weight	16.7	6.9	7.8	16.2	27.1	13.9	16.2	10.8	16.6	82.8	6.8
Weight person/wk	1.67	0.69	1.11	1.35	1.59	0.82	1.62	0.98	3.32	6.9	1.13
Comments					Wed bag some old wastes					An = Anomaly bags provided were not only from those days, Fri asked to put out only daily trash	

## Household Waste Stream Materials Analysis: Buada Community Nov-Dec 2003

### OTHER Materials

#### OTHER Material category

Date/ Day	Rubber	Shoes	Nappies	Glass	Fabrics	Alkaline Battery	Tetrapak	Organics
Sun 23								
Mon 24	0.5	0.6 5 thongs	8.9	6.2 4 beer	1.5	0.9	0.4	8.9
Tues 25	0	0.2 2 thongs	2.9	2.0 3 beer	0.5	1 'AA' single item	0.1 10 pcs.	1.8
Wed 26	0	0.1 1 thong	3.7	4.5 1 beer	1.1	1.6	0.1 8 pcs	4.0
Thurs 27	0	0.5 3 pcs (1 thong)	4.1	2.1 2 beer	0.2	1 'AA' single item	0.1 10 pcs	3.8
Fri 28	0	0.05	2.5	2.9	0.1	0.2 2 pcs 'D'	0.1 6 pcs	2.5
Sat 29	0	0	2.3	3.7 6 beer	1 small pc.	0.4 4 pcs 'D'	0.1 5 pcs.	4.9
Sun 30								
Mon 1	0	0.2 1 pc.	0.6	1.7	0.2	0	0.3 7 pcs.	2.5
<b>Total Weight</b>	<b>0.5</b>	<b>1.5</b>	<b>24</b> Calc. 25 <b>3 bags</b>	<b>23.2</b> Calc.23.1	<b>3.8</b> calc.3.6 <b>1/2bag</b>	<b>3.0</b> calc. 3.1	<b>1.1</b> calc. 1.2	<b>23.4</b> calc. 28.4 <b>4 bags</b>
<b>Comments</b>		Some shoes removed from site during week – reused?		16 beer bottles, brown glass stubbies 375ml all other glass clear.  4 bags, but not full by volume, only weight				Error reading daily weights on scale? Contains significant paper, esp. 2 Kg sugar bags

Unit: Kgs waste materials collected.

## Household Waste Stream Materials Analysis: Buada Community Nov-Dec 2003

Plastic Materials by Number and category

Day	1	2	3	4	5	6	Bags Inc. soft plastics	Other Rigid Plastic
Mon	2.3	0.7	0.0	0.05	0.3	0.6	3.0	2.2
Tues	0.2	0.1	Single litre bottle	Single lid	.05	0.1	0.4	0.4
Wed	1.5	0.5 #	Single Spice bottle	0	0.3	0.5	2.5	3.0 8 videos
Thurs	1.3	0.1 6 pcs	1 pc.	1 pc.	0.1	0.5	0.9	4.2 3 videos lge.toy
Fri	0.3	0.4 3 pcs	0.1 2 pcs	0	0.3	0.4	1.2	1.5 2 videos
Sat	0.6	0.2 3 pcs	0	1 pc.	0.4	0.3	0.7	0.3
Sun								
Mon	0.3	0.1	0	0	0.3	0.5	0.9	0.4
Total Qty Bags	<b>3</b>	<b>1</b>	-	-	<b>1/2</b>	<b>2</b>	<b>3</b>	<b>2</b>
Total Kg	6.5 calc. 6.5	2.4 calc. 2.4	0.3	0.1	1.6 calc. 1.75	2.6 calc.2.9	11.6 calc.9.6	12.5 calc. 12.0
Comments	Most water bottles	# Wed: contains Liquids, esp oils.		Milk powder tin lids		Dispos- -able food plates and cups, inc. meat tray.	Soft plastic, virtually all food packaging Scale reading error?	Rigid plastic, unident- ified. Some video cassettes, Toys,

Unit: Kg.

**Household Waste Stream Materials Analysis: Buada Community Nov-Dec  
2003  
Metals  
Metals**

Day	Al Can	Al foil	Other Alumin	Stainless Steel	Copper	Brass	Steel Can 'Food'	Other steel
Sun								
Mon 24/11	0.5	0.3	0.0	0.1 single item	0.0	0.0	8.9	1.4
Tues 25/11	0.24 14 pcs	0.1	0	0	0	0	3.3	1.7 inc.pot
Wed 26/11	0.35 20 pcs	0.05	0	0	0	0	5.5 #	0.2
Thurs 2/11	0.24 14 pcs	0.05	0.1	0.05 1 pc fork	0	0	8.5	2.8
Fri 28/11	0.4 17 pcs	0.1	0	0.5	0	0	4.5	0.4
Sat 29/11	0.5 29 pcs	0.05	0	0	0	0	1.8	0
Sun 30/11								
Mon 1/12	0.12	0.05	0	0.4	0	0	1.9	0
Total Kgs	2.3 1 bag	0.7 calc. 0.7	0.1	1	0	0	38.1 calc.34.4 6 bags	6.9 calc. 6.5
Comments	1 can = 17.24g	Inc. al food trays		28/11 two wristwatches and I fork some items reused!			# many old tins (from 10)	Mostly household - Aerosols, Hardware items, Two automotive, (one a pulley)

Unit: Kg .

## Household Waste Stream Materials Analysis: Buada Community Nov-Dec 2003

### Paper Products

Day	White Paper	Thin board	Carton	Magazine	Other Inc. books
Sun 23 <sup>rd</sup>					
Mon 24 <sup>th</sup>	0.05	1.8	0.6	0.9	0.3 inc. 1 egg box
Tues 25 <sup>th</sup>	0	0.3	0	0	0.1 bits of Australian newspaper
Wed 26 <sup>th</sup>	0.1	0.8	0	0	0.05
Thurs 27 <sup>th</sup>	0	1.2	0.9	0.05	0.05 1 egg box
Fri 28 <sup>th</sup>	0.05	0.8	0.2	0	0
Sat 29 <sup>th</sup>	0.05	0.6	0	0	0.05 1 egg box
Sun 30 <sup>th</sup>					
Mon 1 <sup>st</sup>	0.1	0.4	0.4	0.1	0
Total Items Bags		<b>2</b>	<b>1 box</b>		
Total Kg	0.7 wet, daily wts est. total 3.5	6.7 calc.5.9	2.2 calc. 1.7 – wet?	1.1 actual 1.9 -wet	0.7
Comments	Very little, some in organics as scraps	Teabag boxes, mosquito coil boxes, small cartons, soap powder boxes,	Often only pieces of cartons		All newspapers imported, so rare

Unit: Kg.



**Household Waste Stream Materials Analysis: Buada Community Nov-Dec  
2003  
Other Items**

Day	Other Mixed odds	Plate Glass	Ceramic	Leather	Lead-Acid Battery	Household Electrical/ Consumer
Mon 24 <sup>th</sup>	2.0	0	0	0	0	0
Tues 25 <sup>th</sup>	0.1	0.6	0	0.2 belt	0	0
Wed 26 <sup>th</sup>	0.6	0	0	0	0	0
Thurs 27 <sup>th</sup>	0.4	0	0	0	14.9 4 pcs motorcycle	1.8 2 pcs battery charger and shaver
Fri 28 <sup>th</sup>	0.6	0.4	0.2 broken cup	0	0	5.0
Sat 29 <sup>th</sup>	0.2	0	0	0	0	0.05 1 small toy
Sun 30 <sup>th</sup>						
Mon 1st	0.7 1 soft toy	0	0	0	0	0
Total KGs	4.3 1 bag calc.4.6	1	0.2	0.2	14.9	6.9
Comments	Inc. composite wrappers and odd household and automotive, eg light globes					28/11, inc. 1 large loudspeaker

Unit: Kgs



## Appendix II

### Collected sheets from IWP Workshop held at Buada Chapel Hall Buada District Republic of Nauru, 16<sup>th</sup> – 20<sup>th</sup> June 2003

Below are extracts from documentation of the above workshop. These sheets indicate the prevalent attitudes and thoughts of the Buada Community with regard to waste; the full document remains with the NC IWP Nauru.

Red Team			
#	Problems	Stakeholders	Solutions
1	Littering	Community Private Businesses Rehab Justice Economic Development Media	Provide Rubbish Bins Awareness (include in school curriculum) Media Publicity Etc
2	Waste (Household & Drainage Systems)	Community Works Department Overseas Aid	Regular Service Funds for Digesttor
3	Animal Waste	Community	Proper Fencing/drainage systems Centralize Animal Pens
4	Land Clearing (erosion & Building Construction)	Community Landowners Private Constructors Works	Land Control Consultancy
5	Illegal Dumping	Community & Outsiders Justice Department Landowners Works NPC	Penalty (fines/enforce laws) Community Watch
6	Backyard Dumping	Community	Wheelie Bin Reduce Household Waste
7	Imported Goods/ Products	Main Stores e.g. C&P, J&S Justice	Tax Goods Sponsorship for clean-ups Recycling

<b>White Group</b>		
<b>Stakeholder</b>	<b>Problems</b>	<b>Solutions</b>
Community (Buada) Rehab Dept of Economic Development	Rubbish - Littering - Backyard Dumping	Public Clean up Awareness Wheelie Bin (availability) Improving Collection Service Recyclable
Works Department (Government) Buada Community	Cesspit	Improving Cesspit tank Capacity (size) Collection Service Maintenance Design and Construction
<b>Green Team</b>		
<b>Stakeholders</b>	<b>Likely Problems</b>	<b>Likely Solutions</b>
Buada Community	Dumping sites (attitude) Brackish Gutters	Enforce Dumping Penalties IWP Consultation (awareness) Maintenance (Govt) (awareness)
Landowners	Attitude Clan	Profit/Non-Profit Talk to Elders
Youth	Attitude Uneducated Social group	Responsibility Put into practice (remove bad habits) Peer Pressure
Businesses	Market Site left unclean Financial & technical Equipment	Clean up afterwards Finance Workshops or Training
Media	Lack of promotional and educational material	Obtain funds Training Upgrade equipment
Church	Mens Womens	Cleanliness is next to Godliness Set good examples Encourage children
Individual	Attitude	Boost self-esteem Aware of options
Education	Lacks waste promotion Lacks discipline	Enforce & increase to do the right thing Discipline
Poultry	Overcrowded ? pet Sewage problem	One pig area You see you catch (finders keepers) Sewage compost = “emwarere ena”

*Emily Ephraim 13Yrs*

### **Identifying Waste**

- Rubbish - Empty boxes
  - Broken toys
  - Empty bottles & cans
  - Paper waste
  - Rags
  - Nappies
- Heavy Rubbish - broken cars
  - heavy rusty steels
- Littering - Cans
  - bottles
  - paper
  - plastic
- Household waste – Cesspit
  - Stale food

### **Cause of waste**

- Rubbish - No wheelie bin
  - Pick up of rubbish not regular
  - Lazy to deliver their own rubbish
  - No heavy duty trucks to pick up the heavy rubbish
  - Because of the delay of salary workers are not efficient in doing their work
- Littering - No public rubbish bin
  - Children are not disciplined about littering at home
  - There's always someone else to pick up after them (e.g government paid workers)
  - The law on littering is not strict.
- Household waste
- Cesspit leak – People don't bother to look into the leaking problem.
- Overflow - Septic tank out of order
  - Ordered septic tank but service not efficient.

Food leftovers – If no pig farm they just throw their leftovers outside.

**Effect on waste**

Rubbish - People get sick because of rubbish.

- Plants will suffocate because of rubbish
- Attract flies & mosquito
- Our house won't be hygienic
- Burnt rubbish outside our home will pollute us.

Littering - Broken bottles and cans will endanger us.

- If children burn the plastic from littering it will affect our environment.

Household waste

(Overflow or leak) Cesspit - It will affect our underground water if it

- Is near it
- Over hygiene

Food leftovers - Our hygiene.

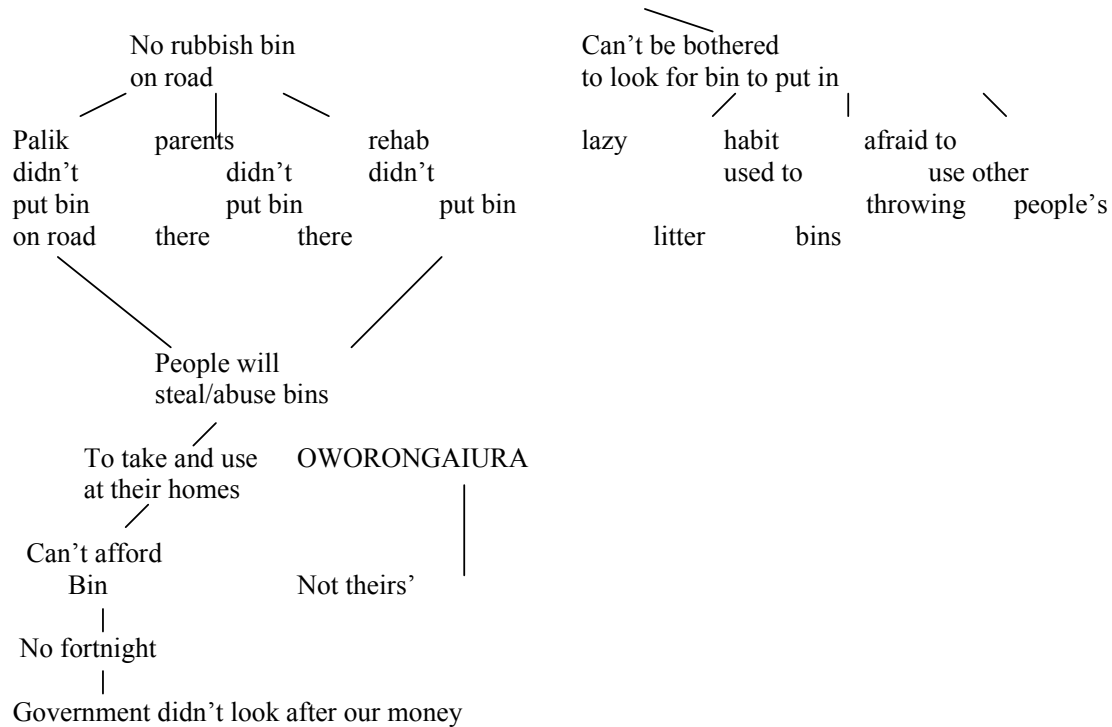
*Irana (Nano) Aeomage  
 (14yrs) Kamed Renzo  
 (15yrs) Madang Aeomage*

**What is waste?**

Cans, bottles, littering  
 Broken cars  
 Petrol oil

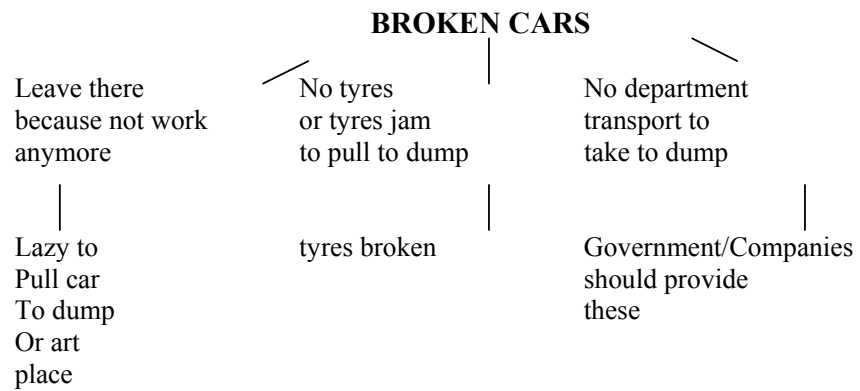


**Cause?**

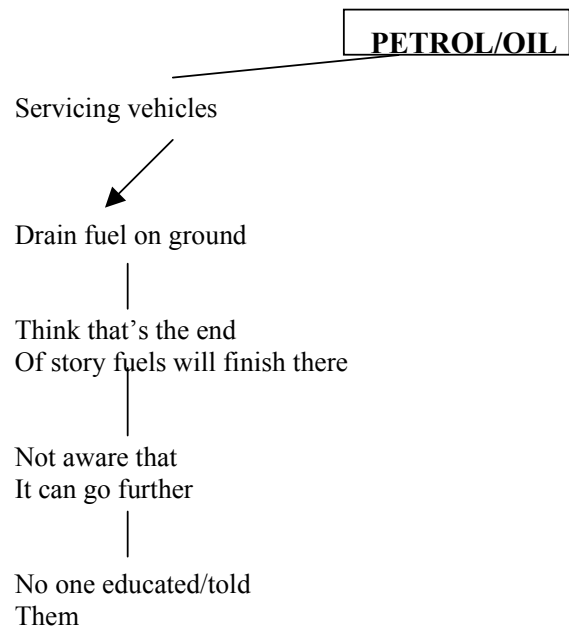


**Effect :** will poison water source and cannot use underground water to do many things

around the house eg shower, washing, watering



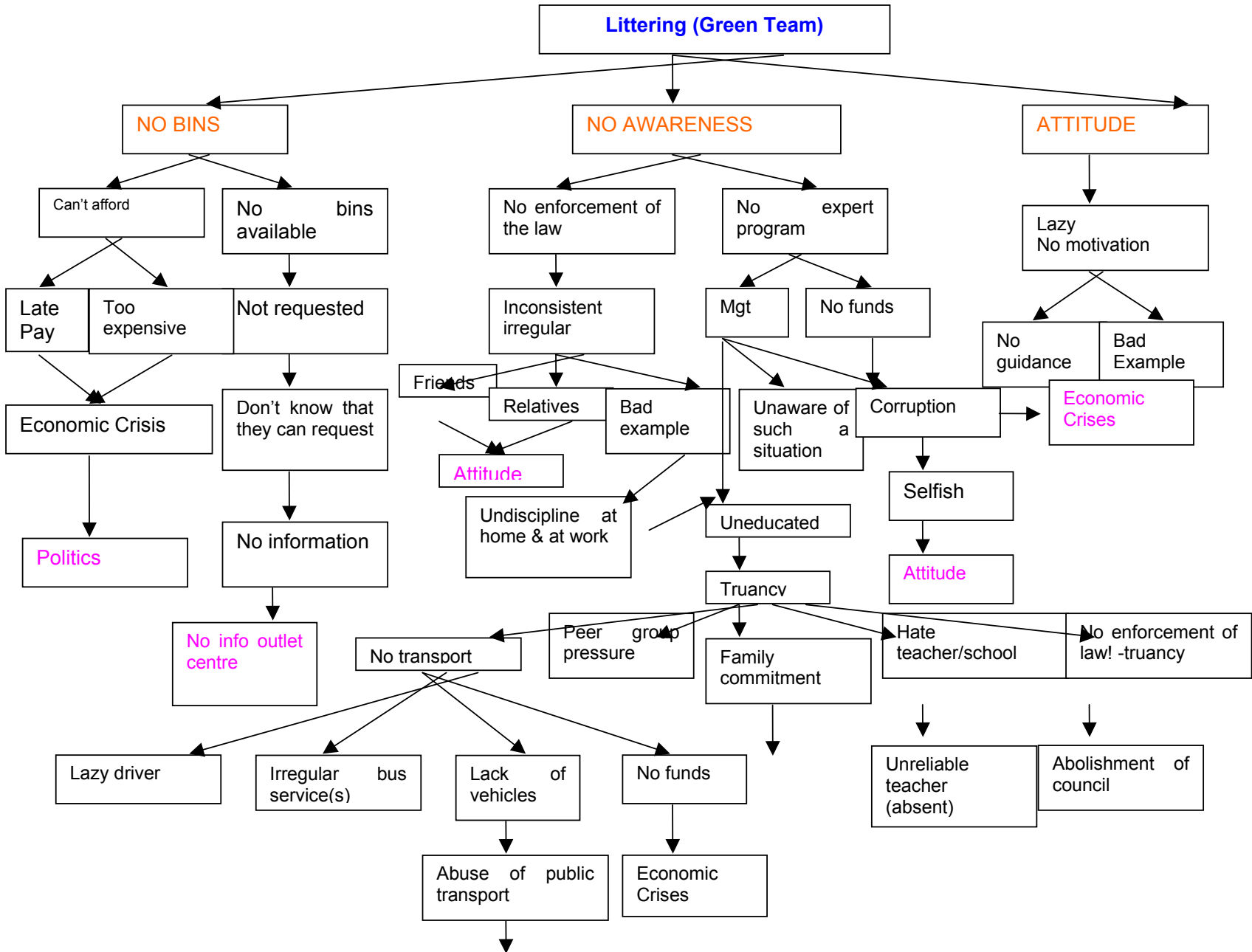
**Effect:** Will breakdown and rust, fall apart, rust bits fall into water – poison it, make it rusty.





**Effects:** Petrol/oil will seep into water source and contaminate poison underground water  
plants – will kill plants oily and smelly for shower

- eg. Cannot use underground Water for showering, watering



# Buada Community IWP Nauru Pilot Project



Community Based Waste Reduction

# Buada Garbologists



**A Week's  
Worth of  
Garbage**



**Everyone helps out**

**Building the  
community's first  
Banana Circle**







**There's got to be a better way than burning the rubbish.....**



A day in the Life of the Buada Garbologists



Now if you will just come a little closer I am sure we can get the root of the problem.....







Some of  
these  
Garbologist  
scrub up a  
lot better  
than others!



62 Kg per capita per annum: 42 tonnes a year from about  
670 people in the community





**Point Sources of pollution and waste come in all forms for Buada and Environs**



No Where to Go at the End of the Road.....



**Full of PCBs? Let's hope not, for all our sakes....**



**Precious water  
that should be  
going on the  
garden after  
washing the  
dishes....**





Buada's uncontained 'Municipal Waste Facility'





**Typical  
Pinnacle  
Country  
surrounding  
Buada  
Community**



**Overview of the Village and Lagoon**



Looking east from the lagoon to the last mining areas



**South of the Lagoon:**

**Refugee Camp to the left**

**Rubbish Dump to the right**





**The place to start first: Protect the Buada Lagoon**