

CWIP

**Waste Audit Report for
Twenty-Five Businesses in
Negril**

ARD

Coastal Water Quality Improvement Project

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Waste Audit Report for Twenty-Five Businesses in Negril

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Government of Jamaica's
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Implemented by:

Associates in Rural Development, Inc.
P.O. Box 1397
Burlington, Vermont 05402

Prepared by:

Velva Lawrence

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Acronyms

NWC	National Water Commission
CWIP	Coastal Water Improvement Project
NGO	Non-Government Organization
NCC	Negril Chamber of Commerce

1.0 Introduction

An important programme activity of the Coastal Water Quality Improvement Project (CWIP) is the improvement and strengthening of environmental management practices of businesses as outlined by Contract Result 3 (CR 3) of their objectives (Appendix 1). In this regard, C-WIP has targeted their interventions at small and medium sized enterprises (SMEs) and in December 1999 supported a survey of businesses conducted by the Negril Chamber of Commerce (NCC) of the Negril Business District. The information generated by this survey has been used to select twenty-five businesses for participation in a waste audit.

These businesses included the following:

Supermarket¹	-	1
Photo shop	-	1
Garage	-	1
Gas station	-	1
Water sports facility	-	1
Grocery shops	-	2
Laundries	-	2
Health facilities	-	2
Bike rental facilities	-	2
Commercial Plazas	-	3
Restaurants	-	4
Small Hotels²	-	5

The waste audits provided information on:

- Sources of wastewater
- Volume of wastewater
- Disposal of wastewater
- Composition and volume of solid waste
- Utilisation and disposal of solid waste
- Water management programmes
- Energy conservation efforts/methods
- Use and disposal of hazardous materials, where applicable.
- Existing environmental challenges

In addition the results from the audits will be used to train small and medium sized enterprises operating in Negril in environmental management systems, and the materials will be used to develop case studies for various categories of businesses.

¹ A supermarket was audited in one of the three commercial plazas and the data is also presented in this section.

² These usually have restaurants and bars attached.

2.0 Methodology

Businesses to be audited were chosen by C-WIP subsequent to a survey of small and medium sized businesses in the Negril Area. The Negril Chamber of Commerce then sent letters to the prospective participants requesting their involvement in the audit exercise.

Field Visits

All businesses were visited subsequent to discussions with the managers/operators of the facilities in order to sensitise them to the objectives of the audit. During the field visits, the following site inspection was done:

- Managers/Operators were interviewed and a questionnaire administered
- Solid waste containment areas were inspected
- Grease traps were examined to assess efficacy of grease retention
- Soakaways and septic tanks were examined and located where possible,³ if business was not connected to National Water Commission (NWC) sewage system
- Photographs taken of some of the areas being audited

Interviews

The interview methods utilised during the waste audits included telephone conversations and on-site interviews with operators using questionnaires prepared for each type of business. An example of a questionnaire used for a small hotel is attached in Appendix 2.

Estimation of Wastewater

Wastewater volume was calculated using available water bills. In some cases however, persons estimated the volume of water used as they received estimated bills from the NWC or shared metres with other businesses or houses.

Characterisation of Solid Waste Stream

In many cases the exact volume of the solid waste generated was unknown and quantities were given in number of containers disposed of over a specified time period (for example, number of 55 gallon drums/week, number of garbage bags per day, etc.). The dominant component of the solid waste was estimated on a percentage basis from inspection of garbage and/or information on waste composition given by operators of the businesses.

Conversion Factors used in calculating the volume of solid waste were:

Cubic yards x 0.7646 = cubic meters

150 kg solid waste equivalent to 1 cubic metre

Gallons x 3.785×10^{-3} = cubic metres (Used for 55 gallon drums)

Characterisation of Wastewater Streams

Samples of wastewater generated by several facilities were collected and analysed for specified parameters in order to assess the pollution potential of both gray water and sewage effluent. The results of these samples indicate the characteristics of effluent which would be expected to be

³ However, there were a few operators who were reluctant to show us the soak away areas.

discharged from small restaurants, hotels, plazas, gas stations and laundries. The majority of the businesses sampled had not yet connected to the NWC central sewage system.

These samples were always collected with the permission of the operators. There were instances when the permission was given at a time when cleaner wastewater was being discharged and this is identified in the document.

3.0 Results

The results of the audits are presented for each category and results are summarised when there is more than one business in each category. Data collated on wastewater and solid waste volumes are presented, along with disposal methods utilised. However, there were instances where it was not possible to obtain the required information from the operators of the business due to a lack of knowledge or an unwillingness to cooperate on the specific issue.

3.1 Commercial Plazas

Three commercial plazas, Plaza I, II & III, were audited. Each plaza has a variety of businesses. Therefore the information in this section is not summarized but is presented for each plaza.

Plaza I

Plaza I is located in Negril Square and is the oldest plaza in Negril. It has a wide range of businesses inclusive of the following:

- Supermarket
- Bargain Centre
- Stationery Shop
- Fruits and Vegetables Shop
- Photo Shop
- Barber and Beauty Shop
- Restaurant
- Pastry Shop
- Travel Agency
- Credit Union
- Cable and Wireless Jamaica Ltd
- Disco
- Communications Shop
- Sports Shop and Cambio
- Duty Free Shop

The waste stream from Plaza I consists of solid waste, wastewater and used cooking oil. The waste profile and volume varies significantly for the enterprises present. It was impossible to audit all the fifteen businesses present in the plaza due to time constraints and unavailability of persons operating businesses. However, examples of all the types of business were audited.

Wastewater Disposal

The total amount of wastewater from the plaza could not be ascertained as there are several metres, and some businesses did not know which metre they were connected to. However, several businesses such as the Supermarket, and Restaurant have individual metres and provided information on their water use (Table 21).

Table 21 Water Use for Four Businesses in Plaza I

Facility	Monthly Volume of Wastewater Litres)
Supermarket	18,925
Vegetables and Fruits Shop	757
Restaurant	40,000.00

Wastewater streams are divided into gray water and sewage. The gray water from kitchens and restaurants runs in open concrete drains to a soak away which is located within the green area at the entrance to the plaza. The sewage effluent allegedly flows into the collecting tank of a defunct sewage treatment plant, from which it is pumped into the morass (Photo 17).

At the time of the audit the sewage effluent was not being treated. However, the plaza was in the process of collecting funds from the various businesses for connecting the sewage systems to the NWC sewer. The supermarket had already connected.

Some shops have individual bathrooms while others use the shared bathrooms.

A sample was collected from the storage tank of the sewage plant. The results are given in Table 22.

Table 22 Analytical Results for Sample Collected from Sewage Treatment Plant in Plaza 1

BOD mg/L	COD mg/L	TSS mg/L	Oil & grease mg/L	Nitratem g/L	Total Phosphate mg/L	pH	Coliform Level MPN/100ml
9.7	75	24.57	14.8	2.2	7.31	7.08	1100

These results appear low for untreated sewage. It is unlikely that anaerobic digestion would result in such low levels of nutrients, BOD and suspended solids if fresh sewage was entering the system daily. The surface of the tanks were also covered with a green moss, had no floating plastic or other material, and appeared undisturbed (Photo 17).

Photo 17 Defunct Sewage Treatment Plant at Plaza I



When the audit was done the effluent had not been treated for some time due, it is alleged, to the unwillingness of owners of units to contribute to the maintenance cost. Blowers had not been used for years due to the foul odour which emanated in the plaza when they were turned on. It can therefore be assumed that poorly treated sewage effluent has been discharged from this plaza for a significant period of time.

There is some attempt to remove grease from the gray water from businesses such as the restaurant. However, it apparently does not work well as it was revealed during the grease trap audit that the system gets blocked with grease and the operators have to clean the disposal system regularly.

Solid Waste Composition

The majority of the solid waste collected from the Plaza I is generated by the supermarket, and this business disposes of 11.47 m³ (15 cu yd) of solid waste each day. The operator disclosed that he generates 90% of the solid waste that comes out of the plaza, the majority of which is cardboard (Table 23) (Photo 18). Components such as styrofoam containers from meat packaging, plastic covering of boxes, paper and plastic bags occur in very small amounts. 0.29m³ – 0.44 m³ (44 to 66 kg) of discarded product is removed twice per month.

Table 23 Solid Waste Profile for Supermarket

Type of Waste	% of total waste
Cardboard	98%
Discarded product, plastic bags, styrofoam containers, paper, plastic wrapping material	2%

Other businesses audited had different waste profiles as shown below (Table 24). The solid waste from the restaurant is dominated by food cuttings, the Credit Union by paper, the Photo Shop by photographic paper, and the fruits and vegetables shop by cardboard boxes. The solid waste is stored in two metal bins and collected by a private contractor for disposal at the prescribed solid waste disposal site. The bins are too small for the volume of waste and are usually overflowing (Photos 1 & 19). None of the waste is considered hazardous.

Table 24 Major Components of Solid Waste Generated by Several Businesses in Plaza 1

Business	Type of Waste	% of Total Waste
Fruits and Vegetables Store	Cardboard Boxes (Approx. 10 /day)	80 %
	Plastic wrapping, spoilt Fruits and Vegetables ⁴ , mesh bags	20%
Photo Shop	Photographic Paper ⁵	>90%

⁴ The majority of the spoilt fruits and vegetables are collected by individuals for animal feed.

⁵ Picture waste is sent to main office in Ocho Rios

Business	Type of Waste	% of Total Waste
Restaurant	Peelings/cuttings from vegetable and fruits	50%
	Left Over food and meat cuttings	20%
	Plastic shopping bags	20%
	Small amount of Plastic cups, occasional metal cans, paper bags	10%
Credit Union	Paper from computer printouts and adding machine tapes	60 – 70%
	Drink boxes, small amount plastic bottles, paper bags, plastic bags, styrofoam lunch boxes.	30 – 40%
Stationery shop	Cardboard Boxes	Given away

Photo 19 Solid Waste at Plaza 1



Energy Conservation

Energy conservation within the plaza was due mainly to the use of fluorescent bulbs and lack of air conditioning.

Environmental Challenges

Area for Improvement	Recommended Action
Solid Waste Disposal.	Reduction in the solid waste stream can be done through participation in proposed recycling program. More than 90% of the solid waste can be collected, with the majority being cardboard. However, the proponents of the recycling program must ensure that staff of the different enterprises train their staff to sort and store cardboard effectively (for example it must not get wet).
Disposal of Wastewater. Both sewage and gray water are being disposed of in environmentally unfriendly ways, and are more than likely polluting the marine environment.	<p>Connection to NWC system for sewage disposal. The managers/owners of shops in the plaza are to ensure that all businesses are connected to the NWC system. At the time of the audit several of the businesses were ready to connect but others are not. Therefore, consensus has to be reached</p> <p>Connection to NWC system for gray water disposal.</p> <p>Installation of a grease trap on the gray water system.</p>

Plaza II

Plaza II is located near to the town square, along the beachfront of Norman Manley Boulevard. The following entities are present:

- Craft Market
- Planning Agency
- Two NGOs
- Community Centre
- Snack counter and Public Changing Room in Park Area
- Tourist Board Information Centre (at entrance)

The craft market contains a variety of stalls, which sell craft items (Jamaican and imported), two cook shops, and craftsmen, who make their craft items on site.

The waste stream from the complex consists of solid waste, wastewater and intermittent air emissions. The air emissions are from intermittent burning of solid waste, usually wood chips from making of craft items.

Wastewater Disposal

The wastewater generated by Plaza II has ranged from 348,220 – 1,286,900 (92,000 to 340,000 gallons) per month. However, the higher reading was recorded for water usage for the period May to July 1999, when there were underground leaks within the complex. Also, approximately 15% of the water use recorded for Plaza II is associated with persons outside of the complex, for example from Red Ground, who do not have a personal water supply, and collect water from a pipe on the grounds of the complex.

Plaza II has recently connected to the NWC sewerage system. Prior to the connection the wastewater was disposed of as follows.

- Central Holding tanks which are emptied once every six months under low rainfall conditions and once every three months under heavy rainfall conditions. This infers that the integrity of the tank has been breached and there is movement of wastewater and water between the tank and the surrounding soil.
- Soakaways, which are used for dispersion of the gray water from cook shops. This is attributed to the poor layout of the craft market, which necessitated the use of alternative disposal methods other than the central holding tank. The management of the complex has stated the intention of regularising the disposal method on connection to the NWC system

There is generation of oily wastewater but no grease trap has been installed. The cook shops are still using the soakaways.

Solid Waste Composition

The major components of the solid waste generated by the complex are cardboard, plant material and plastic bags (Table 25). Biodegradable material forms 25% of the total waste stream. Solid waste is stored in a metal skip close to the road and collected by private contractor every two days for disposal at the prescribed waste disposal site.

None of the waste is considered hazardous.

Table 25 Solid Waste Profile for Plaza II

Type of Solid Waste	% of total Solid Waste	Comment
Cardboard	30 %	Some from external sources
Plastic bags, rice bags, styrofoam,	30%	From fruit vendors
Yard Waste, Fruit and vegetable waste (example coconut and sugar cane), wood shavings	25%	Majority is biodegradable
Paper	5%	Mainly from offices
Empty Plastic containers	5%	
Glass	5%	

Most of the waste generated by the offices in Plaza II is dominated by paper or lunch waste (plastic bottles, lunch boxes and residual food). For example at one NGO, 70% of the solid waste stream is lunch waste, while at the other it consists mainly of paper. The paper in both NGOs is usually reused subsequent to disposal

Hazardous Material

No hazardous material was identified on the complex. However, there is the adjacent Fisherman's beach, which has a fuel storage facility and underground storage tank

Greening of Complex

There has been some effort to make the complex environmentally friendly. This included:

- Use of low flush toilets in refurbished changing facilities on beach
- Use of fluorescent bulbs in offices
- 3 phase wiring
- Some composting by a NGO (Photo 20). Cuttings from garden, leaves and residual fruit material are placed on the heap. The compost is used occasionally to fertilize plants adjacent to the compound.
- Use of dry toilet for sewage by one NGO.

It is difficult to properly manage water use due to the impact of outside influences.

Photo 20 Composting Heap Maintained by a NGO



Environmental Challenges

Areas for Improvement	Recommended Action
Solid Waste Disposal.	Reduction in the solid waste stream can be done through participation in proposed recycling program.
Wastewater Disposal	Ensure connection of cook shops in complex to NWC system instead of disposal to soakaway
Wastewater quality	Installation of grease trap on wastewater disposal system

Plaza III

Plaza III is operated is located on the West End Road, close to the centre of the town. The shops in the plaza are rented to small businesspersons, which are mainly craft vendors (approximately 55%). There are 45 shops and 11 stalls. The businesses include the following:

- Craft Vendors
- Clothing
- Cook Shops
- Barber
- Record Shop
- Lotto Shop
- Art Gallery
- Bridal Shop
- Dressmaker
- Tattoo Shop (Part Time)
- Jewelry Repair
- Stone Sculpting

The waste generated by the plaza includes solid waste, wastewater, and used cooking oil.

Wastewater Disposal

The volume of wastewater generated by the plaza ranges from 704,010 – 319,755 litres (186,000 – 243,000 gallons) per month. The major portion of the gray water would be from the two cook shops, as the operation of the majority of the businesses does not result in the discharge of wastewater. All operators and clients will of course generate sewage effluent.

The plaza is connected to the NWC sewage system. There is a grease trap for pretreatment of oily waste. However, it is only cleaned twice per year.

Solid Waste Composition

The main components of the solid waste are cardboard boxes and packaging material (both plastic and paper), accounting for approximately 60% of the total waste stream (Table 26). The solid waste is stored in drums and plastic garbage bags for collection by the WPM every two days (Photo 21).

Photo 21 **Solid Waste Storage at Plaza III**



Table 26 Solid Waste Profile for Plaza III

Type of Solid Waste	% of total Solid Waste	Comment
Cardboard boxes and packaging material	60 %	Some from external sources
Plastic bottles and containers	20%	
Office Paper	20%	This amount varies from 0 to 20%.

No hazardous waste is present in the waste stream.

Cook Shops

The two cook shops operate in the Plaza III. They are relatively small establishments and therefore do not generate significantly large amount of waste (Table 27).

Table 27 Type of Waste generated by Cook Shops in Plaza III

	Cook Shop I	Cook Shop II
5 gallon oil bottles	1/week	1/week
1 gallon ketchup bottle	2	2
Plastic soda bottles	Few, most are taken away	Few, most are taken away, sells around 36 every two days.
Vegetable cuttings	Unknown	Unknown
Meat and Chicken cuttings		To dog food.
Used Cooking Oil	3.78 Litres/week, bottled and place in garbage	3.78 Litres/week, bottled and place in garbage

Greening of Plaza

The greening of the plaza is through:

- Use of low flush toilets
- Mulching using garden waste.
- Use of sunlight and fluorescent bulbs in office areas. However, the shops and the lighting of the outside areas use other bulbs. The use of normal bulbs for outdoor lighting is due to theft of fluorescent bulbs.

Environmental Challenges

Area for Improvement	Recommended Action
Solid Waste Disposal.	Reduction in the solid waste stream can be done through participation in proposed recycling program.
Disposal of Used Cooking Oil	Collection for reuse, for example by RYCo.

3.2 Supermarkets

Two supermarkets participated in the waste assessment exercise. Both were located in plazas and shared waste disposal facilities with the other businesses (in the plazas).

Solid Waste Composition

The audits revealed that the waste stream from a supermarket is dominated by cardboard, which can form between 98 - 99% of the total solid waste generated and be as high as 250 cardboard boxes in one day (Table 1, Photo 1). This makes the solid waste from these facilities suitable for the recycling project if the cardboard is kept dry and stored in an appropriate manner. The extraction of the cardboard from the solid waste stream will significantly reduce the volume coming from plazas with supermarkets and reduce the unsightly conditions at solid waste containers, for example skips, after unpacking exercises (Photo 1). The plus for the operators is the reduction in their garbage disposal cost.

Table 1 Solid Waste Profile for a Supermarket

Type of Waste	% of total waste
Cardboard	98%
Discarded product, plastic bags, styrofoam containers, paper, plastic wrapping material	2%

Other components of the solid waste include expired product, spoilt fruits and vegetables, and small amounts of plastic and styrofoam⁶ packaging material. Spoilt meat products are normally returned to the distributors and is therefore not a significant part of the solid waste stream.

Solid waste generated by supermarkets is disposed of at prescribed waste disposal sites by private contractors. Storage prior to collection is in skips and metal bins.

Photo 1 Solid Waste Generated by a Supermarket



⁶ From packing of meat.

Wastewater Generation

Wastewater generated by supermarkets is relatively small. Water is used only in bathrooms and for sanitation purposes. One supermarket uses 18,925 litres (5000 gallons) per month. The other did not have a common metre and the wastewater generated could not be measured.

Energy Conservation

Energy conservation measures include the use of fluorescent bulbs in both supermarkets and the insulation of freezers and covering of coolers during the nights in one supermarket.

Environmental Challenges

The environmental challenges the supermarkets face and recommended remedial actions are outlined below.

Area for Improvement	Recommended Action
Disposal of Solid Waste Generates high volume of cardboard.	Participation in proposed recycling programme. Requires sorting of waste, collection and storage of cardboard in a designated area, such as a dedicated bin. Cardboard should be kept clean and dry. Therefore employees must be trained to sort and store cardboard appropriately.

3.3 Grocery Shops

Waste assessments were done for two grocery shops. Grocery shop A is small and located on the Morass side of the Norman Boulevard. Grocery Shop B is medium sized and located on the West End Road. Both operators live adjacent to their businesses. However, Shop A retails goods only and does not sell meat. Shop B offers goods for both retail and wholesale and sells meat.

Wastewater Disposal

Shop A does not generate any significant amount of wastewater as the bathroom facilities are located at the house. Shop B generates wastewater which is disposed of via a septic tank and soak away.

Solid Waste Composition

Shop A could not ascertain the volume of solid waste generated due to the combination with the household waste. It was approximated that three garbage bags of waste were produced each week consisting of empty box drink containers, plastic drink bottles, cardboard boxes, glass bottles, empty tin cans and a small amount of plastic bags.

Shop B produces 0.42 m³ (2 X 55 gallon drums) of garbage each week. During the spring break this amount increased significantly. Cardboard boxes form the major portion of the waste produced, around 90%, while empty juice boxes, plastic and metal containers and make up the remaining 10%. Solid waste from Shop B is stored in drums for collection by WPM. However, some of the boxes are burnt.

None of the waste collected from either shop is considered hazardous.

The operators of both shops are interested in participating in the recycling program planned for Negril, especially for cardboard. However, the concern was expressed concerning timely collection of the cardboard, which could attract pests if not moved regularly.

Environmental Challenges

Areas for Improvement	Recommended Action
Disposal of wastewater. Sewage and gray water released to the coralline limestone of the West End has the potential to pollute marine waters.	Connection to the NWC Central Sewage System.
Disposal of solid waste.	Reduce volume through participation in the proposed recycling program. This will require a bin for storage of sorted cardboard. Abandon burning of solid waste.

3.4 Photo Shop

The Photo Shop develops and processes film, takes photographs, sells photographic supplies and videotapes weddings. This business generates wastewater, solid waste and air emissions.

Wastewater Generation

The Photo Shop generates wastewater inclusive of sewage and wastewater from film processing operations. However, the operator of the Photo Shop is unaware of how much wastewater is generated as the shop apparently has a shared water metre with adjacent buildings on the premises. The business is not linked to the NWC sewage system and disposes of its wastewater via a soak away. Some of the wastewater is considered hazardous due to the occasional disposal of waste chemicals (2,200 ml each month). These chemicals are described in Table 2.

Table 2 Chemicals used in Film Processing at Photo Shop

	Amount Used monthly	Type of Chemical	Constituents
A	1200 ml	Colour Developer	Water, Potassium carbonate, Diethylenetriaminepentacetate, pentasodium salt
B	200 ml	Colour Developer	2% Formaldehyde, Diethyleneglycol, nonylphenolpolyethylene oxide.
C	800 ml	Colour Developer	Water, Ethanol, Sodium disulphite, 2-[(4-amino-3-methylphenyl)ethylamino]-sulphite(1:1)(salt)
	100 ml	Fixer Replenisher	Water, Sodium metabisulphite, Ammonium thiosulphate

Solid Waste Composition

One 55-gallon drum or 0.21 m³ of solid waste is generated every 2 days (not open on Sunday). The main component of the solid waste is discarded photographic paper. Other constituents include the following:

- Empty plastic containers
- Plastic bags
- Cardboard
- Lunch/Food waste
- Plastic bottles

Solid waste is stored in a drum for collection by WPM. There is some burning of material if the truck is late. The volume of the individual constituents could not be ascertained as the solid waste from the photo shop is mixed with that produced by other persons conducting businesses nearby. None of this waste is considered hazardous.

Air Emissions

There is some air emissions from open burning of garbage.

Storage of Hazardous Material

A small volume of hazardous material is stored in tightly closed plastic containers, in carton boxes, in the area used for film development.

Environmental Challenges

Area for Improvement	Recommended Action
Wastewater quality – There is potential for contamination of the marine environment by chemicals discharged by the operation.	Connect to the NWC system
Reduction in Solid Waste Stream	Participate in proposed recycling system
Disposal of solid waste	Stop open burning and store all waste for collection by garbage contractor.

3.5 Small Hotels

Five small hotels (Hotel A, B, C, D & E), were audited, ranging in number of rooms from 19 to 86. All the facilities audited also operate restaurants and bars which cater to walk in customers.

Hotel A is located on the beachfront of the Norman Manley Boulevard in Negril. It has nineteen rooms, and a restaurant, which forms the major part of its business. This hotel has 49 employees during the normal periods and 80 during the peak period of Spring Break for about 6 weeks. The hotel operates a laundry.

The types of waste generated by Hotel A are solid waste, wastewater and used cooking oil.

Hotel B is located on the West End Road in Negril and the facility is on both sides of the road. The reception and main accommodation area is on the landward side while the restaurant, bar and several other buildings are on the seaward side. The hotel has 20 rooms and the restaurant caters for both guests and walk-ins. Hotel B generates solid waste, wastewater and used cooking oil. These are disposed of in several ways and there is significant reuse of the organic component of the waste.

Hotel C is located along the coastal strip of the Norman Manley Boulevard. It consists of two properties, Resort I and Resort II. Resort II was opened in 1999, but the original resort has been in operation for 14 years.

Hotel C has a total of 86 rooms (Resort I has 42 and Resort II has 44). This hotel operates its own laundry and has a swimming pool. Both are located at Resort II. The hotel offers an all-inclusive package along with a European Plan, and has a mainly European clientele. It also operates bars and restaurants which are open to the public. The occupancy of the hotel ranges from 70 – 100%.

The waste stream of this hotel consists of solid waste, wastewater and used cooking oil.

Hotel D is located on the Norman Manley Boulevard in Negril on the beachfront. It is a small hotel, with forty-nine (49) rooms. It offers a combination of family and double/single occupancy rooms, non-motorised water sports such as kayaking and parasailing, and operates a restaurant. Hotel D also operates its own laundry. The waste stream consists of wastewater, solid waste and used cooking oil

Hotel E is located on the West End road in Negril adjacent to the sea cliffs. It has 52 rooms and also operates a restaurant and bar. The hotel also has live entertainment, which is patronised by visitors staying at other hotels. Occupancy levels range from 15 - 80% outside of spring break and during spring break is 150% for the first three weeks due to the practice of allowing more than two persons per room.

The hotel also operates its own laundry. The types of waste generated include solid waste, wastewater and used cooking oil.

Wastewater Disposal

Hotel A generates around 1,135,500 litres (300,000 gallons) of water each month. However, it is linked to the NWC sewerage system and no wastewater is disposed of on site. The oily water from the kitchen is routed through a grease trap, which is cleaned once every 1 ½ to 2 weeks (Photo 13).

The volume of wastewater generated by **Hotel B** ranges from 465,555 – 685,085 litres (123,000 – 181,000 gallons) each month, an average of 571,535 litres (151,000 gallons). The hotel is not yet linked to the NWC sewerage system and uses a soak away to dispose of all its wastewater. The operator cited the expense of connection (exacerbated by the hard coralline material, which has to be excavated for installation of the connection), as the major obstacle to connecting to the system. There is a grease trap attached to the wastewater pipe, which is not monitored properly and is cleaned only if it backs up. Its efficacy also needs to be determined, as at the time of audit there was little trapped grease in the first compartment.

Photo 13 Grease Trap at Hotel A

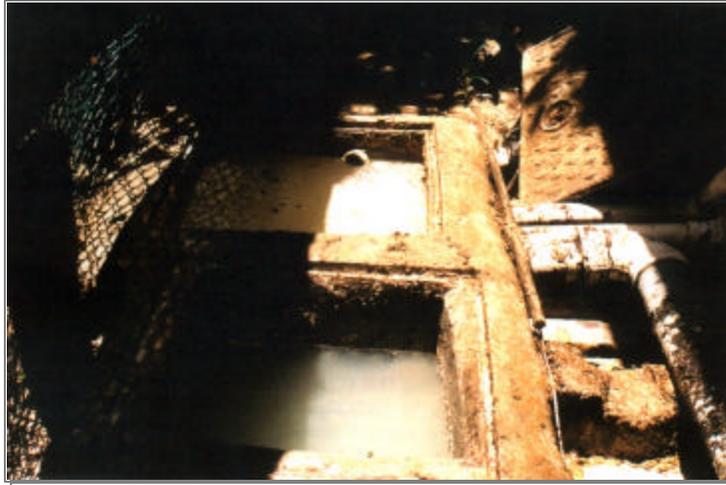


Photo 14 Grease Trap at Hotel C



The hotel operates a laundry. Low phosphate detergent has been used in the laundry. However, the use was discontinued due to the higher cost and the inconsistent availability. Only small amounts of cleaning agents are stored on the compound and the required amount of bleach, fabric softener and detergent are bought weekly.

Disposal of wastewater is by soakaways, which are located on both sides of the road.

Both resorts of **Hotel C** generates around 2,700,000 litres of wastewater at 100 % occupancy, which is discharged into the NWC sewage system. This relatively high volume of wastewater is due to the presence of a pool and laundry at Resort II. The oily wastewater from the kitchen passes through a grease trap (Photo 14), prior to entering the sewer main. The grease trap is monitored daily and cleaned as often as needed. An inspection conducted during the audit

revealed that the grease trap was removing significant amounts of the oily residue from the wastewater. However, it was a single chamber grease trap and this reduced the efficacy of the process.

Hotel D generated 654,805 litres (173,000 gallons) of wastewater in January of 2000 at 59% occupancy. Due to the operation of a restaurant, the facility generates oily wastewater, which is routed through a grease trap. This grease trap works well as was evidenced by the presence of trapped grease in the first chamber and the clearer water in the second chamber. However, the grease trap needs to be cleaned more often as there was too much fat accumulated in the first chamber.

Diversey Lever supplies cleaning products used in the laundry, and Hotel D uses low phosphate detergent. Products used are Formula 101, F 901 and a low temperature emulsifier.

Hotel E generates 264,950 – 1,261,000 litres (70,000 – 333,154 gallons) of wastewater each month. However, the facility was not yet linked to the NWC sewerage system at the time of the audit, but the operators indicated that they were in the process of doing so.

A combination of soakaways and septic tanks are used for the disposal of wastewater. Wastewater from the kitchen goes to the soak away whereas the rooms are linked to a septic tank. The manager indicated that the septic tank is emptied between once to twice each month, except during the spring break period when it is emptied at least 3 times each month. However, this must be erroneous information as the is at least a quadrupling of the occupancy rate during the spring break, inferring that the septic tank should be emptied at least 8 times each month. The oily wastewater from the kitchen flows into the soak away without any removal of fatty residue, as there is no grease trap at this facility.

A summary of the volume of wastewater and disposal methods is given in Table 14.

The popularity of the restaurants contributed significantly to the water use and therefore it was observed that hotels with smaller number of rooms could have higher water consumption than their larger counterparts.

Table 14 Reported Volume of Wastewater and Method of Disposal for Five Small Hotels in Negril

	No of rooms	Volume of Waste Water (Litres)	Method of disposal	Grease Trap Present
Hotel A	19	1,135,500	NWC	Yes
Hotel B	20	465,555 - 685,085	Soak away	Yes
Hotel C	86		NWC	Yes
Hotel D	49	654,805	NWC	Yes
Hotel E	52	264,950 – 1,261,000	Septic Tank for rooms Soak away for kitchen	No

Solid Waste Composition

Solid waste generated by the hotels varied in composition and volume (Table 15).

Table 15 Solid Waste Profile of Five Small Hotels in Negril

	No of rooms	Volume of Solid Waste (weekly)	Dominant Constituent	Method of disposal
Hotel A	19	14 – 21m ³	Food waste/trimmings	Private contractor Composting
Hotel B	20	2.2m ³	Plastic cups & bottles ⁷	Western Parks and Markets Composting and animal feed
Hotel C	26	25.83 m ³⁸	Left over food	Private Contractor
Hotel D	49	12.2 m ³	Yard Cuttings	Private Contractor
Hotel E	52	2.94 – 5.81m ³	Not sure	Private Contractor

Hotel A generates approximately 1.5 – 3 m³ of solid waste each day depending on the occupancy level. However, during spring break this amount increases significantly. The solid waste is placed in garbage bags and stored in a skip.

Table 16 Solid Waste Profile for Hotel A

Type of Solid Waste	% of Waste Stream
Discarded Food	50%
Cardboard	30%
Paper	20%

The waste is collected by a private contractor and disposed of at the prescribed waste disposal site.

Hotel B generates approximately 2.2 m³ of solid waste each week. This is exclusive of residual food and food cuttings, which is removed three times each week and reused for pig feed. The amount of food cuttings and residual food ranges from 0.54 to 1.4 m³ weekly. Eighty percent of the yard waste is composted. Bougainvillea and coconut are not composted due to the hard

⁷ This facility uses all the food cuttings and waste oil as animal feed and therefore these two categories do not contribute to this waste stream. Hence the dominance of plastics.

⁸ At 100% occupancy.

nature of the wood. Material such as glass (bottles), paper and cardboard, plastic containers and cups are stored in 55-gallon drums and taken to the prescribed waste disposal site by WPM (commercial pickup).

Table 17 Solid Waste Profile for Hotel B

Type of Solid Waste	% of Total Waste Stream	Comments
Plastic Containers	60%	Cups and bottles
Glass Bottles	15%	
Yard Waste (20 % of total amount)	10%	For example, coconut and bougainvillea with hard woody sections
Paper and Cardboard	8%	
Tin Cans	5%	
Food cuttings and residual food		Collected and used as pig feed. Therefore not part of waste stream.
Yard Waste (80% of total amount)		This portion is composted

Hotel C generates approximately 3.69 m³ of solid waste each day. This waste stream is dominated by leftover food (Table 18, Photo 15). Solid waste is stored in a 4 cu yd skip (Photo 16) and 55-gallon drums at Resort II. It is collected daily by a private contractor and disposed of at the prescribed waste disposal site.

Table 18 Solid Waste Profile for Hotel C

Type of Solid Waste	% of Total Waste Stream	Comments
Left over food	70	
Cardboard boxes, plastic bags and paper, leaves and yard cuttings	23	Plastic bags for storage of goods
Food Cuttings	5	Meat trimmings used to make stock
Plastic cups	2	Mainly for beach use. Glasses used otherwise

The main components of the solid waste generated at **Hotel D** are:

- Vegetable Matter/Food cuttings
- Yard Cuttings
- Plastic and Cardboard
- Paper

This hotel and restaurant does not use plastic cups, plates or forks, which are usually significant contributors to the solid waste stream at other restaurants. However, no composting is done and therefore the garden waste and yard cuttings form a large portion of the solid waste stream. Seventy-five percent of the solid waste is biodegradable (Table 19).

Table 19 Solid Waste Profile for Hotel D

Solid Waste	% daily volume	Approximate Daily ⁹ volume (m ³)
Yard Cuttings	50%	0.87
Food Cuttings/Peelings	25%	0.45
Cardboard +Plastic + paper	25%	0.45

The total volume of solid waste is 12.23 m³ (16 yd³)¹⁰ per week. Solid waste is stored in a skip and collected 4 times each week and disposed of at the prescribed waste disposal site. No portion of the solid waste is considered hazardous.

Photo 15 Solid Waste from Hotel C



⁹ The approximate daily volume was calculated using the percentages of the daily volume of solid waste generated.

¹⁰ (2 cu yd x 4 times per week)

Photo 16 Skip at Hotel C



The daily volume of solid waste generated by **Hotel E** is estimated to range from 0.42 – 0.83 m³. However, this is low for a hotel of 52 rooms. During the spring break period the daily volume of waste would be much higher and exceed 2 m³. The main constituents of the solid waste stream are:

- Yard cuttings/garden waste
- Plastic cups and containers
- Food cuttings/trimmings
- Cardboard (small amount)
- Paper (small amount)

However, the approximate percentage of each component could not be ascertained. The solid waste is bagged and placed in and adjacent to metal drums for collection by a private contractor. The waste is then disposed of at the prescribed waste disposal site.

Used Cooking Oil

All the hotels audited collect and store their waste oil in 55-gallons or 27-gallon drums. Three (A, C & E) have their oil collected by RYCo Ltd. Hotel B combines it with food cuttings for animal feed and Hotel D gives it to employees.

Green Practices

Reuse of Organic Material

All the small hotels that were audited generate a large volume of organic material, consisting of food cuttings, trimmings and garden waste. Only two of these facilities have implemented measures to reuse this material. At Hotel B all the organic matter generated in the kitchen is used for animal feed along with the waste oil. Additionally, 80% of the garden waste is used for composting. At Hotel A, there has been partial composting of the garden waste and seagrass washed up on to the shore. However, the food cuttings and cuttings from the kitchen are placed in the solid waste destined for the dump.

Water Conservation Program

Only two of the hotels audited, hotels A and D, have a water conservation programme. They have installed low flush toilets and low flow showerheads to varying degrees (Table 20). Hotel D also offers guests the option to wash towels less frequently. Hotel A also reported a system of check valves in the pipes from storage tanks to the rooms to prevent or reduce trickling of water through pipes when the rooms are not occupied. All the hotels indicated that they had attempted to sensitize staff to the importance of conserving water. However, most revealed that this process has had limited success.

Table 20 Green Practice of Five Small Hotels in Negril

Hotel	Reuse of Organic Material	Collection of Used Cooking Oil	Water Conservation	Energy Conservation	Low Phosphate Detergent	Collects Rainwater
A	Yes	Yes	Yes	Yes	No	Yes
B	Yes	Yes	No	Yes	No	No
C	No	Yes	Yes	Yes	Yes	No
D	No	Yes	Yes	Yes	Yes	Yes
E	No	Yes	No	Yes	Yes	No

Collection of Rainwater

Two hotels (A and D), collect rainwater to supplement their inflow from the National Water Commission.

Energy Conservation

All of the hotels audited have some element of energy conservation in their daily operation as shown in Table 20. All utilize fluorescent in some area of their operation and four (4) have solar water heaters. Three facilities have 220 volt refrigerators and freezers and two have light sensors in the outdoor lighting. Most of the facilities have made attempts to sensitize staff to the importance of energy conservation but have had very limited success.

3.6 Restaurants

Four restaurants were included in the audit process and these have to the potential to impact on the Morass, rocky and sandy beaches due to their locations.

- Restaurant A - West End Road (Cliff)
- Restaurant B - Negril Morass
- Restaurant C - West End Road (Cliff)
- Restaurant D - Beach Strip

All four facilities generate solid waste, wastewater and used cooking oil.

Restaurant A is located along the rocky shore on the West End Road in Negril. This small business provides pastries, meals and a variety of drinks. All the food sold is prepared on site. This restaurant generates solid waste, wastewater and used cooking oil.

Restaurant B is located along the Westmoreland to Negril main road adjacent to the Negril Morass and southwest of the South Negril River. The restaurant is open from 7:00 am to 11:00 p.m. and serves breakfast, lunch and dinner. Solid waste, wastewater and used cooking oil are generated from the daily operations of this restaurant.

Restaurant C is located adjacent to the rocky beach (cliffs) in the West End. It serves snacks, meals and a variety of drinks and is open between 8:00 am and 12:00 p.m. It has been in operation for six years.

This restaurant generates wastewater, used cooking oil and solid waste. The volumes of each waste vary throughout the year, and can increase by as much as 700% during the peak of the spring break period.

Restaurant D is a restaurant and beach bar that is located on the Negril Beach Strip, Norman Manley Boulevard. It offers breakfast, lunch and dinner and has a local and international menu. The number of persons using the facility ranges from 40 on a very slow day to 1500 during the peak period of spring break. The facility generates solid waste, wastewater and used cooking oil.

Solid Waste Composition

The solid waste streams of the restaurants are dominated by food cuttings and spoiled food (Table 11). Other common components are glass bottles, plastic cups and bottles, cardboard boxes and paper cups. Styrofoam boxes, plastic packaging material, metal tins, paper and aluminum foil, constitute a small portion of the waste (1 – 3%). The solid waste from these establishments is stored in open concrete structures, skips or drums. The garbage is collected by WPM commercial operations or private contractors, and disposed of at the prescribed waste disposal site.

Detailed information on the waste profile for each restaurant is in Appendix 3.

Table 11 Characterisation of Solid Waste for Four Restaurants in Negril

Restaurant	Reported Volume of Solid Waste (Weekly)	Dominant Waste	Method of Disposal
A	2.16 m ³ (1.5 x 55gallon drums daily)	Food Cuttings/Trimmings	WPM Animal Feed
B	2.94 m ³ (2 x 55gal drums/day)	Food trimmings and spoiled food.	WPM
C	9 m ³ (1323 kg)	Paper cups and paper ¹¹	Private contractor Composting
D	2.8 – 8.82 m ³	Food cuttings/trimmings	Private Contractor

¹¹ Reuses most of the biodegradable material.

The volumes of solid waste generated by these restaurants will increase significantly during spring break. For example, at Restaurant C the volume increases by 700% to 63 m³ weekly and has to be collected twice per day. Restaurant D reported that during this period they cater to approximately 1500 persons daily, whereas in the slow period they may have only 40 patrons (Table 12). The reported 300% increase in solid waste volume for spring break period is considered low

Table 12 Variations in Daily Volume of Solid Waste Produced by Restaurant D

Use of Facility	No. 55 gallon Drums/day ¹²	Calculated Daily Volume (m ³)
Low	2	0.4
High	4	0.83
Spring break	6	1.26

None of the waste generated by the four restaurants is considered hazardous. For three of the facilities the solid waste storage area was utilized by persons adjacent to the restaurant, both commercial and residential.

Wastewater Disposal

The volume of wastewater varied significantly and ranged from 94,625 litres (25,000 gals) to 283,875 litres (75,000 gals) per month (Table 13). However, the accuracy of some of the volumes reported, for example that for Restaurant C, is in doubt.

Only one of the restaurants (Restaurant A), was connected to the NWC system at the time of the audit although the other three indicated that they were either in the process of connecting or had plans to connect (Table 13). The operator of Restaurant C reported that the major obstacle to connection was the cost, due mainly to the geology of the West End (Hard Limestone). The wastewater from Restaurant B is disposed of in two ways: Grey water is piped into the morass (Photo 9), while the sewage flows into a septic tank (Photo 10) which the manager indicated is cleaned two or three times each month. There is no grease trap attached to the wastewater disposal system¹³. The lid to the septic tank is sealed.

Restaurant C uses a concrete storage tank located under the bathrooms for collection of both gray water and sewage (Photo 11). The owner stated that this was emptied three times each week, but daily during the spring Break period. Restaurant D uses a soak away for gray water and a septic tank for sewage. The Operator reported that the septic tank is cleaned as needed.

It is to be noted that septic tanks are prone to develop cracks and leak, thereby acting only as concrete lined soakaways. During the course of the audit, no cesspool emptiers were observed in Negril.

¹² Gallons x 3.785x10⁻³ obtains cubic metres.

¹³ A soak away which was used previously for waste water disposal had to be abandoned and clogging by fat residue could have contributed to this.

Table 13 Reported Volume of Wastewater and Method of Disposal for Four Restaurants in Negril

Restaurant	Volume Waste Water (Litres)	Method of Disposal	Grease Trap
A	94,625 (Approx. 25,000 gals)	NWC System	Yes
B	275, 423	Gray water – piped to morass Sewage – Septic Tank which is cleaned bimonthly or quarterly.	No
C	94,625 (Approx. 25,000 gals)	Septic Tank – Emptied 3 times each week.	No
D	283,875 (75,000 gals)	Sewage – Septic Tank Kitchen – Soakaway	No

A sample of the gray water was collected for analysis. The results indicate that the gray water has a high pollution potential having high COD, TSS, nitrate and oil and grease levels (Table 14). The earthen drain utilized for transferring the wastewater to the morass also had a congealed fat layer on the surface in several places. Bubbles coming to the surface from the substrate also indicated anaerobic activity due to oxygen depletion.

It is expected that the effluent being sent to the soakaways by other restaurants would have similar characteristics and are contributing to the pollution of the marine environment.

Table 14 Analytical Results for Grey Water Discharged by Restaurant B

BOD mg/L	COD mg/L	TSS mg/L	Oil & grease mg/L	Nitrate Mg/L	Total Phosphate mg/L	pH
244	2408	479.31	292.0	83.16	2.18	6.12

Photo 9 **Earthen Canal with Grey Water from Restaurant B**



Photo 10 **Septic Tank at Restaurant B**



Used Cooking Oil

The waste oil generated by all four restaurants is collected and stored in 55-gallon drums provided by RYCo Ltd (Photo 12). This oil is collected every 2 weeks to two months.

Energy Conservation

Energy conservation was not a high priority among the restaurants audited. However, all used fluorescent bulbs when lighting was necessary. Two of the buildings were open and require limited lighting. However, there are areas such as the provision of hot water through solar heaters and the use of energy efficient freezers, which should be applied to these facilities.

Table 11 Water and Energy Conservation Measures at Four Restaurants Audited in Negril

Restaurant	Water Conservation	Energy Conservation Program
A	NO	Fluorescent bulbs, three phase electricity. However no 220 volt equipment.
B	YES Low flush toilets. Sensitized staff to water conservation	Fluorescent bulbs
C	NO	Open building using mainly natural lighting
D	NO Attempts to sensitize Staff	Open building using mainly natural lighting

Photo 11 Septic Tank Located under Bathroom at Restaurant C



Water Conservation

Only Restaurant B had any significant water saving thrust in place through the use of low flush toilets and sensitization of staff to the importance of water conservation (Table 11).

Photo 12: Used Cooking Oil Storage Drum at Restaurant C



Environmental Challenges

Area for Improvement	Recommended Action
Solid Waste Disposal. The major components of the waste stream are reusable or recyclable.	Participation in proposed recycling program Participation in a composting program for reuse of the organic portion of the solid waste.
Sewage and gray water disposal The disposal of gray water into an earthen canal leading to the morass and eventually to the South Negril River is polluting the coastal waters. Similarly the use of soakaways in sandy and fissured limestone. There is also potential seepage from the septic tank to the ground water.	Connection to the NWC system. Installation of Grease Traps to prevent grease in gray water impacting on the lift pumps of the sewage system.
Water Conservation	Use of low flush toilets by all restaurants and training of staff

3.7 Laundries

Chemical Usage

Two laundries were audited. Laundry A is located on the northwest boundary of the main road from Negril to Savanamar. This laundry does not offer dry-cleaning services. The majority of their business comes from individuals who want articles laundered and pressed. Only a small amount of laundry is done for hotels. There are five employees at the laundry. The equipment present includes:

- Steam Boiler (which uses diesel fuel)
- Two dryers (uses steam)
- One large 200 lb. washing machine (uses electricity)
- One 500 LB water extractor

The laundry uses mainly detergent and bleach as cleaning agents. The estimated amount of each material use is shown in Table 6.

Table 6 Cleaning Agents and Amounts Used in Laundry A

	Cleaning Agents	Amount Used
Laundry A	Super Sud Powder Detergent	20 lbs./day
	Bleach	1 gallon /week
	Fabric Softener	

A limited amount of the laundry is done by hand and is usually for articles of clothing which need to be sorted from the others being washed. The washing machine uses electricity, but the dryers use steam generated by the boiler. The boiler uses diesel as fuel and uses 165 gallons per week (3 x 55gallon drums). There were no significant spills of the diesel fuel on the date of the audit.

Laundry B is located on the West End Road in Negril and is open for 24 hours. This Laundry offers dry-cleaning, washing and ironing services. Washing is the dominant activity and accounts for over 90% of the total business. The facility currently does the laundry for Grand Lido due to the loss of their laundry to fire.

The cleaning agents used by the facility includes:

- Bleach [Chlorite with NaOCL, Chlorine Available 4% and Chloro-do with sodium hypochlorite, Available chlorine 3%]
- Laundry emulsifier [phosphate esters, metasilicates, buffered alkalis and glycol ether]
- Super Sud Detergent [not low phosphate].
- Dry cleaning solvent – PERSCOL from Diversey Lever.
- Low temperature bleach – F401 – non phosphated, chlorinated bleach
- Neutraliser – Rust Stain removing Sour. Liquid Klera-cid. This is a corrosive substance.
- Low temperature emulsifier. F-401 NP. Non –solvent water based product to assist detergents to remove oil and grease, etc.

The information on the amount used was not provided. The cleaning agents are stored in a storage room with a concrete base.

Wastewater Disposal

Neither of the laundries is connected to the NWC sewage system and dispose of their wastewater using a combination of septic tanks, open drains and soakaways (Table 7). Laundry A generates approximately 386,070 litres (102, 000 gallons) of wastewater per month and disposes of the gray water into two canals on either side of the building which lead into the morass and ultimately to the South Negril River (Photo 5). The sewage is sent to a septic tank. The operators of Laundry B indicated that the business generates approximately 105,980 litres (28,000 gallons) and disposes of the gray water into a soak away in the coralline limestone of the West End. A septic tank is also used for disposal of sewage. However the information given for the volume of wastewater produced by Laundry B is obviously inaccurate as it offers a 24 hour service and does more business than Laundry A. The volume for Laundry B should therefore be at least twice that of Laundry A. Laundry B also offers dry-cleaning services but this is usually a small portion of their business.

Table 7 Reported Volume of Wastewater generated by Two laundries in Negril and \ Method of Disposal

	Volume Waste water (Litres)	Method of Disposal
Laundry A	386,070	Gray water – earthen canals into morass. Canal flows to South Negril River Sewage – Septic Tank/Soak Away
Laundry B	105,980	Grey water – soak away in limestone Sewage – Septic Tank/Soak Away

Photo 5 Earthen Canal with Wastewater from Laundry A



One sample of gray water was collected from each laundry and analyzed for several parameters (Table 8)

Table 8 Analytical Results for Wastewater Samples Collected from Two Laundries in Negril

	BOD mg/L	COD mg/L	TSS mg/L	Oil & grease mg/L	Nitrate mg/L	Total Phosphate mg/L	pH
Laundry A	5.4	80	40.37	7.9	<0.76	12.95	12.95
Laundry B	6.65	281	89.63	11.3	<0.76	4.7	7.8

The sample for Laundry A was taken during use of a specific chemical to do a laundry for Grand Lido and was not a typical wash using detergent. Unfortunately it was not possible to repeat this sample. The product being used was Yellowgo Dye Stripper which contains titanous sulphate, sulphuric acid, citric acid and ammonium bifluoride. The two parameters not in compliance with NRCA discharge standards are total phosphate and the pH, which indicates that the wastewater is highly alkaline.

For Laundry B, the sample for which permission was received came from the rinsing cycle and is not an accurate depiction of the wastewater characteristics. Apart from COD, and oil and grease, all other parameters are in compliance with the NRCA trade effluent discharge standards

Solid Waste Composition

Both laundries generate very small amounts of solid waste, 1 – 1.5 kg/day. The solid waste consists mainly of plastic bags, plastic containers, spray starch tins and cardboard boxes (Table 9). The solid waste from Laundry A is burnt.

Table 9 Components of Solid Waste Stream of Laundries

	Components of Waste	
Laundry A	Empty Plastic Detergent Bags	1/day
	Empty plastic Containers	
	Spray Starch Tins	6/week
	Lunch boxes and box drinks	
Laundry B	Plastic bags	
	Plastic bottles and cardboard	

Disposal of Dry Cleaning Solvent

Information supplied during the interview indicate that the dry cleaning solvent from Laundry B (PERSCOL) is collected when dirty and poured into a 55-gallon drum which is sent back to the supplier once per year. The solvent is changed when it gets dirty.

Energy Conservation

There is no formal energy conservation program at Laundry B. However, lighting is provided by fluorescent bulbs. According to the operators, the washing machines are also energy efficient. Liquid petroleum gas (LPG) is used for the dryers, which is more efficient than electricity. The operators of Laundry A also do not consider that there is a formal energy conservation program in

place. However, fluorescent bulbs provide all the required lighting and steam is used for the dryers and iron instead of electricity.

Environmental Challenges

Areas for Improvement	Recommended Action
Disposal of wastewater. Sewage and gray water released to the coralline limestone of the West End or sent by earthen drain to the morass. Both disposal methods have the potential to pollute the marine environment.	Connection the NWC Central Sewage System.
Solid waste disposal, which is done by open burning at Laundry A.	Garbage collection by waste disposal company.

3.8 Health Facilities

Two health facilities were audited, one is a government run institution (Facility A) and the other is privately operated (Facility B).

Facility A is located along the main road between Savanna-la-mar and Negril, adjacent to the Shell Gas Station. It is a Type III Health Centre and provides health care for a wide cross section of the public. It conducts clinics on child health, family planning, dental, antenatal, postnatal care, diabetes and hypertension, and for food handlers' permits. It also undertakes outreach programs to the communities and has school health programs and addresses community organizations. Approximately 250 – 300 persons are seen each week.

Facility B is located on Norman Manley Boulevard adjacent to the Negril Morass. It is a general practice and performs only minor medical procedures. There are between 10 – 15 patients seen each day and approximately 50% generate some form of waste.

Solid Waste Composition

Solid waste generated by these institutions consists of both Clinical (medical) and non-clinical material. The waste profile for both facilities is shown in Table 10. Facility B burns all of its non-hazardous material except for metal tins, whereas Facility A uses a combination of open burning and disposal by WPM.

Table 10 Waste Profile for Two Health Facilities in Negril

	Type of Waste	Method of Disposal
Facility A	Used Needle (syringes)	Incineration
	Dressings/soiled bandages	Burnt
	Paper (office)	
	Cardboard boxes	
	Disposable diapers	WPM
	Plastic bottles	
	Glass Bottles	
Juice/drink boxes		

	Type of Waste	Method of Disposal
Facility B	Paper (mainly examination paper) Soiled Bandages Plastic (disposable instruments, plastic wrappers, containers) Needles Metal (Soda Cans, tubes, medical containers)	Burnt Incinerator WPM

Hazardous Material

Both facilities generate medical waste in the form of soiled bandages, used needles and soiled paper from examination tables. The used needles are stored in closed containers and taken to Savanna-la-mar hospital for incineration (Photo 6). The soiled bandages and examination paper are burnt (Photo 7). Facility A has an incinerator, which is in disrepair (Photo 8).

Wastewater Disposal

Wastewater from Facility A is disposed of via the NWC sewage system. However, Facility B, utilizes a septic tank and soak away. Facility B generates 34,065 litres (9000 gallons) of wastewater each month. However, it was not possible to ascertain the volume of wastewater generated by Facility A.

Environmental Challenges

Area for Improvement	Recommended Action
Solid Waste Disposal. Open burning is environmentally unfriendly and unsafe due to close proximity to gas station.	The incinerator should be repaired or replaced. The Kiwanis Club of Negril has been provided with project enquiry forms from the Environmental Foundation of Jamaica, a potential funding agency
Reduction in solid waste stream	The amount of solid waste disposed of can be reduced through sorting for extraction of paper, cardboard, glass and plastic bottles, and participation in the proposed Negril Recycling Program.

Photo 6 Container Used for Storage of Used Needles at Health Facility A.



Photo 7 **Open Burning at Health Facility A**



Photo 8 **Defunct Incinerator at Health Facility A**



3.9 Gas Station

The gas station audited retails fuel and also operates a garage. It also sells snacks, lubricants, engine oil, tyres and car parts.

Solid Waste Composition

The constituents of the solid waste stream are shown in Table 4. The main components of the solid waste are plastic bottles and cardboard boxes (Photo 2). Although battery changes are done these are not retained at the gas station but returned to clients. The solid waste is stored in a metal bin and taken to the prescribed waste disposal site by a private contractor.

Table 4 Solid Waste Generated by Gas Station

Type of Solid Waste	% of Total Waste Stream
Plastic Oil bottles	45%
Cardboard Boxes	40%
Plastic bottles, juice cans, yard sweeping, paper and occasional car parts	5%

Wastewater Generation

The gas station generates approximately 227,100 litres (60,000 gallons) of wastewater each month. This business is not linked to the NWC system but uses a septic tank and tile field for disposal of wastewater. A sample was collected from the septic tank and the results of the analysis are shown in Table 5.

The effluent has high nitrate and phosphate levels (40.04 and 22.36 mg/L respectively). The COD and coliform level are also out of compliance with the NRCA standards. The high coliform level is expected, as there is no chlorination of the effluent.

Table 5 Analytical Results for Sewage effluent and gray water at Negril Shell Gas Station

BOD mg/L	COD mg/L	TSS mg/L	Oil & grease mg/L	Nitrate mg/L	Total Phosphate mg/L	pH	Coliform Level MPN/100 ml
64.87	178	48.97	2.6	40.04	22.36	6.72	≥2400

The efficacy of the tile field could not be ascertained. However, the area was bare of grass in some sections and vehicles were also observed parked on the surface. This could lead to compaction of the tile field and impairment of its ability to function.

Wastewater generated by the garage is oily and is a combination of spilled engine oil and water used for cleaning purposes. There is an oily water sump which collects oily wastewater and acts as a basic oil water separator (Photo 3).

Photo 2 Solid Waste in Metal Bin at Gas Station



Photo 3 **Oily Water Sump at Gas Station**



Waste Oil Disposal

The waste engine oil is collected and stored in 55-gallon drums (Photo 4). It is used in hydraulic trucks during the Frome sugar crop or by individuals for insect control or marking playing fields.

Photo 4 **55-gallon Drum for Storage of Waste Engine Oil**



Storage and Monitoring of Hazardous Material

As is typical of all gas station large amounts of hazardous material are stored on the compound. The Negril Shell Gas station has the capacity to store 102,195 litres (27,000 gallons) of unleaded and diesel fuel. The fuel is stored in seven (7) tanks. Four are steel tanks coated with fibreglass and three (3) are steel vaulted and coated with polyurethane material (for leak proofing).

There are monitoring wells located at different points on the compound. These became necessary after there was leakage of product from poorly sealed tanks in the late 1980s, which surfaced in the morass. Those faulty tanks were replaced. The other monitoring method is the use of poles to monitor the movement of the gasoline relative to recorded sales. They also indicate if water has entered the tanks.

Spill Prevention and Cleanup

Spill prevention during delivery is ensured through the placement of environmental spill containers at the opening into the tank. These collect any overflow from the hoses delivering the product from the trucks. Sawdust and sand is available for cleanup of spills.

Environmental Challenges

Area for Improvement	Recommended Action
Disposal of wastewater, currently by use of septic tank and tile field.	Connection to the NWC Sewage System
Reduction in solid waste	Participation in proposed recycling programme. Forty percent of the solid waste is cardboard boxes which can be sorted and stored in bins for collection.

3.10 Garage

The garage audited provides both mechanical and body repair services and has four (4) employees. It is a relatively small establishment.

Solid Waste Composition

The main components of the solid waste stream and the disposal methods applied are listed below:

Table 3 Characterization of Solid Waste from Garage

Solid Waste	% of Solid Waste Generated	Method of Disposal
Scrap Metal and Old Car Parts including 4 engine blocks each year	90%	To Dump (intermittently)
Plastic bottles, Lunch boxes, Cardboard, empty containers, batteries, and glass from broken windscreens.	10%	Burnt

The solid waste is dominated by scrap metal and old car parts, including four (4) engine blocks per year. Disposal of plastic bottles, lunch boxes, cardboard, and empty containers is done daily through burning. The scrap metal is moved intermittently to the nearest waste disposal site. The operator could not say when the scrapped cars and stored scrap metal would be collected for disposal.

There were the shells of five (5) scrapped vehicles on the land opposite the garage. Some had obviously been there for a significant period of time as they were rusting and were partially covered in climbers/withers.

The only hazardous component of the solid waste stream is batteries. The operator stated that these are usually given away or bought by persons to play radios. It is estimated that the amount of solid waste exclusive of engine blocks is 2.5 kg/day.

Wastewater Generation

Wastewater generated by the garage is minimal. The water supply is from a 150-gallon tank and is used mainly for the washing of hands. The wastewater simply percolates into the ground. There is no sewage effluent as a pit toilet is used for disposal of human excreta.

Environmental Challenges

Area for Improvement	Recommended Action
Disposal of solid waste by burning.	Participation in the proposed recycling programme. Bins are required to sort glass and cardboard. Send residual amount of solid waste to the waste disposal area.
Scrap metal and old cars stored on site.	Removal of derelict vehicles and scrap metal to waste disposal site.
Waste oil collection and disposal.	Improve waste oil collection. Collect as much as possible of 25% which seeps into the ground

Connection to the NWC may not be possible as the operator does not own the land on which the garage is located.

3.11 Bike Rental Facilities

Two bike rental facilities were audited in Negril. Bike Rental A (BRA) is located on the West End Road and the other, Bike Rental B (BRB) adjacent to the Negril Morass on the Norman Manley Boulevard. BRA rents both bikes and bicycles while BRB rents bikes only.

Solid Waste Composition

The volume of solid waste generated by BRA is unknown. However, according to the operator, it consists mainly of yard cuttings and leaves from trees. Parts taken off the bikes are stored in a box. The operator stated that yard waste is collected in garbage bags and taken to Tensing Pen for composting. Other non-biodegradable material is stored in a 55-gallon drum and collected by WPM.

Engine oil is purchased in 5-gallon Plastic containers. However, these containers are reused by BRA or given away for storage of water for purposes other than drinking.

The operator of BRB indicated that this business generates a limited amount of solid waste, as the majority of the mechanical maintenance of the bikes is done off- site. The oil change for the larger bikes is done in Savanna-la-mar at the garage that maintains the bikes. The manager indicated that the smaller two stroke engines only require oil refills and the plastic oil bottles are collected by a vendor that sells bulk oil. The batteries, which are the hazardous elements of the waste stream, are disposed of with the small amount of solid waste generated by the operation. This would be mainly from office activities, and contains paper, drink and food containers. The waste is collected by WPM.

The leaves swept from the surrounding area and the garden cuttings are collected and placed on a heap in the backyard to be broken down. The resulting material is used as fertiliser

Wastewater Disposal

Approximately 18,925 litres (5000 gallons) of water is used by BRA each month. It is used for flushing toilets, cleaning of premises and washing of bikes. The wastewater from the washing of the bikes soaks into the ground as the bikes are washed on an unpaved area. The premises is not linked to the NWC system and the sewage is disposed of in a soak away. The operator has never experienced any problems with the system not working properly and the waste water not percolating downwards into the ground.

The volume of wastewater generated by BRB could not be ascertained. Wastewater consists of sewage, gray water from bathrooms and washing of bikes. All wastewater from the bathroom is discharged into a soak away. The water from the washing of the bikes soaks into the ground as the bikes are washed on an unpaved area.

Waste Engine Oil

The operator of BRA stated that waste oil is collected and used for lubrication of bikes during servicing. It is stored in 5-gallon plastic containers.

Environmental Challenges

Area for Improvement	Recommended Action
Disposal of wastewater. Sewage disposal utilising a soak away within a coastal area has the potential to pollute coastal waters. The fissured limestone of the West End facilitates seepage into the coastal waters, adversely affecting water quality. The washing of the bikes also generate oily waste water.	Both Bike Rental Companies should connect to the NWC sewage treatment system.
Disposal of Batteries	When a hazardous disposal site is provided for the northwestern region of Jamaica, batteries should be sorted from the solids waste stream and disposed of at this site

3.12 Water Sports Facility

The water sports business audited is located on Norman Manley Boulevard in Negril. The services offered include:

- Cruises on Sailing Vessels
- Parasailing
- Jet ski rentals
- Snorkeling and glass bottom boat tours
- Picnic trips to Booby Cay

The waste stream consists of solid waste, wastewater and waste engine oil.

Solid Waste Composition

The operator stated that approximately five (5) jumbo garbage bags are generated each day. The components of the waste are:

- Cardboard boxes (chicken parts and rum)
- Plastic forks
- Plastic containers – soda bottles (2 litre), ketchup bottles, oil bottles
- Paper cups
- Glass bottles – some are reused
- Small amount of cuttings and peelings (for example, cabbage, carrot and Callaloo)
- Left-over food – used as dog food
- Batteries from parasailing equipment

The operators were unable to estimate the volume of waste or the percentages of each component of the waste stream. The waste is stored in a square concrete garbage storage area.

The solid waste is generated mainly by the cruises to Booby Cay and is the residue of meals and drinks provided. Two litre soda bottles are used to decrease the number of plastic bottles used for sodas and to improve collection. Bulk beer is used to decrease the number of bottles but of course it increases the number of plastic cups. Paper plates are not used.

Several components are reused. These include the left-over food, which is fed to dogs, and some of the glass bottles.

Elements of the solid waste considered hazardous are discarded batteries (from jet skis). These are not sorted separately but are sent to the dump with other solid waste.

Wastewater Disposal

This business generates 44,000 litres of wastewater. Wastewater is generated from washing/flushing of skis and preparation of food. Sewage from the boats is collected in holding tanks and pumped into the NWC sewage system. The operator stated that all wastewater, except that from flushing of skis, is disposed of in the NWC system. A grease trap is attached to the food preparation area. It is cleaned twice per month.

Used Cooking Oil

No used oil is generated, as oil is not used in cooking.

Waste Engine Oil

Waste engine oil from the sailing and parasailing boats is disposed of in the solid waste in the original plastic bottles.

Energy Conservation

There is no energy conservation programme, possibly due to the relatively small electricity bill of approximately \$2,000/month.

Water Conservation

The only water conservation measure used is increasing the awareness of staff to conserving water.

Environmental Challenges

Area for Improvement	Recommended Action
Disposal of Waste Oil in Solid Waste Stream	Collect and dispose of oil at a waste oil collection point such as the Shell Gas Station
Disposal of Batteries	When there is provision for the disposal of hazardous material at proposed landfills in Jamaica, dispose of according to prescribed procedure. Until then there is no appropriate solution
Reduction in solid waste	Participation in proposed recycling programme

4.0 Participation in Recycling Program

All of the businesses which participated in the audit exercise are willing to participate in the proposed recycling programme for Negril. However, not all of these businesses have significant amounts of material suitable for recycling. For example in the hotels, the solid waste is dominated by organic material resulting from preparation and serving of meals, which is suitable mainly for composting or animal feed (Table 28).

Cardboard

The businesses with the highest volume of cardboard is supermarkets, followed by medium sized grocery shops and hotels and restaurants. Cardboard boxes form over 90% of the solid waste from Supermarkets and they can generate up to 250 boxes each day. However, in order to maximise on the collection of this cardboard, the staff of the supermarkets will have to be properly trained to collect and store the boxes. They must be kept clean and dry.

Glass

Hotels and restaurants are the major sources of glass. This will consist mainly of drink and alcohol bottles from bars. However, the percentage of the solid waste from these businesses is usually low.

Plastic Bottles

Most of the businesses audited have plastic bottles suitable for recycling, due to the ubiquitous use of plastic containers.

Table 28 Businesses with Significant Amounts of Recyclable or Reusable Material in Solid Waste Stream

Type of Business	Recyclable Material	Reusable Material
Supermarket	Cardboard (98 – 99%)	
Garage	Small amount of glass and cardboard, plastic bottles	Used engine oil
Gas Station	Cardboard (40%), plastic bottles	Used engine oil
Grocery Shops	Cardboard, plastic bottles, glass	Fruit and vegetable cuttings
Hotels	Glass, cardboard	Fruit and vegetable cuttings Used cooking oil
Restaurants	Glass, cardboard, plastic bottles	Used cooking oil, garden waste
Water Sports	Cardboard boxes, plastic bottles	Used engine oil
Plazas	Cardboard boxes, paper, plastic bottles	Fruit and vegetables, cuttings, used cooking oil

5.0 Conclusions

5.1 Level of Connection to NWC Sewage System

Only 35% of the businesses audited were connected to the NWC sewage system. Table 29 has data on the numbers connected for each category of business. It is to be noted that neither of the two laundries are connected, and two of the small hotels, businesses which are expected to generate significant volumes of wastewater. To decrease the potential of small businesses polluting the marine environment the level of connection to the NWC system must increase significantly.

Table 29 Level of Connection to NWC System

Type of Business	Connected	Not Connected	Other Method Used
Restaurant	1	3	Soak away Earthen canal to the morass Septic tank
Small Hotels	3	2	Septic tank Soak away
Grocery Stores		2	Soak away Septic tank
Garage		1	Pit latrine
Gas Station		1	Septic tank and tile field
Photo Shop		1	Soak away
Laundries		2	Septic tank Soak away Earthen canal to morass
Health Facilities	1	1	Soak away
Bike Rental Facility		2	Soak away
Water Sport Facility	1		
Plaza	2	1	Soak away Defunct sewage treatment plant
TOTAL	9	17	

5.2 Summary of Solid Waste Disposal Methods

The majority of the solid waste disposal is done in five ways (Table 30):

- Collected by a private contractor and taken to the waste disposal site
- Collected by MPM and taken to the waste disposal site
- On-site burning
- Composting, on and off-site
- Fed to animals

Table 30 Summary of Solid Waste Disposal Methods of Twenty-five Businesses in Negril

Type of Business	Private Contractor	WPM	Burning	Composting	Animal Feed
Restaurant A		√			
B		√			
C	√			√	√
D	√				
Small Hotels A	√			√ (Intermittent)	
B		√		√	√
C	√				
D	√				
E	√				
Grocery Stores A		√	√		
B		√	√		
Garage			√		
Gas Station	√				
Photo shop		√	√		
Laundries A			√		
B		√			
Health Facilities A		√	√		
B			√		

Type of Business	Private Contractor	WPM	Burning	Composting	Animal Feed
Bike Rental Facility A B			√	√	
Water Sport Facility	√				√
Plaza I II III	√	√ √			
TOTAL	9	10	4	3	3

Table 30 has breakdown of the disposal methods used by the businesses audited. Eight businesses burnt all or a part of their solid waste, four practiced some level of rudimentary composting and three use food waste to feed animals. Nineteen of the businesses had part or all of their solid waste disposed of at a waste disposal site.



Coastal Water Quality Improvement Project

A Bilateral Environmental Development Initiative of the Government of Jamaica's Natural Resources Conservation Authority and United States Agency for International Development

CR 3

Improve Environmental Practices

A. ABOUT CWIP

The Coastal Water Quality Improvement Project (CWIP) is a 6-year bilateral development initiative between the Government of Jamaica's Natural Resources Conservation Authority (NRCA) and the United States Agency for International Development (USAID). The project was implemented in January 1998, and comprises five main "contract result" program activities:

- *support community-based initiatives to address environmental concerns (CR 1);*
- *improve operations & maintenance of municipal wastewater systems (CR 2);*
- *improve environmental practices of industry and commercial establishments (CR 3);*
- *develop NGO partnerships to expand and standardise coastal water quality monitoring (CR 4);*
- *improve co-ordination of coastal zone management activities among GOJ agencies, international donors, and NGOs (CR 5).*

These five distinct, but interrelated activities, associated with coastal water quality improvement will be carried out to form a synergy of interventions impacting on coastal zone management, wastewater management, and solid waste disposal.

These will contribute to the achievement of the USAID/Jamaica Strategic Objective 2 – Improved quality of key natural resources in selected areas that are both environmentally and economically significant.

The Government of Jamaica (GOJ), with the assistance of development partners, is taking proactive measures to address the problems confronting critical coastal zone ecosystems.

The GOJ, through the NRCA, and USAID have jointly developed CWIP to help address coastal zone management problems, especially coastal water quality, confronting targeted coastal zone communities.

COASTAL RESOURCES MANAGEMENT CHALLENGE

Coastal zone ecosystems in critical economic areas of Jamaica are experiencing serious environmental stress and degradation. The very environmental and natural resources base, which generated the tourism-related trade and economic growth, is now being threatened.

The proper management of the coastal zone ecosystem is intrinsically linked to the sustainability of the tourist sector. A serious commitment to reverse present trends in coastal zone environmental degradation, especially coastal water quality, is required to ensure economic vitality as well as a healthy environment for the local communities.

B. IMPROVE ENVIRONMENTAL PRACTICES (CR 3)

OVERVIEW

The reduction of the levels of waste generated (waste reduction/minimization), the development of systems to manage its collection, treatment and disposal and the involvement of communities/ stakeholders are all elements required to reduce and control the pollution entering the environment. Additionally, the efficient use of resources (water, energy etc;) are also important to achieving sound environmental management.

Improving and strengthening sound environmental practices is the objective of the CR 3 component of the CWIP project. This can be achieved in part by encouraging the use of Environmental Management Systems (EMS) as a tool to help in the implementation and continuous improvement of business's environmental performance, business operation while offering opportunities to gain a competitive edge in the marketplace.

MAJOR ACTIVITIES

- Promote national EMS policy, incentives and initiatives
- Support EMS site interventions for tourism-related enterprises
- Support EMS site interventions for industrial commercial enterprises
- Support recovery and recycling initiatives which met a market demand.

10. Are you linked to the NWC sewerage system? Yes No
11. If yes, is this how you dispose of all your wastewater? Yes No
12. If no, how do you dispose of the wastewater which does not go into the sewage system?.....
13. Do you generate oily wastewater? Yes No
14. If yes, do you have any wastewater treatment system (for example a grease trap) which separates the oil from the wastewater prior to disposal? Yes No

Solid Waste

15. How much solid waste do you generate?
16. What are the main components of your solid waste?
- Discarded Food Empty containers (plastic/metal)
- Plastic bags Cardboard Paper Other (specify)

Type of Solid Waste	% of Waste Stream	Comments

17. How do you dispose of your solid waste?
- Burnt Stored and taken to dump by private contractor Incineration
- Buried Stored and picked up by local Garbage Collection Agency
18. Is any of this waste hazardous? Yes No
- If yes, describe
19. Approximately what percentage of your solid waste is hazardous?
.....
20. Is the hazardous waste sorted from other types of waste? Yes No
- If yes, how is it disposed of?
- Incineration Burying Open burning

Waste Oil

21. Do you collect your waste oil for reuse? Yes No

22. If yes, who collects it?

Storage Of Hazardous Waste/Inputs

23. Do you store large volumes of raw materials (hazardous or otherwise) on your compound?

Yes No

24. If yes, describe your storage facility/container.....

.....

25. Are special procedures in place for containment of spillage of any hazardous material?

Yes No

Sawdust Absorbent pads Collection Trays

Other (specify)

Greening of Hotel

27. Do you have a water management/conservation program in place in your Hotel?

Yes No

28. If yes, describe.

Low flush toilets Low flow showerheads

Reuse of gray water for irrigation Options re washing of towels

Staff Training Other (specify).....

29. Do you use low phosphate detergents in your laundry? Yes No

30. Are you involved in a composting program or compost any portion of your solid waste?

Yes No

31. Do you have a energy conservation program in place? Yes No

32. If yes, describe:

Solar water heaters Fluorescent bulbs

Three Phase electricity and 220V equipment

Light sensors in outdoor lighting Staff awareness

Proposed Recycling Program for Negril

25. If a recycling program were introduced into Negril would you be willing to participate in this project? This would involve sorting of your solid waste for collection and reuse.

Yes No

Auditors Comments:

Waste Profiles for Four Restaurants Audited

Restaurant A generates approximately 0.21 m³ of solid waste per day (1½55-gallon drums). The waste components are

- Food trimmings/peelings
- Cardboard boxes
- Paper bags
- Aluminum foil
- Plastic packaging material
- Stale or spoiled food (small amount due to reuse)

Table A2.1 Waste Profile for Restaurant B

Type of Waste	% of Waste Stream	Comment
Plastic containers and bottles	40%	Includes ketchup and bleach bottles
Discarded Food	30%	Highest during slow periods
Food Trimmings/Peelings	25%	
Cardboard boxes	3%	
Residual Food	1%	
Glass Bottles	0.5%	
Paper and Plastic packaging material	0.5%	

Table A2.2 Waste Profile for Restaurant C

Type of Solid Waste	% Total Waste
Paper cups Paper (small amount) Small amounts of plastic bottles and plastic packaging material.	44%
Glass (Liqueurs, rums, etc)	30%
Cardboard	25%
Aluminum tins	1%

Table A2.3 Solid Waste Profile for Restaurant D

Solid Waste	% daily volume
Food Cuttings/Trimmings	70%
Plastic Cups	15%

Solid Waste	% daily volume
Glass bottles	5%
Cardboard boxes	5%
Styrofoam and pizza boxes	3%
Plastic packaging Material	1
Paper	1

CWIP

Coastal Water Quality Improvement Project