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Environmental Audits for Sustainable Tourism

Environmental Management Audit

Negril Gardens Hotel

Negril, Jamaica, W.I

Final Report

EAST Report No 97-199

November 1997

Prepared for
EAST Project
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A project funded by the U S Agency for International Development

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- Project 4 Install flow diverters in all toilet tanks
- Project 5 Install displacement devices in all water tanks of conventional (4 gallon/flush) toilets
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Executive Summary

What is an environmental management system?

- ▶ An environmental management system (EMS) is a management tool through which a property can evaluate and improve its environmental performance, and establish, achieve and sustain its own environmental performance objectives

Why should Negril Gardens develop an EMS?

- ▶ An EMS will help Negril Gardens sustain the social and physical environment on which it depends for its survival. Tourists visit Negril to savor the beauty of its reefs, beaches and nature and to experience the warmth and kindness of its people. The day Negril loses these valuable attributes will mark the end of its tourism industry.
- ▶ Hotel guests are increasingly taking an interest in the environment. A recent poll conducted by *Conde Nast Traveler* revealed that
 - 91% of the respondents were concerned about the environmental conditions at the destination to which they are making travel plans,
 - 50% claimed that the environment had become a factor in their travel planning over the last ten years,
 - 25% have changed travel plans because of what they perceived to be an environmental issue at their chosen destination

The “green” image created and sustained through an effective EMS will therefore provide Negril Gardens with an additional marketing tool

- ▶ Since many environmental measures are aimed at reducing the consumption of water, energy, chemicals and materials, an effective EMS will help the property save money and ensure the sustainability of the measures and actions that yield these savings

During the course of the audit, the EAST team reviewed Negril Gardens’ water, energy, chemicals and materials consumption practices, evaluated its policies, procedures and management structure, identified ways to improve its environmental performance and develop an effective EMS. The audit revealed that Negril Gardens could greatly benefit by becoming a more “environmentally friendly” property (see box below)

Savings & Economics Summary

By implementing only 10 of the 58 measures presented in this report, Negril Gardens will

- lower its water consumption by 1,220,000 gallons/year, resulting in savings of 536,000 J\$/year,
- lower its consumption of electricity by 120,00 kWh/year, resulting in savings of 564 000 J\$/year,
- reduce its consumption of laundry chemicals by 30%, resulting in savings of 189,000 J\$/year,
- save 625,000 J\$/year by converting the electric billing system from rate 20 to 40

Most of the recommendations given in this report have payback periods of less than 1 year

It must be emphasized that, in the absence of an effective EMS, these savings may not be achieved or may only be short-lived

I. Introduction

1.1 EAST Project

The Environmental Audits for Sustainable Tourism (EAST) Project is an activity funded by the U S Agency for International Development (USAID) that is designed to assist the tourism and hospitality industry implement effective environmental management systems (EMS)

The specific objectives of this project are (1) to develop greater awareness and understanding of the benefits of environmental management systems and audits among hoteliers, restaurateurs, allied tourism businesses, as well as in the manufacturing industry, (2) to train Jamaican consultants on EMS auditing techniques, (3) to assist a select, representative number of tourism establishments in carrying out environmental audits, and (4) to help finance, on a cost-sharing basis, specific audit recommendations in the participating establishments to demonstrate the financial benefit of the systematic application of environmentally friendly practices and, thereby, encourage others in the tourism industry to do likewise EAST is being implemented by Hagler Bailly Services (USA) under the direction of USAID/Jamaica and the Jamaica Hotel and Tourist Association

1.2 Audit Team

The audit of the Negril Gardens Hotel was conducted by an interdisciplinary team in August 1997 The team members included Hugh Cresser, EAST Project Coordinator, Peter Illig, Team Leader and EMS Specialist, Hagler Bailly (USA), Patricio Gonzalez, Environmental Engineer, Hagler Bailly (USA), Kimberly Moffitt, Hotel Operations Specialist, HVS International (USA), Adam Abelson, Hotel Marketing Specialist, HVS International (USA), Lloyd Marsh, Senior Energy Engineer, Metrocad (Jamaica), Dinsdale Williams, Energy Engineer, Metrocad (Jamaica)

The EMS audit consisted of a detailed analysis of all departments and key service areas designed to identify the environmental aspects and impacts of the property's activities, and to formulate recommendations on how to improve the property's environmental performance and its environmental management system (EMS)

1.3 Audit Protocol

The audit protocols used by the audit team covered the following issues

- ▶ ISO 14001 EMS gap analysis
- ▶ Water use and wastewater generation
- ▶ Energy use and efficiency
- ▶ Solid waste generation and handling
- ▶ Chemicals use and management
- ▶ Hotel procedures and operations

2. Background Information

2.1 Description of the Property

Negril Gardens is a 66 room hotel situated on both the land side and ocean side of Norman Manley Boulevard in Negril, Jamaica. The property is owned by Friends International and managed by Friends International Resorts. Key Negril gardens personnel include

- ▶ Mr Michael Gayle, General Manager
- ▶ Ms Lisa Richards, Administration
- ▶ Mr Lynton Nelson, Maintenance
- ▶ Mr Bensford Evans, Food and beverage
- ▶ Ms Michelle Biggs and Ms Andrea Scott, Housekeeping and laundry
- ▶ Ms Michelle Biggs, Front office
- ▶ Mr Lunford Scarlett, Accounts
- ▶ Ms Lisa Richards, Entertainment

2.2 Occupancy Data

The occupancy information given by Negril Gardens to the audit team covers the 12-month period from September 1995 to August 1996. This data is summarized in the following table and is used as the basis for the calculations presented in this report.

Month	Occupancy (room nights/month)
September 1995	1,217
October	1,507
November	1,627
December	2,039
January 1996	1,933
February	1,811
March	1,954
April	1,611
May	1,318
June	1,100
July	1,144
August	1,647
Yearly total	18,908

This data yields the following occupancy criteria for Negril Gardens

$$\begin{aligned}
 \text{Average occupancy} &= (18,908 \text{ RN/year}) / (12 \text{ months/year}) \\
 &= 1,576 \text{ RN/month} \\
 &= (18,908 \text{ RN/year}) / (65 \text{ rooms} \times 365 \text{ days/year}) \\
 &= 79.7\%
 \end{aligned}$$

$$\begin{aligned} \text{Number of guest nights} &= (18,908 \text{ RN/year}) \times (2 \text{ GN/RN}) \\ &= 37,816 \text{ GN/year} \\ &= 582 \text{ GN/year/room} \end{aligned}$$

Note Since Negril Gardens' guest night information was not available during the audit, the preceding calculations assume that, on average, there are two guest nights per room night

2.3 Water Consumption and Wastewater Generation

2.3.1 Current water use at Negril Gardens

The water consumption and wastewater disposal information collected by the audit team is presented in the following tables

NWC water consumption figures			
Month	Water use gallons/month	Water cost JS/month	Unit cost JS/1,000 gal
September 1996	493,370	87,521	177.4
November	452,848	80,664	178.1
January 1997	679,712	121,246	178.4
February	542,394	97,988	180.7
March	588,328	107,486	182.7
April	692,557	124,828	180.2
June	523,613	94,211	179.9
July	632,883	114,412	180.8

Note NWC water consumption figures were available for only 8 months in the 1996 - 1997 period

Septic tank pumping service				
Month	Service freq loads/month	Service cost JS/month	Discharge vol gallons/month	Unit cost JS/1,000 gal
July 1996	75	225,000	150,000	1,500
August	63	189,000	126,000	1,500
September	50	150,000	100,000	1,500
October	80	240,000	160,000	1,500
November	102	306,000	204,000	1,500
December	76	228,000	152,000	1,500
January 1997	77	231,000	154,000	1,500
February	78	234,000	156,000	1,500
March	80	240,000	160,000	1,500
April	71	213,000	142,000	1,500
May	93	279,000	186,000	1,500
June	74	220,000	148,000	1,486

- Notes • Each tanker truck load is equivalent to a volume of 2,000 gallons
 • 27% of water used at Negril Gardens is pumped out of the cesspools

Based on this data, the average water and wastewater figures for Negril Gardens are

Average water cost = 180 J\$/1,000 gallons

Average water use = 575,700 gal/month
 = 183 gal/guest night (for a total of 37,816 guest nights/year)
 = 103,600 J\$/month

Av cesspool service = 77 tanker loads/month
 = 153,200 gal/month
 = 229,600 J\$/month

2 3 2 Real cost of the water used at Negril Gardens

Negril Gardens' wastewater disposal system (septic tanks and tile fields) cannot effectively handle the effluent presently generated by the property. As a result, each month this property pays for the removal of an average of 77 tanker loads of wastewater and sludge from its septic tanks. In contrast, a well designed and constructed septic tank and tile field system that is properly maintained and hydraulically loaded is generally pumped out once every 6 months - 3 years

Given this situation, the actual cost of the water used at Negril Gardens must include both the fee paid to the water utility (NWC) and the fee paid to the septic tank pumping service. Accordingly, the actual cost of water used at Negril Gardens is calculated as follows

Average fee paid to NWC = 180 J\$/1,000 gallons

Cesspool pumping cost = (av monthly cesspool fee) / (av monthly water use)
 = (229,600 J\$/month) / (575,700 gallons/month)
 = 399 J\$/1,000 gallons

Real cost of water use = 180 J\$/1,000 gallons + 399 J\$/1 000 gallons
 = 579 J\$/1 000 gallons

2 3 3 Impact of water conservation at Negril Gardens

- ▶ Given the high cost of water use at Negril Gardens, it is in this property's best interest to engage in an aggressive water conservation program. The comparison made in the following table between Negril Gardens and a "water efficient" property shows that this property could achieve important financial benefits through water conservation. In addition to the financial benefits, a reduction in water consumption will also reduce the hydraulic loading on and, thereby, improve the performance of the wastewater disposal system. In fact, a hydraulically overloaded septic tank has an exceedingly short wastewater retention time which prevents the proper settling of solids and the flotation

of oils and fats. Short retention times thus increase the discharge of solids from the septic tank and the possibility of clogging the tile field.

Average water consumption for hotels		Savings if Negril Gardens achieved the water consumption of a water efficient property	
Location	Water use	Water savings	J\$ savings
Water efficient property	154 gal/guest night	1,097,000 gal/year	635,000 J\$/year
Negril Gardens	183 gal/guest night		

- Notes
- The figures presented in this table are based on an average occupancy of 18,908 RN/year or 37,816 GN/year
 - The International Hotels Environmental Initiative uses the following figures to rate the relative water efficiency of hotels (with gardens and in-house laundry services)

Property size	Water efficiency rating - water use figures are in gal/GN				
	Good	Fair	Poor	Very poor	Negril Gardens
50 - 150 rooms	< 154	154 - 178	178 - 213	> 213	183

- It appears that Negril's new sewer and wastewater treatment plant will not be operational until mid-1999. Negril Gardens will therefore have to live with its defective and costly wastewater disposal system for another 2 years. However, even after the completion of Negril's new sewer system, the property will still pay for the disposal of its wastewater. It is expected that the sewerage fee will double the cost of water for commercial customers.

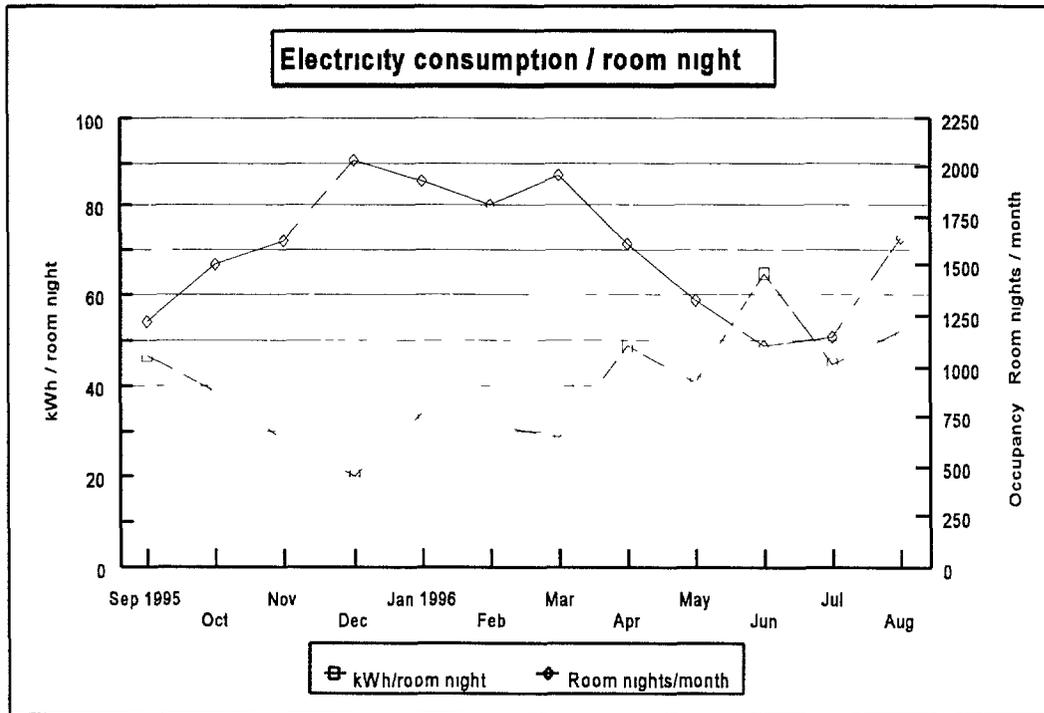
By conserving water, Negril Gardens will therefore save a substantial amount of money regardless whether it disposes its wastewater through its tile fields or the sewer.

2.4 Electricity Consumption

The electricity consumption information collected by the audit team is presented in the following table and graph

Month	kWh/month	JS/month	JS/kWh	RN/month	kWh/RN
September 1995	57,280	262,294	4.58	1,217	47.1
October	58,560	277,606	4.74	1,507	38.9
November	45,440	223,922	4.93	1,627	27.9
December	41,120	209,790	5.10	2,039	20.2
January 1996	66,080	337,249	5.10	1,933	34.2
February	56,800	289,969	5.11	1,811	31.4
March	55,840	285,345	5.11	1,954	28.6
April	78,720	311,022	3.95	1,611	48.9
May	53,600	273,956	5.11	1,318	40.7
June	71,680	193,130	2.69	1,100	65.2
July	51,040	245,891	4.82	1,144	44.6
August	85,440	310,452	3.63	1,647	51.9
Year total	721,600	3,220,626		18,908	

Note This information was derived from JPSCO bills



Based on this data, the average electricity figures for Negril Gardens are

$$\begin{aligned}\text{Average energy consumption} &= (721,600 \text{ kWh/year}) / (12 \text{ months/year}) \\ &= 60,130 \text{ kWh/month}\end{aligned}$$

As can be clearly seen in the graph, Negril Gardens' electricity consumption index (i.e., the consumption of electricity per room night) varies widely throughout the year. In fact, the electricity consumption index for June (65.2 kWh/RN), the lowest occupancy month, is more than 3 times higher than the electricity consumption index for December (20.2 kWh/RN), the highest occupancy month.

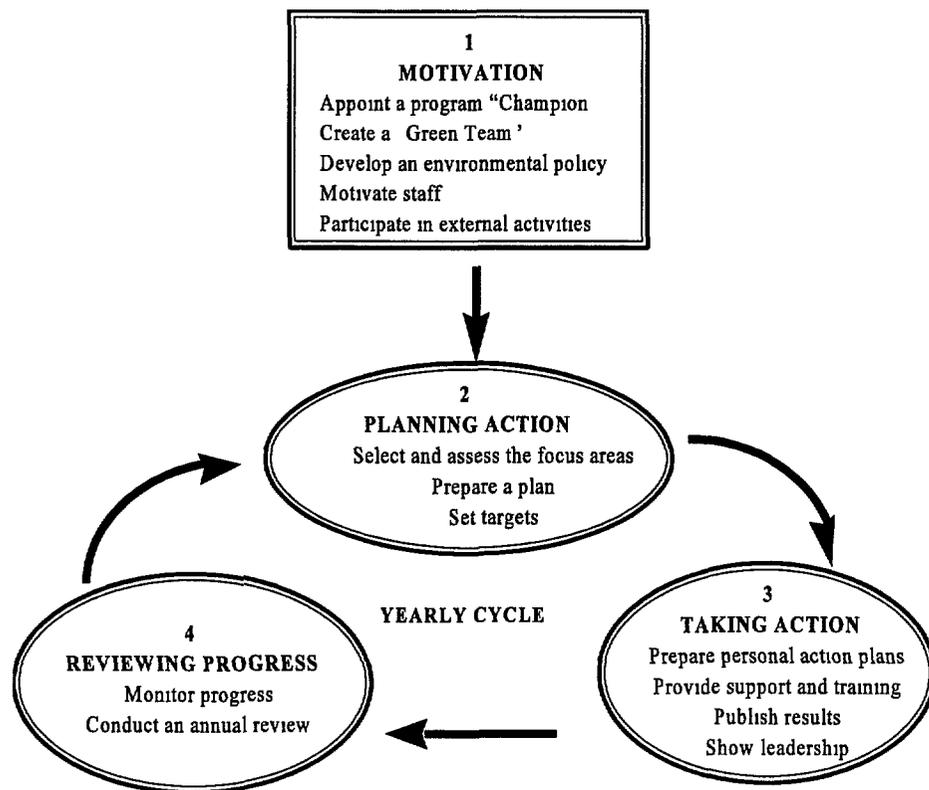
Although the electricity consumption index is expected to vary with time because of changes in weather, occupancy rates and guest type (e.g., large influx of college students during the spring break vacations), and because of the existence of power loads that are not affected by occupancy (e.g., pool pumps, public area lighting), the 320% variation seen at Negril Gardens is excessively high.

Negril Gardens should therefore investigate why it takes 3 times more energy to provide a room night in June as it does in December.
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3. Guidelines for the Development of an Environmental Management System

3.1. Environmental Management System (EMS) Overview

Becoming an environmentally friendly property is not a challenge that can be met overnight. It is a long-term commitment and a continuous process of improvement which should be integrated in the daily operations at a pace which is right for each property. The key phases in the creation and development of an effective environmental management system are illustrated below.



The four phases are

- ▶ **Motivation** -- in which you begin to integrate the initiative in your property by appointing a "Champion" to coordinate the program, creating a "Green Team" to assist in the implementation and monitoring of the program, developing a policy which defines the property's environmental objectives, and by motivating the staff to participate and contribute to the program
- ▶ **Planning action** -- in which you select and conduct a detailed review of the property's priority areas, identify measures to be taken, prepare an action plan and set a timetable for the implementation of the program

- ▶ **Making it happen** -- in which staff commitment is gained for the action plan, responsibilities are allocated, and the plan is implemented
- ▶ **Reviewing process** -- in which progress is monitored against set targets and objectives, an annual review of overall progress is conducted to assess the successes and failures, and priorities are set for the coming year

As shown above, phases 2, 3 and 4 form a yearly environmental management cycle. Each year the property will go back through this cycle again, using the review of the previous year's successes and failures to improve the effectiveness of its EMS and revise, if necessary, its environmental policy.

3.2 Motivation

3.2.1 Appoint the environmental program's "Champion"

From the outset Negril Gardens will need to appoint a "Champion" who will have the responsibility for coordinating and implementing the environmental program. This person must have a good operational knowledge of the hotel, the respect of other employees, a commitment to the project, and the full support of the property's owners and top management. The Champion will keep the environmental program on line, ensure good business and environmental results are achieved, and ensure the participation or cooperation of all staff members.

3.2.2 Create a "Green Team"

The creation of a "Green Team" is crucial to ensure the introduction and the implementation of environmental policies. The functions of the Green Team include:

- ▶ assist the program Champion in the day-to-day management, supervision and troubleshooting of the environmental program,
- ▶ keep the property's staff motivated and dedicated to the principles of the environmental program,
- ▶ develop new ideas and strategies for improving the program,
- ▶ act as the principal link between the property and local community groups or environmental organizations.

To be most effective, the Green Team must be composed of highly motivated individuals selected from each of the property's departments and representing all levels of employee hierarchy -- from executive-level to line-level employees. The actual size of the Green Team will depend on the requirements of Negril Gardens' environmental program, however, when assembling the team, keep in mind that as the group gets larger, the team as a whole becomes less focused and less productive.

The employees selected for the Green Team must have the motivation and the character needed to insure the success and the dissemination of the program. Criteria for the selection of team members may include:

- ▶ recommendations by managers or supervisors,
- ▶ nomination by fellow employees, or
- ▶ a simple application process which requires the candidates to explain their expected contribution to the environmental program and their reasons for wanting to join the team

Note Negril Gardens should create for the “Champion” and “Green Team” more personalized names which reflects this property’s “personality ” In this report, the terms “Program Champion” and “Green Team” are used as generic names to represent two of the key components of an effective EMS

3 2 3 Develop an environmental policy for Negril Gardens

An environmental policy is an important tool for communicating, both internally to employees and externally to guests, that the property is serious about its role in preserving and protecting the environment The policy should therefore embody the property’s commitment to the environment and define the goals it wishes to achieve

The formulation of the environmental policy should be a concerted effort, involving management, the program Champion, the Green Team and all interested staff members This combined effort will insure that the environmental policy is understood and respected by all employees, and will provide the staff with a sense of ownership over the property’s environmental program

The breadth of the environmental policy adopted by the hotel will define the complexity and magnitude of the environmental management system that will be needed to put the policy’s words into actions The property is therefore advised to develop a first policy that is appropriate to the nature and scale of its environmental impact, but not overly ambitious The first environmental policy should include manageable commitments which bring obvious benefits to the property or help remedy its most significant environmental impacts Examples of commitments appropriate for a first environmental policy include

- ▶ safeguarding natural resources by achieving a more efficient use of water, energy, chemicals and materials,
- ▶ preventing pollution by reducing the amount of waste generated by the property
- ▶ complying with all applicable environmental regulations

After mastering the basic principles and operations of its EMS, Negril Gardens should broaden the scope of its environmental policy, and review its objectives and targets Examples of complete and comprehensive environmental policies are given below and in Appendix I

The environmental policy must be clearly communicated and explained to all current employees and all new hires It should be discussed in staff meetings included in employee handbooks and posted on the staff notice board Once the property has put into practice the key elements of its EMS and achieved the first noticeable results, management should place a framed copy of the environmental policy in the hotel lobby, in full view to all guests and visitors

Hotel Code of Conduct

By the Negril Area Environmental Protection Trust (NEPT) and the Negril Chapter of the JHA

We pledge our commitment to the environment of our area, as well as that of the whole Earth, and therefore strive always to

- Make the best, most efficient use possible of the resources available to us, including water and energy knowing that in so doing we are not only being good neighbors in our resort community, but also minimizing negative impacts inherent in the provision of these services,*
- Respect, preserve and protect the air, water land, plants and animals within our care,*
- Comply with all regulations and statutes concerning development and the environment*
- Minimize waste and all forms of pollution*
- Make the smallest impact possible on the natural beauty and bounty of our area our city, our country and our world, and to enhance this beauty and bounty wherever we can*
- Create wise management policies to benefit our business our customers our staff and the environment realizing that these are integrated,*
- Work together with others to achieve wider environmental and development goals*
- And in all way, to be good stewards of our natural world, for this and future generations*

3 2 4 Motivate the staff

Use staff meetings to inform all employees of the program's objectives and to call for their ideas and support. Involving the staff not only helps gain their commitment to the initiative, but it also allows the program to benefit from their creativity and experience. Line-level employees often know best how to reduce waste and improve efficiency, and how to carry out specific programs and actions in the most practical manner. The Champion and the Green Team should, therefore, strive to gain the support and collaboration of their colleagues at all levels and in all the departments of this property.

In most cases, staff will not effectively practice environmentally-conscious behavior unless they are given proper training and motivated through an appropriate incentives program. For example, employees will engage more willingly in good housekeeping practices once they are clearly instructed on what must be done, informed of the benefits of these practices, and encouraged and rewarded by management. Since staff participation in the environmental program can generally save the property a lot of money, management should take the time to devise an appropriate and effective incentive program.

Incentives can include monetary rewards such as sharing with the staff part of the water and energy savings achieved through the environmental program, or giving bonuses to particularly deserving employees. Incentives can also include non-monetary rewards such as

extra paid vacation days, parties and gifts (e.g., t-shirts with the hotel's "green team" logo, gift certificates)

3.2.5 Participate in external activities

Negril Gardens' management and staff should get involved in local and national initiatives, attend events, subscribe to environmental publications, discuss environmental issues with colleagues in the industry, and promote "networking" of good ideas through the Negril Chapter of the JHTA. Participation in external activities will help the property gain a deeper understanding of the issues, learn of how others are tackling their environmental problems, and enhance the property's reputation in the industry.

An effective and productive way for Negril Gardens to further enhance its environmental program is by developing strong community relationships. By actively participating in local civic and environmental activities, Negril Gardens will highlight its leadership role and bolster the motivation of its employees by allowing them to positively affect the community in which they live and by providing them an alternate means for professional growth.

The development of the composting program with the All Ages School is an excellent way for Negril Gardens to deepen its involvement with the community. In addition to this program, we recommend that Negril Gardens organize other community programs, such as a beach cleanups or join in the efforts of the Negril Environmental Protection Trust.

3.3 Planning action

3.3.1 Select and assess the program's focus areas

The Green Team, under the leadership of the Program Champion, must review the property's activities in order to determine which areas, departments or issues should be targeted first by the environmental management program. This review process is generally conducted by

- 1) identifying the environmental aspects of the property's activities -- an environmental aspect is an element of a property's activity which interacts, in a beneficial or detrimental manner, with the environment,
- 2) evaluating these environmental aspects in order to determine which of these have a significant negative impact on the environment,
- 3) highlighting the areas of significant negative environmental impact that can be affected through the property's environmental program

The environmental aspects of the various activities carried out in hotels can generally be classified in at least one of the following categories

- water use,
- energy use,
- solid waste generation,
- generation of water pollutants,
- use of hazardous products,
- generation of air emissions, and
- damage to the eco-system

A description of the environmental impacts and the types of activities associated with Negril Garden's principal environmental aspects is given in Appendix II

The identification of environmental aspects and impacts provides the property with a sense of its current environmental performance and enables the property to establish the environmental targets and objectives of its future EMS activities. The background information and the recommendations given in this report should help Negril Gardens identify its principal priority areas.

After selecting the priority areas for the environmental program, the Green Team will have to conduct a detailed review of each priority area. The purpose of this review process is

- 1) To assess current performance in each particular priority area. Current performance can be best evaluated by calculating environmental performance indicators from the property's energy, water and solid waste bills, chemicals and materials purchase records, and hotel occupancy records. Examples of the type of indicators which can be used by Negril Gardens to gauge its current environmental performance include
 - gallons of water consumed by the property per guest night
 - kWh consumed by the property per guest night

- number of tanker loads pumped from the septic tank per guest night
- gallons of water consumed per pound of material processed through the laundry
- pounds of laundry (or number of wash loads) processed per guest night
- pounds of laundry chemicals used per guest night
- pounds (or volume) of solid waste hauled out of the property per guest night
- pounds of materials (glass, paper, plastic, metals) recycled per guest night
- pounds of a specific chemical product used per guest night

This initial assessment is very important since it provides the benchmark against which progress will be measured in a particular focus area (e g , the laundry room) or in the property as a whole

- 2) To identify improvement options The Green Team will need to identify what is already being achieved in order to gain an idea of where improvements can be made without sacrificing other operational criteria This is where discussion with key staff in each area is not only very useful (they often understand best where and how improvements can be made) but also essential if they are to be committed to the process

The findings and conclusions of this preliminary review process should be recorded so that they may be used, at the end of the yearly EMS cycle, to evaluate the results and achievements of the environmental program

3 3 2 Prepare a plan

The preparation of the action plan involves four important steps

- decide which of the actions identified by the review should be pursued first,
- define the steps to implement each action,
- allocate responsibility for these steps,
- set target dates for action

The action plan should prioritize

- actions needed to meet environmental laws and standards,
- good management practices which are simple and will bring a combination of environmental and business benefits,
- investment measures which have a rapid payback

The action plan forms given in Appendix III illustrate the outputs of this task

The task of working up the plan of action may involve testing the performance, cost and operational implications of an option It may be wise to try out an idea before fully implementing it

3 3 3 Set targets

The purpose of setting targets is to provide clear benchmarks against which to measure the success of the program. However, since changing environmental practice takes time and effort, the Green Team should carefully evaluate the program's targets. It is often better to set targets which are achievable and which can provide real satisfaction once achieved, than to set over-ambitious targets which only lead to failure and staff demoralization.

The targets established by the Green Team for the property's environmental program can either be based on environmental performance indicators or on specific actions that must be completed by a given date.

Examples of indicator-based targets include

- Reduce the amount of water consumed by the property per guest night in 1998 by 10% with respect to the 1997 figure
- Reduce the mass of solid waste hauled out of the property per guest night in 1998 by 20% with respect to the 1997 figure
- Before the end of 1998, achieve a water use ratio of 2.5 gallons per pound of laundry processed

Examples of action-based targets include

- Start a composting program for all garden waste by March 1998
- Develop a check list for a guest room preventive maintenance program by January 1998, and begin the program by February 1998

3 4 Taking action

3 4 1 Prepare personal action plans

Negril Gardens' employees must clearly understand that responsibility for minimizing the waste of energy, conserving water, recycling materials, and other tasks defined by the property's environmental program is part of their job. They must be aware that they will be recognized if they carry out these responsibilities successfully, and noticed if they do not. The key to achieving this objective is to translate the overall action plan into personal action plans which detail the specific and general actions expected of specific employees.

Examples of personal action plans are provided in Appendix IV

3 4 2 Provide support and training

The key to success for any environmental program is education. Employees must learn how to perform their daily tasks in a manner that will maximize conservation, and understand why Negril Gardens is undertaking this effort and the positive effects this effort will have on them, their families and the local community. This understanding will provide a sense of ownership in the environmental effort that will contribute to its long-term success.

The objectives of the training program are simple to ensure that all employees understand the property's important environmental issues and have acquired the skills to perform their work in an environmentally responsible manner

3 4 3 Publish results

Employees want to know the results of their endeavors Management and the Green Team should therefore regularly post the results of monitoring on the staff notice board, congratulate success, and rewarding individuals or departments that have done particularly well

Many hotels put up energy and water consumption monitoring results on their staff notice boards The results for the current month are displayed in a simple graphic format and compared with the previous month and the same month in the previous year Staff take a great interest and pride in these results

Negril Gardens may also decide to publicize the results of its environmental program in promotional literature

3 4 4 Show leadership

Achieving staff commitment is an ongoing task -- if enthusiasm is to be maintained, staff need to be constantly reminded of the objectives and targets which have been set Management and the Green Team must demonstrate its continued commitment and leadership, notice when action is being taken and when lapses occur, and continually refresh enthusiasm in the challenge of transforming Negril Gardens in an environmentally friendly property Like customer care, good environmental management practices must become part of the management culture

3 5 Reviewing progress

3 5 1 Monitor progress

The saying, "you cannot manage what you do not measure," applies as much to environmental management as to other areas Negril Gardens needs to establish good monitoring procedures to insure that the program is working and achieving its objectives Monitoring should be regular and scheduled How regular depends on the subject being monitored, but it should be sufficiently frequent to enable corrective action to be taken if there is a major change from targeted performance

Energy and water consumption should be monitored on at least a weekly basis by checking all of the property's meters This activity need not take a member of staff more than 10 minutes a week Examples of water and energy monitoring forms are provided in Appendix V

Especially in the early days when progress will be patchy, and difficulties will arise, the

Green Team should frequently hold short meetings with relevant individuals to review the progress made, and to help sort out problems as they arise

Effective utilities metering will pay back very rapidly. Some hotels have installed separate utility metering for different parts of the hotel. This enables them to better identify where energy or water wastage is occurring. Typically the cost of installing new meters will be met from utility cost savings in the first year.

3.5.2 Conduct an annual review

Once a year Negril Gardens will need to step back to check the progress in its environmental performance. This review might best be undertaken by the Champion and may take the form of a short report attaching completed targeting and monitoring forms of the initiatives undertaken. Alternatively, management may prefer to use independent consultants if it feels that Negril Gardens does not have the resources or expertise in house to perform this task. The review should cover the property's environmental management capabilities as well as the progress made with specific environmental actions. It should entail:

- A general review of the property's environmental performance to assess what progress has been made, and to help re-prioritize action
- A summary of measured achievements against set targets and objectives
- Discussions with relevant staff to identify the difficulties that have arisen, and the successes, and their recommendations for future action

This review process is invaluable. It will highlight problem areas as well as help identify the most appropriate environmental management approach for Negril Gardens. Management and the Green Team can then begin to plan for the coming year -- but this time on the basis of the experience acquired over the past year.

4. Recommendations for Improving the Property's Environmental Performance

Table 1 provides a summary of the recommendations proposed by the audit team to help the property address many of its activities that have a negative impact on the environment. It is important to note, however, that this list only contains the recommendations identified during the course of a three day audit, these recommendations should therefore be viewed as only a the first phase of the property's continuous EMS process

The recommended actions listed in Table 1 are classified by department or area of activity (e.g., maintenance department, housekeeping department, guest rooms, gift shop) and by the environmental aspect category addressed by each recommendation (e.g., water use, energy use, solid waste generation)

An evaluation of the environmental impact, the implementation cost and the cost effectiveness of each recommended action is provided in the last three columns of Table 1. The ratings used to qualify the recommendations are defined as follows

Criteria	Rating	Description of rating
Environmental benefit of the action	High (H)	Significant reduction of the property's impact on the environment (e.g., a large reduction in the toxicity or volume of generated waste, a significant improvement in the use of water, energy, chemicals or other products)
	Moderate (M)	Moderate reduction of the property's impact on the environment
	Low (L)	Low or insignificant reduction of the property's impact on the environment
Cost to implement the action	High	Cost > 1,750 J\$ per room (50 US\$ per room)
	Moderate	Cost = 350 to 1,750 J\$ per room
	Low	Cost < 350 J\$ per room
Cost effectiveness of the action	High	Payback < 2 months
	Moderate	Payback = 2 months to 1 year
	Low	Payback > 1 year

The property's management and staff can use the ratings to select the recommendations that should be implemented first and to identify the recommendations that yield the greatest benefits -- that is, High environmental benefit, Low implementation cost and High cost effectiveness

The high priority actions listed in Table 1 are highlighted with the "⊗" symbol. These actions are those which either have an immediate payback (cost effectiveness = H) or have a high environmental benefit combined with a moderate payback (cost effectiveness = M)

TABLE 1 RECOMMENDATIONS FOR IMPROVING NEGRIL GARDENS' ENVIRONMENTAL PERFORMANCE

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effecti-veness
MAINTENANCE DEPARTMENT		H=high	M=moderate	L=low
General issues	<p>☉ Negril Gardens should implement a formal preventive maintenance program (PMP) that will cover the property's equipment. The equipment should be routinely checked, and the maintenance schedules and results should be tracked in a PMP log book. A PMP program ensures that equipment is running efficiently and safely, it also extends the useful life of the equipment.</p>	H	M	H
Water use	<p>Water consumption at Negril Gardens (183 gallons per guest night) is greater than the industry average for a water efficient property (154 gallons per guest night). Since the cost of the water used by Negril Gardens is extremely high (579 J\$/1,000 gallons -- this value includes the fee paid to NWC and to the cesspool pumping service), it is in this property's best interest to engage in an aggressive water conservation program.</p>	H	see specific actions	see specific actions
	<p>☉ Promptly fix all leaks in faucets, toilets, pipes and other fixtures. Several of the guest room and public bathrooms inspected by the audit team had leaky toilets and faucets -- such leaks can prove to be extremely costly. For example, a single dripping tap can waste up to 10,000 gallons per year and cost this property 1,800 J\$/year. Maintenance staff should replace damaged faucet washers, replace defective flapper balls and check toilet tanks for scale deposits that might obstruct the flapper. The cost of repairing such leaks is generally minimal.</p>	M	L	H
	<p>☉ Continue the installation of low flow shower heads. Since the low flow shower heads currently installed by Negril Gardens use 1.5 to 2.5 gpm as compared to 5 gpm for the standard shower heads, the use of these devices is a highly cost effective water conservation measure. Negril Gardens started installing new low flow shower heads a few weeks before the visit of the audit team.</p> <ul style="list-style-type: none"> • Potential savings = 480,300 J\$/year • Implementation cost = 55,300 J\$ • Payback period < 6 weeks <p>This recommendation is detailed in Project 1</p>	M	L / M	H
	<p>☉ Reduce water consumption in guest rooms, public restrooms, kitchen and bar and by installing flow aerators on all faucets that are not yet equipped with such water conservation devices. The use of flow aerators is particularly important in places such as the kitchen where taps are used frequently or left running for long periods of time.</p> <ul style="list-style-type: none"> • Potential savings = 3,370 J\$/year/faucet • Implementation cost = 60 J\$/faucet • Payback period < 1 week <p>This recommendation is detailed in Project 2</p>	M	L	H

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effecti-veness
	Consider installing "hand free" (spring loaded, infrared or foot valve) faucets in locations where the taps are likely to be left running when not in use (e g , hand washing station in the kitchen, public restrooms)	M	M	M
	<p>▶ Establish a policy to replace any damaged or unusable guest bathroom toilet with a 1.6 gal/flush model</p> <p>▶ Replace all conventional toilets with 1.6 gal/flush toilets in frequently used public or employee restrooms</p> <p>For guest bathroom toilets</p> <ul style="list-style-type: none"> • Potential savings = 5,590 J\$/year/toilet • Implementation cost = 1,000 J\$/toilet • Payback period = 3 months <p>For public or employee restroom toilets</p> <ul style="list-style-type: none"> • Potential savings = 10,1400 J\$/year/toilet • Implementation cost = 4,000 J\$/toilet • Payback period < 5 months <p>This recommendation is detailed in Project 3</p>	M	M	M
	<p>⊗ Install in each toilet a flow diverter on the hose which feeds water to the toilet bowl's refill pipe. By diverting back into the water tank part of the flow that normally drains to the toilet bowl, this simple device can be used to set a suitable water level in the toilet bowl and avoid the waste of water resulting from overflowing the toilet bowl. Flow diverters can be easily installed on almost any conventional toilet (i.e., 4 to 5 gallons per flush) and can save from 0.5 to 1 gallon per flush</p> <ul style="list-style-type: none"> • Potential savings = 43,800 J\$/year • Implementation cost = 6,500 J\$ • Payback period < 2 months <p>This recommendation is detailed in Project 4</p>	M	L	H
	<p>⊗ Install displacement devices in the water tanks of all conventional toilets (4 to 5 gallon tanks). The use of these devices can reduce by about 0.5 gallon the amount of water used for each flush</p> <ul style="list-style-type: none"> • Potential savings = 43,800 J\$/year • Implementation cost = 2,600 J\$/year • Payback period < 1 month <p>This recommendation is detailed in Project 5</p>	M	L	H

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effecti-veness
	<p>⊗ Given the high cost of NWC water (180 J\$/1,000 gallons), Negril Gardens should seriously consider collecting and reusing the rainwater that falls on the rooftops of its cottages and buildings. The principal uses for the collected rainwater include grounds irrigation and laundry -- rainwater is naturally soft and would therefore eliminate the need for the water softening chemicals currently used in the laundry, or the need to purchase the water softening system that is currently being considered.</p> <p>A 15,000 ft² rain catchment would be able to produce most of the water used by the laundry room (424,600 gal/year) and save the property 76,400 J\$/year.</p> <p>This recommendation is detailed in Project 6</p>	H	M / H	M
	<p>Monitor water consumption and calculate monthly gallons/room night or gallons/guest night figures. Use this information to spot potential problems or leaks in the water supply lines and evaluate the progress of the water conservation efforts.</p> <p>The audit team discovered that the daily water use data collected by the maintenance department was not accurate. The consumption figures of the three meters were totaled without observing the fact that the garden side meters measure m³ and the beach side meter measures 1,000 of gallons. The audit team prepared and gave the maintenance department new data collection forms that should eliminate possible confusion in future data collection efforts. Copies of these forms are given in Appendix VI.</p>	M	L	not applic
Energy use Electricity and lighting	The property's overall voltage supply is low. Negril Gardens should consider upgrading its voltage to 415 V, 3ph to compensate for low voltage.	M	unknown	unknown
	Negril Gardens's system loading is not balanced. This property should consider redistributing its loads to reduce the imbalance and lower distribution losses.	M	unknown	unknown
	Negril Gardens should investigate power factor correction measures to remedy the existing low power factor (82%) conditions.	M	unknown	unknown
	<p>⊗ Negril Gardens is currently billed at rate 20. This property should consider converting to rate 40 in order to reduce its energy bills.</p> <ul style="list-style-type: none"> • Potential savings = 625 000 J\$/year • Implementation cost = 70 000 J\$ • Payback period < 6 weeks <p>This recommendation is detailed in Project 7</p>	L	M	H

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effectiveness
	<p>⊗ Although pool filter pumps are generally operated continuously, experience has shown that pool water quality can be maintained by running the filter pumps for 12 to 16 hours per day Negril Gardens should therefore shut off its filter pump at night, this measure will save energy and increase the useful life of the pump</p> <ul style="list-style-type: none"> • Potential savings = 19 300 J\$/year • Implementation cost = negligible • Payback period = immediate payback <p>This recommendation is further detailed in Project 8</p>	M	L	H
	<p>There is a large number of incandescent bulbs used around this property (especially for exterior illumination) Wherever possible, Negril Gardens should consider replacing burnt-out incandescent bulbs with energy efficient fixtures (e g , compact fluorescent bulbs)</p> <p>Guest room lights</p> <ul style="list-style-type: none"> • Potential savings = 86,200 J\$/year • Implementation cost = 478 J\$/bulb • Payback period < 13 months <p>Exterior lights</p> <ul style="list-style-type: none"> • Potential savings = 14,400 J\$/year • Implementation cost = 478 J\$/bulb • Payback period < 11 months <p>This recommendation is detailed in Projects 9 and 10</p>	M	M	L/M
	Lighting levels in the kitchen are poor and should be upgraded to improve working conditions for kitchen staff	H	M	not applic
	Laundry room equipment and ventilation fan need servicing (drive belts need adjusting)	M	M	M
	⊗ Maintenance and management should encourage staff to turn off lights and equipment that are not in use	M	L	H
Energy use Air conditioning	The louvered windows and the large gaps under many entrance doors result in a significant heat gain in the guest rooms and add to the load on the a/c units Install durable weather stripping on the louvered windows and at the base of the entrance doors to reduce heat gain and the energy consumed by the a/c units	M	L	H
	Provide regular maintenance to the a/c units many of Negril Gardens a/c units are in need of servicing	M	M	M
	Bathroom windows are left open in many rooms while the air conditioners are on Negril Gardens garden should consider installing door closure devices on bathroom doors to eliminate heat gain from bathroom windows	M	M	M

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effecti-veness
Energy use Hot water supply	<ul style="list-style-type: none"> ▶ Insure that the thermostats of all guest room water heaters are appropriately set Hot water temperature in guest bathrooms should not exceed 120°F (49°C) Supplying water at temperatures greater than 125°F decreases the energy efficiency of water heaters and increases the risks of scalding guests ▶ Check all hot water thermostats frequently adjusting temperatures of hot water heaters is pointless if the thermostats are malfunctioning 	M	L	H
Solid waste generation	<ul style="list-style-type: none"> ⊗ Negril Gardens should implement a hotel-wide recycling program to segregate glass, metal, cardboard, paper and green waste from its general waste stream <p>This recommendation is detailed in Project 11</p>	H	M	M
	<ul style="list-style-type: none"> ⊗ Sell old equipment to a scrap dealer or use it for parts Currently, old equipment is usually thrown out This practice not only increases the amount of waste being disposed of, it is also a lost source of revenue 	H	L	M
Damage to the ecosystem	Negril Gardens should stop discharging untreated gray water from it laundry operations in the wetlands located behind the tennis court The discharge of sewage and noxious effluents in bodies of water or onto the ground is prohibited by Jamaica's Natural Resources Conservation Authority Act	H	M / H	not applic
Generation of air emissions	Implement a CFC phase-out program This program should include the proper handling and recycling of R-11 and R-12 CFC refrigerant from old equipment, and the gradual replacement of old equipment with CFC-free equipment	H	H	not applic

FRONT OFFICE AND GIFT SHOP

Solid waste generation	<ul style="list-style-type: none"> ⊗ Implement a paper reuse program Once-used paper (i e , printed on one side only) can be reused as scrap paper for taking notes writing inter-office memos, etc 	M	L	H
	<ul style="list-style-type: none"> ⊗ In the gift shop replace the brown paper currently used to wrap breakable items with used newspaper 	L	L	H
	<ul style="list-style-type: none"> ⊗ Whenever feasible, don't automatically give out plastic bags for gift shop purchases instead ask guests if they would like one Replace plastic bags with paper bags 	L	L	H

PURCHASING DEPARTMENT

Solid waste generation	Purchase as much recycled paper products as possible (office paper toilet paper, facial tissues, paper towels etc) Most paper products manufacturer have environmentally friendly alternatives which contain a minimum of 20% POST CONSUMER waste The price and quality of recycled paper products are often comparable to those of virgin paper products Negril Gardens must be commended for already purchasing many recycled paper products and the purchasing department should be encouraged to persevere in its efforts	H	L	not applic
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Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effecti-veness
	⊗ Implement a program to return all chemical drums to distributors	M	L	H

HOUSEKEEPING DEPARTMENT

Water use	⊗ Instruct housekeepers to use a bucket when cleaning instead of allowing the faucets to run continuously	M	L	H
Energy use	<p>⊗ Develop a list of specific instructions for the housekeeping staff Use this list to define the specific tasks and actions that must be performed by housekeepers while preparing a guest bedroom The following items should be included in this list</p> <ul style="list-style-type: none"> ▶ Leave the guest room door closed during room preparation If the door must be left open, turn the air conditioner off • Do not replace the trash can liners (plastic bags) unless these are soiled or otherwise unacceptable for further use • Report all malfunctioning equipment to the maintenance department (the hotel operator could be used as the central point for the collection of this information, however, the maintenance department should be contacted directly for all urgent repairs) Pay particular attention to water leaks in toilets, faucets and shower heads, excessively high flows from faucets or shower heads, sticking toilet flush handles, sink and bathtub stoppers which don't work or don't fit properly, damaged windows or louvers, scalding hot water, malfunctioning air conditioners • Before leaving the guest room <ul style="list-style-type: none"> ◦ turn all lights, televisions and radios off, ◦ turn the a/c unit off or, if this is unacceptable to the guests adjust the a/c thermostat to a "low cool" (or lowest possible) setting, ◦ if the a/c is left on, make sure that all windows and louvers are properly closed, ◦ ensure that faucets and toilets are not running <p>The property can also use this list to instruct housekeepers on the requirements of the linen reuse and a recycling program</p>	M	L	H
	<p>⊗ Many guests leave the air conditioner running and lights on after leaving the room for the day s activities Negril Gardens should place a tactful note in the rooms to encourage guests to turn off air conditioners and lights whenever they leave their rooms for extended periods</p> <ul style="list-style-type: none"> • Potential savings = 156,000 J\$/year • Implementation cost = 20,000 J\$ • Payback period < 2 months <p>This recommendation is detailed in Project 12</p>	M	L	H

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effecti-veness

LAUNDRY

Water use / Energy use / Generation of water pollutants	<p>☉ Let guests decide if they want to replace their linens and towels every day International and Jamaican (JHTA) experience has revealed that such an option can reduce the laundry load by up to 40% By reducing the volume of materials processed through the laundry, the hotel can lower its water, chemicals and energy costs, lengthen the service life of its laundry equipment, and reduce its discharge of pollutants to the environment</p> <ul style="list-style-type: none"> • Potential savings = 378,000 J\$/year • Implementation cost = 20,000 J\$ • Payback period < 3 weeks <p>This recommendation is detailed in Project 13</p>	H	L	H
Energy use	The drying and cooling times on the drying machines are manually set This practice should be controlled and optimized in order to conserve energy in the laundry room	M	L / M	M
	☉ Washer and dryers are not always operated at optimal loads Negril Gardens should insure that the washing machines and dryers are operated at recommended <u>full</u> load as often as possible	M	L	H
Solid waste generation	Discontinue the practice of wrapping linens and towels in plastic bags Purchase durable, reusable canvas bags as an alternative	M	L	M
Generation of water pollutants	Discontinue the use of the Swift LD-500 water conditioner This product contains poly and pyro-phosphates which damage aquatic systems, and should be replaced by a phosphate-free alternative	H	L	not applic

KITCHEN

General	Plant an herb garden Chef Bailly expressed an interest in planting an herb garden in order to supply the restaurant with fresh herbs This feature will reduce costs in purchasing, diversify the existing landscape and increase the marketability of the restaurant and hotel We also recommend that the plants should be labeled and made available to the guests to view to enhance the guest experience	M	L	M
Water use	☉ Make an effort to thaw as few items as possible under running water Use the refrigerator or a basin of water as an alternative when possible	M	L	H
	Instead of hosing down the kitchen every day the stewards should mop the floors to conserve water	M	L	M
Energy use	The exhaust fans should be regularly cleaned	M	L	M
Solid waste generation	Purchase sealable reusable plastic containers (e.g. Tupperware) to reduce the use of disposable plastic wrap for food storage	M	L	M
Generation of water pollutants	☉ Purchase a measuring cup for pot washer to control the amount of concentrated dish soap that is used Currently an excessive amount of soap is used	M	L	H

Environ aspect of the hotel's activity	Recommended action	Criteria		
		environ impact	cost	cost effectiveness

RESTAURANT AND BAR

Water use / Solid waste generation	Discontinue the practice of supplying guests with new glasses or disposable cups for each drink they order. If a guest orders the same beverage twice, offer to refill the glass as an alternative to giving a new glass. This measure will cut down on water used for dish washing, chemical use, and the generation of solid waste.	M	L	M
Solid waste generation	Wherever possible, replace disposable plastic or paper wares with reusable alternatives	M	L	M
	☉ Reduce packaging waste by purchasing sugar, jellies and jams, butter and cereal in bulk	M	L	H
	☉ Do not give straws out automatically with drinks. Guests should be asked if they would like one. Replace plastic straws with paper straws.	L	L	H
	Implement a policy to use/sell excess inventory before introducing new items to the menu (i.e. wine)	M	L	not applicable
	Replace paper napkins with linen napkins	L	L	L
	☉ Eliminate the use of paper doilies	L	L	H

POOL

Water use	☉ Sweep the pool deck instead of hosing it down, or at least minimize the amount of water used to clean the pool deck. A continuously running hose is a very costly alternative to a broom.	M	L	H
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GARDENS

Water use	☉ Sweep patios and walkways instead of hosing them down. A continuously running hose is a very costly alternative to a broom.	M	L	H
	☉ Irrigate the grounds early in the morning or in the evening to reduce the amount of water lost by evaporation.	M	L	H
Solid waste generation	☉ Start a composting program for the garden's green waste and the kitchen's vegetable and fruit scraps. The finished compost can then be used on the hotel grounds to replace chemical fertilizers. This recommendation is detailed in Project 11	H	L	M
	☉ Use durable and reusable canvas bags rather than disposable plastic bags to gather green garden waste.	M	L	H

Project I: Install low-flow shower heads

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 473,000 gallons/year if low-flow shower heads are installed in all guest bathrooms
- ▶ Saves the property 480,300 J\$/year in reduced water, septic tank pumping and electricity bills
- ▶ Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping Reduces the seepage of wastewater around the septic tanks
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 6 weeks

Current situation In mid-August Negril Gardens started a gradual program to replace its existing shower heads with low-flow models At the time of the audit, only a few guest rooms were equipped with these water conservation devices

Recommendations Once the property has found a low-flow shower head that performs properly with the hotel's water pressure management is encouraged to rapidly replace all of its old showerheads

Input, assumptions and calculations

- a) Water and energy savings for each low flow shower head installed
- ▶ Assume one 5-minute shower per guest night Since Negril Gardens is a beach hotel, this assumption is very conservative
 - ▶ Assume a piped water temperature of 70°F (21°C) and a shower water temperature of 105°F (41°C)
 - ▶ The low flow shower heads consume less than 2.5 gal/min while the existing fixtures consume approximately 5 gal/min
 - ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal
 - ▶ The hotel has 65 guest rooms and an occupancy rate of 37,816 guest nights per year This corresponds to an average of 582 GN/year/room
 - ▶ The electricity consumed by the guest rooms water heaters costs 4.72 J\$/kWh and contains 860 kcal/kWh The water heaters have an assumed efficiency of 95%

Given the preceding information the water and energy savings achieved by installing a low flow shower head in a single guest room are calculated as follows

$$\begin{aligned}
 \text{Water savings} &= (5 \text{ min/GN}) \times (5 \text{ gal/min} - 2.5 \text{ gal/min}) \\
 &= 12.5 \text{ gal/GN} \\
 &= (12.5 \text{ gal/GN}) \times (582 \text{ GN/year/room}) \\
 &= 7,275 \text{ gal/year/room or } 27,500 \text{ lit/year/room} \\
 &= (7,275 \text{ gal/year/room}) \times (579 \text{ J}/1,000 \text{ gal}) \\
 &= 4,210 \text{ J}/\text{year/room}
 \end{aligned}$$

$$\begin{aligned}
 \text{Energy savings} &= (27,500 \text{ lit/year/room}) \times (1 \text{ kcal/lit}^\circ\text{C}) \times (41^\circ\text{C} - 21^\circ\text{C}) \times (1/0.95) \\
 &= 578,900 \text{ kcal/year/room} \\
 &= [(578,900 \text{ kcal/year/room}) / (860 \text{ kcal/kWh})] \times (4.72 \text{ J\$/kWh}) \\
 &= 3,180 \text{ J\$/year/room}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total savings} &= \text{water savings} + \text{energy savings} \\
 &= 7,390 \text{ J\$/year/room}
 \end{aligned}$$

b) Total savings resulting from installing low-flow shower heads in all guest rooms

$$\begin{aligned}
 \text{Total water savings} &= 7,275 \text{ gal/year/room} \times 65 \text{ rooms} \\
 &= 472,900 \text{ gal/year}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total financial savings} &= 7,390 \text{ J\$/year/room} \times 65 \text{ rooms} \\
 &= 480,300 \text{ J\$/year}
 \end{aligned}$$

c) Implementation cost and payback period

- ▶ The cost of a low-flow shower head ranges from 300 to 850 J\$, however, the following calculations will use the conservative cost of 850 J\$/unit. The cost effectiveness of this water and energy conservation measure is therefore calculated as follows

$$\begin{aligned}
 \text{Total implementation cost} &= (850 \text{ J\$/room}) \times 65 \text{ rooms} \\
 &= 55,300 \text{ J\$}
 \end{aligned}$$

$$\begin{aligned}
 \text{Payback period} &= (55,300 \text{ J\$}) / (480,300 \text{ J\$/year}) \\
 &< 6 \text{ weeks}
 \end{aligned}$$

Comments

- ▶ To avoid guest dissatisfaction, the property is strongly encouraged to identify and purchase low-flow shower heads that have a proven performance record. Some models provide showers that do not “feel good” and may drive guests to take baths instead of showers
- ▶ Low-flow shower heads must be cleaned periodically to remove the scale deposits and other impurities which may affect the quality of the water stream
- ▶ Possible supply sources include
 Mr. John Albino
 AquaSaver Sales Inc
 5062 South 108th Street #291
 Omaha, NE 68137
 Tel: (402) 895-4073

The low-flow showerheads supplied by AquaSaver Sales cost 9.80 USD each for 1-20 units, 8.80 USD each for 21-100 units, and 8.00 USD each for orders greater than 101 units. Shipping 50 showerheads from the US to Jamaica costs approximately 35 USD.

Project 2: Install flow aerators on all faucets

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 5,820 gallons/year for each flow aerator installed in a guest bathroom
- ▶ Saves the property 3,370 J\$/year for each 60 J\$ aerator installed in a guest bathroom. These savings are the result of lower water and septic tank pumping bills
- ▶ Saves energy by reducing the consumption of hot water in restroom and work area sinks
- ▶ Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping. Reduces the seepage of wastewater around the septic tanks
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 1 week

Current situation Most faucets in guest bathroom sinks, public and employee restroom sinks, and work areas (e.g., kitchen, bar, laundry) are not equipped with flow aerators

Recommendations Equip all faucets with flow aerators. These water saving devices reduce the output of faucets from 5 - 7 gal/min down to 1.5 - 2.5 gal/min. The 1.5 - 2.5 gal/min aerators are generally used in bathroom sinks, and the 2.5 gal/min models are used in kitchen faucets. The use of flow aerators is particularly important in places where taps are used frequently (e.g., public and employee restrooms) or are left running for long periods of time (e.g., kitchen and bar sinks)

Input, assumptions and calculations

- a) Water savings achieved by installing a faucet aerator in a guest bathroom sink
- ▶ Assume the faucet is operated for 4 minutes per guest night
 - ▶ The average flow of a bathroom sink faucet with no aerator is 4 gal/min. By installing a faucet aerator, this flow can be reduced to 1.5 gal/min
 - ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal
 - ▶ The hotel has 65 guest rooms and an occupancy rate of 37,816 guest nights per year. This corresponds to an average of 582 GN/year/room

The water savings achieved by installing a flow aerator in a single guest bathroom sink are calculated as follows

$$\begin{aligned}
 \text{Water savings} &= (4 \text{ min/GN}) \times (4 \text{ gal/min} - 1.5 \text{ gal/min}) \times (582 \text{ GN/year/room}) \\
 &= 5,820 \text{ gal/year/room} \\
 &= (5,820 \text{ gal/year/room}) \times (579 \text{ J\$/1,000 gal}) \\
 &= 3,370 \text{ J\$/year/room}
 \end{aligned}$$

b) Implementation cost and payback period

- ▶ The cost of a faucet aerators ranges from 30 to 60 J\$ The cost effectiveness of this measure is therefore calculated as follows

Total implementation cost = 60 J\$/room

Payback period = (60 J\$/room) / (3,370 J\$/year/room)
< 1 week

Comments

- ▶ The water and financial savings achieved by installing aerators on frequently used faucets in public restrooms, kitchen, bars and other work areas will be significantly greater than the figures calculated above
- ▶ If some of Negril Gardens' faucets cannot be equipped with flow aerators, the savings achieved by these devices should justify the purchase of new fixtures in public restrooms and work areas (payback ~1 to 4 months) and in guest bathrooms (payback ~6 months to 1 year)
- ▶ In addition to the use of flow aerators, the output of faucets can also be controlled by adjusting the shut-off valves located on the lines which bring water to the faucets In many cases, these valves are wide open and thus subject the faucets to the full pressure carried by the water distribution system In order to conserve water, this property should adjust these valves to reduce the water pressure acting on the faucets and thereby reduce the maximum flow output of the faucets

Project 3: Replace existing 4-gal/flush toilets with water-saving toilets

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 5,590 gal/year per guest bathroom toilet and 17,520 gal/year per public restroom toilet
- ▶ Saves the property 3,240 J\$/year per guest bathroom toilet and 10,140 J\$/year per public restroom toilet These savings are the result of lower water and septic tank pumping bills
- ▶ Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping Reduces the seepage of wastewater around the septic tanks
- ▶ The payback for replacing a guest bathroom's damaged 4 gal/flush toilet with a water efficient model is approximately 3 months
- ▶ The payback for replacing an operational 4 gal/flush public restroom toilet with a water efficient model is less than 5 months

Current situation Guest bathrooms and most public restrooms are equipped with 4-gallons per flush toilets None of the toilets inspected by the audit team had any type of water conservation device in place

Recommendations For guest bathrooms, establish a policy to replace any damaged or unusable toilet with a 1.6 gal/flush model For all frequently used public or employee restrooms, replace all conventional toilets with 1.6 gal/flush toilets

Input, assumptions and calculations

- a) Water savings resulting from installing a water-saving toilet in a guest bathroom
- ▶ Assume 4 flushes per guest night
 - ▶ Water-saving toilets use 1.6 gal/flush while most of Negril Gardens' toilets use 4 gal/flush
 - ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal
 - ▶ The hotel has 65 guest rooms and an occupancy rate of 37,816 guest nights per year This corresponds to an average of 582 GN/year/room

Given the preceding information, the water savings achieved from replacing an existing guest room toilet with a 1.6 gallon/flush toilet are

$$\begin{aligned}
 \text{Water savings} &= (4 \text{ flushes/GN}) \times (4 \text{ gal/flush} - 1.6 \text{ gal/flush}) \times (582 \text{ GN/year/room}) \\
 &= 5,590 \text{ gal/year/room} \\
 &= 3,240 \text{ J$/year/room}
 \end{aligned}$$

b) Implementation cost and payback for replacing a guest bathroom's damaged 4 gal/flush toilet with a 1.6 gal/flush toilet

- ▶ Cost of a conventional toilet = 3,000 J\$
- ▶ Average cost of a 1.6 gal/flush toilet = 4,000 J\$
- ▶ The following calculations assume that the property's standard practice is to replace a damaged guest bathroom toilet with a new 4 gal/flush unit

The cost effectiveness of replacing a damaged guest bathroom toilet with a water-saving model rather than a conventional model is calculated as follows

$$\begin{aligned}\text{Implementation cost} &= (4,000 \text{ J\$/room} - 3,000 \text{ J\$/room}) \\ &= 1,000 \text{ J\$/room}\end{aligned}$$

$$\begin{aligned}\text{Payback period} &= (1,000 \text{ J\$/room}) / (3,240 \text{ J\$/room/year}) \\ &= 3 \text{ months}\end{aligned}$$

Comments

- ▶ The preceding analysis shows that it is economically beneficial to replace any damaged 4 gal/flush toilet with a 1.6 gal/flush toilet even in low use areas, such as guest bathrooms
-

c) Water savings resulting from replacing a 4 gal/flush public restroom toilet with a 1.6 gal/flush toilet

- ▶ Assume that on average a public or employee restroom toilet is flushed 20 times per day
- ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal

The water savings achieved by replacing a 4 gal/flush public restroom toilet with a 1.6 gal/flush model are

$$\begin{aligned}\text{Water savings} &= (20 \text{ flushes/day/toilet}) \times (4 \text{ gal/flush} - 1.6 \text{ gal/flush}) \times 365 \text{ days/year} \\ &= 17,520 \text{ gal/year/toilet} \\ &= 10,140 \text{ J\$/year/toilet}\end{aligned}$$

- d) Implementation cost and payback for replacing an operational 4 gal/flush public restroom toilet with a 1.6 gal/flush model
- ▶ Average cost of a 1.6 gal/flush toilet = 4,000 J\$
 - ▶ These calculations conservatively assume the replaced conventional toilet has no economic value

The cost effectiveness of this water conservation measure is

Implementation cost = 4,000 J\$/toilet

Payback period = $(4,000 \text{ J\$/toilet}) / (10,140 \text{ J\$/year/toilet})$
< 5 months

Comments

- ▶ The preceding analysis shows that it is economically beneficial to replace all 4 gal/flush public restroom toilets with new water-saving units, even if the existing toilets are still perfectly operational
- ▶ In order to minimize the clogging problems associated with some water-saving toilet models, the property is strongly encouraged to identify and purchase water-saving toilets that have a proven performance record. The purchase of low-cost water-saving toilets of uncertain performance may end up costing the property dearly and causing much aggravation. The property is also encouraged to purchase and test a few water-saving units before implementing this recommendation throughout the property.

Project 4: Install flow diverters in all toilet tanks

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 75,630 gallons/year if flow diverters are installed in all guest room toilets
- ▶ Saves the property 43,800 J\$/year in reduced water and septic tank pumping bills
- ▶ Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping Reduces the seepage of wastewater around the septic tanks
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 2 months

Current situation Guest rooms are equipped with 4-gallons per flush toilets None of the toilets inspected by the audit team had any type of water conservation device in place

Recommendations Install in each toilet a flow diverter on the hose which feeds water to the toilet bowl's refill pipe By diverting back into the water tank part of the flow that normally drains to the toilet bowl, this simple device can be used to set a suitable water level in the toilet bowl and avoid the waste of water resulting from overflowing the toilet bowl Flow diverters do not affect the performance of the toilet because they do not reduce the water level in the toilet tank or the amount of water used to flush the waste from the bowl Flow diverters can be easily installed on most conventional toilets (i.e., 4 to 5 gallons per flush) and can save from 0.5 to 1 gallon per flush Flow diverters are used in many US hotels which are not equipped with water-saving toilets

Input, assumptions and calculations

a) Water savings resulting from the use of flow diverters

- ▶ Assume 4 flushes per guest night
- ▶ Assume flow diverters will reduce by 0.5 gallon the amount of water used to refill the bowl after each flush This is a conservative assumption since reported water savings range from 0.5 to 1 gal/flush
- ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal
- ▶ The hotel has 65 guest rooms and an occupancy rate of 37,816 guest nights per year

Given the preceding information, the water savings achieved by installing flow diverters in all guest room toilets are calculated as follows

$$\begin{aligned}
 \text{Water savings} &= (4 \text{ flushes/GN}) \times (0.5 \text{ gal/flush}) \times (37,816 \text{ GN/year}) \\
 &= 75,630 \text{ gal/year} \\
 &= (75,630 \text{ gal/year}) \times (579 \text{ J\$/1,000 gal}) \\
 &= 43,800 \text{ J\$/year}
 \end{aligned}$$

b) Implementation cost and payback period

- ▶ Flow diverters cost approximately 100 J\$/unit The cost effectiveness of this measure is

$$\begin{aligned}\text{Total implementation cost} &= (100 \text{ J\$/guest bathroom}) \times (65 \text{ guest bathrooms}) \\ &= 6,500 \text{ J\$}\end{aligned}$$

$$\begin{aligned}\text{Payback period} &= (6,500 \text{ J\$}) / (43,800 \text{ J\$/year}) \\ &< 2 \text{ months}\end{aligned}$$

Comments

- ▶ Flow diverters should also be installed in all public and employee restrooms Since these facilities are used more frequently than guest bathrooms, flow diverters installed in public or employee restrooms will achieve significantly higher water savings than those calculated above
- ▶ Flow diverters should not be installed in 1.6 gal/flush toilets
- ▶ Possible supply sources include

Mr John Albino
AquaSaver Sales Inc
5062 South 108th Street #291
Omaha, NE 68137
Tel (402) 895-4073

The flow diverters (AquaSaver™) supplied by AquaSaver Sales cost 2.50 USD/unit
Shipping 50 - 100 flow diverters from the US to Jamaica costs approximately 10 USD

Project 5: Install displacement devices in all water tanks of conventional (4 gal/flush) toilets

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 75,630 gallons/year if displacement devices are installed in all guest bathrooms
- ▶ Saves the property 43,800 J\$/year in reduced water and septic tank pumping bills
- ▶ Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping Reduces the seepage of wastewater around the septic tanks
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 1 month

Current situation Guest rooms are equipped with 4-gallons per flush toilets None of the toilets inspected by the audit team had any type of water conservation device in place

Recommendations Equip all conventional toilets (4 gal/flush) with displacement devices to reduce the amount of water used in each flush Displacement devices include home-made plastic bottles filled with pebbles, flexible panels, and filled bags, these devices are placed in the storage tank of conventional toilets to reduce the volume but not the height of the stored water The device must be compatible with the existing toilet and not interfere with the flush mechanism Negril Gardens should test the effectiveness of the displacement units in a few guest or employee bathrooms before implementing this water conservation measure throughout the property

Input, assumptions and calculations

a) Water savings resulting from the use of displacement devices

- Assume 4 flushes per guest night
- ▶ Assume the displacement devices reduce by 0.5 gallon the amount of water used in each flush Reported water savings range from 0.5 to 1 gallon per flush
- ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal
- ▶ The hotel has 65 guest rooms and an occupancy rate of 37,816 guest nights per year

The water savings achieved by installing displacement devices in all guest room toilets are

$$\begin{aligned}\text{Water savings} &= (4 \text{ flushes/GN}) \times (0.5 \text{ gal/flush}) \times (37,816 \text{ GN/year}) \\ &= 75,630 \text{ gal/year} \\ &= (75,630 \text{ gal/year}) \times (579 \text{ J}\$/1,000 \text{ gal}) \\ &= 43,800 \text{ J}\$/\text{year}\end{aligned}$$

b) Implementation cost and payback period

- ▶ The cost of a commercial displacement device is approximately 170 J\$. However, Negril Gardens' maintenance staff could produce home-made displacement devices at a negligible cost (e.g., a recycled plastic bottle filled with pebbles or concrete). The following calculations assume a cost of 40 J\$ for a home-made displacement device.

The cost effectiveness of this water and energy conservation measure is

$$\begin{aligned} \text{Total implementation cost} &= (40 \text{ J\$/guest bathroom}) \times (65 \text{ guest bathrooms}) \\ &= 2,600 \text{ J\$} \end{aligned}$$

$$\begin{aligned} \text{Payback period} &= (2,600 \text{ J\$}) / (43,800 \text{ J\$/year}) \\ &< 1 \text{ month} \end{aligned}$$

Comments

- ▶ These devices should also be installed in all public and employee restrooms. Since these facilities are used more frequently than guest bathrooms, displacement devices installed in public or employee restrooms will achieve significantly higher water savings than those calculated above.
- ▶ Displacement devices should not be used in 1.6 gal/flush toilets.

Project 6: Use rainwater for laundry or other operations

Summary of results and benefits

- ▶ A 15,000 ft² rain catchment will reduce the purchase of NWC water by 424,600 gal/year and save the property 76,400 J\$/year
- ▶ The use of rainwater for laundry operations reduces the property's consumption of water softening chemicals and may eliminate the need to purchase a water softening system
- ▶ Collecting rainwater from the Negril Garden's impervious surfaces will reduce the ponding of water on the hotel's grounds and lower the saturation of the soil, thereby improving the performance of the tile fields

Current situation On average, the Negril area receives 57 inches of rainfall per year, therefore, each ft² of rain catchment surface could theoretically collect 35 gallons of water per year. At the present time, Negril Gardens does not collect and reuse any of the rainwater that falls on the property.

Recommendations Consider collecting and reusing the rainwater that falls on the property's impervious surfaces (e.g., rooftops and, possibly, the tennis court). The collected rainwater could then be used for laundry room operations or for irrigation.

Since rainwater is virtually free, plentiful during at least 6 months of the year, and relatively clean it is an ideal source of water for laundry room operations. Furthermore, the use of naturally soft rainwater in the laundry will greatly reduce the use of the water softening chemicals currently added to the wash water, and may eliminate the need to purchase the water softening system currently being considered by Negril Gardens. Water softening columns are moderately costly and consume a significant amount of water and salt in their regular regeneration cycles. With a properly designed rainwater catchment and storage system, Negril Gardens will need to use water softening chemicals only occasionally (i.e., when there is not enough rainwater in the storage tank).

Since times of peak rainwater supply always coincide with times of minimum irrigation, the use of collected rainwater for grounds irrigation is a less attractive alternative.

Input, assumptions and calculations

a) Water savings resulting from using collected rainwater in laundry room operations

- ▶ Since the use of rainwater in laundry operations only reduces the purchase of water from the NWC not the disposal cost, the following calculations use a water cost of 180 J\$/1,000 gal
- ▶ After implementing the linen reuse program, the laundry room should consume on average 48,800 gal/month (i.e., 756,000 gal/year - 170,000 gal/year)
- ▶ Assume that Negril Gardens can collect rainwater over a 15,000 ft² area (i.e., the surface area of three tennis courts)
- ▶ Due to a lack of information, these calculations will not take into account the savings resulting from reducing the consumption of water softener or avoiding the purchase of a

water softening system

- ▶ The following calculations do not include the savings achieved by reducing the use of water softening chemicals or the avoided cost of a water softening system
- ▶ The precipitation data for Negril is given in the following table

Month	1997 precipitation		30 year mean precipitation	
	mm	gal/ft ²	mm	gal/ft ²
Jan	58	1 43	97	2 39
Feb	134	3 30	44	1 08
Mar	15	0 37	57	1 40
Apr	67	1 65	92	2 26
May	212	5 22	164	4 03
Jun	170	4 19	158	3 89
Jul	149	3 67	160	3 93
Aug	157	3 87	175	4 30
Sep	119	2 93	155	3 81
Oct			180	4 57
Nov	-		80	1 97
Dec	-	-	71	1 75
Year total		-	1 433 mm	35 2 gal/ft ²

Based on this information, the average monthly precipitation is 4 09 gal/ft² from May to October, and 1 63 gal/ft² from November to April

- ▶ Assume that 90% of the rainfall over the catchment area is collected and stored (i.e., 10% loss)

$$\begin{aligned} \text{Volume of collected rainwater (May - Oct)} &= 90\% \times (4.09 \text{ gal/ft}^2/\text{month}) \times 15,000 \text{ ft}^2 \\ &= 55,200 \text{ gal/month} \\ &> 100\% \text{ of the monthly laundry water needs} \end{aligned}$$

$$\begin{aligned} \text{Volume of collected rainwater (Nov - Apr)} &= 90\% \times (1.63 \text{ gal/ft}^2/\text{month}) \times 15,000 \text{ ft}^2 \\ &= 22,000 \text{ gal/month} \\ &= 45\% \text{ of the monthly laundry water needs} \end{aligned}$$

$$\begin{aligned} \text{Total water savings} &= [(48,800 \text{ gal/mo}) + (45\% \times 48,800 \text{ gal/mo})] \times 6 \text{ mo/year} \\ &= 424,600 \text{ gal/year} \\ &= 76,400 \text{ J\$/year} \end{aligned}$$

b) Implementation cost and payback period

- ▶ No information is available at the present time on the cost of a rain collection and storage system. The property should contact a local contractor to obtain a cost estimate for this system.

Project 7: Convert from billing rate 20 to rate 40

Summary of results and benefits

- ▶ Reduces Negril Gardens' energy bills by 625,000 J\$ per year
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 6 weeks

Current situation

- ▶ The requirements needed to qualify for billing rate 40 are
 - Minimum peak demand of 20 kW
 - Service character 3 phase, 50 Hz, 220 V delta or 415/240 star system
- ▶ The property's service is 220 V, 3 ph, delta connected, and its peak demand is greater than 20 kW Therefore, Negril Gardens is qualified to be billed under rate 40

Recommendations Negril Gardens should convert from billing rate 20 to rate 40

Input, assumptions and calculations

- ▶ Negril Gardens' average power demand = 145 kW
- ▶ Negril Gardens' average monthly electricity consumption = 60,130 kWh
- ▶ The fees related to the two billing rate codes are as follows

	Rate code 20	Rate code 40
Customers charge	6 J\$/month	497 J\$/month
Demand charge	none	176 J\$/kW
Energy charge	2 286 J\$/kWh	1 215 J\$/kWh
Fuel charge	1 276 J\$/kWh	1 259 J\$/kWh
Foreign exchange adjustment	32.6%	32.6%

a) Average electricity bill for Negril Gardens under rate 20

$$\begin{aligned} \text{Cost / kWh for rate 20} &= [(2\,282 \text{ J\$/kWh}) + (1\,276 \text{ J\$/kWh})] \times 1.326 \\ &= 4.72/\text{kWh} \end{aligned}$$

$$\begin{aligned} \text{Average bill for rate 20} &= [(60,130 \text{ kWh/month}) \times (\$4.72/\text{kWh})] + (6 \text{ J\$/month} \times 1.326) \\ &= 283,800 \text{ J\$/month} \end{aligned}$$

b) Average electricity bill for Negril Gardens under rate 40

$$\begin{aligned}\text{Cost / kWh for rate 40} &= [(1\,215 \text{ J\$/kWh}) + (1\,259 \text{ J\$/kWh})] \times 1\,326 \\ &= 3\,28 \text{ J\$/kWh}\end{aligned}$$

$$\begin{aligned}\text{Demand charge for rate 40} &= 145 \text{ kW} \times 176 \text{ J\$/kW/month} \times 1\,326 \\ &= 33,840 \text{ J\$/month}\end{aligned}$$

$$\begin{aligned}\text{Average bill for rate 40} &= [(60,130 \text{ kWh/month}) \times (3\,28 \text{ J\$/kWh})] + 33,840 \text{ J\$/month} \\ &\quad + (497 \text{ J\$/month} \times 1\,326) \\ &= 231,700 \text{ J\$/month}\end{aligned}$$

c) Savings achieved by converting from rate 20 to rate 40

$$\begin{aligned}\text{Difference between rate 20 and rate 40 bills} &= (283,800 - 231,700) \text{ J\$/month} \\ &= 52,100 \text{ J\$/month} \\ &= 625,200 \text{ J\$/year}\end{aligned}$$

d) Implementation cost and payback period

- ▶ Negril Gardens will need to hire a consultant to develop the proposal and prepare the application for the rate change to JPSCO. The consulting fee is estimated at 70,000 J\$.

$$\text{Implementation cost} = 70,000 \text{ J\$}$$

$$\begin{aligned}\text{Payback period} &= (70,000 \text{ J\$}) / (625,200 \text{ J\$/year}) \\ &< 6 \text{ weeks}\end{aligned}$$

Project 8: Reduce the time of operation of the pool filter pump

Summary of results and benefits

- ▶ Reduces Negril Gardens' energy consumption by 4,088 kWh/year, resulting in savings of 19,300 J\$/year
- ▶ This recommendation has an immediate payback

Current situation The swimming pool's filtration system is equipped with a 1.5 HP (1.12 kW) pump. This pump operates 24 hours per day.

Recommendations Experience shows that pool water quality can be maintained by running the filter pumps for 12 to 16 hours per day. Negril Gardens should therefore shut off its filter pump at night in order to save energy and to increase the service life of the pump. The pump can either be shut off manually or Negril Gardens may decide to repair the filtration system's existing timer.

Input, assumptions and calculations

- ▶ Assume that the pool's filter pump is shut off from 10 PM to 8 AM
- ▶ The cost of energy at Negril Gardens is 4.72 J\$/kWh

a) Energy savings resulting from shutting off the pump during nighttime

$$\begin{aligned}\text{Energy savings} &= 10 \text{ hr/day} \times 1.12 \text{ kW} \times 365 \text{ days/year} \\ &= 4,088 \text{ kWh/year} \\ &= 19,300 \text{ J$/year}\end{aligned}$$

b) Implementation cost and payback period

- ▶ The following calculations assume that Negril Gardens decides to manually control the operation of the pool pump. The implementation cost is therefore negligible and the payback of this recommendation is immediate.

Project 9: Use energy efficient lighting in guest rooms

Summary of results and benefits

- ▶ Reduces Negril Gardens' energy consumption by 20,420 kWh/year and saves the property 86,200 J\$/year
- ▶ Negril Gardens will recover the investment required to implement this recommendation in 13 months

Current situation Most guest rooms are equipped solely with incandescent bulbs

Recommendations In the guest rooms, replace all burnt 60 W incandescent bulbs with 15 W compact fluorescent bulbs. Both the 60 W incandescent and the 15 W compact fluorescent bulbs generate the same amount of light, therefore the switch will not affect the quality of lighting in the guest rooms

Input, assumptions and calculations

- ▶ Each guest room has three lamps which are equipped with 60 W incandescent bulbs. In an occupied room, each lamp burns for approximately 8 hours per day
- ▶ The average occupancy at Negril Gardens is 79.7%
- ▶ The cost of energy at Negril Gardens is 4.72 J\$/kWh
- ▶ The characteristics of the incandescent and CF bulbs are as follows

Cost of a 60 W incandescent bulb	= 22 J\$/bulb
Service life of an incandescent bulb	= 800 hours/bulb
Cost of a 15 W compact fluorescent bulb	= 500 J\$/bulb
Service life of a compact fluorescent bulb	= 10,000 hours/bulb

a) Operating cost of a single lamp equipped with a 60 W incandescent bulb

$$\begin{aligned} \text{Hours of operation} &= 8 \text{ hr/day/lamp} \times 79.7\% \times 365 \text{ days/year} \\ &= 2,327 \text{ hr/year/lamp} \end{aligned}$$

$$\begin{aligned} \text{Energy cost} &= 60 \text{ W} \times 2,327 \text{ hr/year/lamp} \\ &= 139.6 \text{ kWh/year/lamp} \\ &= 659 \text{ J$/year/lamp} \end{aligned}$$

$$\begin{aligned} \text{Cost to replace burnt bulbs} &= [(2,327 \text{ hr/year/lamp}) / (800 \text{ hr/bulb})] \times 22 \text{ J$/bulb} \\ &= 2.91 \text{ bulbs/year/lamp} \times 22 \text{ J$/bulb} \\ &= 64 \text{ J$/year/lamp} \end{aligned}$$

$$\begin{aligned} \text{Total operating cost} &= \text{energy cost} + \text{cost to replace burnt bulbs} \\ &= 659 \text{ J$/year/lamp} + 64 \text{ J$/year/lamp} \\ &= 723 \text{ J$/year/lamp} \end{aligned}$$

b) Operating cost of a single lamp equipped with a 15 W compact fluorescent bulb

$$\begin{aligned}
 \text{Hours of operation} &= 2,327 \text{ hr/year/lamp (same as above)} \\
 \text{Energy cost} &= 15 \text{ W} \times 2,327 \text{ hr/year/lamp} \\
 &= 34.9 \text{ kWh/year/lamp} \\
 &= 165 \text{ J$/year/lamp} \\
 \text{Cost to replace burnt bulbs} &= [(2,327 \text{ hr/year/lamp}) / (10,000 \text{ hr/bulb})] \times 500 \text{ J$/bulb} \\
 &= 0.23 \text{ bulb/year/lamp} \times 500 \text{ J$/bulb} \\
 &= 116 \text{ J$/year/lamp} \\
 \text{Total operating cost} &= \text{energy cost} + \text{cost to replace burnt bulbs} \\
 &= 165 \text{ J$/year/lamp} + 116 \text{ J$/year/lamp} \\
 &= 281 \text{ J$/year/lamp}
 \end{aligned}$$

c) Energy savings achieved by replacing incandescent bulbs with CF bulbs

$$\begin{aligned}
 \text{Savings for 1 lamp} &= \text{operat cost with incandescent bulbs} - \text{operat cost with CF} \\
 &= (723 \text{ J$/year/lamp}) - (281 \text{ J$/year/lamp}) \\
 &= 442 \text{ J$/year/lamp}
 \end{aligned}$$

Once all guest room lamps are equipped with CF bulbs, the total energy savings will be

$$\begin{aligned}
 \text{Total energy savings} &= (139.6 \text{ kWh/year/lamp} - 34.9 \text{ kWh/year/lamp}) \times 3 \times 65 \text{ lamps} \\
 &= 20,420 \text{ kWh/year} \\
 \text{Total financial savings} &= (442 \text{ J$/year/lamp}) \times 3 \times 65 \text{ lamps} \\
 &= 86,200 \text{ J$/year}
 \end{aligned}$$

d) Implementation cost and payback period for replacing a burnt incandescent bulb with a compact fluorescent bulb

$$\begin{aligned}
 \text{Implementation cost} &= \text{cost of a CF bulb} - \text{cost of a incandescent} \\
 &= 500 \text{ J$/bulb} - 22 \text{ J$/bulb} \\
 &= 478 \text{ J$/bulb} \\
 \text{Payback period} &= \text{implementation cost} / \text{savings for 1 lamp} \\
 &= (478 \text{ J$/bulb}) / (442 \text{ J$/year/bulb}) \\
 &< 13 \text{ months}
 \end{aligned}$$

Project 10: Use energy efficient lighting in gardens

Summary of results and benefits

- ▶ Reduces Negril Gardens' energy consumption by 3,420 kWh/year and saves the property 14,400 J\$/year
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 11 months

Current situation Most garden/exterior lamps are equipped with 60 W incandescent bulbs

Recommendations Replace all burnt 60 W incandescent bulbs with 15 W compact fluorescent bulbs. Both the 60 W incandescent and the 15 W compact fluorescent bulbs generate the same amount of light, therefore the switch will not affect the quality of the property's exterior lighting

Input, assumptions and calculations

- ▶ There are 26 incandescent bulbs (60 W) used for garden illumination. On average, garden lights are operated 8 hours per day
- ▶ The cost of energy at Negril Gardens is 4.72 J\$/kWh
- ▶ The characteristics of the incandescent and CF bulbs are as follows

Cost of a 60 W incandescent bulb	= 22 J\$/bulb
Service life of an incandescent bulb	= 800 hours/bulb
Cost of a 15 W compact fluorescent bulb	= 500 J\$/bulb
Service life of a compact fluorescent bulb	= 10,000 hours/bulb

a) Operating cost of a single lamp equipped with a 60 W incandescent bulb

$$\begin{aligned} \text{Hours of operation} &= 8 \text{ hr/day/lamp} \times 365 \text{ days/year} \\ &= 2,920 \text{ hr/year/lamp} \end{aligned}$$

$$\begin{aligned} \text{Energy cost} &= 60 \text{ W} \times 2,920 \text{ hr/year/lamp} \\ &= 175.2 \text{ kWh/year/lamp} \\ &= 827 \text{ J$/year/lamp} \end{aligned}$$

$$\begin{aligned} \text{Cost to replace burnt bulbs} &= [(2,920 \text{ hr/year/lamp}) / (800 \text{ hr/bulb})] \times 22 \text{ J$/bulb} \\ &= 3.65 \text{ bulbs/year/lamp} \times 22 \text{ J$/bulb} \\ &= 80 \text{ J$/year/lamp} \end{aligned}$$

$$\begin{aligned} \text{Total operating cost} &= \text{energy cost} + \text{cost to replace burnt bulbs} \\ &= 827 \text{ J$/year/lamp} + 80 \text{ J$/year/lamp} \\ &= 907 \text{ J$/year/lamp} \end{aligned}$$

b) Operating cost of a single lamp equipped with a 15 W compact fluorescent bulb

$$\begin{aligned}
 \text{Hours of operation} &= 2,920 \text{ hr/year/lamp (same as above)} \\
 \text{Energy cost} &= 15 \text{ W} \times 2,920 \text{ hr/year/lamp} \\
 &= 43.8 \text{ kWh/year/lamp} \\
 &= 207 \text{ J\$/year/lamp} \\
 \text{Cost to replace burnt bulbs} &= [(2,920 \text{ hr/year/lamp}) / (10,000 \text{ hr/bulb})] \times 500 \text{ J\$/bulb} \\
 &= 0.292 \text{ bulb/year/lamp} \times 500 \text{ J\$/bulb} \\
 &= 146 \text{ J\$/year/lamp} \\
 \text{Total operating cost} &= \text{energy cost} + \text{cost to replace burnt bulbs} \\
 &= 207 \text{ J\$/year/lamp} + 146 \text{ J\$/year/lamp} \\
 &= 353 \text{ J\$/year/lamp}
 \end{aligned}$$

c) Energy savings achieved by replacing incandescent bulbs with CF bulbs

$$\begin{aligned}
 \text{Savings for 1 lamp} &= \text{operat cost with incandescent bulbs} - \text{operat cost with CF} \\
 &= (907 \text{ J\$/year/lamp}) - (353 \text{ J\$/year/lamp}) \\
 &= 554 \text{ J\$/year/lamp}
 \end{aligned}$$

Once all exterior lamps are equipped with CF bulbs, the total energy savings will be

$$\begin{aligned}
 \text{Total energy savings} &= (175.2 \text{ kWh/year/lamp} - 43.8 \text{ kWh/year/lamp}) \times 26 \text{ lamps} \\
 &= 3,420 \text{ kWh/year} \\
 \text{Total financial savings} &= 554 \text{ J\$/year/lamp} \times 26 \text{ lamps} \\
 &= 14,400 \text{ J\$/year}
 \end{aligned}$$

d) Implementation cost and payback period for replacing a burnt incandescent bulb with a compact fluorescent bulb

$$\begin{aligned}
 \text{Implementation cost} &= \text{cost of a CF bulb} - \text{cost of an incandescent bulb} \\
 &= 500 \text{ J\$/bulb} - 22 \text{ J\$/bulb} \\
 &= 478 \text{ J\$/bulb} \\
 \text{Payback period} &= \text{implementation cost} / \text{savings for 1 lamp} \\
 &= (478 \text{ J\$/bulb}) / (554 \text{ J\$/year/bulb}) \\
 &< 11 \text{ months}
 \end{aligned}$$

Project II: Implement a property-wide recycling and composting program

Waste management

A waste management program will help Negril Gardens reduce the amount of waste it produces, save materials, resources, energy and money, and reduce the property's impact on the environment by drastically reducing the amount of solid waste disposed in its dump or other locations. The principal elements of an effective waste management program include what is generally called the three R's: reduce, reuse and recycle. These three elements are detailed below.

A waste management program begins with a waste review, where the quantity and type of waste produced in the property are examined. Once this review is completed, the possibilities for the waste management program can be assessed by considering each kind of waste and deciding whether it is possible to avoid the generation or the disposal of this waste through the reduce, reuse and recycling options. Whatever waste cannot be avoided through the reduce, reuse and recycle components of Negril Gardens' waste management program will have to be discarded. In most cases, however, an effective waste management program can have a significant impact in reducing the amount of waste generated by a property.

Reduce

Reduce the quantity and the impact of the waste produced by the property by avoiding natural wastage, by using more durable goods that will need to be disposed less frequently, by avoiding the purchase of excessively packaged goods, and by minimizing the use of hazardous materials or other products which have a significant impact on the environment. The reduce component of the waste management program is obviously the first option that should be considered by the property. By reducing the generation of wastes, Negril Gardens will conserve resources, reduce its use of natural resources, and reduce the amount of materials its employees will need to handle and the volume of waste the property will need to dispose.

The bulk of the responsibility for the "reduce" element of the waste management program lies with the purchasing department, since the less material that is brought into the property, the less the property will have to discard (be it by disposal to a dump site, donation or recycling). Employees who have the authority to decide what is discarded as waste also play an important role in reducing the property's waste output. The type of actions which can be taken by the property to reduce the production of waste and to lower the impact of the generated waste include:

- Avoid purchasing items (e.g., foods, chemicals, appliances, parts, maintenance items) that are excessively packaged. In North America, packaging alone can account for up to 40% of a hotel's waste stream.
- Purchase food items in bulk rather than in individually packaged portions (e.g., sugar, salt, pepper, jams/jellies, condiments, butter, cereals, syrup, cream, etc.).
- Reduce or eliminate the use of disposable plates, place mats, wares, and cups.
- Use refillable containers for chemicals, cleaners and foods.
- Replace individually packaged amenities in guest bathrooms with refillable amenity.

dispensers

- Minimize the use of straws, and replace plastic straws with paper straws
- Do not automatically supply guests with new glasses or paper cups for each drink ordered at the bar, but offer to refill the glass if a guest orders the same beverage twice
- Eliminate the use of paper wrap for guest room drinking glasses. Instead, store the drinking glasses upside-down
- Use cloth rather than paper towels and napkins
- Use cloth or canvas bags for laundry
- Use cloth or canvas bags to collect garden waste rather than disposable bags
- Use containers with lids in preference to plastic wrap
- Avoid using laundry, kitchen or housekeeping detergents which contain phosphates
- Minimize the purchase and keep track of the use of harsh or hazardous chemicals (e.g., drain cleaning agents, solvents, bleach)
- Purchase rechargeable or mercury-free batteries

Reuse

Reuse items in their original form for the same or a different purpose rather than disposing of them. If an item cannot be reused by the property, Negril Gardens should investigate the possibility of selling or donating them to employees, outsiders, charitable organizations, local schools and businesses. Examples of reuse actions are listed below.

- Remove used bathroom soap bars only when the guest checks out of the room
- Do not discard amenity bottles unless fully empty
- Reuse computer or other paper (i.e., printed on one side only) as scrap paper for taking notes and writing internal memos
- Purchase soft-drink and water in reusable rather than disposable bottles
- Reuse leftover pads/pencils from meeting rooms. The restaurant staff can use the pads to take orders
- Give preference to vendors which supply their products in returnable/refillable containers
- Give used amenities to any interested parties (e.g., charities, local schools, employees) rather than discarding them
- Reuse guest bathroom soap bars on the property. Soap bars can be flaked and used in certain laundry machines or used in a variety of cleaning operations around the property. Small pieces of soap which are not readily reusable can be collected, melted (with a small amount of water and low heat) and cast in a suitable mold (e.g., a rectangular box) to produce a large bar of soap that can be used for general cleaning operations
- Replace the trash can liners only when these are soiled or unsuitable for further use
- Repair and reuse damaged furniture or donate it to interested parties (e.g., charities, schools, employees, businesses)

Recycle

Many items that cannot be reused in their original form can be sold or given away to processors for recycling. The type of products which can generally be recycled include

- Green waste from kitchen and garden (this material can be composted on site or given to a local composting program)

- White paper and mixed paper
- Glass bottles and jars
- Plastic bottles and containers made of PETE (typically used for soft-drink and water bottles) and HDPE (typically used for milk jugs and chemical containers)
- Aluminum cans and foil
- Steel cans or "tins"
- Steel scrap such as old pipes and appliances
- Other metals such as copper and brass
- Frying oil and grease
- Motor oil (from cars, motor boats and jet skis)

At the present time only one company (RYCO-JA, a recycler of waste oil and grease) collects recyclable materials in the Negril area. However, the EAST project, in collaboration with the Negril Chapter of the JHTA and the Negril Area Environmental Protection Trust (NEPT), will strive to organize a recycling project for the Negril area by acting as a link between the interested hotels and the recycling companies based on the island. Although EAST's survey of Jamaican recycling companies is not yet complete, the companies listed below have already been identified. At the conclusion of this survey, the EAST project will provide Negril Gardens with an updated list of recycling companies, and details on the requirements related to the collection, sorting, quality, and packaging of the recyclable materials.

Glass Recycling

West Indies Glass Company Contact - Michael Austin, (809) 923-0787-9 Glass must be sorted into three color groups: clear, brown, and green. The company pays J\$300.00 per ton (2,000 lbs) and will provide free transportation to pick up the recyclables when there are five tons of any color glass available at any site.

Plastics

Wysinco Environmentals, Ltd Contact- Mrs Pat Wright, (809) 943-9800 Since October 1997, this company only collects plastic (PET) bottles from schools and specifically media announced pick up points. Therefore they ask that plastic bottles be donated to a school in the community, which earns "points" for kilograms of plastic and trades them in for computers, videos, paint, tools, etc. If Negril Gardens wishes to drop off PET bottles at the Wynsinco Recycling Plant (located at PO Box 367 White Marl, Spanish Town, St. Catherine, Jamaica), the company will pay the hotel \$8.00 per kilogram for them.

Plastic/Metal Drums

Kemcan Development Company Contact - Ms Usherwood, (809) 922-5270 At present, this company is only recycling plastic and metal drums which it will pick up provided there are 30-50 drums.

Paper

Nature's Handmade Paper Contact - Ms Gloria Dorman, (809) 993-8172 Nature's Handmade Paper is a small company set up with the assistance of the Peace Corps in 1986 This company is prepared to do a special project for the Negril hotels, whereby they will provide hotel stationery, guest cards, etc made out of the paper that the hotels recycle The cost of the paper recycling is negotiable

JA Pottinger & Co , Ltd Contact - Mr Pottinger or Ms Nadine Higgins, (809) 926-8957 This company picks up paper products from hotels – provided there is one truck load full (50 large garbage bags) – and exports the paper for recycling The price for this service is negotiable and the company is prepared to meet with EAST/JHTA to discuss a program for the Negril area

Another paper recycling option is to sell it to companies needing packaging materials, such as Exotic Flowers of Montego Bay

Metal/Aluminum

Contact Louis Daley for information regarding the recycling efforts organized by Mr McLaughlin in Mandeville

Waste vegetable oil (frying oil) and grease

Recycling Corp of Jamaica (RYCO-JA) Contact - Mr Kevin Mullane, (809) 968-7002, (1-800) 991-7926 RYCO-JA collects used vegetable oils and grease from kitchens which is then recycled in the production of chicken feed RYCO provides, free of charge, covered steel drums for the storage of the used oil and grease and collects the material from each participating property on a regular schedule This recycling scheme lowers the discharge of oil and grease to the septic tank (thus reducing potential clogging problems in the tile field) and reduces the amount of yellow grease imported into Jamaica for the production of animal feed

Composting

Composting has become the increasingly popular method by which to dispose of food scraps, floral waste and garden waste

A well-run composting programs yields significant benefits including

- a reduction in the cost ties to waste handling and disposal,
- a reduction in the environmental impact resulting from the disposal of wastes in dumps or landfills,
- it provides the property with a high-profile program which can be advantageously used in public relations and media efforts,
- it provides the property with a constant supply of high quality fertilizer and soil conditioner

Studies have revealed that up to 75% of waste generated in food service functions consists of compostable food scraps and other organic materials. If the compostable material, along with the recyclable plastic, glass, and metal items are diverted from the waste stream, the property can achieve a truly significant reduction in the amount of waste generated by the food service area.

Negril Gardens can process its compostable materials on site or it may decide to participate in the composting program developed by the Sheffield All Ages School. The Sheffield All Age School, with the assistance of NEPT-assigned Peace Corps volunteers, has undertaken a project to collect and compost green waste from hotels. The compost produced by the Sheffield All Ages School would be sold to hotels and nearby farmers, and the proceeds would be used to support school activities. Contact Principal Samuel Spragg, (809) 957-3035, to coordinate the details of the program.

Both pre-consumer and post-consumer food scraps can be composted. Pre-consumer food scraps include cuttings left from vegetable preparations, as well as complete servings of food which have been prepared, left unserved, and cannot be reused. Post-consumer scraps are food left on dishes after meals have been served. Although food scraps will be numerous and diverse, other wastes can be composted as well. Below is a list of commonly composted wastes.

- Produce – vegetables, fruits, peels, rinds, salads, etc
- Bread and pastries, excess batter
- Frozen foods
- Coffee grounds/filters, tea bags
- Egg shells
- Flowers waste
- Green waste from the garden and beach (grass, leaves, twigs, branches, seaweed)
- Paper items – paper, napkins, paper towels, paper plates and cups, paper food wrappers
- Dairy products (see note 1)
- Seafood (see note 1)
- Meat trimmings, without bones or large quantities of grease or fat (see note 1)

Note (1) Although these items can be composted, they often generate foul odors and attract animals and pests. If the compost pile will be located close to public or work areas, Negril Gardens should exclude these items from its composting program. If these items are composted, the compost pile should be kept covered.

Not everything is compostable and some materials can lower the quality of the finished compost or hamper the composting process. The type of wastes which must be excluded from the compost pile include

- Garden waste contaminated with pesticides
- Glass
- Metals
- Unsoiled paper (if it can be recycled)
- Cardboard
- Plastics
- Aluminum foil or plastic wrap

- Batteries
- Diseased plants
- Wood chips from chemically treated wood products

Contamination of compostable material can be avoided only if employees know which items should not be discarded in the container for compostable materials. Continuous employee education and motivation and appropriate signage will help. In most instances, placing a sign on a container which reads "Compost only – no bones, plastics, glass or metals" should make the point.

Hotels and resorts often find it easier to have the composting program evolve slowly, that is, to start with flower and garden wastes and pre-consumer food scraps from prep stations in the kitchens, then add additional materials like paper, and finally add post-consumer leftovers from guests' and employees' plates.

It is important to keep the program simple and efficient, in the long-run, it should not require additional staff time. In fact, the system, in coordination with a comprehensive recycling program, can streamline the entire disposal system from both a labor and a space efficiency standpoint.

The collection system – the separating of recyclable material from the waste stream – is paramount to the composting program. Its primary objectives are:

- Maximize the capture rate of compostable materials
- Eliminate non-organic contaminants such as plastics, glass and metals
- Minimize labor and space requirements

Project I2: Switch air conditioners off in unoccupied rooms

Summary of results and benefits

- ▶ Lowers the property's electricity consumption by 33,100 kWh/year, resulting in annual savings of 156,000 J\$
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 2 months

Current situation

- ▶ Many guests leave the a/c running after they leaving their rooms for their daily activities
- ▶ Housekeepers do not shut off or lower the cooling setting on the a/c units before leaving a guest room that was just cleaned
- ▶ Many housekeepers leave the doors open while preparing guest rooms even if the a/c unit is running This practice results in an unnecessary waste of energy

Recommendations

- ▶ Place a tactful note in all guest rooms to encourage guests to turn off air conditioners, TVS, and lights whenever they leave their rooms for extended periods of time
- ▶ Request that housekeepers leave the guest room door closed during guest room preparation If the door must be left open during guest room preparation, ask housekeepers to turn off the a/c units
- ▶ Before leaving the guest room, ask the housekeepers to turn the a/c units off or, if this is unacceptable to the guests, to adjust the a/c thermostat to a "low cool" setting (or the lowest possible setting)
- ▶ Investigate the possibility to control the operation of the a/c units with infrared sensors and magnetic door switches

Input, assumptions and calculations

- a) Energy savings achieved by asking guests and housekeeping staff to turn off the a/c units when rooms are unoccupied
- ▶ Assume that 50% of the guests leave the a/c running after leaving their rooms and that on average, guests are outdoors between 10 AM and 5 PM
 - ▶ Assume that through guest participation and housekeeping staff training the amount of energy wasted during the 10 AM to 5 PM period can be reduced by 50%
 - ▶ The power demand of one a/c unit is 1 kW
 - ▶ The average occupancy at Negril Gardens is 79 7%
 - ▶ The energy cost at Negril Gardens is
 - Energy charge = 2 282 J\$/kWh
 - Fuel charge = 1 276 J\$/kWh
 - Foreign exchange adjustment = 32 6%
- Total energy cost = (2 282 J\$/kWh + 1 276 J\$/kWh) x 1 326
= 4 72 J\$/kWh

Given this information, the energy savings are

$$\begin{aligned}
 \text{Energy savings} &= (50\% \times 79.7\% \times 65 \text{ rooms}) \times (50\% \times 7 \text{ hours/day} \times 1 \text{ kW/room}) \\
 &= 90.7 \text{ kWh/day or } 33,100 \text{ kWh/year} \\
 &= (33,100 \text{ kWh/year}) \times (4.72 \text{ J\$/kWh}) \\
 &= 156,000 \text{ J\$/year}
 \end{aligned}$$

b) Implementation cost and payback period

- ▶ The following calculations assume that the cost of the guest room information cards and staff training does not exceed 20,000 J\$. Therefore, the cost effectiveness of this measure is

$$\text{Total implementation cost} = 20,000 \text{ J\$}$$

$$\begin{aligned}
 \text{Payback period} &= (20,000 \text{ J\$}) / (156,000 \text{ J\$/year}) \\
 &< 2 \text{ months}
 \end{aligned}$$

Comments

Negril Gardens could achieve even greater energy savings by controlling the operation of its guest room a/c units with infrared sensors and magnetic contact switches. Such devices ensure that the a/c units are either turned off or adjusted to a lower cooling setting whenever a room is unoccupied. However, the installation of sensors and switches requires a sizeable investment on behalf of Negril Gardens. The estimated implementing cost for this option is

$$\text{UL-listed passive infrared sensor} = 2,660 \text{ J\$/room}$$

$$\text{Magnetic contact switches} = 1,750 \text{ J\$/room}$$

$$\text{Installation cost} = 1,750 \text{ J\$/room}$$

$$\text{Estimated implementation cost} = 6,160 \text{ J\$/room}$$

$$= 400,000 \text{ J\$ (for all 65 rooms)}$$

Project 13: Implement a guest room towel and linen reuse program

Summary of results and benefits

- ▶ Reduces water consumption and wastewater generation by 170,000 gallons/year
- ▶ Saves the property 378,000 J\$/year in reduced water, electricity and chemical purchases
- ▶ Reduces the amount of water pollutants discharged by laundry room operations
- ▶ Increases the service life of linens and laundry room equipment
- ▶ Negril Gardens will recover the investment required to implement this recommendation in less than 3 weeks

Current situation Currently, all guest room towels and linens are laundered every day

Recommendations The property should let guests decide if they want to replace their linens and towels every day International and Jamaican (JHTA) experience has revealed this measure can reduce the laundry load by up to 40%, and that in certain hotels more than 80% of guest are willing to participate in the towel/linen reuse program By reducing the volume of materials processed through the laundry, the hotel will lower its water, chemicals and energy costs in addition to lowering its discharge of pollutants to the environment

The successful implementation of this measure demands the full participation of the housekeeping staff but requires only a minor capital investment The property will need to train its housekeeping staff, and purchase or print cards that inform guests of the importance of water conservation and of the choices that are available to them Guests can also be told of the linen and towel reuse policy as they check into the hotel

Hotels worldwide have developed several different approaches for their towel and linen reuse programs Some of the widely accepted approaches include

- guests are asked to decide when they want their towels and linens replaced
- linens are replaced every two or three days and upon checkout,
- the bottom sheet is removed each day and replaced with the used top sheet and a clean top sheet is used to make the bed

Input, assumptions and calculations

a) Water energy and chemical savings resulting from the linen reuse program

- ▶ Industry surveys show that towel/linen use in hotels range from 4 to 6 lb per guest night and according to commercial laundry equipment manufacturers, institutional washing machines use from 2 to 2.5 gallons per pound of linen laundered The following calculation assume that a beach property such as Negril Gardens uses 15 gallons of laundry water per guest night (i.e., 6 lb/GN x 2.5 gal/lb)
- ▶ The cost of the water used at Negril Gardens is 579 J\$/1,000 gal
- ▶ The hotel has an occupancy rate of 37,816 guest nights per year
- ▶ Assume a piped water temperature of 70°F (21°C) and average laundry water temperature of 110°F (43°C)

- ▶ The electricity consumed in laundry's water heater costs 4.72 J\$/kWh and contains 860 kcal/kWh. The water heater has an assumed efficiency of 95%.
- ▶ Based on a review of chemical purchases (January to July 1997) it is estimated that this property spends 661,000 J\$/year on laundry room chemicals.
- ▶ Assume that the linen and towel reuse program will reduce the laundry load by 30%.
- ▶ These calculations do not account for the energy savings achieved by reducing the load processed through the dryers.

Given the preceding information, the water, energy and chemical savings are calculated as follows:

$$\begin{aligned}
 \text{Water savings} &= 30\% \times (15 \text{ gal/GN}) \times 37,816 \text{ GN/year} \\
 &= 170,000 \text{ gal/year or } 643,000 \text{ liters/year} \\
 &= (170,000 \text{ gal/year}) \times (579 \text{ J}/1,000 \text{ gal}) \\
 &= 98,400 \text{ J}/\text{year}
 \end{aligned}$$

$$\begin{aligned}
 \text{Energy savings} &= (643,000 \text{ lit/year/room}) \times (1 \text{ kcal/lit}/^\circ\text{C}) \times (43^\circ\text{C} - 21^\circ\text{C}) \times (1/0.95) \\
 &= 14,890,000 \text{ kcal/year} \\
 &= [(14,890,000 \text{ kcal/year}) / (860 \text{ kcal/kWh})] \times (4.72 \text{ J}/\text{kWh}) \\
 &= 81,700 \text{ J}/\text{year}
 \end{aligned}$$

$$\begin{aligned}
 \text{Chemical savings} &= 30\% \times 661,000 \text{ J}/\text{year} \\
 &= 198,000 \text{ J}/\text{year}
 \end{aligned}$$

$$\begin{aligned}
 \text{Total savings} &= \text{water savings} + \text{energy savings} + \text{chemical savings} \\
 &= 378,000 \text{ J}/\text{year}
 \end{aligned}$$

c) Implementation cost and payback period

- ▶ The following calculations assume that the cost of the program information cards and staff training will not exceed 20,000 J\$. Therefore, the cost effectiveness of this measure is:

$$\text{Total implementation cost} = 20,000 \text{ J\$}$$

$$\begin{aligned}
 \text{Payback period} &= (20,000 \text{ J\$}) / (378,000 \text{ J}/\text{year}) \\
 &< 3 \text{ weeks}
 \end{aligned}$$

Comments

- ▶ Standard practices in the hotel industry indicate that this property should not use much more than 756,000 gal/year in its laundry room operations (based on 6 lb linen/GN, 2.5 gal/lb linen, 37,816 GN/year, and assuming that towels and linens account for 75% of the total laundry load). However, this figure is significantly lower than the 1,440,000 gallons of laundry water per year (120,000 gal/month) estimate given by the maintenance department. This property is therefore encouraged to investigate this 684,000 gal/year gap.

Appendix I

Hotel Environmental Policy

By the International Hotels Environmental Initiative

We recognize that our business has an important role to play in protecting and enhancing the environment for future generations and to help secure the long term sustainability of the tourism industry

To this end our hotel is committed to taking action

- To achieve sound environmental practices across our entire operation*
- To comply fully with all environmental legislation*
- To minimize our use of energy, water and materials*
- To reduce our pollution to a minimum and, where appropriate, to treat effluents*
- To invite our customers, suppliers and contractors to participate in our efforts to protect the environment*
- Where we can, to work with others in the tourism industry, in public agencies and the community to achieve wider environmental goals*
- To provide all employees with the training and resources required to meet our objectives*
- To openly communicate our policies and practices to interested parties*
- To monitor and record our environmental impacts on a regular basis and compare our performance with our policies, objectives and targets*

Appendix II: Summary of Negril Gardens' environmental aspects, impacts and EMS objectives

Type of environ aspect of the hotel's activities	Type of activities which have these environmental aspects	Environmental impact of the activities	Objective of the property's EMS
WATER USE	<ul style="list-style-type: none"> - Use of guest room and public bathrooms - Laundry room and operations - Housekeeping and cleaning operations - Kitchen and bar operations - Garden upkeep 	<ul style="list-style-type: none"> - Inefficient use of a valuable resource - Excessive consumption reduces the amount of clean water available to the Negril community 	<ul style="list-style-type: none"> - Reduce water consumption
ENERGY USE	<ul style="list-style-type: none"> - Operation of a/c units, water heaters, washing machines, dryers and pool pumps - Use of hot water and lighting 	<ul style="list-style-type: none"> - Inefficient use of valuable and non-renewable resources - Generates air pollution (mainly at the power plant), greenhouse gases, acid rain 	<ul style="list-style-type: none"> - Reduce energy consumption
SOLID WASTE GENERATION	<ul style="list-style-type: none"> - Office operations (paperwork) - Food purchasing, preparation and serving - Bar operations - Maintenance operations - Garden and beach upkeep 	<ul style="list-style-type: none"> - Disposal of solid wastes in inadequate municipal dumps - Contamination of groundwater and surface water - Loss of raw materials 	<ul style="list-style-type: none"> - Reduce the amount of solid waste generated by the property
GENERATION OF WATER POLLUTANTS	<ul style="list-style-type: none"> - Laundry room operations (e g , use of phosphate based detergents) - General housekeeping and cleaning operations (excessive use of chemical cleaning and disinfecting products) - Maintenance operations (improper disposal of used oil and spent solvents) - Food preparation (disposal of grease/oil) 	<ul style="list-style-type: none"> - Increases pollutant load discharged to surface and groundwater - Reduces the effectiveness of septic tanks and wastewater treatment systems 	<ul style="list-style-type: none"> - Reduce the pollutant load contained in the hotel's effluent
USE OF HAZARDOUS PRODUCTS	<ul style="list-style-type: none"> - Laundry room operations (use of bleach and acid or caustic cleaners) - General housekeeping and cleaning operations (use of bleach, toxic cleaning chemicals, insecticides) - Maintenance operations (use of lead paint, drain clearing chemicals) - Grounds keeping (pesticides/insecticides) 	<ul style="list-style-type: none"> - Exposes guests and employees to hazardous products 	<ul style="list-style-type: none"> - Reduce the number and amount of hazardous products used on the property
GENERATION OF AIR EMISSIONS	<ul style="list-style-type: none"> - Maintenance operations (e g release of CFC from air-conditioning units use of solvents) - General housekeeping and cleaning operations (use of aerosols) - Grounds keeping (insecticide fogging) 	<ul style="list-style-type: none"> - Release of CFCs to the atmosphere - Exposes guests and employees to hazardous air pollutants 	<ul style="list-style-type: none"> - Phase out CFC refrigerants - Reduce the use of solvents - insecticides - pesticides
DAMAGE TO THE ECOSYSTEM	<ul style="list-style-type: none"> - Discharge of untreated gray water in wetlands - Use of fertilizer, insecticides and pesticides in the gardens 	<ul style="list-style-type: none"> - Damages the environment and ecosystem surrounding the property 	<ul style="list-style-type: none"> - Reduce the damage caused by the property's operations on the ecosystem

Appendix III

ACTION PLAN FORM			
MAINTENANCE DEPARTMENT - WATER CONSERVATION ISSUES			
Action	By whom	Target date	Actual date
<p>Implement a leak detection and prevention program</p> <ul style="list-style-type: none"> • Prepare a plan for carrying out a monthly inspection of the property's water distribution system, guest bathrooms, public restrooms, kitchen, bar, beach showers, and irrigation system • Develop the checklist forms that will be used to track the preventive maintenance work conducted by this program • Hold a training workshop to teach housekeeping staff on how to detect and report malfunctioning equipment and leaks Prepare a summary of this information for inclusion in housekeeping staff's training manual • Begin the first round of inspections Repeat the cycle of inspection each month • After each round of inspection, present summary of findings to general manager 	<p>J Doe</p> <p>J Doe</p> <p>G Bush</p> <p>Maint staff</p> <p>J Doe</p>	<p>12/1/97</p> <p>1/1/98</p> <p>1/15/98</p> <p>2/1/98 - onw</p> <p>3/1/98 - onw</p>	
<p>Install 1 6 gallon/flush toilets in the beach-side public restrooms</p> <ul style="list-style-type: none"> • Identify the type/brand of 1 6 gal/flush toilets which have given satisfactory results in Negril Get recommendations from maintenance staff of other hotels • Contact vendor and place order for 4 units • Install the units • Monitor weekly to insure proper performance Continue the weekly monitoring for two months following installation 	<p>P Peters</p> <p>S Holmes</p> <p>P Peters</p> <p>P Peters</p>	<p>2/1/98</p> <p>3/1/98</p> <p>< 1 mth after receipt</p> <p>after installation</p>	
<p>Water consumption monitoring program</p> <ul style="list-style-type: none"> • Prepare the forms that will be used to collect data from the property s 3 meters • Train all members of the maintenance staff on how to properly read the meters enter the information on the forms and calculate the property s weekly water consumption • Begin collecting the water consumption monitoring program • On the first day of each month, calculate the total water consumption and collect total guest night figures for the previous month Calculate gallon/GN value for the previous month Provide the gallons/GN figure to the Green Team 	<p>T Rex</p> <p>T Rex</p> <p>Maint staff</p> <p>P Peters</p>	<p>12/1/97</p> <p>12/15/97</p> <p>1/1/98 - onw</p> <p>2/1/98 - onw</p>	

Appendix IV

Personal Action Plan - Housekeeping staff		
Action	By whom	Date
<p>Guest room preparation checklist</p> <ul style="list-style-type: none"> • If the guests have left their a/c running, leave the guest room door closed during room preparation. If the door must be left open, turn the air conditioner off • Do not replace the trash can liners (plastic bags) unless these are soiled or otherwise unacceptable for further use • Report all malfunctioning equipment to the hotel operator -- contact the maintenance department directly only if the need for repair is urgent <p>Pay particular attention to water leaks in toilets, faucets and shower heads, excessively high flows from faucets or shower heads, sticking toilet flush handles, sink and bathtub stoppers which don't work or don't fit properly, damaged windows or louvers, scalding hot water, malfunctioning air conditioners</p> <ul style="list-style-type: none"> • Collect all recyclable items placed in the guest room green recycling containers. Recyclable items consist of <ul style="list-style-type: none"> ◦ clear, green, and amber glass bottles ◦ plastic beverage bottles ◦ aluminum beverage cans ◦ metal cans ◦ newspaper ◦ white paper • At the end of your shift, place all collected recyclables in the appropriate recycling bins located by the laundry room • Before leaving the guest room <ul style="list-style-type: none"> ◦ turn off all lights, televisions and radios ◦ turn the a/c unit to the low cool setting if the guests have left the a/c running ◦ if the a/c is left on, make sure that all windows and louvers are properly closed ◦ ensure that faucets and toilets are not running 	<p>All house-keeping staff</p>	<p>Start on 12/01/97</p>
<p>Towel and linen reuse program</p> <ul style="list-style-type: none"> • • • 		

Appendix VI

DAILY WATER CONSUMPTION						
DATES	FROM	TO				
	Beach side - 1000 gal		Garden side - m ³		Back area - m ³	Read by
Previous reading	_____		_____		_____	
SUNDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
MONDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
TUESDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
WEDNESDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
THURSDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
FRIDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
SATURDAY	_____	Read	_____	Read	_____	
	_____	Cons	_____	Cons	_____	
TOTAL	_____		_____		_____	

NOTE 1 m³ = 264 4 GALLONS

DAILY ELECTRICITY AND GAS READINGS							
DATES	FROM		TO				
	ELECTRICAL			GAS			Read by
	GARDEN	BEACH		GARDEN	BEACH		
Previous readings							
SUNDAY			Read			Read	
			Cons			Cons	
MONDAY			Read			Read	
			Cons			Cons	
TUESDAY			Read			Read	
			Cons			Cons	
WEDNESDAY			Read			Read	
			Cons			Cons	
THURSDAY			Read			Read	
			Cons			Cons	
FRIDAY			Read			Read	
			Cons			Cons	
SATURDAY			Read			Read	
			Cons			Cons	
TOTAL							
SIGN			DATE				