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## ***SECTION SIX***

### ***ENVIRONMENTAL MANAGEMENT SYSTEM***

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#### **6.1 Introduction**

An **Environmental Management System** (EMS) is a set of processes and practices that organizations or companies use to reduce their environmental impact. It involves a continual cycle of planning, implementing, reviewing, and improving processes and actions to meet both its business and environmental goals. The Environmental Management System (EMS) also reflects the Company's emphasis on continuous improvement in operations by measuring and evaluating its environmental performance.

In considering the proposed expansion project for Hugh Parkey's Belize Adventure Island, the proponents will implement an Environmental Management System to further aid the company in achieving its environmental goals. This action first includes the identification of the impacts, its mitigation measures and proposed monitoring plans along with the required contingency management plans.

#### **Required Key EMS Elements**

The organization's environmental management system must demonstrate the following key elements:

- Setting an environmental policy,
- Determining significant environmental impacts,
- Setting goals for compliance and environmental performance,
- Assigning responsibility,
- Implementing and documenting programs,
- Evaluating and measuring effectiveness, and
- Demonstrating performance.

These key elements are essential in carrying out a successful management system that will benefit the project in all its environmental endeavors. This section will facilitate the necessary framework for the project to meet its environmental goals and in so doing, promote the existence and conservation of the natural surroundings in which the project site is to be located.

#### **6.2 Benefits**

There are a range of benefits associated with operating an effective Environmental Management Systems (EMS):

### **6.2.1 Financial**

- ▶ Cost savings through the reduction of waste and more efficient use of natural resources (electricity, water, gas and fuels).
- ▶ Avoiding fines and penalties from not meeting environmental legislation by identifying environmental risks and addressing weaknesses.
- ▶ Reduction in insurance costs by demonstrating better risk management

### **6.2.2 Operational and Internal**

- ▶ Improved overall performance and efficiency.
- ▶ More efficient, less hazardous production processes
- ▶ Improved consistency by reducing waste and disruption of production.
- ▶ More clearly defined staff responsibilities
- ▶ Improved internal communications and morale, often leading to sound environmental solutions suggested by staff, proves seriousness of the company

### **6.2.3 External**

- ▶ Better public perception of the organization, leading to improved sales
- ▶ Reduction of the impact (e.g. noises, smells, dust) of your activities on the local residents, leading to more community support

### **6.2.4 Benefits of third party verification**

- ▶ Ensures that the EMS is consistent according to set protocols.
- ▶ Provides credibility and integrity in reporting and publishing environmental information.
- ▶ Demonstrates commitment to environmental transparency and accountability.

## **6.3 Impact Mitigation Measures**

Impact mitigation is a critical component of the EIA process. It aims to prevent adverse impacts from happening and to keep those that do occur within an acceptable level. Opportunities for impact mitigation will occur throughout the project cycle.

The objectives of mitigation are to:

- find better alternatives and ways of doing things;
- enhance the environmental and social benefits of a proposal;
- avoid, minimize or remedy adverse impacts; and
- Ensure that residual adverse impacts are kept within acceptable levels.

This section provides a summary of the key potential residual impacts of the preferred option and recommended mitigation measures intended to reduce the potential negative impacts resulting from actions of the construction period and post construction period. This key is by no means limited and other issues may be added as the EMS is being implemented.

### **6.3.1 Mitigation Measures In Relation To Dredging and Land Reclamation Activities**

There will be three (3) sets of dredging activities associated with the proposed project: which includes the dredging of a marina basin to accommodate the berthing of marine vessels, dredging of the three (3) burrow pits for land reclamation purposes, dredging or excavating of the South Island Development.

The issues of concern related to the dredging operation are the navigational and berthing of the dredge at the burrow site, as well as the dredging or excavation activity itself which poses a threat of physical harm and injury. This is especially relevant to boat traffic in the area. The mitigative responses to this are in large part in relation to the placement of navigational aids such as buoys and lights to alert and ward off mariners.

The primary aquatic impacts arising from the dredging operations are expected to be an increase in sedimentation and turbidity, as well as an increase in BOD and Hydrogen Sulphide. The impact of the dredging of the marina basin and South Island Development is to be moderate (See Table 5.1). This has been as a function of the modest scale of the dredging operations, the consistency of the seafloor material to be dredged and consequently the mobility of the sediments, as well as the location of the proposed dredging operations.

The issues associated with the actual dredging of the burrow pits is sedimentation and turbidity impacts to the marine environment. The mitigative response to these impacts is to mechanically contain or enclose the sediment plume produced from the excavation process through the deployment of sediment curtains. Other related responses include activities designed to ameliorate the re-suspension of sediments, as well as measures that would reduce the physiological stress on sessile and slow moving benthic organisms.

Secondary mitigational measures include the rapid undertaking of the overall dredging operation in addition to the vacuuming of the re-suspended sediments ashore to decrease the potential of the expansive dispersal of sediments, nutrients, possible toxics and adjusting the overall mechanics of the dredging operation to allow for the re-colonization of the area by benthic organisms.

The impacts from the dredging operations are expected to be localized and should be confined to the areas immediately associated with the dredged site in the nearshore environment. The following table summarizes the proposed mitigation measures that will be implemented by the proposed expansion project for all approved dredging operations.

**Table 6.1:** Mitigation Responses in relation to Dredging Impacts

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Actual Dredging or Burrowing of ‘Cutter Head’ and other dredging equipments (excavator, back hoe)	1a. Disturbance of seafloor and suspension of fine sediments and re-deposition of coarse fraction.	1a1. Direct physical destruction of benthic habitat, and attenuation of light impeding photosynthesis of seagrass, macro-algae and other autotrophs	1a1a. Use of ‘Silt Curtains’ at burrow pit, ensuring that lower end of ‘skirt’ is resting upon or is at least 1 meter of seafloor, and ensuring that top of ‘skirt’ is always above surface of water.
			1a1b. Monitoring and where necessary repairing and/or replacing leaky pipes and faulty couplings of ‘spoil’ discharge pipes.
			1a1c. Applying velocity reduction measures where spoils are deposited such as baffles to precipitate solids and curtail turbid influences in effluent stream.
			1a1d. Decrease time frame over which dredging operation is to take place to avoid daily re-suspension of sediments over long time frame.
			1a1e. Ameliorate impacts of daily re-suspension of sediments by suctioning sediments that have resettled or re-deposited in the area.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Actual Dredging Contd.			1a1f. Ameliorate re-suspension of sediments by confining dredging operations to calmer sea states.
			1a1g. Assist re-colonization of seafloor by benthic plants and invertebrates by ensuring that walls of dredged areas are not at an angle steeper than 35 degrees.
		1a2. "Blanketing" or smothering effects on benthic habitat and sessile and slow-moving invertebrates.	1a2a. Institute monitoring programme to ensure that light penetration at seafloor is at least 25% of surface irradiance 2,000 ft. from silt curtains.
	1b. Decrease in Dissolved Oxygen and increase in BOD.	1b1. Physiological stress and lethal effects on benthic invertebrates and to a lesser extent, fin-fishes.	1b1a. Completion of dredging operation in as short a time-frame as possible, especially in regards to Dolphin Encounter area.
	1c. Increase in temperatures brought about by the re-suspension of sediments with a 'specific heat capacity' capable of raising water temperatures by as much as 4 – 6°C.	1c1. Lethal and sub-lethal effects on sessile and slow-moving benthic invertebrates.	1c1a. Proper deployment of 'silt curtains' to ensure that suspended sediments at dredged sites are contained and that any re-deposited sediments are 'vacuumed' and rapidly deposited on land

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Actual Dredging Contd.	1d. Deposition of organic rich mud and silt, especially	1d1. Unpleasant smells associated with degassing of Hydrogen sulphide and potential to smother mangrove root systems.	1d1a. Deposition of spoils from marina site and burrow pits in areas already cleared or otherwise denuded – Also deposition in smaller piles that are spread out to facilitate drying by sun and elimination of unpleasant odor.
2. Navigation, Berthing of Dredge and Deployment of Spoil Discharge Pipes.	2a. Navigational hazard.	2a1. Threat of injury and possibly death associated with boat traffic.	2a1a. Ensure that marker buoys and navigational lights are deployed and activated on dredge, sediment curtains and spoil discharge pipes – Buoys are to be large and bright Navigational lights are to be fully operational from 6:00 p.m. to 6:00 a.m. on a daily basis.
3.0 Deployment of spoil and discharge pipes (pontoons)	3a. Same as above	3a1. Installation of discharge pipes can be a navigational hazard	3a1a. Placement of spoils in fence and geotextile containment

### **6.3.2 Mitigation Measures in Relation to Domestic Effluent Impacts**

The primary impacts associated with domestic effluents are: increased nutrients and fecal coliform in the water column as a result of inadvertent discharge, mismanagement, lack of environmental ethics, treatment plant malfunctions etc.

The situation of increased nutrients in the water column is generally referred to as eutrophication. This relates to the macro-nutrients, which are ‘phosphates’ and ‘nitrates’. These are generally derived from gray water effluents, as well as sewage effluents from the flushing of toilets. In general a major source of macro-nutrients in gray water effluents is from detergents. This is also relevant to the proposed development. The greater contribution of nutrients would come from human waste. The main source of macronutrients would be from the occupancy or commissioning of the Marina Services and residential population. For this purpose, this impact has been assessed as high according to Table 5.1.

The sewage technology to be applied is secondary treatment with the reduction of nutrients to levels that are not a threat to the environment and that are well within national standards. The system to be adopted for the proposed project is a prefabricated treatment plant or 'Package Plant' titled a "Purestream ES Model BESST" [See Section 3]. The acronym of the systems stands for **B** Biologically **E** Engineered **S** Single **S** Sludge **T** Treatment.

The issue of fecal coliform associated with the development is an important one. As may be seen from Annex V. , the *E. coli* readings were zero. The generation of *E. coli* becomes a significant consideration with the commissioning of the development. The primary impact from these features of the development has been characterized as 'Low'. The application of the BESST Sewage Treatment Technology combined with water conservation measures dampens and greatly diminishes the potential human health impacts from fecal coliform.

**Table 6.2:** Summary of Impacts Associated with Human Wastes and Domestic Effluents

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Human Waste and Domestic Effluents	1a. Nutrient enrichment from the injection of macro-nutrients into the environment.	1a1. Stimulus to plant growth on land and in the water column, in the case of the latter this includes phytoplanktons, seagrass, and macroalgae including the possibility of the overgrowth of reefs by macroalgae.	1a1a. Installation of BESST Treatment technology to treat waste to 'Tertiary' Levels, where Total Nitrogen Loads are reduced to less than 10 mg/l and Phosphorus are reduced to 2-3mg/l.
			1a1b. Reduce effluents going into the environment by recycling effluents to flush toilets – effluents from BESST Treatment Plant will be stored and disinfected through chlorination before it is reused for flushing toilets.

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Human Waste and Domestic Effluents Contd.			1a1c. Reduce further nutrients potentially going into the water column by using stored treated effluents from BESST Treatment Plant for irrigation purposes.
	1b. Human Health and Biosecurity risks	1b1. Infection of humans and dolphins, including those in captivity with pathogenic viruses and bacteria.	1b1a. Thorough disinfection of effluents potentially going into water column or otherwise making contact with humans by use of BESST Sewer Treatment Plant which incorporated chlorination of effluents.
			1b1b. Reduction of effluents going into the environment by use of BESST Treatment Plant. And incorporation of recycling and reuse of effluents for flushing of toilets and watering of lawn.
	1c. Suspended Solids from un-dissolved components of human waste and domestic effluents.	1c1. Suspended solids would impede light penetration in the water column and photosynthesis.	1c1a. Installation of solids trap prior to BESST Treatment to reduce TSS to less than 10 mg/l

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Human Waste and Domestic Effluents Contd.	1d. Sedimentation associated with settlement of flocculent fraction of human waste and domestic effluents.	1d1. Blanketing of seafloor and suffocation of slow-moving and sedentary invertebrates.	1d1a. Application of BESST Treatment technology reduces TSS to less than 10 mg/l, this in combination with effluent recycling and reuse regime reduces to insignificant levels suspended solids in the water column.
	1e. Increase in BOD substances and consequent reduction in dissolved oxygen.	1e1. Induction of physiological stress and in extreme circumstances death in relation to sessile and slow moving invertebrates.	1e1a. Application of BESST Treatment technology reduces BOD to less than 10 mg/l, this in combination with effluent recycling and reuse regime reduces to BOD to insignificant levels in the water column.

### **6.3.3 Mitigation Measures in Relation to Solid Waste Management**

The solid waste accruing from the general commissioning of the Hugh Parkey’s Belize Adventure Island operation includes organic and inorganic components that cover both the construction and operational phases of the proposed expansion project. The organic component includes in large part discarded and unconsumed food from the restaurants and refreshment stands followed by the ‘green’ waste produced as a result of the land clearing and pruning processes. The inorganic waste includes wastes that are either classified as combustible and non combustible.

The construction phase activities have the capacity to generate substantial volumes of solid wastes. This varies from felled trees and shrubbery in relation to land-clearing, to concrete mouldings and form boards from the erection of buildings, to styrofoam packaging, wooden planks and metal strips from shipping crates. Other significant solid waste components from the construction phase includes: PVC piping, masonry slabs and chippings, food wrappings, aluminum cans and beverage cartons, as well as plastic and glass bottles are also expected to be a substantial part of the solid waste. Discarded food is also a relevant solid waste item during the construction phase.

One of the major impacts of the wastes generated by the development would be the attraction of feral animals such as raccoons, rats and crocodiles and birds to the area to scavenge. The mitigative response to be implemented by Hugh Parkey’s Belize Adventure Island Development is the judicious collection and segregation of the wastes into organic and inorganic components (See Table 6.3 below). These wastes are to be removed from the caye on a regular and recurrent basis (See Table 6.3 below). The implementation of a public education campaign focused on the tourists and visitors in general is also a part of the mitigative response (See #1a1b in Table 6.3 below).

The only secondary impact of note would be in regards to the land-based ecosystems. These impacts relates to the fact that there is to be little or no discarded food lying around in a way that would be available to feral animals, given the regular collection, bagging, composting and disposal of this category of waste.

**Table 6.3:** Mitigation Measures in Relation to Solid Wastes

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Commissioning of the operational processes of the proposed expansion project including the relevant amenities.	1a. Discarding of waste food and food containers.	1a1. Attraction of feral animals such as rats, raccoons, crocodiles, and birds to the area to scavenge and in effect shift the ecological balance in a way not induced by nature.	1a1a. Judicious collection of discards by staff and storage in impervious plastic bins for transportation to Belize City sanitary landfill site.
			1a1b. Definition and implementation of education and sensitization program focused on tourists and visitors in general, in the form of interactive posters and brochures posted in strategic locations such as restaurants, gift shops, and rest rooms.

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
1. Commissioning of the operational processes Contd.	1b. General discarding of cans, bottles and plastics in general from foods, general packing materials and other utilitarian functions.	1b1. Habitat for mosquitoes and other insect pests, as well as aesthetic pollution from odor and unsightly accumulation of solid waste.	1b1a. Separation of discard and refuse into organic and inorganic components where they will be secured in plastic garbage bags and stored in plastic bins for transportation into Belize City – organic will be composted on site and used as nutrients for landscape activities where as the inorganic will be transported into Belize City when sufficient quantities have accumulated to justify removal.
		1b2. Entanglement and ingestion of plastics floating in the water column by sea turtles, birds and other fauna in the area.	1b2a. Judicious collection, confinement and disposal of solid wastes as described above.

#### 6.3.4 Mitigation Measures in Relation to Energy Generation

The main impacts associated with the energy generation process are petroleum and noise pollution that will arise as a result of the operation phase of the development. This is especially true considering the two sources of energy generation method chosen by the project proponents – wind energy and diesel generated energy.

The primary source of electrical energy for the proposed expansion project is to be from wind turbine. This is to be complemented by standby power in the form of diesel generators. The mitigation measures that are to be put in place are mainly in relation to the running of the power lines as well as in relation to noise and petroleum pollution.

The petroleum pollution issue is of great importance considering the operation of the diesel generators (supplementary source). This method of energy generation is also interlinked with the sourcing and transportation of the required fuel for its operation. In considering the custodial

chain of petroleum management, the proponent will be required to implement mitigation measures in every phase of the fuel management program.

The noise pollution issue is of greater relevance than the petroleum pollution issue, in regard to energy generation. The installation of diesel generators as a back-up source of electricity makes noise pollution a relevant issue. The scope of the proposed development and indeed the overall energy requirement of the initiative have resulted in a categorization of the ‘primary impacts’ as ‘moderate adverse’. This noise pollution can be mitigated by the ‘muffling of the generator noise and the use of sound-proof tiles at the generator stations, as well as their placement in areas far removed from the recreational activities of the caye and movement of staff and guests.

Noise pollution is also an issue for the primary source of energy. In considering the amount of wind turbines that will be installed, the ‘net or cumulative’ effect as a single source would pose a problem to the surrounding dwellings. Nevertheless, mitigation measures will be in placed to counteract this issues by simply purchasing low noise pollution turbines, locating the ‘bank’ away from any residential components and paths and by ‘turning’ on individual turbines as the requirement increases.

Secondary impacts associated with the energy generation component include the placement of the generators and the ‘effect’ the wind turbine would have on the caye’s bird population and flight patterns. The mitigation measures for these are discussed in the following table.

**Table 6.4:** Mitigation Measures in relation to Energy Generation

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Operation of Stand by Diesel Generators to generate electricity.	1a. Excessive noise pollution to neighboring development and activities	1a1. Increase in ambient noise levels as a result of t energy generation use	1a1a. Attenuate noise levels by enclosing generators with sound attenuation material and by the proper use of mufflers and other sound reduction devices designed to minimize the ambient impact.
			1a1b. Examine and develop a best siting scenario for the operation of such generators at full occupancy and generator capacity.

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Operation of Stand by Diesel Generators Contd.	1b. Soil pollution due to hydrocarbon spills/leaks	1b1. Contamination of waterways and soil on direct contact	1b1a. Contain all fuel tanks in an enclosed concrete wall capable of storing 110% of the total stored volume
			1b1b. Develop a contingency plan to address any spills and leaks that can occur both on land and at sea during transportation.
	1c. Air pollution due to generation process	1c1. Air pollution can impact on the ambient residential air, especially during prevalent winds.	1c1a. Develop and implement a preventative maintenance manual to address all concerns related to repair and operation of the equipments
2. Wind Turbines	2a. 'Net or cumulative' noise pollution from the bank of turbines operating at the same time	2a1. Increase in overall ambient noise, especially around the turbine areas.	2a1a. Turbine not expected to supersede the $L_{MAX}$ 65 dB threshold. System is designed to shut off at wind speed exceeding 56 mph.
	2b. 'Shadowing' effects on the receiving environment during operation	2b1. Disorientation of some guests and staff	2b1a. Varying wind speed and direction reduces shadowing instances. Moreover, placement of wind turbines to follow installation guidelines for health and safety reasons. Guests/residents with 'shadowing' problems should be identified

Development Activity	Primary Impacts or Environmental Disturbance	Secondary and Tertiary Level Environmental Impacts	Mitigation Measures
	2c. Increase mortality of both birds and bats of the area.	2c1. Loss of diversity and caye visitation as a result of wind turbine operation.	2c1a. Placement of the turbine units in areas not identified as 'primary migration routes' would mitigate against an increase in mortality rate for the bats and birds of the area.
			2c1b. Turbine tower design have changed, smoother cylindrical poles prevent roosting. Turbine rotor speeds have reduced, reducing injury to birds/bats. In addition avian studies have shown that these new design have reduced the impact to bird migration pathways or habitats.

### 6.3.5 Mitigation Measures In Relation To Socio-Economic Concerns

Development projects of any kind can modify or enhance the economic viability of a given area. The social impact assessment in principle include the process of evaluating the intended and unintended consequences of the development, and identifying and articulating the mitigative measures that are to be put in place to circumvent and ameliorate these impacts.

Relevant in this regard are the issues of the disruption and erosion of economic activities in the area: The most pertinent being fishing. The issues of the loss of fishing gears, and declines in the productivity of fishing grounds have been dealt with in Table 6.5 below.

Pertinent also in terms of resource use conflicts is the issue of tourism. The area is used as general sea-lane for general marine traffic as well as a general 'sea lane' for transporting tourists to and from the atolls and surrounding cayes. The navigational issues dealing with the relationship of these to dredging activities are outlined in Table 6.5 below. In addition, the growing tourism industry has the need for both skilled and unskilled workers to cater to the industry's demands.

**Table 6.5:** Mitigations In Relation to Socio-Economic Concerns

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Construction Activities	1a. Temporary but potentially marked increase in amount of people moving into the area.	1a1. Increased demand on services in the area.	1a1a. Construction will be planned and strictly scheduled such that only the absolute amounts of people necessary are in the area at any given time.
			1a1b. Hugh Parkey’s Belize Adventure Island has 5 large boats with a combined capacity of over 250 passengers which is far in excess of the capacity that it would need to move its construction crews, thus no strain will be put on the transportation infrastructure or service for the area.
			1a1c. Hugh Parkey’s Belize Adventure Island currently has a kitchen/restaurant servicing its guests and workers: Thus no additional strain will be placed on facilities on the surrounding cayes in terms of food and refreshments.

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Construction Activities Contd.			1a1d. In terms of living accommodations, Hugh Parkey's Belize Adventure Island currently has adequate accommodations for over 50 people, this is in excess of the needs of the construction crew: Thus no strain will be put on any residents or facilities in the area.
	1b. Movement of materials and supplies and heavy equipment into the area.	1b1. Human health and safety issues.	1b1a. Safe and secure mooring of boats when loading and offloading equipment and supplies.
			1b1b. Navigation of boats to and from the caye observing and international and national sea lane rules and navigational protocol, and ensuring that equipment and supplies are securely stored and fastened during transportation.
			1b1c. Response to construction injury includes first aid kit on-site, and in severe case the deployment of boat to ferry injured party (ies) into Belize City.

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Construction Activities Contd.			1b1d. Berthing of dredge securely with adequate lighting at nights, and buoys and warning flags marking sediment curtains and spoil discharge pipes.
	1c. Employment of foreigners and persons not from immediate areas and Belize City.	1c1. Lack of economic opportunities to people in the overall region.	1c1a. Hiring people from immediate area and Belize City in circumstances where requisite skills and competencies are available at competitive costs.
2. Operational Phase of Development.	2a. Employment of foreigners and persons not from surrounding cayes and Belize City.	2a1. Lack of economic opportunities.	2a1a. Hiring people from immediate area and Belize City in circumstances where requisite skills and competencies are available at competitive costs.
	2b. Health and safety issues.	2b1. Diving accidents including nitrogen narcosis and the 'bends'.	2b1a. Access by boat to 'hyperbaric chamber' in San Pedro.
			2b1b. Pre-dive briefing by trained and experienced dive guides on safety issues.
	2c. Housing and accommodation.	2c1. Potential for lack of adequate housing for staff.	2c1a. Construction of new quarters with more space per person, and improvement in the physical quality of the physical facilities

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
	2d. Increase in marine traffic.	2d1. Increase in number of boats coming to the facilities.	2d1a. A service marina will be constructed to accommodate the projected number of boats associated with the expansion project.
3. Resource use conflicts	3a. Potential loss of spawning area for lobster in mangroves and near-shore areas on/off south-east portion of caye from dredging impacts.	3a1. Potential decline in recruitment of lobsters and consequent decreases in lobster harvests.	3a1a. Much of dredging activities off north west and east side of caye away from spawning/nursery area: Dredging on east side of caye to be far north of spawning/nursery areas.
	3b. Potential loss or decline in productivity of 'conch beds' and 'lobster shade' areas around caye.	3b1. Potential decline in landings and income from fishing.	3b1a. Limited dredging on east side of island where most fishing areas are located, and where dredging occurs on east side it is to be away from heart of fishing activities: besides silt curtains will be deployed in areas of actual dredging to contain sedimentation and turbidity influences.
	3c. Potential loss of lobster traps and 'shades' or 'sumbras' from direct physical impact of 'cutter head' and sedimentation and turbidity influences.	3c1. Potential need to replace fishing gear and loss of income from decreased landings.	3c1a. Dredging activities to be completed within the shortest possible time to limit negative impacts in both space and time.

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
3. Resource use conflicts Contd.		3c2. Difficulties in locating traps and the consequent decline in landings and loss of income.	3c2a. The deployment of silt curtains and confining dredging operations to calmer sea states should decrease the possibilities of trap loss.
	3d.Potential disruption of tourist activities.	3d1. Relates mainly to boat traffic through area.	3d1a. Installation of buoys, beacons and other navigational aids to ward off marine traffic from the silt curtains and spoil discharge pipes: Also relevant is relatively short duration of undertaking.

### 6.3.6 Other related Impacts

The proposed project will also have other impacts that can be attributed to a negative outcome if not addressed or correctly mitigated. These impacts can have a cumulative effect if not successfully mitigated and addressed by the proposed development. The impacts can occur in both the construction and operation phases along with the proposed phasing of the development.

These impacts include the need for proper safety and health practices, water usage related issues, design concepts issues, marine traffic and environmental disturbance. The mitigative responses to these impacts include the implementation of several plans to ameliorate and circumvent the negative effects associated with the development. Such plans will focus on specific objectives of each impact and coordinate the mitigation measures accordingly.

**Table 6.6:** Mitigation Measures in Relation to Other Impacts

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1. Water usage related issue	1a Loss of potable water	1a1. Reduce water availability and loss of profitability	1a1a. Implement a water conservation plan to address the water needs.

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
1 Water Usage Contd.			1a1b. Develop a contingency plan for water shortage (s) and water contamination if so is the case.
			1a1c. Implement a water recycling plan (Section 3) aimed at utilizing wastewater for non potable uses.
2. Design Concepts	2a. Loss of land to development and building infrastructure	2a1 Loss of vegetation cover and habitat area	2a1a. Plan layout poses less environmental impact to construct and operate.
			2a1b. Conservation of the natural contouring and aesthetics of the mangrove forests, lagoon and beaches.
3. Marine Traffic	3a. Increase number of users and marine vessels to the area	3a1 Impact on natural environment by increased boat usage	3a1a. The movement of marine vessels to the area should be scheduled
		3b1. safety for traditional users and other users	3b1a. All watercraft activities be regulated and designated markers in places in special impact areas
			3b1b. Safe and secure mooring of craft, docking facility
			3b1c. All watercraft activities be monitored and regulated
			3b1d. Hazardous areas and areas of specific importance be demarcated

<b>Development Activity</b>	<b>Primary Impacts or Environmental Disturbance</b>	<b>Secondary and Tertiary Level Environmental Impacts</b>	<b>Mitigation Measures</b>
4.0 Environmental Disturbances	4.a. Noise pollution from the operation of construction equipment and machinery	4.a.1 Disturbance of wildlife and neighboring activities	4a1a. All installed equipment such as a power generator etc., be enclosed to minimize noise impacts
	4b. Airborne pollutants from proposed construction and operational activities	4b1. Same as above, incremental airborne pollutants to Airshed	4b1a. Operation of heavy machinery (dredger, excavator, back hoe) and equipment operated during daylight hours.
			4b1b. Burning of organic combustibles will be limited during the construction and operational phases.
5.0 Dolphin Biosecurity	5a. Diseases resulting from the construction activities.	5a1. Induce stress and other physiological related symptoms as a result of noise and other construction activities	5a1a. Removal of animals during the construction and post construction phase.

## **6.4 Environmental Monitoring Plan**

Comprehensive or targeted monitoring can be used as an integral component of responsible life-cycle environmental management of major projects, plans or programs. Current EIA process considerations are focused on the use of monitoring in conjunction with the implementation of mitigation measures.

Additional valid purposes of environmental monitoring include, but are not limited to, establishing a baseline conditions, documenting and managing experienced impacts, evaluating the effectiveness of mitigating measures, and validating impact-prediction techniques (Canter, 1993).

### **6.4.1 Purpose of Environmental Monitoring**

Numerous purpose (and implied benefits) can be delineated pre- and/or post-EIA environmental monitoring. For example, Marcus (1979,) identified the following six general purposes or case of information gleaned from the conduction of post-EIA monitoring:

1. Environmental monitoring provides information that can be used for documentation of the impacts that result from a proposed action; this information enables more-accurate prediction of impacts associated with similar federal actions.
2. The monitoring system could warn agencies of unanticipated adverse impacts or sudden changes in impacts trends.
3. The monitoring system could provide an immediate warning whenever a preselected impact indicator approaches a predetermined critical level.
4. Environmental monitoring provides information which could be used by agencies to control the timing, location, and level of impacts of a project. Control measures would involve preliminary of regulation and enforcement measures.
5. Environmental monitoring provides information which could be used for evaluating the effectiveness of implemented mitigation measures.
6. Environmental monitoring provides information which could be used to verify predicted impacts and thus validate impact prediction techniques. Based on these findings, the techniques---for example, mathematical models---could be modified or adjusted, as appropriate.

#### **6.4.2 Principles Underpinning Environmental Monitoring**

The principles underlying environmental monitoring as it relates to any given development is to observe for any changes over time that may be associated with the development. These changes would in principle vary over time in both magnitude and direction. In the case of the latter it is important to understand that changes in environmental parameters and functions may be positive or negative. Thus in principle a monitoring plan does not necessarily focus on the perceived or anticipated negative changes precipitated by a given development, or indeed vice versa where the focus may be on the positive or beneficial changes only. The parameters chosen are those that have been identified in the analytical process as being affected in the most significant way by the development.

#### **6.5 Specific Monitoring Plan**

The proposed monitoring plan for the project will entail those parameters and ecosystem components that have been identified through the mitigation matrix and other mitigation factors.

These issues include:

- Water Quality monitoring (Marine and Effluent)
- Beach Dynamics
- Waste Management
- Soil contamination (spills)
- Biodiversity
- Environmental health and safety
- Engineering aspects
- Socio economic influence
- Others

### 6.5.1 Surface Water Quality Monitoring Program

As with so many of the EIA's, the marine component plays an important role in the overall scheme of the proposed development. With this in mind, it is critical to conserve the marine environment and its resources in order to promote a healthy and stable marine ecosystem around the proposed project.

Pollution from all the different sources can pose a serious threat to the marine ecosystem and therefore considering the negative impacts, the proposed development plans to incorporate a complete water quality monitoring program. This program, which will further be developed by the proponent and DOE, will form part of the EMS and also of the water resources management plan previously discussed in Section 3.2.

Water samples will be collected and analyzed on a monthly basis for the following parameters using the recommended protocol required by the *Effluent Limitations Regulations* (this regulation recommends the use of the Standard Methods for the Analysis of Water and Wastewater):

*a) In situ Measurements*

- Salinity
- Temperature
- Dissolved Oxygen
- Ph
- Turbidity
- Total Dissolved Solids
- Conductivity

*b) Laboratory Analysis*

This will include the determination of

- Total Suspended Solids
- Total Nitrate
- Total Phosphate
- Total and Fecal Coliform
- E. Coli

**Table 6.7:** Monitoring Plan for Surface Waters

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
Nutrients (Phosphate and Nitrates)	Monthly	10 mg/l	Incorporate previous monitoring sites along with - Marina basin - 0.5 mile east of East Side Development - 0.5 mile south of South Island	High Priority	DOE, CZAMAI

<b>Parameter</b>	<b>Frequency</b>	<b>Critical Level</b>	<b>Geographic Area</b>	<b>Priority</b>	<b>Agency Responsible</b>
TSS/TDS	Monthly	100 mg/l	Incorporate previous monitoring sites along with - Marina basin - 0.5 mile east of East Side Development - 0.5 mile south of South Island	High Priority	DOE, CZMAI
Turbidity	Monthly	Observing disappearance of secchi disc and comparing this over time at different locations.	Incorporate previous monitoring sites along with - Marina basin - 0.5 mile east of East Side Development - 0.5 mile south of South Island	High Priority	DOE, CZMAI
BOD	Monthly	200 mg/l (EPA/WHO)	Incorporate previous monitoring sites along with - Marina basin - 0.5 mile east of East Side Development - 0.5 mile south of South Island	High Priority	DOE, CZMAI
Dissolved Oxygen	Monthly	< 4.0 mg/l (DOE)	Incorporate previous monitoring sites along with - Marina basin - 0.5 mile east of East Side Development - 0.5 mile south of South Island	High Priority	DOE /Fisheries, CZMAI
- Total Coliform - E. coli - Fecal Coliform	Monthly	0/100 ml of sample	Incorporate previous monitoring sites along with - Marina basin - 0.5 mile east of East Side Development - 0.5 mile south of South Island	High Priority	Public Health

### 6.5.2 Wastewater Monitoring Program

Just as with the water resources monitoring program the proposed development intends to develop a wastewater monitoring program that will be tied into the program described in Section 6.5.1. This program among others will monitor the quantity and quality of treated effluent (wastewater) generated by the treatment plant.

In addition, the program will also develop a maintenance plan encompassing structural failures, inspections, monitoring of equipment (treatment plant, grease traps, oil/water separators, etc.) short and long term repairs as well as training for new employees in charge of supervising the plant. Also, notice and warning signs will be posted throughout the project site and especially the marina on proper wastewater practices. At the marina, this will include the prohibition of bilge and sewage disposal near the adjacent areas.

Samples of the treated wastewater will be collected and sent to an approved DoE laboratory for testing or in default tested in house (DoE permission required). In any event, the developer will comply with all applicable laws relating to this matter. Table 6.8 shows a proposed monitoring template that will be reviewed by the project and DoE.

**Table 6.8:** Wastewater Monitoring Template

<b>Date</b>	<b>Dissolved Oxygen</b>	<b>Ph</b>	<b>Total Phosphate</b>	<b>Total Nitrate</b>	<b>TSS</b>	<b>BOD</b>	<b>F. Coliform</b>	<b>E. Coli</b>
<b>(day/month/year)</b>	<b>(mg/l)</b>	<b>(Units)</b>	<b>(mg/l)</b>	<b>(mg/l)</b>	<b>(mg/l)</b>	<b>(mg/l)</b>	<b>(count)</b>	<b>(count)</b>
____/01/____								
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____/12/____								
<b>Annual Average</b>								

### 6.5.3 Solid Waste Monitoring Plan

As part of the overall management structure, the proposed development plans to undertake an intensive solid waste monitoring plan in order to address all the relevant issues that can arise from the collection, storage and disposal of garbage. Table 6.9 describes the outline for which the activity will be monitored. Indicators will be developed to keep track of this activity and report any incident/accident to the local authorities. Such examples include inadvertent spillage during barging, flying or ‘blowing’ away of uncontained garbage etc.

**Table 6.9** Parameters for Solid Waste Monitoring

Parameters	Frequency	Critical Levels	Area/ Locale	Priority	Agency Responsible
<b>Solid Waste Management</b>					
Collection	Daily	Same as above	Anywhere where available trash receptacles are located.	High	SWMA, DOE , Public Health
Disposal	Weekly	Clean environment	Collected waste will be transported to the Belize City dump site at mile 3 on the Western Highway	High	SWMA, DOE , Public Health
Storage	Daily	Same as above	At WTS on the project site	High	SWMA, DOE , Public Health
Management	Daily	Development, implementation and documentation	All aspects of the management plan	High	SWMA, DOE , Public Health

#### *Management Issues*

Waste generated by tourism facilities normally includes paper and cardboard items, glass and aluminum products, plastic items, organic waste, building materials and furniture, and used oils and fats. Hazardous wastes may include batteries, solvents, paints, antifouling agents, and some packaging wastes. Tourists typically may generate up to twice as much solid waste per capita as local residents, resulting in increased stress on local waste management infrastructure.

The following principles of waste reduction in tourism and hospitality facilities should also be considered as part of a formal Waste Management Plan:

- Buying in bulk quantities whenever possible;

- Use of refillable, bulk dispensers (e.g. toiletries) rather than individually packaged products; Working with suppliers to limit use of, and establish recycling for, product packaging;
- Avoiding use of polystyrene foam in all operations;
- Providing in-room recycling procedures and appropriate receptacles;
- Use of glass or durable plastic instead of disposable plastic items (e.g. straws, cups);
- Implementing organic-waste composting;
- Disposing of wastes only after all waste prevention and recycling strategies have been explored and maximized.

The proposed expansion project will carefully evaluate its options and implement a waste minimization strategy (See Section 3.4.8) to cope with the anticipated generated volume. Options however, are limited, especially considering that the local infrastructure for the handling and disposal of solid waste (Mile 3 Dumpsite).

#### **6.5.4 Biodiversity Monitoring Program**

The objectives of the monitoring programs are to minimize and reduce the environmental impacts on wildlife and their habitats, and to minimize detrimental effects on protected or endangered species. The use of the caye for recreational activity should be carried out with caution.

Recommended Monitoring Measures for flora and fauna are as follows:

- A checklist will be developed in order to ensure data collection in terms of the abundance of local species. In the event of an important sighting e.g. manatees, crocodiles or other important species, the sighting will be recorded.
- Assist in any way possible by relocating animals if found within the construction sites, if necessary. (Belize Dive Connection is part of the Manatee Stranding Network).
- Establish communications with relevant Government Departments or NGOs in the event for the need for relocation of wildlife (e.g. crocodiles).
- Restrict land clearing only to areas required in order to minimize habitat destruction or reduce buffer zone area.
- Posting of warning signs throughout the property about wildlife, especially the crocodiles.
- Minimize effects on the receiving environment by minimizing the negative impacts that may hamper potential navigational interests.
- Confinement of the construction activities to as small an area as possible.
- Establish monitoring program for biological communities for a period of three years. This should focus on features of mangrove habitats, which are likely to reflect changes in

environmental conditions (such as specie composition and distribution, changes in number of individuals, girth, height and litter, birds, fish and other animals.

**Table 6.10** Proposed Biodiversity Monitoring Plan

<b>Parameters</b>	<b>Frequency</b>	<b>Critical Levels</b>	<b>Area/Locale</b>	<b>Priority</b>	<b>Agency Responsible</b>
<b>Biodiversity</b>					
Bird Abundance	Twice per year, during December and in June (i.e. winter and summer)	Population changes and diversity profile to be noted and compared with existing data	To be done on entire caye.	Moderate Priority	Forest Dept.
Manatee population	Twice per year during December and June.	Population changes to be noted over time.	- Waters surrounding caye - Manatee 'hole' just south-west of Brown's Caye	High Priority	CZMAI, Fish. Dept.
Feral Animal Population (Crocodiles, raccoons and rats)	Twice per year during June and December	Population changes to be observed over time.	- Primary Development Site - Adjacent recreational sites (Dolphin Encounter, board walk, marina etc.)	Moderate Priority	Forest Dept., Public Health
Finfish Populations	Twice per year during June and December, and coincident with coral reef survey	Population changes and shifts in diversity to be observed over time and compared with pre-development situation.	Marina and dredged sites around caye	High Priority	Fish. Dept.

<b>Parameters</b>	<b>Frequency</b>	<b>Critical Levels</b>	<b>Area/Locale</b>	<b>Priority</b>	<b>Agency Responsible</b>
Sea-grass biomass and density	Twice per year during June and December.	Sea-grass biomass and density to be observed over time for any discernible trend that may be associated with the proposed development.	Dredged sites and marina basin. Additional areas could include the mangrove reserve areas and others determined by the authorities.	High Priority	Fish. Dept.
Sea-grass Re-colonization Rate of the Burrow Pits.	Twice annually in June and December.	Estimate seagrass biomass by count of rhizomes.	Burrow pits and other dredged areas of the expansion project	Moderate Priority	Fish. Dept.

### 6.5.5 Social Monitoring

Due to the increase in the demand for permanent employment in the country, this project will result in positive benefits for the Belize District. A number of new jobs will be created during the implementation of this project. These are mostly laborers who will be required to live in. Technical staff will also be required for the day-to-day operations of the expansion areas, restaurants, administration etc.. Adequate housing facilities with proper sewage disposal (treatment plant) will be constructed or improved at the site.

It is expected that employment will come mainly from Belize City and nearby communities such as Ladyville and Hattieville. The proposed expansion project will also design an Emergency Management System (See Section 6.6). Staff will be identified for first aid training. This training is offered free of cost by the Red Cross Society. It is also recommended that an emergency evacuation plan be set in the event that any emergency takes place.

**Table 6.11** Social Monitoring Issues

<b>Parameter</b>	<b>Frequency</b>	<b>Critical Level</b>	<b>Geographic Area</b>	<b>Priority</b>	<b>Agency Responsible</b>
Fisheries Landings	Quarterly	Assess lobster and conch landings from selected area and observe for trends over	- From Brown's Caye in the north to mid-way between Foreman's	High Priority	Fish. Dept.

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
		time that may be related to the development.	Caye and Water Caye in the south, on both the eastern and western sides of the cayes for the fishing grounds		
Employment	Annually	Ratio of locals to foreigners as well as migrant workers	Construction site and administration of proposed project	High Priority	Labour Department
Services	Annually	Acceptable/non acceptable	Marina and residential component	High Priority	BTB, BTIA

### 6.5.6 Other Monitoring Plans

The proposed expansion project will also implement other monitoring plans as part of their EMS program. These plans will be further expanded as the project develops and gradually comes to light. The following table summarizes the proposed monitoring plan that will aid in both the yearly environmental audit and reporting scheme.

**Table 6.12:** Proposed Monitoring Plan Hugh Parkey's Belize Adventure Island

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
<b>Beach Dynamics</b>					
Beach erosion	Quarterly	Observable loss of beach material.	- North-east main development site	Moderate Priority	CZMAI, Fish. Dept.
<b>Engineering Aspects</b>					
Safety considerations in relation to navigational lights, marker buoy for the dredge.	Construction phase activities to be done on a weekly basis.	All lights aboard the dredge as well as beacons marking the path of the spoil delivery pipes and	- Associated with the dredge, spoil delivery pipes and sediment curtains.	High Priority	Port Authority

Parameter	Frequency	Critical Level	Geographic Area	Priority	Agency Responsible
		sediment must be functional, and all marker buoys must be deployed appropriately.			
Technical integrity of dredging operation.	Construction phase activity to be done on a daily basis.	Inspection of sediment curtains and spoil delivery pipe for overflows and leakages respectively.	- Done along the entire path of the sediment curtains and spoil delivery pipes.	High Priority	CZMAI, Fish. Dept.
		Inspection of shore-based spoil deposition pit or de-watering 'bund' for leakages and collapse of walls.	- Done along perimeter of bund.	High Priority	DOE, CZMAI, Fish. Dept.

## 6.6 Disaster and Contingency Management Framework

The proposed expansion project will expand on the disaster management and contingency plan (DMCP) it currently has for the existing development. With this in mind, the expansion project will focus on five types of disasters that could affect the development in some way or the other. In considering this possibility, the proposed expansion project plans to incorporate the following table of potential disasters and their respective plans

**Table 6.13** DMCP for Hugh Parkey's Belize Adventure Island

Disaster	Description	Response Plan	Stages
Hurricanes and tropical storms	This natural phenomenon can drastically affect the resort's infrastructure and operation should a hurricane strike the caye.	Hurricane Preparedness Plan	Alert, Response, Recovery
Fire	This anthropogenic and to some extent natural event poses a serious problem to the infrastructure and occupants of the resort.	Fire Prevention and Response Plan	Response

<b>Disaster</b>	<b>Description</b>	<b>Response Plan</b>	<b>Stages</b>
Fuel/oil Spills and leaks	This incident affects the soil and water on a whole if not properly addressed.	Spill Contingency Plan (Tier levels)	Response, Recovery
Climate Change	This slow occurring natural occurrence can pose serious risks to the project if not adapted and monitored over time.	Tidal Rise Contingency Plan	Alert, Response
Medical	Medical emergencies can occur at any moment without giving notice and therefore requires a quick and coordinated effort to respond to this need.	Medical Emergency Plan (Transportation and Evacuation)	Response, Recovery
Environmental Health and Safety	Required training in the different disaster and contingency field.	Environmental Safety	Alert, Response, Recovery

It is anticipated that once in operation, the development of the resort will develop a more detailed plan of action for the proposed DMCP scenarios in order to mitigate and ameliorate any potential negative impact these could have on the environment.

### **6.6.1 Administrative Framework**

The proposed expansion project will be required to integrate any existing management plan in the administrative framework presently being contemplated. With this, it will be the responsibility of the expansion project to formulate an Emergency Committee to address the potential disasters outline in Table 6.13. This committee will elect an Emergency Coordinator or his/her designate who will chair and oversee the preparation activities in relation to the potential disasters described (See Table 6.13).

The emergency committee must conduct periodic meetings to address and update important issues relating to the disaster management plans. Such important issues should be the objectives of the committee, their roles and responsibilities, updates as well as their terms of reference (TOR) which they will abide by. The Emergency Committee will also decide on the election policies for the assistants and coordinators. Furthermore, the committee must submit any disaster reports to upper management and authorities if required.

### **6.6.2 Hurricane Preparedness Plan**

The existing project presently has a hurricane preparedness plan currently in place. Therefore in considering this disaster, the expansion project will be incorporated into the present plan. With this in mind, the plan will incorporate the following components.

### 6.6.2.1 Purpose of Plan

This hurricane preparedness plan is to:

- (i) To establish the coordinating mechanisms necessary for Hugh Parkey’s Belize Adventure Island to prepare and implement measures to safeguard property and lives of all concerned during the threat of a storm or hurricane.
- (ii) To ensure that the coordinating mechanism that will ensure maximum safety of property or lives during an incoming storm, is put in place, and to make sure the developer and residents/guests are familiar with the mechanism.

### 6.6.2.2 Storm Information System

The “official alert” system for hurricane entails the coordination between the management of Hugh Parkey’s Belize Adventure Island and the National Emergency Management Organization (NEMO) in conjunction with the Belize National Meteorological Service (NMS). The proposed project will follow the official alert and hurricane categories put in place by NEMO described in the following tables:

**Table 6.14** NEMO Warning Flag System

<b>Flags</b>	<b>Phases</b>
One Red Flag	Preliminary Alert Phase (Storm/Hurricane Watch)
One Red flag with Black Center	RED I Phase (storm or hurricane watch)
Two Red Flags with Black Centers	RED II (Warning Phase)
One Green Flag	Green Phase ( ALL CLEAR)

**Table 6.15** NEMO Hurricane Categories

Tropical Depression	29 mph – 38 mph
Tropical Storm	39 mph – 73 mph
Hurricane Category 1	74 mph – 95 mph
Hurricane Category 2	96 mph – 110 mph
Hurricane Category 3	111 mph – 130 mph
Hurricane Category 4	131 mph – 155 mph
Hurricane Category 5	Above 155 mph

### 6.6.2.3 Action Plan

The following is a generic implementation plan as outlined by the National Emergency Management Organization. The implementation plan has been modified to fit this project.

#### *Preliminary Alert - Hurricane Watch*

This is the First Phase, and means that a storm or hurricane may threaten within 72 hours. A storm or hurricane is within 21° N 80° W of Belize.

***Actions to be taken:***

- (i) The Emergency Committee should be prepared to convene and take action if the NEMO issues a warning.
- (ii) Stay informed by radio and television of the storm progress.
- (iii) Obtain hurricane tracking charts for Committee members and interested parties,
- (iv) Obtain the contact number etc. from the management, including residents and guests with marine vessels, and inform vessel owners of the alert phase,
- (v) Ensure that contact is made with all guests and captains of vessels, whether by direct or indirect means to alert them of the phase and to make initial contact.
- (vi) Prepare a checklist (electronically) of items required in the event of a strike
- (vii) The Emergency Coordinator will identify and categorize items or equipment to be removed as follows: list of equipment to stay, and list of those to be removed to an approved shelter.
- (viii) Prepare a tentative list of all the guests and management staff on the island.

***Hurricane Warning – Red 1 Phase (Watch)***

During this phase, a hurricane may threaten within (36) thirty-six hours. A hurricane or storm is located within 20° N 87° W.

***Actions to be taken:***

- (i) Advise all vessel Captains to leave the marina areas immediately and take their vessel to safe harbor.
- (ii) The Emergency Coordinator will advise all employees and available human resources to install the hurricane shutters on the buildings and other related infrastructures.
- (iii) Advise all occupants of the caye including guests and employees to be prepared to evacuate the caye upon the recommendations of NEMO.
- (iv) Identify official shelter for guests, visitors and any other employee in need of such shelters,
- (v) Update NEMO on all actions taken.

***Hurricane Warning – RED 2 Phase***

Whenever Phase 2 (Red) is given, this means that a hurricane is likely to strike Belize within (24) twenty-four hours.

***Actions to be taken:***

- (i) The checklist of items required will then be printed and each head of department will be provided with a checklist,
- (ii) The precautionary list will be printed and provided to each head of department,
- (iii) Final hurricane preparations should be concluded,
- (iv) Evacuation of employees, guests and residents should be completed.

***Fourth Phase – Green (All Clear)***

This is the ALL CLEAR, which will be declared by NEMO after the hurricane has passed and it is safe to return to review the effects of the hurricane.

***Actions to be taken:***

- (i) The Emergency Committee will attempt to return and survey the project site as soon as possible,
- (ii) The Emergency Committee will immediately make a brief report on all damages (supported with photographs), and prepare an estimate of damages, and submit the same to NEMO and Management for their perusal.
- (ii) Employees of the project will report as previously advised.
- (iii) Clean-up phase will commence with the assistance of project employees, and all available human resources, where possible.

**6.6.2.4 Safety Precautions**

These precautions will be made available to each head of a residence or a home owner in the event of a hurricane. These will be delivered during Phase 2 – Red Warning Phase, and shall be updated every year by the Committee.

The following are some basic precautionary guidelines that should be followed in the event of a tropical depression or storm. In the event of a hurricane, a full evacuation should be executed at the earliest.

1. Pay no attention to rumors. Only rely on the official reports and weather advisories but under no circumstances telephone the Weather Services, nor any other national radio station or B.T.L. exchange as this will hamper the hurricane tracking and information service for everyone.
2. Close and secure all hurricane shutters properly.
3. Be sure that a window or door can be opened on the side of the house opposite to the one facing the wind.
4. Be sure that you have an adequate supply of drinking water as well as canned food or other food that needs no cooking or refrigeration. If you own a coal or kerosene stove get it into working order and procure a supply of kerosene and coal as it may come in handy after a hurricane.

5. Keep a good flashlight handy as well as candles and storm lanterns as the electricity supply will likely be cut off or knocked out during the storm.
6. Check on everything that may blow away or be torn loose during a storm and store them inside the buildings if possible. Remember that garbage cans, garden tools, signs, awnings and other objects may become weapons of destruction in hurricane winds.
7. If the center of the “eye” of the storm passes directly over you, there will be a lull in the wind lasting from a few minutes to half an hour or more depending on the speed of movement of the hurricane. Remain in a safe place. Make emergency repairs if necessary during the lull, but remember that the wind may return suddenly from the opposite direction, frequently with even greater violence.
8. Never leave your shelter until the official “ALL CLEAR” has been given.

### **6.6.3 Fire Prevention and Response Plan**

Fire outbreaks are considered both life threatening and disastrous to any development. In considering this possibility, the proposed expansion project will employ fire protection equipment along with a fire prevention plan. Since the caye is uninhabited and has no fire suppression system, the project creates its own service via the Environmental Committee in the form of engineering controls (fire protection equipment, building design and materials) and the fire prevention plan.

#### **6.6.3.1 Purpose of Plan**

The primary objective of the project is to ensure that the coordinating mechanism that will ensure maximum safety of property or lives during a blaze, is put in place, and to make sure the developer or residents/guests are familiar with the mechanism. In addition the plan will:

- (i) increase awareness to residents/guests, management and others of the need for a fire prevention and response plan,
- (ii) To establish the coordinating mechanisms necessary for Hugh Parkey’s Belize Adventure Island to prepare and implement measures to safeguard property and lives of all concerned should a fire occur in a building
- (iii) Indicate all possible evacuation routes for each building on the project site.

#### **6.6.3.2 Fire Prevention**

It is important to remember that prevention is better than cure in medicine; well that same principle applies to fire. While water may be plentiful, it’s immediately availability may not be a possibility. Therefore the proposed project plans to implement the following prevention schemes:

**I. Use of fire retardant material** - The use of nonflammable building material will be encouraged within the expansion project. This will include also the use of fire rated doors and fire resistant barriers.

**II. Qualified personnel to install electrical system** - Only certified wiring Technicians

will be allowed to carry out any electrical work on the premises. This will need to be approved by the Belize Electricity Limited.

**III. Building Codes** - The project will call for the construction of condos, villas, townhouses and other buildings, with heights above (1) one and (2) two stories high. A set of building codes will be developed by the engineers of the project. The engineering standards will also include provisions for adequate and safe wiring; plumbing, heating, and cooling systems are also in conformity with acceptable building codes.

### **6.6.3.3 Fire Protection Equipment/Systems**

The proposed expansion project plans to implement fire protection equipment and systems in order to protect their buildings and related infrastructure. This equipment will offer some sort of protection from a fire in one form or another. The following are fire detection, notification and suppression systems that can control a fire.

#### *1) Fire alarm detection and notification systems.*

- *Smoke and heat detectors:* The project will install fire detection equipment in the form of smoke and heat detectors in each of the units and in the building hallways and walkways. These detectors will activate a smoke alarm possibly signaling a fire or something burning.
- *Manually activated pull station:* Each building floor will also have a manually activated pull station in the event that someone sees a fire. It is essential that both residents/guests and staff are aware of these warning devices and their potential use.

#### *2) Fire Suppression Systems.*

- *Hydrants:* Fire hydrants will also be used on the project. These hydrants will be spaced out according to each developmental zone and zone densities. Water for these hydrants will be gotten from the recycled wastewater. A portable water pump with hoses will be coupled to the hydrants and used to extinguish the fire.
- *Fire Extinguishers:* Hugh Parkey's Belize Adventure Island will install multi-purpose dry chemical (Class ABC) fire extinguishers at all the key areas such as hallways, infrastructure buildings, maintenance areas etc. Dry chemical extinguishers will range in sizes of 7 lbs to 10 lbs.

### **6.6.3.4 Fire Response**

It is difficult to consider a response plan for the expansion site especially considering the different scenarios that can accompany a fire outbreak. Nevertheless, it is important to have a fire combating plan in place where trained workers would utilize the necessary equipment (See Fire Protection Equipment/System) to extinguish a small fire or smolder bigger flames.

An evacuation plan must also accompany the fire combating plan in the event of an occurrence. These plans must be schematically developed and placed at strategic locations determined by the emergency committee. The evacuation plan will also involve the use of evacuation cards to disseminate the procedures and conditions necessary for an evacuation. These cards must be

handed out and made known to each member of staff and management as well as the guests on the resort.

### 6.6.4 Spill Contingency Plan

The proposed expansion project will require a Spill Contingency Plan for the activities that will be undertaken. This plan will primarily apply to the handling of fuels and marina component of the project. Therefore, the plan will provide an organizational structure and procedures for preparing and responding to hydrocarbon spills and leaks both on land and at sea. It is better to understand the purpose of the response plan in order to tackle every spill situation. Such understanding coupled with training will enable those involved in the response effort to determine the best practical procedures given the various conditions.

#### 6.6.4.1 Purpose of Plan

The purpose of the plan is to outline the procedures necessary to reduce and contain the effect of a spill by means of a well-coordinated response in conjunction with the following:

- To increase staff awareness on Spill Response procedures taking into consideration the different governmental tier response levels.
- To define the coordinating mechanisms necessary for management and staff to utilize their resources in Response Procedures.

#### 6.6.4.2 Response Policy

The response policy will call for a timely and effective response to incidents which requires basic training in the response policies as well as the use of contingency equipments to contain and clean up a spill after it occurs. Because the approaches and methods for responding to oil spills are constantly evolving, and each spill provides an opportunity to learn how to better prepare for future incidents, contingency plans also are constantly improving and providing increased protection to human health and the environment from these accidents. The following tables are DOE Tier levels as described by the National Emergency Preparedness Plan for Oil Spills (NEPPOS).

**Table 6.16** Marine Spills Levels

<b>Tier</b>	<b>Quantity (gals)</b>	<b>Location</b>	<b>Response</b>
I	1,000-10,000	Coastal/ Marine	To be managed by polluter
II	10,000-100,000	Coastal/ Marine	Requires Government assistance for management
III	>100,000	Coastal/ Marine	Requires Government and/or external assistance

**Table 6.17** Inland Spill Level

<b>Level</b>	<b>Quantity</b>	<b>Location</b>	<b>Response</b>
A	<1,000	On land or Inland	To be managed by polluter
B	>1,000 or poses significant health hazard and requires evacuation	On land or Inland	Responsible party requires GoB assistance to manage the discharge.

For the purpose of this project both Tier I and Level A will be considered. This is especially so because of the fuel transportation from the mainland to the caye.

### **6.6.4.3 Fuel Management**

Fuel management is a very critical safety issue considering the remoteness of the project site. It is however, not a difficult task to do considering the small volumes that will be handled by the project during construction and operation. Fuel will be managed to prevent spills and leaks via the following:

- *Storage:* Fuel will be stored inside a reinforced concrete containment wall. This will be designed to contain 110% of the maximum tank volume. To protect against any accidental fire the tank will be sited away from all electrical installations.
- *Documentation:* It is important to keep in mind that the project must order the correct amount or volume of fuel required for operation. For this reason, all the fuel consumed and received must be recorded.
- *Maintenance:* It is necessary to inspect all containment walls and fuel containers. Improper functioning of these can lead to unnecessary spills and leaks. Another important issue is fuel lines. The less there are, the better. It is with that reason that the fuel tanks must be as close as possible to the generators.

### **6.6.4.4 Waste Oil Management**

Although not required to be developed fully considering the volumes produced, it is important however, to reiterate that the project is in an ecologically fragile environment. Small oil spills for this matter, do fall under the Spill Contingency Plan. Waste oil will be managed according to the following:

- *Storage:* All waste oil will be stored in properly sealed container and inside a containment wall.
- *Handling:* Used oils are a legal responsibility of Hugh Parkey’s Belize Adventure Island and thus should be handled adequately and with care.

- *Disposal:* Although the volume may be very small, it is important to properly discard the accumulated waste oil. Once stored, the waste oil should be disposed by an approved or certified contractor.

#### **6.6.4.5 Contingency Equipment**

Spill response equipment is the most important component in the Spill Contingency Plan. This equipment can vary depending on the size and type of the activity. For the interest of Hugh Parkey's Belize Adventure Island the following equipment will be required:

- Spill response Kits – these will be made available to the maintenance staff and installed at key locations such as generators, boats, etc.
- Containment Booms – these are mostly for marine spills and will be deployed if required.

#### **6.6.5 Tidal Rise Contingency Plan**

This contingency plan is especially important considering that the caye's undeveloped portion is below sea level. Land reclamation activities would increase this level to approximately 5 feet. Global warming is predicted to cause significant rises in sea level over the course of the twenty-first century. The natural phenomenon is an extremely slow process taking several years to decades to materialize. Nevertheless, sea level rise can impact the project's shoreline.

Such impact can include increased shoreline erosion, high storm surges, flooding, project inundation, changes in the surface water quality and ground water characteristics, increased flood risks and loss of tourism, recreation and transportation functions. Considering its importance from an economic long term investment, the following sections summarize the contingency plan for sea level rise at the project site.

##### **6.6.5.1 Purpose of the Plan**

The overall objective of the expansion project is to mitigate the effects of this long term phenomenon by:

- Preventing erosion and protecting vulnerable areas prone to such activity
- Prepare a comprehensive plan to remediate the problem by formulating tidal charts, sea level maps and the other necessary tools.

##### **6.6.5.2 Adapting to Sea Level Rise**

Adaptive responses focus on protection of shores or allowing them to retreat, with subsequent loss of existing shoreline systems and structures. The following points describe the importance of undertaking such a task.

- **Erecting walls to hold back the sea** - Most response strategies to future sea-level rise have concluded that coastal locations will merit protection with bulkheads, dikes, and

pumping systems. Bulkheads, seawalls, and rock revetments already are being used to halt erosion to protect land that is well above sea level.

- **Elevating land surfaces and beaches** - The effects of rising sea level can be offset by elevating beaches, land surfaces, and structures as sea level rises. A key benefit of this approach is that the character of the shore is not altered.
- **Protecting natural shorelines by allowing shores to retreat** - Several planning measures have been proposed to enable some shorelines to remain in roughly their natural state as sea level rises, rather than be replaced with structures. For the most part, these measures apply to areas that are not yet developed.
- **National assessments of adaptive responses** – There has been no documentation on the effects of sea level rise in Belize. Nevertheless, these adaptive responses should be carried out in order to estimate the economies of scale in considering the responses.

### **6.6.5.3 Climate Change Effects**

According to Usher, (Usher 2000), the changes in the hydrological cycle in Belize as a result of climate change, would be characterized by changes in sea levels, the intensity of hurricanes and its accompanying storm surge, and changes in rainfall patterns and temperature. These changes may result in devastating impacts on the project such as:

- Exacerbated erosion of the coastline and accompanying beach loss;
- Alteration or destruction of mangrove communities due to changes in precipitation and seasonality, resulting in the alteration of the productivity of mangrove ecosystems,
- Increased inundation as a result of sea level rise, with consequences such as salt-water intrusion,
- Vulnerability to flooding and soil erosion of low lying areas within project site,
- Loss in net tourism economic activities as a result of the combined effects of climate change,

These issues are of a limited scale to the project site; nevertheless, the net effect of a national scale would be more visible. Planning will include the elevation of property by land filling, the construction of buildings to standards to withstand major hurricanes, and the establishment of building codes and guidelines that will be satisfactory to minimize damage during disasters.

### **6.6.6 Medical Emergency Plan**

This plan is a new concept that must be implemented based on the expanding growth of the tourism industry. In considering this, the proposed expansion project plans to implement and develop a medical emergency plan to respond to such an incident. Any response to an emergency medical situation will depend strongly on the situation, the patient involved and availability of resources to help them. It will also vary depending on the location of the emergency such as whilst on the cay.

### **6.6.6.1 Purpose of the Plan**

The primary objective of the plan is to respond to a medical emergency in a quick manner by:

- Establishing the coordinating mechanism necessary to respond to a medical emergency and to implement basic first aid treatment if applicable.
- Develop and implement a coordinating mechanism necessary to secure appropriate emergency transportation to a recognized health institution.

### **6.6.6.2 Basic First Aid**

First aid treatment usually involves the use of a first aid kit, which is a collection of supplies and equipment for use in giving first aid, particularly in a medical emergency. Most first aid kits contain bandages for controlling bleeding, personal protective equipment such as gloves and a breathing barrier for performing rescue breathing and CPR (cardiopulmonary resuscitation), and sometimes instructions on how to perform first aid.

#### *Aims*

The 3 main aims of first aid, commonly referred to as the “3 Ps” are:

- **Preserve life**
- **Prevent further injury**
- **Promote recovery**

### **6.6.6.3 Transportation (Evacuation) of Patient**

When conventional first aid requires additional medical attention, the patient must be transported to a recognized health institution for further treatment as quickly as possible. For this reason it is important to establish relations with the health institution and notify them on the project’s plan and determine whether the institution is able to assist in emergency cases. In any event, the Emergency Committee will be required to make transportation arrangements to the health institution in the event of a medical emergency.

Considering the aforementioned importance, all medical emergencies requiring further treatment will be transported to the Karl Heusner Memorial Hospital or to any approved tertiary health care facility (Universal Health Center or Belize Medical Associates) in Belize City.

### **6.6.6.4 Contact Information**

Contact information is an important factor in considering emergency situations. It can be used for any disaster emergencies. The following table lists the emergency services for the proposed project.

**Table 6.18** Hugh Parkey’s Belize Adventure Island Emergency Services

<b>Institution/Department</b>	<b>Contact Number</b>	<b>Alternate Number</b>
Karl Heusner Memorial Hospital	223-1548	223-5686
Administrative Manager	TBFIM	TBFIM
Director	TBFIM	TBFIM
Other	TBFIM	TBFIM

### **6.6.7 Environmental Safety**

Environmental safety is a growing concept that must be developed, especially considering the growing number of tourists who visit the country. Moreover, this concept must be practiced on a daily basis by those who make up the tourism industry. With this in mind, the Emergency Committee of the proposed development will develop safety training programs for the resort and marina. This program will not be required to divulge in general or in details about the many risks and hazards that exist or affect the project. Nevertheless, it’s important to address these concerns, especially considering the location of the project.

#### *Training*

Training is the field concerned with workplace learning to improve performance. Such training can be generally categorized as *on-the-job* or *off-the-job*. On-the-job describes training that is given in a normal working situation, using the actual tools, equipment, documents or materials that they will use when fully trained. On-the-job training is usually most effective for vocational work. Off-the-job training takes place away from normal work situation which means that the employee is not regarded as productive worker when training is taking place. An advantage of off-the-job training is that it allows people to get away from work and totally concentrate on the training being given. This is most effective for training concepts and ideas.

#### **(a) Hurricane Preparedness Plan**

Hurricanes and storms can cause severe property damage and flooding, especially considering the project environment. Moreover, the restoration time is virtually unknown with these types of sustained damages. With this in mind, the Emergency Committee will carry out yearly training in the form of drills to fine tune and sort out the preparation process. These drills are important in accessing the integrity and functionality of the preparedness plan.

#### **(b) Fire Prevention and Response Plan**

Fire outbreaks are dangerous if not contained and extinguished in time. Time is of the essence when dealing with fires. The Emergency Committee will ensure that the persons assigned to fight a fire are properly trained. Training can be carried out by the National Fire Service upon request. The trainee will basically get an understanding of the concepts of a fire and how to properly operate and use a fire extinguisher to fight small fires.

The training will be enhanced to include the usage of the project’s fire hydrant system to extinguish large fires that might occur. Special attention will be paid to this section as it signifies

the last line of defense for the proposed project. The training will also include the maintenance of both the fire extinguishers and fire hydrant systems.

### **(c) Spill Contingency Plan**

Training in this field will be limited to small localized spills that could occur in the marina and adjacent waters. Precedence will be given to the small spills since the probability is much higher. Trainees in this area will be required to learn the basics in spill containment and remediation process.

This will involve the deployment of spill kits to the required areas and also undertaking remediation services. Training in this field can be undertaken by the Department of the Environment, or private consultancies.

### **(d) Tidal Rise Contingency Plan**

There are no specific training in this field nevertheless, a monitoring program of some sort must be develop of some sort to monitor the erosion of the project site, deposition of sediments and water quality and flooding where necessary.

### **(e) Medical Emergency**

Much of first aid is common sense, and people are almost certain to learn some elements as they go through their life (such as knowing to apply an adhesive bandage to a small cut on a finger). However, effective life-saving first aid requires hands-on training by experts, especially where it relates to potentially fatal illnesses and injuries, such as those that require Cardiopulmonary Resuscitation (CPR), as the procedures may be invasive, and carry a risk of further injury to the patient - which the '3 aims' of first aid above, clearly try to avoid.

Training in first aid is often available through the Red Cross or through commercial providers, who will train the staff for a fee. This commercial training is most common for training of employees to perform first aid in their workplace.

As the key skill to first aid is preserving life, the single most important training a first aider can receive is in the primary diagnosis and care of an unconscious or unresponsive patient. The most common mnemonic used to remember the procedure for this is ABC, which stands for **Airway, Breathing and Circulation**.

### **(f) Others**

There are many other on the job training that somehow involves the environment, for example solid waste collection, water quality sample collection, landscaping, life guard, fuel dispatcher etc. In the tourism field, there are many such instances that require some sort of qualification and training. Nevertheless, the proposed development plans to implement training exercises into the operation of the project.

## 6.7 Conclusion

*Newton's Law provides that for every action there is an equal and opposite reaction.*

The Council on Environmental Quality (CEQ) on the other hand provides that “Whenever a proposed project will result in potential significant adverse environmental impacts, measures must be taken which will limit or avoid that impact. These may include conditions of approval, revisions to the project, and, less frequently, approving an alternative project with fewer impacts. Where such measures are imposed, there must be a program for monitoring or reporting on the project's compliance with those measures”.

As described from the conotation above, the proposed project will have its degree of impact on the receiving environment. Based on these assumptions, the different monitoring programs plan to include as much activities that are related to the development and operation of the proposed subdivision. Once Environmental Clearance has been granted, the Environmental Compliance Plan will request a more formal and detailed monitoring program from the different activities.

Likewise, the mitigation plan presented in this document must also be included in the ECP. Furthermore the Department of the Environment, along with other interested parties, will be required to monitor the project site in both its construction (dredging/excavation) phase and operation phase and to ensure that the monitoring program and mitigation measures presented in the tables above are properly put in place and functioning as planned.

In obtaining quick and decisive responses, the Emergency Committee of the proposed expansion project should have regular meetings, training and drills to update their continued effort in disaster preparedness and management. It is in fact a coherent relationship between management and employees to display sound actions in the case of a disaster. This relationship extends far beyond the property boundary lines as members also take this experience at home. A quick and well-planned response is always an essential tool in dealing with any natural or man-made disasters.