

Hunting Caye



**Overview of Recommendations
for
Environmental Best Practices**



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Location

The Living Reef Centre is to be located on Hunting Caye, one of the Sapodilla Cayes that lie within the Sapodilla Caye Marine Reserve, 35 miles east of Punta Gorda, in Toledo District. The Marine Reserve, the most southerly part of the Belize Barrier Reef, is recognised for its unique and globally important ecosystem by its designation in 1996 as a marine reserve, and as one of seven marine protected areas that form Belize's World Heritage Site.

The building will be situated centrally on Hunting Caye, on land belonging to the University of Belize.



Photograph One: Hunting Caye (Aerial View).
Earthwatch

Key Terrestrial Biodiversity

- **Tropical littoral forest and beach communities**

Probably Belize's most threatened ecosystem, tropical littoral forest and beach communities have been previously cleared extensively on Hunting Caye to make way for coconut plantations, and more recently for tourism and residential development. The littoral forest is an important component of the neotropical migratory bird route, with species moving down the outer Atolls of Lighthouse Reef and Glover's Reef, to the Sapodilla Cayes, and from there to Guatemala and Honduras, where they again hook up with the mainland and its "infinite" resources (L. Jones, pers. com.).

The ground-cover vines and herbaceous vegetation of the beach communities form a crucial nesting habitat for the hawksbill turtle (*Eretmochelys imbricata*). This critically endangered species (IUCN, 2006) nests higher on the beach than other species, typically excavating nest holes amongst the herbaceous and shrubby littoral vegetation on the seaward side of littoral forest.

Within the University of Belize land on Hunting Caye, this ecosystem has been almost completely eradicated – with a current garbage 'dump' positioned amongst the few remaining specimens of natural vegetation.

The construction site has been heavily impacted in the past, and currently has no natural vegetation (Photograph Two). The construction will therefore not require any clearance of littoral forest or beach vegetation. In terms of this critical ecosystem, therefore, considerations



Photograph Two: Construction Site
Wildtracks

regarding the development of the Living Reef Centre can be based largely upon rehabilitation of this ecosystem from current and past impacts, rather than just on possible negative impacts resulting from construction.

In line with the Earthwatch Institute's environmental ethos, there is therefore significant scope to reverse the long-term trend of habitat degradation on the site, through rehabilitation of much of the former littoral vegetation, and implement best management practices to minimize future impacts. (Annex 1: Vegetation regeneration plan)

Sea Turtles – Hawksbills

The hawksbill turtle is one of two critically endangered reptile species in Belize, the other being the freshwater Central American river turtle (or hicatee). Nesting data records for hawksbills indicate a serious decline in both nesting activity and nesting success throughout Belize (Smith et. al. 1992; Mahil, 2005), reflecting in part increased human impacts on nesting beaches. Beach development typically involves the removal of native beach vegetation (the hawksbill's nesting habitat) to leave sand beaches that are then planted with coconuts – resulting in a de-stabilized island structure with increased susceptibility to erosion and hurricane damage.

Four hawksbill turtle nests were observed and mapped at the extremities of the eastern beach of the University of Belize property in 2006 – within the remnants of littoral herbaceous and shrubby vegetation. These may represent the nesting output of just two female turtles. Development and management of the Earthwatch Institute / University of Belize Living Reef Centre, in liaison with TASTE, offers the potential to re-establish much of the eastern beach of the property as a prime nesting site for this species, with ongoing implementation of best management practices designed to minimize negative impacts on nesting behaviour and nest success and thereby make a positive contribution to the long-term prospects of this critically endangered species within Belizean waters.

NB: Cathi Campbell, an authority on this species, will be making her own detailed recommendations – the notes presented here are therefore intended as a summary of primary observations and concerns, and should be harmonized in line with her observations where necessary

Identified Potential Impacts and Recommendations

For most purposes, it is practical to separate potential impacts from the Earthwatch Institute / University of Belize Living Reef Centre into two groupings: those associated with design and construction, and those associated with site management. Careful facility design and implementation during construction will significantly reduce potential negative impacts from site management.

Construction Phase

Best practices for minimal environmental impact need to be followed throughout the construction phase, from the timing of construction to the transport of materials to the cayes, the sourcing of water and the impact of the construction crew.

Timing of Construction

- Construction should be timed for before May, to avoid the hawksbill nesting and hatching season from May to November.
- The timing of the construction of the second floor should also take into account the hawksbill nesting and hatching season
- In terms of minimizing impacts on tourism activities on the western shoreline, construction should avoid peak visitation (Easter, and the cruise ship days (15th of February and possibly 15th March)

Transport of Materials

- All materials should be checked on the mainland before loading to ensure that no exotic species – especially rats – are being transported to the caye
- The barge carrying materials will need to dock on the western side of the caye, with materials carried to the construction site.
- A single route should be designated for transport of materials from the dock to the construction site to minimize impact to the vegetation
- Docking should be done with extra care to minimise impacts to the seagrass and coral
- In terms of minimizing impacts on tourism activities on the western shoreline, delivery of materials should avoid peak visitation (Easter, and the cruise ship days (15th of February and possibly 15th March)

Sourcing of Water

- Whilst Hunting Caye already shows signs of salt intrusion into the aquifer, there was question of sourcing water from the adjacent cayes. This is not considered to be viable as the quantities of water required could result in salt intrusion of the ground water aquifer on these cayes too. It is recommended that water should therefore be collected on site in rainwater vats, and/or brought in from the mainland.

Impacts of Construction

- The forms for the foundations should be well sealed to prevent leakage of heavily limed water into the freshwater lens of the caye
- If paint is used for finishing the building, maximum effort should be made to ensure that brushes are cleaned and disposed of correctly, as are paint tins, to avoid leaching into the groundwater aquifer. Use of wood preservatives should be minimized, and pressure-treated pine should not be used below ground-level.

Impact of the Construction Crew

- All members of the construction crew (including the transportation crew) need to be aware of the rules and regulations of the Marine Reserve, and the activities they can and can't do whilst on the Caye and/or within the Marine Reserve.
- All members of the construction crew should be aware of the conservation requirement to protect the turtle nesting beach, and therefore all recreational activities should be focused on the western beach
- All members of the construction crew should try to minimize any vegetation clearance outside of the footprint of the building, especially towards the eastern beach
- No member of the construction crew should bring any animal onto the caye – including dogs and cats
- All solid waste should be carried to the mainland for appropriate disposal

Infrastructure

- **Sewage:** The sewage and liquid waste systems should be designed to cope with 100% occupancy – a capacity of 32 people
- The sewage treatment bio-remediation system installed on Hunting Caye by TASTE is the preferred option for the Living Reef Centre. TASTE figures for sewage handling by the system indicate that the existing facilities have the capacity to cope with additional users associated with the Living Reef Centre, and indeed may even benefit from greater use during drier weather. Extension of the system, or installation of a second one, should be considered if the bio-remediation filtration system shows signs of water-logging under ongoing heavy load.
- **Freshwater:** There should be adequate rainwater capture and storage for all uses (drinking, bathing, kitchen use etc.), at full capacity, with supplemental water storage for water brought from the mainland if necessary. If possible, the station should not be reliant on the freshwater lens under the caye (initial studies suggest that this water is already contaminated, with elevated levels of nitrates and *E. coli*. The contractor also suggested that there has already been salt intrusion into the groundwater by too much draw, resulting in low salinity readings).

Operational Phase

Numerous aspects of site management have the potential to cause negative impacts on the biodiversity of the caye itself, and on the surrounding marine habitats. It is recommended that best environmental practices be used by management, laid out in site operations policies. With adequate training, the Site Manager operating within these policies will have the potential not only to minimize potential negative impacts associated with the utilization of the Living Reef Centre, but also to reverse the long-term trend of degradation of natural resources that has taken place on Hunting Caye to date.

- Potential impacts during the operational stage include the impacts of light on turtle nesting and hatching (particularly on the Critically Endangered hawksbill), and the impacts of visitor behaviour (whether students, volunteers or researchers) on both the nesting turtles and the surrounding reef. Rotating the building (Diagram One) should focus the majority of the activity on the western side, away from the turtle nesting beach.



Diagram One:
Plan of Living Reef
Center, Hunting Caye

Adapted from: Sheldon
Mahung. (Architect),
for: The University of
Belize & Earthwatch
Institute

Minimizing visitor impacts on nesting and hatching turtles

- The station manager needs to have a clear remit for control of visitor impacts on the turtle nesting beach, with guidelines in place for both nesting and hatching events
- All visitors, to the facility during nesting and hatching season, whether students, teachers, volunteers or researchers, should be briefed on acceptable behaviour around the turtle nesting beach, and clear signage should be posted to reinforce good visitor behaviour
- A single path should be angled from the beach to the building, to ensure controlled visitor access.

Minimizing light impacts on nesting and hatching turtles

- All lighting for the building should be chosen and positioned with visibility from the nesting beach in mind. (See Witherington B. E. and R.E. Martin. 1996; Cathi Campbell site report)
- If exterior lighting is considered necessary, it should be placed on the western side of the building, with screening from the eastern beach, either by the building itself, or by vegetation (Photograph Three; Annex One)



Photograph Three: Example of vegetation screening beach from light impacts
Wildtracks

- The building should be set back 20m from the eastern beach ridge, and rotated (Diagram One), whilst still capturing the breeze in the accommodation area.
- Native vegetation should be used to screen the building lights from the nesting beach, with paths (one to the east, one to the west) angled to avoid straight line of sight from the beach to the lights of the building.
- Where possible, solar and wind power should be utilized. Whilst the preferred option is the installation of a combined system of solar power and wind generator, the cheaper option is a diesel-powered generator, with greater potential for negative environmental impacts. If a generator is to be used in nesting season, potential negative impacts of

vibration (potential to disturb nesting and hatching turtles) can be minimized by the installation of an adequately cushioned mounting pad on which the generator should be mounted, and bunkered to prevent excess noise. Low noise, but expensive, units are available; otherwise well-designed noise baffles should be built into the generator house. For minimizing disturbance to nesting turtles, it is recommended that the generator should be shut off after 7:00pm at night from May to November.

- The need for clean fuel & oil transport & storage should be taken into consideration re. diesel generators, and also for running the boats associated with the facility and research and education activities being implemented.

Increasing the Viability of the Turtle Nesting Beach

- Restoration of the natural beach vegetation on the turtle nesting beach will provide the correct environment to encourage hawksbill nesting.
- Coconuts on the beach ridge should be removed, as should any grass, and it is strongly recommended that natural vegetation be re-established on the eastern turtle nesting beach to improve aesthetics and biodiversity conservation in general (Annex One).
- Periodic beach cleanups should take place, removing litter from the beach and vegetation, but leaving the vegetation in place
- An information board highlighting the conservation status and decline of the hawksbill turtle, its preferred nesting habitat, and the potential impacts on the nesting beach that are being mitigated through careful planning and visitor management, could be placed at the entrance to the beach to increase awareness of users

Other Actions to Mitigate Impacts

The site visit to the University of Belize and other properties on Hunting Caye, along with a brief visit to Frank's Caye, clearly demonstrate a significant requirement to strengthen understanding about the critical importance of the threatened littoral vegetation, the incompatibility of coconut trees in terms of preserving natural vegetation, and the relative ease of using locally occurring flora to create and maintain aesthetically very attractive grounds – that maintain critical nesting sites for hawksbill turtles, help site conservation of native flora, are important for migratory birds, and support the goals of the protected area. A rough plan and supporting rationale for the re-establishment of natural vegetation is presented in Annex One.

Local flora that has evolved for conditions on the cayes should need little attention once re-established, and will not need fertilizers or other chemical applications that would pose a risk to the surrounding marine habitats. Maintenance groundwork should be done manually, and use of herbicides and / or pesticides should not be sanctioned.

Spraying or fogging (typically with Malathion) against biting insects should not be permitted outside buildings. Spraying against sand-flies was observed during the site assessment – including over shallow water (Photograph Four). Such practices are wholly incompatible with the conservation mandate of the Sapodilla Cayes Marine Reserve, and should never be tolerated within the University of Belize property. It is recommended that stakeholders collaborate in the conservation of the Sapodilla Cayes Marine Reserve, and should lobby for and implement a complete ban on such highly negative management practices on any of the islands within the protected area, an initiative the management of the station should fully support.



Photograph Four: Spraying in the Sapodilla Cayes Marine Reserve, Wildtracks

- Natural vegetation should be planted to form a visual barrier between the station and the tourism area on the west beach to dissuade intrusion by cruise ship visitors into the station area
- Environmental best practices should be implemented at all levels – site management, researchers, teachers and students – to minimize impacts on the caye and reef
- Best management practices should be developed and implemented, covering a broad array of potential chemical hazards – including:
 - Paints
 - Wood preservatives / treatments
 - Pesticides
 - Herbicides
 - Disinfectants
 - Detergents
 - Fuels
- Ensure all boats used by the station minimize oil and gasoline pollution during operation and maintenance
- Ensure all student and research projects are vetted for compatibility with the conservation status of the protected area and the welfare of the species and systems being studied.

Monitoring

- A monitoring programme should be developed to ensure impacts on the caye and adjacent waters and reef continue to be minimized. It is recommended that this should integrate the following:
 - Maintain accurate information on visitation and use of the station
 - A baseline should be developed on water quality parameters of groundwater, and monitored on a regular basis in collaboration with TASTE
 - A baseline should be developed on seawater quality off eastern beach, and monitored on a regular basis, in collaboration with TASTE
 - Boat impacts on seagrass should be monitored on the eastern beach (though boat activity within this area should be minimized, especially during nesting season).
 - A baseline should be developed on algal levels in seagrass on both the eastern and western beaches, as an indicator of potential excess nutrient contamination, This should then be monitored on a regular basis, in collaboration with TASTE
 - Develop a baseline of marine turtle species using the eastern nesting beach, and other areas of Hunting Caye, feeding into TASTE's 3-year monitoring plan – “To determine the abundance and distribution and to monitor changes of major critical habitats and species”
 - Collaborate with TASTE's turtle nest monitoring programme, and ensure monitoring of nest activity and success during the nesting season
 - Ensure all staff log turtle sightings both on land and at sea – identification, georeferenced location, habitat, size estimate, activity
- It is recommended that baseline and monitoring results be incorporated into an annual report, and distributed to relevant agencies

Mahil I. 2005. First Annual Report to the Inter-American Convention for the Protection and Conservation of Sea Turtles. Fisheries Dept. Ministry of Natural Resources, Belize

Smith, Gregory W., Karen L. Eckert, and Janet P. Gibson. 1992. WIDECAST Sea Turtle Recovery. Action Plan for Belize (Karen L. Eckert, Editor). CEP Technical Report No. 18. UNEP Caribbean. Environment Programme, Kingston, Jamaica. 86p.

Witherington B. E. and R.E. Martin. 1996. Understanding, Assessing and Resolving Light Pollution Problems on Sea Turtle Nesting Beaches. FMRI Technical Report TR-2, Florida Department of Environmental Protection.

Annex One

Vegetation Barriers

1. High screening trees

Native seagrapes, saltwater palmetto, and introduced coconut palms form a visual barrier, shielding facilities from other visitors on the west beach, and screening the turtle nesting beach from light impacts

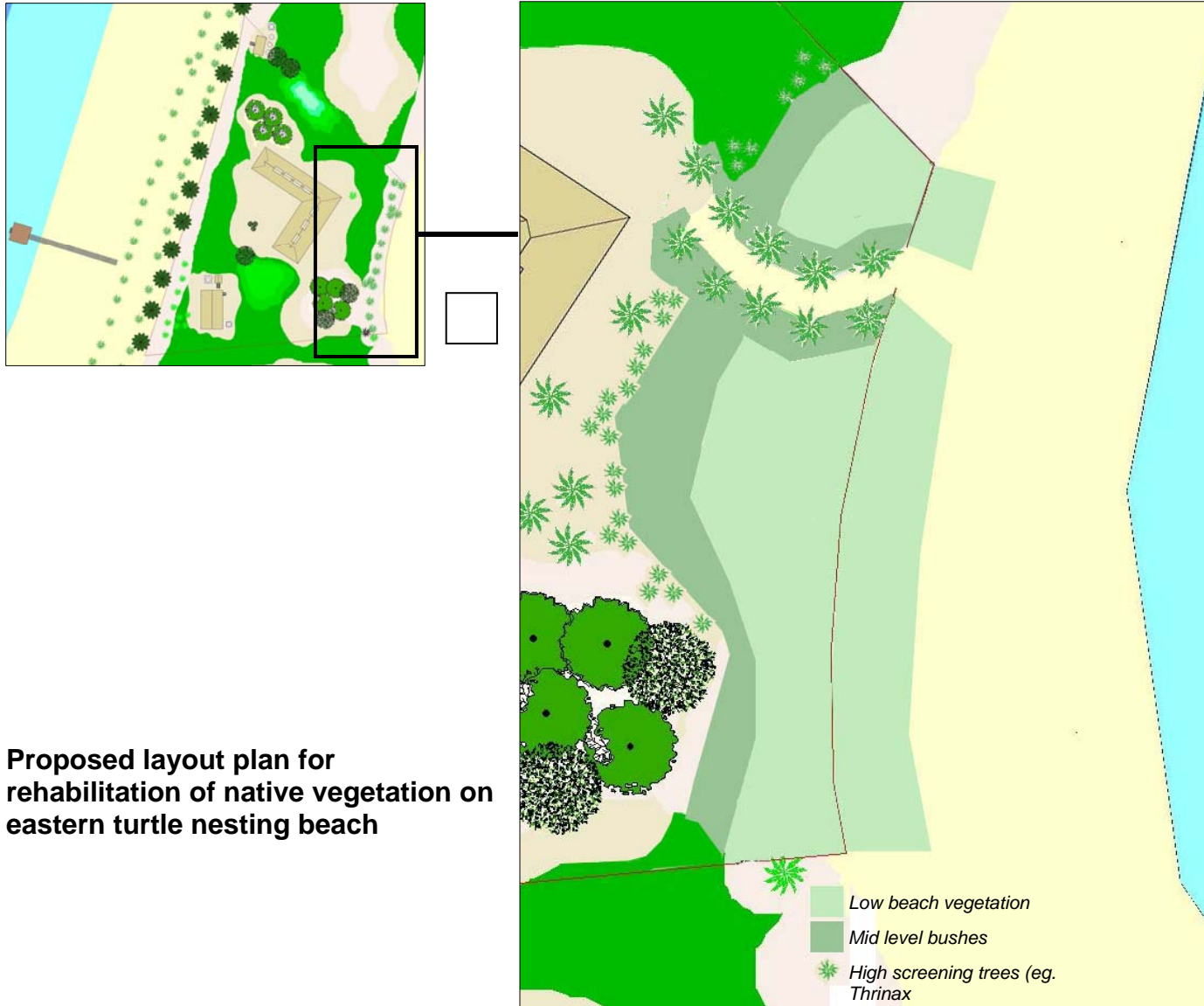
2. Mid-level bushes

Shrubs such as the West Indian sea lavender and bay cedar provide a low, thick barrier between the beach and the building.

3. Low beach vegetation

Loose rooted vines and low growing plants that grow on the sandy beach ridge. These are essential for hawksbill nesting





Low Beach Vegetation

Cakile lanceolata
Seaside bean (*Canavalia rosea*)
Beach morning glory (*Ipomoea pescaprae*)
Ipomoea macrantha
Vervain (*Stachytarpheta jamaicensis*)
Purslane (*Portulaca oleracea*)
Seaside purslane (*Sesuvium portulacastrum*)
Widelia trilobata



Mid-level Bushes

West Indian sea lavender (*Tournefortia gnaphaloides*)
Bay Cedar (*Suriana maritima*)
Spider Lily (*Hymenocallis latifolia*)



High Screening Trees

Saltwater Palmetto (*Thrinax radiata*)
Sea Grape (*Coccoloba uvifera*)

