
SECTION FOUR

DEVELOPMENT ALTERNATIVES

4.1 Introduction

In analyzing the environmental impacts, there are usually two or more development alternatives to consider for each issue. The alternatives may encompass a wide range of consideration and can represent a choice between the construction and operation of a development and the non-development option.

With this in mind, the general principle involved in identifying the option(s) of the proposed development is to ensure that the option chosen, which may be the ‘non development option’, would result in optimal social, economic and environmental returns. In effect the option chosen should corroborate well not only for the developer, but also for the environment and stakeholders in the area.

4.2 The ‘No Action Alternative’

The analyses of alternatives compared results in the selection of the preferred alternative for development based on environmental, technical and economic grounds i.e., the option with the highest cost benefit factor, the most technically feasible and with least residual impact is identified as the preferred option.

The “No-action” alternative or non development option is usually discussed as an option in the EIA process. However, this alternative is difficult to consider as a viable option due to the pre-existing investments which have been incurred by the developers. One of the most costly investments that are normally incurred prior to project approval is land purchase.

In some instances, certain companies make arrangements for land purchase after project approval, after the EIA process. However, there are circumstances when land purchases have been conducted prior to the EIA preparation, thus the application of the EIA discussion of alternatives cannot include the options for alternative project location, as is the case of the expansion project.

The initial investments already incurred were the primary reason for the no action alternative not to be found economically feasible. This option would result in the loss of investment capital, and the loss of economic opportunities such as employment generation, revenue and foreign exchange generation etc. However, the EIA as a planning tool is considered critical for the determination of potential negative impacts, mitigation measures and as an important part of the process of identification of best technology for the project.

However, beneficial results of non-development options cannot be ignored. These benefits include ecological and environmental preservation, and the reduction of stress to existing flora and faunal assemblages. One of the primary habitats that continue to be degraded and lose its ecological characteristics is the mangrove forests, which is an important vegetation type of the coastal plains of Belize. Mitigation measures addressed elsewhere, call for the clearing of this vegetation by selectively identifying important plants within the zone of impact and ensuring their preservation.

The government is under pressure to improve the standard of living of the people. To this end tourism development has been earmarked as one of the most promising avenues to growth. As always the more relevant issue is how to steer this growth in a sustainable direction so that it will do the most good for all the local and national stakeholders. The question then becomes whether the approach to the project is sustainable socially, economically and environmentally and if not how could it fulfill these higher principles.

4.3 Technical and Economic Analysis

For a project to be viable it must ensure that the development is technically, economically and financially feasible. Cost Benefit Analysis (CBA) of projects of this nature often compares the economic feasibility of all options. CBA is concerned with an analysis of cost and benefits for the economy as a whole. The objective is to know the difference between social benefits and social costs.

During the analysis, financiers also looked at the need to develop the site using the most practical technology bearing in mind the objective of maintaining as much as possible, the ecological integrity of the area and the habitats it supports.

Technical and economic feasibility is then weighted against environmental /ecological degradation. Consideration of technical and economic analysis included consideration for population density, suitability of site, accessibility, and protection against natural disasters, construction costs, recreational benefits, job creation and revenue generation.

4.4 Conceptual Strategy for Alternative Analysis

The alternatives to development for the proposed expansion project are outlined in the rationale and the strategy approached of the particular alternative. This new approach is delineated by the different options that are available for discussion and the magnitude and scope of the related impact. The following sections summarize the different development alternatives and their related impacts to the receiving environment.

4.4.1 Potable Water Alternatives

Considering the different options for potable water sourcing, the proposed expansion project has opted to consider three development alternatives. These three options will be looked at from all angles including their related impacts on the receiving environment. Table 4.1 summarizes the options evaluated for the proposed Hugh Parkey's Belize Adventure Island expansion.

Incorporated into the options are also the associated components that will be required to be installed. In addition, the several treatment methods that will be involved by each option will be explored. These alternatives are in response to the sourcing of potable water as defined in Section 3.2.3 and Table 3.4.

Source Alternatives

The required volume of 47,950 gallons/day (See Table 3.2) will be primarily met by rainwater harvesting as described previously. Since the island has little or no ground water potential, various other possible sources or alternatives were investigated to supplement the primary source. Therefore, in considering the existing constraints, the following three (3) alternatives were examined.

- *Desalinization*

The proposed expansion will make use of a desalinization plant (Reverse Osmosis) capable of producing 15,000 gallons of freshwater per day. The plant will be installed beside the existing plant and the desalted water will be transported to the different development zones by a series of transmission mains. The demand from this plant will vary depending on time of year (rainy / dry season).

Probably only one plant would be acquired to accommodate the varied demand and to have backup in place. The input source will be extracted from an abstraction well and the brine will be disposed into an injection well and into the receiving environment. This volume should be miniscule and will instantaneously be dispersed into the deep injection well where it will be safely disposed.

- *Importation*

Importation of water would only occur as a last resort if the desalinization plants were to malfunction. Imported water would be pumped into the reservoir system that will serve as catchment for the rainwater. This method would be restricted and limited to important areas of the development only.

- *Recycling*

Approximately 32,983 gallons (70 %) of good quality treated and post chlorinated effluent will be produced by the treatment plant. This recycled water will be pumped on a demand basis into dedicated distribution lines for flushing toilets. Some 14,864.5 gallons per day will be required for this purpose. The remaining volume will be use for the irrigation of the relatively extensive lawn of the primary development area.

During the construction of phase 1 a color coded systematic recycled distribution system was put in place. This dedicated distribution system would be expanded to the different development zones to deliver recycled wastewater to the building which will also have a color coded

plumbing supply lines to the toilets. This mechanism is important in preventing cross contamination of other transmission lines.

Table 4.1 Summary of Alternative Potable Water Sources

Option	Source	Rationale	Strategy	Impacts
Water Desalinization	Sea, brackish water from perforated wells	This is a very good option. The concerns are that the initial cost is expensive, the energy consumption is high, thus resulting in a high operating and maintenance cost.	Perforated well(s) along with sea abstraction, use of membrane filters, deep well injection for brine, mechanized pumping system with distribution mains and valves.	High water demand requiring bigger plant – minimal volumes of brine that will be required to be injected into deep wells. High overhead expenses at first – use of pressurized systems may require careful maintenance
Barging water to the project site from Belize City and neighboring communities	BWS, community wells	Importing almost four thousand gallons of water on a daily basis requires a dedicated service boat for this purpose.	Barging of water from a dock to dock location, employing pumping mechanism for loading and unloading along with storage tanks on project site	Barging to project is too far and would be expensive considering fuel and transportation costs. This method is prone to accidents at sea.
Wastewater Recycling (Post Chlorinated wastewater)	Wastewater Treatment Plant (BESST System)	Recycling of treated wastewater for flushing of toilets only will reduce the overall water demand on the primary source	Dedicated color coded line will be used for flushing of toilets.	Cross contamination due to improper valve setup. Contamination of land due to leaks, and plant malfunction.

4.4.2 Wastewater Treatment Alternatives

It is anticipated that the proposed development will take into consideration the possible wastewater treatment alternatives described in Table 4.2. As mentioned previously, the project chose a package system with secondary treatment capacity (See Section 3.3.5) such as the BESST or its equivalent for its phase one development. Based on this, various alternatives were

sought and therefore the project will consider the different criteria that will be influencing the proposed alternatives. The various options considered made the following assumptions:

Option # 1 “Individual Treatment Systems”. This system assumed that each separate infrastructure unit would consider installing individual units with the same secondary and tertiary treatment capacities. However, these systems would be individually owned instead of owned collectively.

Option # 2 “Household Systems”. This option considered using Individual Septic Tank Systems, with appropriate leach fields.

Table 4.2 Generic Evaluation of Wastewater Disposal Alternatives

Option	Rationale	Strategy	Impacts
‘Individual Treatment Systems’	Individual treatment units in the buildings would treat waste more effectively and efficiently, lower impacts to receiving environment by means of secondary and tertiary treatment	Individual connections with mechanized pressure systems. Individual reservoir for treated wastewater and subsequent disposal	Medium to high environmental impact due to volume of projected wastewater and sensitivity of the receiving environment. Installation of excessive force mains making it vulnerable to leaks and system malfunction, installation of numerous systems to cope with projected wastewater generation and too many sampling points. Effluent might not meet DOE requirements.
Household Systems	Individually operated system can collect building’s waste water and offer moderate treatment – Dimensions would vary according to number of wastewater generating sources	Gravity feed system involving leach or tile field disposal. Plumbing and gradient considerations.	Not acceptable since area is in contact with the marine environment which influences the functionality of ‘soak away’ to reduce nutrients and fecal pathogens...Possible leaching of effluents into sea which threatens both human health as well as threat to the

			environment from eutrophic or nutrient enrichment influences.
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4.4.3 Solid Waste Disposal Alternatives

In discussing the alternative analysis for the project’s solid waste disposal methods, the development considered and evaluated two disposal options. This approach is important in considering that this action would eliminate the dependency of having a single disposal method, especially considering the nature of the operation, location of the project and fragility of the receiving environment.

Disposal Alternatives

Due to the pre-existing conditions, the alternatives for solid waste disposal are limited to two as listed below:

- ▶ **Option # 1**, on site disposal with some classification
- ▶ **Option # 2**, disposal of all waste to caye dumpsite

Table 4.3 summarizes the disposal alternatives for the subdivision project considering the following elements:

- The first option considered the disposal of the solid waste at a site within the project area.
- The second option was to consider the carting out of both the organic and inorganic (combustible/non combustible) waste to the Belize City dumpsite after relevant approval.

Table 4.3 Domestic Waste Disposal Option

Option	Source	Rationale	Strategy	Impacts
Domestic Waste				
On Site Disposal with minor classification	Construction and operation of proposed project	Rapid disposal of generated waste, as well the utilization of waste to fill low lying area of the project site	Site selection of appropriate areas within project site. Rapid collection and disposal mechanisms for solid waste.	A disposal site on the caye would contaminate the site with pests and diseases as well as the need for adequate land. Water contamination can also occur given the nature of the project location. Moreover, impacting a new site on the property

Option	Source	Rationale	Strategy	Impacts
Barging of both organic and inorganic waste to dumpsite.	Construction and operation of proposed project.	Removal of 100 % generated waste from project site. Significantly reduce impact to receiving environment.	Daily collection and disposal of waste. Provisions for adequate containers for waste collection and transportation to minimize leachate spills and/or leaks.	would threaten the receiving environment. Barging generated waste without classification would not benefit the project site. Disposal of waste at the Belize City dumpsite would incur additional operational expenses.

4.4.4 Energy Generation Alternatives

Development alternatives are an important concept in any environmental impact assessment. As part of the alternative analysis for energy generation, the proposed expansion project will explore its only available alternate source of energy that will suffice the energy demand. This approach is essential considering that this would simply eliminate the dependency of having a single source of energy. The following section summarizes the source description along with their respective impacts.

Table 4.4 Alternative Analysis for Energy Generation

Option	Rationale	Strategy	Impacts
Diesel Generators	In view of a continuous energy supply over an extended period of time, Hugh Parkey’s Belize Adventure Island is considering the use of its existing diesel generators as its supplementary source of producing electrical energy for the expansion phase. This option was chosen because the wind speed and duration can be hampered by climatological	The developer will therefore utilize diesel generators to produce and supplement the wind energy. Considering this, the project plans to utilize its existing two diesel generators capable of generating 1,000 KW a day. Generators will be purchased according to the project’s energy demand.	Generators tend to create excessive noise pollution as a result of their operational process. Pollution risk due to accidental spill from fuel and oil storage tanks can also occur. In addition, air pollution and combustion fumes can pose serious health risk to the humans and contaminate the air over prolonged operation.

	conditions that can reduce the energy deficit.		
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4.4.5 Siting and Placement

The proposed expansion areas will be developed on the zones designated by the project proponents in phase 1 in order to maximize their investment returns. The eventual siting and placement of the overall development and its associated components will play an integral part in the decision making process and more so in this Section.

The general principle involved in identifying option(s) to the proposed development is to ensure that the option chosen, which indeed may be the ‘non development’ option, would result in optimal returns in social and environmental capital: In other words the option chosen should bode well not only for the developer, but also for the environment and stakeholders in the area and by extension the nation. The various options are detailed in Table 4.5 below.

Table 4.5: Options for Development

Development Issue	Option #1 & Justifications (Chosen Option)	Option #2 & Justifications	Option #3 & Justifications (Non- Development)
Overall Development	Location of development phases is consistent with the investor’s development policy for optimum investment return. Location is also consistent geographic occurrence of primary resources.	Other areas would jeopardize investor’s development plan as outlined by the owners. In addition, possible related impacts can be augmented.	Caye in predevelopment state has no economic impact, thus non-development option means potential loss of capital

			investment and revenues.
Siting of North Island Development	Location would maximize investment returns and would utilize ‘less green areas’.	Other areas can accommodate existing north development but would not be as economically achievable.	Development is necessary for capital investment and revenue generation.
Siting of West Beach recreational Area	Site chosen is sandy and requires less reclamation. Beach is designed to expand the range of experiences to visitors to the caye...Thus this decreases the intensity of use and hence impact on any given facility of the proposed development.	Siting of Recreational Beach on southwest or east end of caye would require more reclamation, potentially greater cost to the environment and would be less aesthetic.	Non-development option would forego any revenue generation possibilities and would eliminate one of the primary attractions to site.
Development Issue	Option #1 & Justifications (Chosen Option)	Option #2 & Justifications	Option #3 & Justifications (Non-Development)
East Side	Development of the main existing arrival area of the project site. Added development would increase investment returns and would maximize the available land area.	Minimize development and prolong investment return, maintenance and expansion potential	No –Action option would not maximize the potential investment return and would not support the intended interest.
South island	Development of the South Island would complement the tourism activity presently proposed on the caye.	Minimize development and prolong investment return, expansion potential, maintenance etc.	No development would jeopardize other components of the proposed expansion project
Kayak Trail	Utilize naturally existing canal traversing the South Island for kayak activity only	Use of canal for limited boating and kayak activity	No-Action would not maximize the naturally existing canal.
Siting of Primary Development Infrastructure	Chosen site has advantage of pre-existing infrastructure which will be expanded and improved in many instances...Area is also previously	Any other site on caye would require major dredging, which would be costly in both environmental and financial terms.	Non-development option is not feasible given that current primary development site is main focus of

	reclaimed, thus option will be less costly on the environment as well as financially.		development which if not implemented would severely constrain and make infeasible other aspects of the development.
Overwater Cabañas	Siting Over-water Cabanas in East Side of Island: Location is in shallow seas on side of island with prevailing wind – This provides requisite vista and ambience, especially with respect to biting insects and other nuisance pests.	Siting on Western side of Caye would expose the cabañas to wind gusts and increased wave action; in addition, the guests would not appreciate the beauty of the existing mangrove buffer zone.	Non-development option: Would significantly erode salability of project with consequent loss of jobs and earning power without any good environmental, social or economic justification.
Development Issue	Option #1 & Justifications (Chosen Option)	Option #2 & Justifications	Option #3 & Justifications (Non- Development)
Boardwalks	Use of elevated board walks to facilitate the movement of visitors and guests to the different development areas proposed by the expansion project. Important in considering that the proposed board walk would have minimal environmental impact	Construction of access paths through tidal mangrove swamps to facilitate the movement of visitors and guests.	No-Action alternative would not facilitate the transportation and movement of materials, guests and staff.
Islands	Use of constructed islands to successively link board walks. Islands would be constructed out of ‘pimento and filled with dredged spoils’. ‘Islands’ can be constructed to support single dwellings (cabaña, tree house etc.)	Construction of islands would facilitate the placement of dredged spoils and avoid the expansive transportation of spoils from one place to another.	No-Action alternative would place fill material in other areas not suited for reclamation. Alternative would also decrease the aesthetic value of the board walks

Marina Services	Placement of marina services at the entrance of the channel would facilitate the servicing of marine vessels and would not influence the navigability of the marina areas. Anticipated response time to any hydrocarbon spill/leak can be quickly contained giving the ample space.	Placement of this service elsewhere would be unsuccessful considering the location of the marina and its docking services.	No Action on this alternative would be detrimental considering the distance between the caye and Belize City, especially if the marina is to cater to small marine vessels
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4.4.6 Dredging and Land Reclamation

The proposed expansion development will require some dredging for land reclamation process that will alleviate some portions of the caye presently inundated by the tides. In considering the development alternatives for the dredge fill, the following table summarizes the siting and placement of the coastal burrow pits that will be utilized for land reclamation processes.

Table 4.6 Land Reclamation Activities

Option	Rationale	Strategy	Impacts
Proposed Locations	Primary needs for dredging is to source landfill material to reclaim cayes – without reclamation, caye remains largely inundated and in large part at or below sea level. The Non Development Option is untenable given the nature of the existing environment. Project not technically or economically viable without reclamation	Use of suction dredging machine along with a ‘cutter head’ to remove sediments from the sea floor. Use of pontoons to support pipeline network, construction of spoils containment areas.	Anticipated impacts would require successful mitigation measures to be in place as described in Section 6.3.1.
Use of existing dredged sites	Expansion of existing dredged site to complement or reduce the proposed dredged sites	Use of suction dredging machine along with a ‘cutter head’ to remove sediments from the sea floor. Use of pontoons	Impacting an already disturbed site will cause minimal environmental impact, nevertheless, the dimensions and

		to support pipeline network, construction of spoils containment areas.	volume would be modified possibly leading to more environmental impacts in and around the immediate area.
Transportation of fill material from inland sources	Reduce overall dredge related activity impacts on receiving environment	Selection of inland source with transportation of material by trucks and barge respectively.	Minimal impact, however the venture would be extremely expensive and would not be of native materials that are required for project expansion.

4.4.7 Marina Development Alternatives

It is anticipated that the proposed expansion for Hugh Parkey’s Belize Adventure Island will incorporate the construction of a marina that would facilitate the berthing and docking of marine vessels along with the proposed services and amenities that accompany such a venture. In considering the development alternatives for the proposed marina, the following table summarizes the various options that can be applied to the construction of the project in relation to the anticipated impacts and in addition to the required flushing effects.

Table 4.7 Marina Development

Option	Rationale	Strategy	Impacts
Proposed Location	Fit the natural contour of the lagoon as well as to minimize impact to the receiving environment. Placement would reduce incidence and other accompanied problems of open water marinas coupled with increase shelter availability.	Installation of the entire possible marina related infrastructure including environmental, safety and health concerns.	Minimization of marina related impacts due to the setting of the marina infrastructure within a natural channel contour.
Beside docking area	Utilization of available area suited for marina construction. Easy	Installation of all the possible marina related infrastructure including environmental, safety	Limited docking facility coupled with increase traffic and marina related impacts.

	docking access and other benefits such as transient time etc.	and health concerns	Generation of additional wakes within the transient zone. Increase hydrocarbon spills and leaks.
Flushing Canal	West of proposed marina location ideal for canal placement to enhance flushing of the marina and adjacent areas during tidal activity.	Dredging of a canal west of the marina to enclose the mangrove wetland.	The location of the flushing canal would impact the natural flow of the low lying areas during the tidal activities.
No Canal to enhance the flushing effect	Conservation of mangrove area west of marina and conservation of area north of marina.	Use of natural tidal and wave action activities along with natural drainage of area to enhance the flushing effect of the marina.	No known impacts in relation to the actual dredging of the canal.

4.4.8 Ecological Development Alternatives

In considering the ecological importance, mainly the conservation of the mangrove buffer zone, the expansion project will incorporate a few development alternatives that will address the issue of conservation and protection. The following table summarizes the ecological alternatives of the proposed expansion project.

Table 4.8 Ecological Alternatives

Development Issue	Option #1 & Justifications (Chosen Option)	Option #2 & Justifications	Option #3 & Justifications (Non-Development)
Land Clearance	Selective clearing and pruning for the accommodation of the different infrastructures. This would allow for the conservation of the mangrove buffer zone presently circumventing most of the proposed expansion areas of the caye.	Other method of approach would not be environmentally sustainable given the scope of the proposed expansion project and the placement of the different type buildings in the layout design.	No-Action alternative would conserve the mangrove areas but would not allow for any development thus reducing the potential investment return.
Land Reclamation	Reclamation activities to be carried within scope of development plan. Carrying out reclamation	Partially undertaking such activity would not suffice the project needs for maximum	No-Action alternative would pose a serious risk to the caye, especially considering

	activities in areas slated to be reclaimed	investment returns and tidal rise influences	global warming and the effect of tidal rise.
Open Space	Availability of 'open spaces' within the confines of the expansion project would facilitate the development with a reduced density value contained in the project areas	Lack of the 'open spaces' would increase the human carrying capacity and increase the associated anticipated impacts related to domestic and tourism activities.	No-Action alternative would jeopardize the investor's development policy for the caye in that there would be no buffer zone and no mangrove protection scheme in promoting ecotourism.

4.5 Conclusion

In accessing the comparative evaluation of the different development alternatives presented for the proposed expansion project, the proponents plan to exercise these alternatives as seen fit. This of course, will fall within the scope of the overall environmental performance of the chosen 'alternative' and its associated impacts to the receiving environment.

In any event, it is necessary to layout the different options that are available in order to safeguard the environment and its interconnected elements. In considering the different development alternatives presented, the comparative process stems from both the rationale and strategy approach that was devised to discuss the alternative. Therefore, it is in the best interest of the governing body to 'compare and evaluate' the options described.