8.0 Identification and Assessment of Potential Impacts

The impact assessment provided in this Section complies as far as possible with the EIA TORs issued for CEC by the EMA. This Section of the EIA report is subdivided into three broad parts. Part 8.1 outlines the scope and objectives of the impact assessment section. Part 8.2 outlines the methodology used to predict, describe and assess the significance of potential environmental and social impacts and risks. Part 8.3 applies this methodology to the description and assessment of potential impacts and risks that may arise from the proposed project. Part 8.4 details the actual impact assessment. Part 8.5 comprises summary tables. Part 8.6 addresses the **cumulative impacts** associated with the project and finally Part 8.7 looks at the significance of residual impact.

8.1 Scope and Objectives

The baseline environmental study (**Section 5.0 – Description of the Environment**) and relevant ***Appendices E1, E2, E3 and E4*** provide a description of the area affected by the proposed development plans for Kilgwyn and its main social, air and noise characteristics. It identifies key trends and pressures, showing how these would be affected by the proposed project. A “focusing procedure” has been used to identify the main concerns and issues which need to be considered with respect to the project activities and to confirm ‘valued receptors’ which might be affected by the proposed hotel at Kilgwyn. This combined understanding of the project and the environmental and social conditions in the area forms the basis of this Environmental Impact Assessment (EIA).

8.2 Methodology

The approach to assessing impacts on the biological, physical and social environment was determined through scoping. The approach was commensurate with the potential impacts and risks of the project as well as its associated facilities and with the environmental, biodiversity, and social characteristics of the project area and its area of influence. The potential changes to these features/characteristics that may result from the proposed project are then predicted, described and evaluated using a significance ranking process. The assessment focused on the interactions between project activities, processes, and products and the key environmental features in the project area (and its area of influence) assessing direct, indirect, and cumulative potential impacts and risks to these features. Key project impacts addressed includes; loss and fragmentation of habitats, changes in air and water quality from emissions, effluents, light pollution, noise pollution, sedimentation, changes in micro-climate and changes in land use.

The magnitude of the potential impacts and the risk were estimated based on the likelihood of the impacts. Residual impacts which will occur despite the proposed project alternatives, mitigation strategies and management plans are also discussed.

Consideration was given to the scale of the unique ecology, vulnerability and geographic extent of the feature being affected. Unique ecosystems, species, habitats and environmental services that may only occur in Kilgwyn or Tobago or are endangered/threatened globally were considered highly irreplaceable. Vulnerability relates to the sensitivity of the feature to threats and depends on existing and cumulative future threats to that feature. A vulnerable environmental feature is one that has experienced rapid loss, deterioration or destruction over recent history. Evaluating environmental and social risk therefore requires an understanding of the spatial and temporal severity of the impact, the irreplaceability and vulnerability of the feature, and the likelihood of an impact occurring.

It should be noted that the following were also taken into consideration during impact analysis:

- The Consultants' experience,
- Documented impacts from similar projects,
- The data collected,
- Analysis of the processes in the proposed project,
- Information generated from models,
- Concerns raised from stakeholders in the social surveys; and
- Discussions held among the EIA Study team.

8.3 Impact Prediction and Description

Impacts that may be experienced as a result of a proposed project are predicted and described for each identified VR. The process begins with a qualitative description including the **nature** of the impact (i.e. whether it is direct or indirect), the **class** (positive or negative) and the **likelihood** of the impact occurring. However, to assist in the later assessment of impact significance, a broad ranking is applied to each potential impact. This is achieved by assigning numerical values to several defined descriptors and using these values to give a predicted impact magnitude. The descriptors are grouped into 'basic' and 'supplementary' criteria, as follows.

8.3.1 Basic Criteria

The basic descriptors used in the consideration of potential impacts are as follows:

1. Class: either beneficial (positive) or adverse (negative).
2. Severity (Magnitude): Proportion of the VR that will experience the impact in relation to the total resource.
3. Spatial extent of impact: the geographical area over which the impact will be experienced.
4. Duration of impact: the length of time over which the effect will be experienced.

Class

For each negative potential impact, a numerical value is assigned for each of the severity, spatial extent and duration criteria, according to the following guidelines (potential positive effects are noted as such but are not subject to further numerical interpretation).

Severity

The severity of the potential impact is allocated one of the following numerical values:

1: (negligible) - less than 1% of the VR is likely to experience the described impact

2: (low) - between 1% and 10% of the VR is likely to experience the described impact

3: (moderate) - between 10% and 50% of the VR is likely to experience the described impact

4: (high) - between 50% and 80% of the VR is likely to experience the described impact

5: (very high) - greater than 80% of the VR is likely to experience the described impact

Spatial extent

The spatial extent of impact is allocated one of the following numerical values:

1: Impact will be experienced only in the immediate area of the activity

2: Impact will be experienced in the local area

3: Impact will be experienced on a regional scale

4: Impact will be experienced on a national scale

5: Impact will be experienced on an international scale

It should be noted that for physical impacts on air and water quality, the proportion of VR affected, and the spatial extent of impact are synonymous.

Duration

Duration of impact is described by one of the following numerical values:

1: Impact will be experienced for less than one year

2: Impact will be experienced for one to five years

3: Impact will be experienced for five to ten years

4: Impact will be experienced for greater than ten years but less than 70 years

5: Impact will be more than 70 years

It should be noted that the concept of duration of impact may differ for different potential impacts. An impact may be present only while a project activity is active (e.g. noise), or it could persist long after the project activity has ceased (e.g. visual scarring of the landscape). In the latter case, duration of impact may be regarded as the time the VR needs to recover from the effect. Thus, the duration of impact descriptor incorporates the concept of reversibility or irreversibility of an impact.

Each potential impact is allocated a 'basic impact index', obtained by averaging the three numerical values assigned respectively for severity of impact, spatial extent of impact and duration of impact. The average is rounded up to a whole number where necessary; thus, the basic impact index is a number between 1 and 5.

8.3.2 Supplementary Criteria

The following supplementary criteria may be important in the description of certain potential impacts:

1. Cumulative effects: an impact may be enhanced as a result of the effects of other similar existing or future impacts.
2. Synergism: the interaction of two or more impacts to produce a new or enhanced effect.
3. Controversy: impacts may be enhanced by public interest or perception.

As with the basic criteria, each potential impact is assigned numerical values in terms of the supplementary criteria, according to the following guidelines.

The potential for the impact to be enhanced by **cumulative** effects is allocated a numerical value as follows:

0: no enhancement due to cumulative effects is expected

1: cumulative effects may enhance the impact

2: cumulative effects will probably enhance the impact

3: cumulative effects are highly likely or certain to enhance the impact

The potential for each impact to contribute to a synergistic effect is allocated a numerical value as follows:

0: no synergistic effect is expected

1: a synergistic effect is possible

2: a synergistic effect is probable

3: a synergistic effect is highly likely or certain

The potential effect of controversy on an impact will be allocated a numerical value as follows:

0: no controversy or public interest is expected

1: public controversy may enhance the impact

2: public controversy is likely to enhance the impact

3: public controversy is highly likely or certain to enhance the impact

Each potential impact is allocated a 'supplementary impact index', obtained by averaging the three numerical values assigned respectively for cumulative, synergistic and controversial effects. The average is rounded up to a whole number where necessary; thus the supplementary impact index is a number between 0 and 3.

8.3.3 Impact Magnitude

The predicted magnitude of each potential impact is obtained by comparing the basic and supplementary impact indices as indicated in Table 9-1. The magnitude of impact is categorised as very low, low, moderate, high or very high.

8.3.4 Assessment of Impact Significance

The significance of each potential impact is ranked by comparing the impact magnitude with the VR sensitivity, as shown in Table 8-2. The impact significance is classified as insignificant, minor, moderate or major. Those impacts classed as 'moderate' or 'major' are deemed to require mitigation measures to reduce the significance to 'insignificant' or 'minor'.

8.3.5 Likelihood and Non-Routine Events

It should be noted that the foregoing approach has been formulated to assess potential impacts resulting from expected or routine project activities. The method therefore assumes that the project activity which may cause the impacts will definitely occur. The assessment then considers the degree to which the VR will be affected by the activity. However, the environmental impact assessment must also consider events that are not planned but which may occur in association with project activities. Such 'non-routine events' (upset conditions) are generally incidents or accidents that have the potential to result in a greater impact significance than routine events.

Table 65 - 8-1: Impact Magnitude.

		Basic impact index				
Supplementary impact index		**1**	**2**	**3**	**4**	**5**
	0	Very low	Low	Moderate	High	Very high
	1	Very low	Low	Moderate	High	Very high
	2	Low	Moderate	High	Very high	Very high
	3	Low	Moderate	High	Very high	Very high

Table 66 - 8-2: Impact Significance.

		Impact magnitude				
VR Sensitivity		Very Low	Low	Moderate	High	Very high
	Low	Insignificant	Insignificant	Minor	Moderate	Moderate
	Moderate	Insignificant	Minor	Moderate	Major	Major
	High	Minor	Moderate	Major	Major	Major

The evaluation of impacts arising from non-routine events is accomplished using the same methodology as for routine project activities. However, it must be emphasised that, as noted above, the method does not address the likelihood of the non-routine event occurring. Rather, the method considers the degree to which VRs may be affected assuming that the non-routine event happens. The incorporation of the likelihood of occurrence of a non-routine event into the methodology would always generate a very low impact magnitude, and an insignificant or minor impact significance because by definition such events are unlikely to happen. In comparison, the adopted approach serves to identify the VRs most at risk should such a non-routine event occur.

8.4 Impact Assessment

As stated above environmental impacts are caused by environmental aspects (project activities) and can have either a direct impact on the environment, contribute only indirectly to a larger environmental change or be cumulative in nature. This section reviews each of the environmental aspects described in the detailed project description (**Section 3.0 – Description of Project**) in relation to the VRs likely to be affected. The predicted impacts that may occur are then discussed. The initial qualitative description of the potential impacts discusses how they could arise, together with the relevant pathways. The likelihood of the impact occurring is also discussed and any impacts that could potentially be legally non-compliant are highlighted, if applicable. These criteria, however, are not used in the numerical assessment of significance. Whilst a description of likelihood provides the reader with the estimated probability of an impact occurring, the significance is assessed assuming that the impact does occur. It is assumed that all aspects of the project will be legally compliant.

Note that the mitigation measures proposed to limit these impacts are presented in **Section 9.0 – Mitigation Strategy and Environmental Management Plan** of this document.

8.4.1 Valued Receptors

A valued receptor (VR) is any part of the environment that is considered important or valuable, and merits detailed consideration in the EIA process. In this context the broadest definition of ‘the environment’ is applied, such that VRs may be selected according to economic, social, aesthetic or ethical criteria, as well as by consideration of physical and biological characteristics. The process of selecting VRs may consider legal status, scientific or cultural value, and public perception; and may account for the

views of national or local government, international, national or local non-governmental organizations, or the general public.

The selection of VRs is dependent on the nature of the proposed project, because only those environmental components that have the potential to be affected by the project are selected. This is based on the types of interaction with the environment that the proposed project is expected to have, given its component activities and area of influence. The likely sensitivity of VRs is given a rating (low, medium or high) and this is considered when assigning weightings during impact evaluation. This impact assessment has focused on the VRs, presented in **Table 8-3**.

Based on the baseline studies conducted to date for the proposed project and the existing environmental conditions in the study area, the VRs identified for this project and the reasons for their identification are listed in Table 9-3. These VRs have been chosen based upon the data available at present, however studies conducted in the future may identify additional VRs.

Table 67 - 8-3: Valued Receptors (VRS).

Category	VR	VR Sensitivity	Why is it important?
Air and climate	Air quality	Moderate	Health implications on neighbouring communities. Ecological implications of neighbouring areas. Cumulative impacts in combination with other industry in the area.

Category	VR	VR Sensitivity	Why is it important?
	Global climate	Moderate	Changes in the global climate are leading to far-reaching consequences such as higher frequency of extreme weather events and sea-level rise.
Land	Noise	Moderate	Disturbance of neighbouring human and faunal communities and loss of associated aesthetics for the area.
	Visual Light	Moderate	Disruption of diurnal/circadian patterns for nocturnal species of fauna. Change in local aesthetics for local (human) communities.
Water	Surface Water (Freshwater Environment)	High	Potential contribution to degradation of the adjacent waterways and marine water quality from solid waste and wastewater generation
	Stormwater/ Flood control	High	Loss of infiltration and percolation with increased impervious surfaces with associated infrastructure
	Marine Habitat Quality	High	Direct and indirect impacts to marine wildlife and human users of the sea. Cumulative impacts in combination with other activities (e.g. Airport) in the area.

Category	VR	VR Sensitivity	Why is it important?
Ecology and Biodiversity	Bird communities	Moderate	Modification of 13.28 Ha of niche habitats (i.e. scrub mangrove, herbaceous wetland, ponds and littoral woodland).
	Fish and Aquatic Invertebrate Communities	Low	Loss of freshwater habitats through infilling and impact to existing drains within the wetland system. Loss of edible species of fish and crab from the wetland.
	Other fauna	Low	General biodiversity value.
	Terrestrial biodiversity (flora)	High	General biodiversity value.
	Local and regional communities in the Southwest Tobago area.	High	Provides community and services for Tobagonians. Quality of life for local and regional communities.
Human Environment	Local economy	High	Increased direct employment opportunities for local workers.

Category	VR	VR Sensitivity	Why is it important?
			Static or decreased opportunities for small businesses or cottage industries as 5-star all-inclusive hotels encourage guests to stay on site and enjoy the services and amenities on site.
	Local community	Moderate	Loss of aesthetic appreciation of mangroves by local and regional communities.
		Low	Loss of recreational and subsistence crab catching activities.

8.4.2 Air And Climate

8.4.2.1 Air Quality

Air quality is considered a VR due to the links between air quality and quality of life in general (human and floral / faunal). Reductions in air quality are likely to occur through emissions of gases (including CO, CO_2, NOx, and SO_2), particulates (PM_{10}) and volatile organic compounds (VOCs) and total suspended particulates (TSP). Dust generation may also contribute to a degradation of local air quality.

- Emissions
  Within the context of this project during the construction phase, it is likely that the emission of air contaminants will occur as a result of the following:
- Shipping movements, (as materials and equipment will be initially transported by sea);
- Use of chemicals and solvents, (such as lubricating and fuel oils, acids and caustics, sodium hypochlorite and compressed gas cylinders);
- Use of equipment and machinery (including sheet piling equipment);
- Use of vehicles (e.g. mobilization of personnel, materials and equipment to the area and waste transfer lorries from the area).

The most significant impact on air quality arising from routine project activities will occur from the emission of exhaust gases and particulates from vehicles and equipment (engines and generators). Vehicles and equipment will be used in virtually all aspects of the construction of the resort, whether during the mobilization of personnel, materials and equipment to the area; the use of generators; or ongoing, day-to-day vehicle use. The main gases of concern include Sulphur dioxide (SO_2), the concentration of which is directly dependent on the Sulphur content of the fuel; nitrogen oxides (NOx), which can contribute to pollution in the form of acid rain and disturbances of the ozone layer; and carbon dioxide (CO_2), which is directly related to the total fuel-oil consumption and is a large contributor to climate change.

The emissions of VOCs likely to occur during the combustion and evaporation of welding works as well as evaporation from paints and solvents used on site will be released in small quantities and be localised in effect. With respect to process activities linked to the unloading, storage and transportation of materials, emissions of PM and VOCs may occur. We assume that up-to-date technology will be implemented by building contractors and therefore emissions are expected to be insignificant.

Offsite emissions are likely to be produced throughout the supply chain (procurement of materials). Sources will include the import of materials via road and sea and the manufacturing process of materials, including concrete and steel. The energy-intensive manufacture of these products results in emissions of greenhouse gases (for example, the production of 1 tonne of concrete yields 1 tonne of CO_2) as well as NOx, SOx, CO and PM.

The abovementioned activities, during routine operations, are likely to result in emissions that are highly localized to the source. Those most likely to be affected by reduced air quality are operators of vehicles and equipment, and this should be considered as an occupational health issue. Moreover, communities located along roads and access routes to and from the project site may also be affected by reduced air quality during peak traffic times due to an increase in heavy goods vehicles / trucks in the area.

Emissions of VOCs and PM_{10} that are generated from the construction activities at the resort will persist as long as construction activities are being undertaken, and the effects are likely to be localized.

Trade winds from the east will carry emissions offshore, away from local communities and floral and faunal populations, and this reduces the likelihood of significant negative effects at the local level. As such, the significance of the impact on air quality arising from project emissions is expected to be moderate in this context.

- Dust Generation
  Dust will result from the following project aspects:

- Earthworks (including stockpiling, compaction and grading);
- Construction of access roads (including grading);
- Construction of drainage system (including excavation for piping);
- Vehicle use;
- Pile driving; and
- Transfer of materials

Dust-generating activities are almost exclusively linked to the construction phase. The movement of vehicles on unpaved surfaces can generate large quantities of dust. The action of wind during dry conditions on exposed stockpiles of soil and aggregates stored on site, as well as on any un-paved roads and surfaces, will also exacerbate dust generation. The installation of the perimeter fence will require pile driving or drilling, which may also lead to the generation of dust.

Driving and transport of materials and equipment will be the main sources of dust-generation during the operations phase. However, these are unlikely to be present in sufficient concentrations to result in ecological health impacts.

Dust generation will have localized effects; dispersal is typically limited to several hundred metres from the source (UN, 1992) but it can also affect the wider region when transported by wind. However, given that the prevailing winds are from the east, it is expected that dust will be transported away from construction sites and could lead to effects on marine water quality and associated marine and coastal biodiversity.

Dust generation from the construction and hotel operating activities will cumulatively add to the already-present direct and indirect negative impacts from dust generation from the airport operations.

Impacts are highly likely; however, due to their localised nature and the fact that the majority of dust generation will stop with the cessation of the construction phase, the overall significance of impacts from the generation of dust is expected to be temporary minor.

8.4.3 Land

8.4.3.1 Nuisance from Noise

The use of construction equipment and machinery will be the key source of nuisance impacts such as noise and vibration, and in particular sheet piling activities. Increased use of heavy vehicles and equipment may also increase noise emissions and vibrations through the neighbouring wetland systems. However, the main impacts are expected to last only throughout the construction phase, for preparation of the site, transportation of materials to the site and the building of structures associated with the resort.

Wildlife inhabiting the remaining littoral forest and mangrove edges are likely to be affected or disturbed by the increases in noise generated from construction activities as well as the increased presence of people. Increases in noise may cause temporary behavioural changes with regard to fauna or the net migration of species to neighbouring wetland/forests with similar niche habitats (e.g. Buccoo Mangrove, Friendship Mangrove).

Noise and vibrations generated during construction may have a negative impact on the local communities of Tyson Hall and Friendship based on their proximity to the construction zone.

To mitigate the impact of nuisance noise on receptors within the immediate study area, it has been proposed that working hours during the construction phase be restricted to daytime only. It is also anticipated that any noise generated will meet with the Noise Pollution Rules, 2001 for Trinidad and Tobago with respect to General and Sensitive

zones. The significance of impacts from nuisance noise is anticipated to be moderate during the construction phase of the project.

8.4.3.2 Visual

Negative visual impact may occur as a result of night-time lighting of the hotel during both construction and operation phases. Floodlights will be used across the site, which may be a nuisance to local fauna particularly (nocturnal) or cryptic communities in the area and organisms which rely on photic changes for the completion of diurnal cycles.

The effect of artificial lights on amphibians has not been well studied. However, most frogs are nocturnal, so it is expected that lights have an effect on breeding, feeding, and predator avoidance, as occurs in most other species of animals. Artificial lights have been found to alter nest hiding behaviour and possibly calling, affecting their breeding success. Some frogs gather at lights to forage, making them more susceptible to dehydration and predators, (as well as cars).

Sea turtles are the most well-known species of reptiles that are negatively affected by artificial light. This is particularly true for the beach where past studies have identified that the Hawksbill Turtle has nested in Kilgwyn (Cazabon-Mannette, 2018). Hatchlings can become disoriented by artificial lights leading the small turtles away from the safety of the water, where they succumb to dehydration, predators, or even being run over by human traffic. They also affect nesting females, who may spend valuable energy moving toward lights and away from the water instead of returning to the sea after nesting.

Most mammals are nocturnal. Studies have found that many small mammals eat less food in areas that are lit by artificial light, assumedly to avoid predators. Conversely, other studies have found that predators of small mammals, are attracted to lit areas, possibly for easy prey. Artificial light has also been shown to affect the circadian rhythm

of some mammals, extending the day of diurnal species, and shortening the day of some nocturnal species.

Artificial lighting is detrimental to many insect populations. Light can act like a vacuum disrupting normal flight activity, long distance migrations, or even attract insects that don't normally move from their habitat. Once the insects are effectively trapped by the light, they may be caught by predators, or they may stop to rest on the ground under the light, where they are also preyed upon. Many species of bats use artificially lit areas as an easy foraging ground, which can affect the local population of insects. Distant sky glow may also disrupt insect migrations. Light traps can change the diversity of insects. If a particular species does not reproduce rapidly enough to make up for the loss at the lights, it may disappear from the community. For insects that are important as pollinators, or predators of nuisance insects, their loss is detrimental to wetland and human communities.

Artificial lights can "trap" migratory birds by bleaching their visual pigments, causing them to lose sight of the horizon (particularly sea birds). They then can die from exhaustion or collision with a light source. Light extends the day for diurnal species of birds, making them more susceptible to predators, or causing them to breed too early since they associate breeding with longer days. It can attract seabirds away from their normal feeding grounds, possibly because these birds feed on bioluminescent sea animals and are cued into low levels of light.

The use of directional lighting for all outdoor light sources (which reduces the amount of light emitted in unwanted directions) should reduce light pollution caused during the construction and operation of the hotel. On the beach front “Turtle-friendly” amber or red lights can be deployed to reduce the disorientation of turtles which may seek to nest on the beach.

The significance of impacts from pollution light sources is anticipated to be moderate during all phases of the project. However, with the addition of directed light sources, restriction of construction to daylight hours, red or amber lighting for areas near the beach and along paths bordering the mangrove offset reserve the residual impact of light pollution on fauna is expected to be low.

8.4.4 Water

8.4.4.1 Surface Water (Freshwater Environment) and Stormwater/Flood Control

Natural surface water drainage patterns are governed by land topography, surface geology (i.e. hard or soft rock) and land gradient. Drainage patterns indicate where flows of water travel over the ground and where particulate solids, nutrients, sediment, and pollutants might be collected and transported to the receiving surface waters.

Activities likely to have an impact on the surface water hydrology (and indirectly the freshwater and marine faunal communities of the area) include:

- Pre-construction works
- Land excavating, backfilling, soil compaction and grading works and
- Underground piping, duct bank, basins
- Stormwater Runoff
- Greywater contributions from hotel operations

8.4.4.1.1 Pre-construction

Drainage concerns for this development relate to the possibility of increased surface-water runoff from the development, following grading of the land for the area and the caulking and paving or impermeable surfaces as well as the establishment of buildings. The nature of the paved finish on the property will prohibit the infiltration of water into the ground. In the absence of suitable drainage channels, surface water would collect and run across the site, mobilizing any contaminants and transporting them into the adjacent waterways; and the Kilgwyn Wetland System.

The potential sources of surface runoff are:

- Rain or storm water from roofing on buildings
- Greywater generated from showers, taps, laundry and cleaning activities onsite

Increased turbidity due to runoff and sediment re-suspension during the construction works although of short duration, has the potential to mobilize a large amount of sediment. During the construction and operation phases, the use of fuels on the site increases the risk of leaks and spills potentially impacting on water quality through surface runoff, particularly if contaminants are concentrated around improperly maintained storage areas or from spilled chemicals such as coatings and paints. These chemicals can have an indirect impact of the freshwater biodiversity affecting both fish and invertebrate communities within the wetland based on their toxicity. Leaks and spills of fuel, chemicals and other liquids will be controlled at source and spill kits positioned at strategic locations on entire site. Construction and Hotel personnel will be trained in the optimum application of spill kits to various types of spills. The potential for soil erosion during construction works is also of concern particularly where bare soil / fill is exposed to rain and wind. However, these effects are expected to be of short duration (during early phases of construction only) and are easily mitigated through the provision of temporary site drains, swift paving of cleared areas and the covering of stock-piles.

The changes in drainage patterns will be permanent and surface water runoff will persist throughout the operation of the hotel, the potential impacts on water quality of the freshwater environment are expected to be observed with the wetland, as well as Kilgwyn Bay. Thus, protective measures of silt traps and spill kits must be installed and regularly monitored to ensure reduced contamination and smothering of freshwater and marine life (corals, seagrass beads and benthic invertebrates within the back bay of the Flying Reef. The monitoring plan should be guided by WPR, 2019 and USEPA guidelines.

8.4.4.1.2 During operation

During operation it is anticipated that storm water flows will increase as a result of increased impermeable surfaces, runoff from maintenance cleaning of the hotel site and from irrigation of ornamental gardens. To manage the flow rates of surface water and to manage the risks of potential flooding the developers have proposed a series of bioswales, retention ponds and well-designed drains which will not only reduce/manage the rates of flow to low lying points such as the sluice drain and mangrove wetland but also biologically treat the water (in terms of the bioswales) by removing excess nutrients in runoff. Bioswales are a landscape element designed to stabilize and remove nutrients and pollution from surface runoff water. They consist of a swaled drainage course with gently sloped sides and are typically filled with hydrophyte grasses, vegetation and compost. The water's flow path, along with the wide and shallow ditch, is designed to maximize the time water spends in the swale, which aids in the trapping of nutrients and pollutants. Studies of runoff in New York City United States, a highly urban area, have shown that bioswales can retained about 40% of stormwater conveyed to it from a drainage area 231 times its size, bioswales can leach nutrients into the subsurface flows with nitrogen pollutants having seasonal variations in leachate rates while phosphorus may have more consistent decreases in surface flows over the study period. The study identified that bioswales were capable of leaching a median 1.3 kg nitrogen per year into the subsurface and provide an aggregate decrease in watershed nutrient pollution, from 7.7 to 6 kg nitrogen per year, due to their reduction of combined sewer overflow via stormwater retention (Shetty et. al. 2019).

Therefore, the significance of impacts from the alteration of drainage patterns and surface water runoff is high to moderate during the construction phase of the project and the impacts from contaminated runoff during construction and operation phases are expected to be moderate**.** With the implementation of silt traps and retention ponds during construction the residual risk of flooding and transport of contaminants down-stream to the marine environment will be reduced to low or insignificant particularly if monitoring guidelines and protocols are implemented by management. The proposed

design plans for site hydrology include the use of retention ponds to mitigate flooding and ensure controlled water quality management, the use of step-up pumps to move water to wetland sites to maintain necessary hydrological balances for a healthy wetland community and the use of bioswales to manage infiltration rates and surface runoff water quality during the hotel's operation.

8.4.4.2 Marine Water Quality

Water quality is important as a valued receptor as it provides habitat for a diversity of marine life. It also offers amenity value for recreational users of Kilgwyn Beach. Regulations regarding water quality standards for ambient and contact recreation activities are covered by the Water Pollution Rules of Trinidad and Tobago 2019 (Refer to **Section 1.0 – Legislative and Regulatory Considerations**). Activities occurring at the site during the construction and operation phases that are expected to directly impact on water quality include the following:

- Use of equipment and heavy machinery
- Pre-construction works
- Construction works (infilling, grading and vegetation scrubbing)
- Stormwater runoff during operations

Additionally, the storage of materials and wastes, waste management, decommissioning and operational process activities may also affect water quality indirectly, through surface water runoff. Impacts on water quality arising from the project may include contamination of the water column, and increased sedimentation and turbidity, and thus in-directly affect marine life.

It is anticipated that during the construction phase mitigation checks such as sediments traps, perimeter bunds and retention pools/sumps to restrict transport of chemicals accidentally spilled will be established to eliminate the potential for downstream transport of sediments and chemicals to the marine environment. During the operation phase designs plans have been proposed for the establishment of bioswales, and retention ponds to help manage both the nutrients which may be added to the

environmental as a result of landscaping and garden management and to manage the flow of increased surface freshwater input to the environment. The wetland system will be used as a natural filtration system which will be maintained to support the treatment of stormwater runoff and the filtering of sediment particulates and spill chemicals which may become entrained in surface runoff during the operation phase of the hotel.

There is the potential for direct contamination of the marine environment from guests and tourists using the beach at Kilgwyn. During recreational activities and water sports sunscreen used by guests may wash off and disperse in the surrounding environment. Additionally, some chemicals in the lotion can be absorbed through the skin and detected in urine within 30 minutes of application. Thus, they enter sewers or septic tanks or wash off sunscreen in the shower. In locations without sophisticated sewage treatment and water management systems, sunscreen pollution is inevitable. Chemical sunscreens are the most commonly used. Their most common active ingredients – oxybenzone, butylparaben, and octinoxate – have been identified as environmentally harmful (Brown, 2008). Researchers found that the chemicals can activate latent viral infections in the symbiotic microalgae that the corals rely on for nutrition. Oxybenzone induces coral bleaching by lowering the temperature at which corals will bleach when exposed to prolonged heat stress. Oxybenzone is genotoxic and can damage coral DNA as well as induce severe and lethal deformities. The chemical also acts as an endocrine disruptor (Downs et. al. 2016). In physical sunscreens the most common ingredients are zinc oxide and titanium dioxide. A 2018 study found that non-coated zinc oxide and titanium dioxide nanoparticles (less than 35 nanometers in diameter), can be toxic to corals, fish, and other reef organisms (Corinaldesi et. al. 2018). Their small size, interaction with cells, and cause oxidative stress in sunlight (coral bleaching) damaging hard corals and their symbiotic algae. The anticipated impact of sunscreen on the neighbouring Flying reef is anticipated to be low. All effort will be made for appropriate sunscreens to be sold within the resort however, there are no controls measures which can be instituted to regulate the type and brand of sunscreen used by guests at this time.

Impacts associated with the discharge of sediments and chemicals to the nearshore environment will be address through proposed mitigation strategies and residual impacts are not expected to arise. However, monitoring plans and corrective actions for potential residual impacts have been addressed in Section 10. With the implementation of silt traps and retention ponds during construction, the residual risk of flooding and transport of contaminants down-stream to the marine environment will be reduced to low (minimal) particularly if monitoring guidelines and protocols are implemented in the management plan.

8.4.4.3 Bacterial Contamination

In the baseline assessment in the current state of the environment, Enterococci is used as the most common reference species to indicate faecal contamination of water sources. As outlined above, the sites KTW-4 through KTW-7 exceeded regulatory limits, as residential and agricultural waste from the surrounding areas flow southward through the site (Section 4.3). Bioswales should reduce external bacterial pathogenic loading into the site.

Ensuring that any domestic wastewater generated from the site is treated by the adjacent WWTP or on-site treatment with ultra-violet (UV) disinfection is crucial for reducing the human health and safety impacts.

8.4.5 Ecology and Biodiversity

8.4.5.1 Bird Communities

Literature reviews from birder reports for Kilgwyn from 2021 to 2022 and real-time rapid biological assessment surveys of the project area carried out in March and September 2022 (**Section 5.0 – Description of the Environment**) identified the presence of 43 species of birds. Of these seven (7) were considered strictly coastal or marine, nine (9) were obligatory wetland species and twenty-seven (27) were considered secondary forest species capable of foraging at forest edges and with urban habitats. One (1) species, the Trinidad motmot (*Momotus bahamensis*), observed during real-time surveys was considered endemic to the islands of Trinidad and Tobago. Kilgwyn is notably one of the few sites on the island where White-cheeked Pintails (*Anas bahamensis*) can be regularly observed and it is listed as an important site roosting site for Yellow-crowned Night-herons (*Nyctanassa violacea*) (Caribbean birding Trail, 2022).

None of the birds identified were listed as globally threatened or endangered nor has their local status ranked them as sensitive based on their population distribution or size. It should be noted however that of the sixteen marine and wetland species observed four (4) may have encompassed migratory (winter visitor) populations. The Kilgwyn area is considered a birding hot spot based on its accessibility however, it has a comparatively low observed species richness/ hosts a small number of species for its size (**Table 68 - 8-4**).

Table 68 - 8-4: Observed Bird Species Counts for Trinidad and Tobago Wetlands.

Wetland	Size (Ha)	Number of Bird Species Recorded (eBird) or real time surveys
Kilgwyn	12	43
Buccoo Marsh	≈18	125
Bon Accord	34	166
Caroni Swamp	5611	277

It was not possible to quantify with any certainty the impact of this habitat loss to the existing bird populations. The modification of 13.28 Ha of vegetation at the project site is not likely to result in the loss of local occurrences of the associated bird species. It is anticipated that the Friendship Wetland system and the offset Kilgwyn Mangrove stand (maintained by property owners) will support the relocation of obligatory wetland populations. On site habitats will be further augmented with the use of native species of flora within bioswales and for ornamental green areas on the resort compound. A buffer secondary dry forest system will be maintained at the northern section of the property to support edge species which typically access the Kilgwyn area.

During construction it is anticipated that wildlife inhabiting remaining littoral habitats and mangrove edges will be affected or disturbed by the increase in noise generated from construction activities as well as the increased presence of people. Increases in noise may also cause temporary behavioural changes for birds. Increased use of lighting during construction and operation of the resort may also have impacts on the behavioural patterns of nocturnal wildlife. These nuisance disturbances are likely to impact on nesting and roosting birds in the area and may in some cases prevent use of the preserved mangrove offset the onsite by sensitive species. The impacts to the diversity of bird species inhabiting the site area are considered moderate.

8.4.5.2 Fish and Aquatic Invertebrate Communities

The wetland supports a community of freshwater fish, the population of which was difficult to assess given the inaccessibility of ponds and hindrance of root systems to the use of traditional nets. Surveys of ponds and channels within the Kilgwyn wetland positively identified the presence of a large Granticai/Tarpon (*Megalops atlanticus*) and Guppies (*Poecilia reticulata*). The invertebrate fauna was less diverse. The majority of species observed within the freshwater channels were gastropods such as the conch (*Pomacea diffusa*) or Trumpet snails belonging to the Thiaridae family. The Trumpet snails (i.e. Red-rim melania (*Melanoides tuberculate*) and the Quilted melania (*Tarebia granifera*) were considered invasive species and their high densities are not uncommon for disturbed environments with high nutrient/organic loading. Although listed as freshwater, these snails can inhabit brackish or nearly marine waters and strive in a wide range of temperatures. They are known to compete with, and sometimes replace, native gastropods in their introduced ranges. It is unlikely that loss of wetland area will have any significant impact on these snails or other freshwater invertebrates observed.

Mangrove crabs (*Cardisoma guanhumi*) were present within the transition zone between the dense mangrove forest and the littoral and secondary forest boundaries of the development property. There was some subsistence harvest of these Mangrove Crabs. Loss of access to the site will have some impact on hunters and gatherers operating in the swamp.

It is not likely that the loss of wetland habitat will have a significant impact on the fish and invertebrate fauna of Southwest Tobago. None of the freshwater fish or invertebrates collected were considered rare, endangered, or restricted in their range. The fish population present in Kilgwyn can migrate to the lagoon on the eastern extremes of the wetland system or remain within the proposed offset mangrove ear-marked for landscaping and habitat preservation. Diadromous species can move to the coast to avoid smothering as pools and channels are infilled with the construction zone via the modified and enhanced sluice channel. Invertebrate species which are less

mobile may become smothered within construction zones however none of the species observed were considered rare, threatened or a key stone species.

The significance associated with loss of fish and invertebrate diversity are considered to be low or minor in this context.

8.4.5.3 Other Faunal Communities

Project activities which will impact on biodiversity include pre-construction works (in particular vegetation clearance and infilling of pond/mined out areas), use of equipment, machinery and vehicles and waste management. The results of the field survey identified the area did not appear to support the presence of any protected, rare or endangered species. Charismatic and large fauna observed included Tattoo/Armadillo (*Dasupus novemcinctus***)** Red-tailed Squirrel (*Sciurus granatensis*), Matte (*Tupinambis teguixin*), Green Igauna (*Iguana iguana*), Common Opossum or Manicou (*Didelphis marsupialis*). None of the species observed were considered rare, threatened or a key stone species. It is not considered likely these biological receptors will be significantly impacted from the loss of habitat. Open wetland is still present at Friendship and at the offset Kilgwyn site for relocation. While it is anticipated that animal movements will be altered as a result of anthropogenic landscape changes and increased human presence in the area (particularly during construction) they are unlikely to be significantly impeded. Vehicular traffic will be kept to a minimum during resort operations and the onsite access road through the offset mangrove system will be stilted to ensure the free movement of fauna below the roadway.

Impacts related to improperly managed waste during hotel operations can also result in impacts to wildlife, including uptake of toxins or attraction of nuisance species (pests) to the site due to improperly disposed of domestic food wastes. However, it is expected that waste management systems will be in place and strictly adhered to, and as such, no impacts are expected to arise from improperly treated wastes.

Any wildlife inhabiting the periphery of the site may be affected / disturbed by the increase in noise, generated from sheet piling and other construction activities. Increases in noise may cause temporary behavioural changes. Increased noise and use of lighting during the operation from the hotel may also have impacts on the behaviour patterns of nocturnal wildlife.

The proposed hotel operations can support the conservation of charismatic species such as nesting turtles, tattoo and iguanas. These animals are haunted locally as “wild meat” however, management of site access and the restriction of onsite hunting by locals can support growth of these populations.

Given the context of the site, the terrestrial habitat for wildlife and the number and type of terrestrial species of reptiles, amphibians and mammals recorded, it is expected that the overall impact of the project to terrestrial fauna of Southwest Tobago will be low.

8.4.5.4 Terrestrial Biodiversity

The terrestrial and coastal zone has been historically modified within this area for activities such as the airport runway expansion, illegal mining of sand from the wetland and beach, the establishment of a drainage system for the Kilgwyn and Friendship wetland systems, and the illegal dumping of garbage and industrial scrap waste (iron and materials, scrap building material (e.g. Concrete, plumbing fixtures, car batteries, old tyres). Cumulative project activities which will affect these areas include vegetation clearance, and infilling of approximately, resulting in loss of on-site wetland and coastal littoral habitats and habitat fragmentation resulting from road and building development. It is anticipated that 2.05 Ha of transitional scrub mangrove, herbaceous wetland and seasonal dry forest will be removed and replaced with of paved impermeable surfaces while 11.23 Ha of the total 18.7258 Ha of privately held land will be maintained as open spaces with of manicured lawns and ornamental green area/gardens and bioswales. To reduce the impact of habitat loss and habitat fragmentation and loss of potential food resources the littoral forest along the coast will be maintained with the minimal

culling of a few trees for access to the beach from the resort. A concerted effort will be made by developers to use intrinsic trees to the area such as *Coccoloba uvifera, Citharexylum spinosum, Bursera simarubs, Pithecellobium unguis-cati, Terminalia catappa, Thespesia populnea, Dodonea viscosa, Conocarpus erectus, Spondias mombin*, *Tamarindus indica and Morinda citrifolia* for ornamental spaces and marsh species such as *Eleocharis* spp, *Cyperus* spp, *Fimbristylis* spp and *Acrostichum aureum* in bioswales to maintain similar floral habitats were possible.

Given the context of the site and the sensitivity of the terrestrial habitats present (i.e. based on the services they provide in terms of coastal protection, flood reduction, biofiltration, habitat and resources for wildlife) it is expected that the overall impact of the project to terrestrial biodiversity (flora) will be moderate.

8.4.6 Human Environment

8.4.6.1 Local and Regional Communities

- Employment opportunities
- Indirect impacts to bathing areas
- Increase in traffic and increased pressure on road networks

8.5 Summary Tables

Table 69 - 8-5 summarizes the potential impacts associated with routine project activities, together with their significance. Impacts are grouped by VR. It should be noted that no impacts were deemed to have a synergistic property and as such this criterion has been removed. Nonetheless, the value of zero for synergistic effects was used when calculating the average of the supplementary criteria.

Table 69 - 8-5: Summary Table - Project Activities.

					Basic criteria (1-5)			Supplementary criteria (0-3)		
Category	**Value Receptor**	**VR Importance**	**Project Activity**	**Impact Description**	**Severity**	**Extent**	**Duration**	**Cumulative**	**Controversy**	**Impact Significance**
Air and Climate	Air quality	High	Use of Machinery for site clearing, transportation of raw materials and hotel construction	Dust nuisance from transportation of raw material on surrounding residential and business communities Fugitive dust effect on construction workers and residential communities	4	2	2	1	1	**MODERATE**
					4	2	2	2	1	**MODERATE**
	Global climate	High								
Land	Noise	Moderate	Use of Heavy Machinery for site preparation and construction.	Construction activities negative increase in noise and vibration emanation from the project site.	4	2	2	1	1	**MODERATE**
	Visual	Moderate	Hotel construction and operation	Construction activities negative increase in	3	3	4	2	3	**MODERATE**

					Basic criteria (1-5)			Supplementary criteria (0-3)		
Category	**Value Receptor**	**VR Importance**	**Project Activity**	**Impact Description**	**Severity**	**Extent**	**Duration**	**Cumulative**	**Controversy**	**Impact Significance**
				lighting. Operational lighting of pathways for guests.						
Water	Surface Water (Freshwater Environment) and Stormwater/Flood Control	High	Hotel construction and stormwater management	Alteration of drainage patterns leading to changes in local waterways and coastal water. Mobilization of contaminants into wetland and coastal areas from hotel surface water runoff and degradation of water quality due to surface water runoff leading to indirect loss of wetland and marine biota	4	4	4	3	3	**HIGH**
	Marine Habitat Quality	High	Direct and indirect impacts to marine wildlife and human users of the sea. Cumulative impacts in combination with other activities	Mobilization of contaminants and sediment into coastal areas from site preparation, construction and hotel/resort surface water runoff.	4	3	3	3	2	**MODERATE/LOW Residual**

					Basic criteria (1-5)			Supplementary criteria (0-3)		
Category	**Value Receptor**	**VR Importance**	**Project Activity**	**Impact Description**	**Severity**	**Extent**	**Duration**	**Cumulative**	**Controversy**	**Impact Significance**
			(e.g. ANR International Airport) in the area.	Degradation of water quality due to surface water runoff and direct impact via pollutants added by beach goers e.g. sunscreen. Indirect loss of marine biota						
	Bird communities	Moderate	Land clearing and hotel construction	Destruction/segregation of habitat	3	3	3	1	2	**MODERATE**
	Fish and aquatic invertebrate communities	Low	Land preparation works and hotel construction.	Changes to the characteristics of the aquatic environment; smothering due to silt/sediment re-suspension	3	3	3	1	2	**LOW**
	Other fauna	Low	Land preparation works and hotel construction	Loss of habitat for feeding, disturbance from noise, light and vibration during construction and operation	2	2	3	1	2	**LOW**

					Basic criteria (1-5)			Supplementary criteria (0-3)		
Category	**Value Receptor**	**VR Importance**	**Project Activity**	**Impact Description**	**Severity**	**Extent**	**Duration**	**Cumulative**	**Controversy**	**Impact Significance**
Ecology and Biodiversity	Terrestrial biodiversity	High	Land preparation works and hotel construction	Destruction of vegetation and faunal habitat during site construction	4	4	5	2	1	**MODERATE**
	Mangrove Community	High	Land preparation works	Temporary closing of drainage pathways affecting hydrology within mangrove forest	4	3	1	2	1	**MODERATE**
Human Environment	Employment	Very High	Hotel site clearing, construction and operation	Creation of direct, indirect and induced jobs	5	5	5	3	3	**HIGH**
	Solid Waste	Moderate	Hotel construction and operation	Increased generation of solid waste	3	2	3	1	1	**MODERATE**
	Wastewater	Moderate	Hotel construction and operation	Contamination of terrestrial environment from accidental spillage or ruptured pipes etc.	3	2	3	1	1	**MODERATE**
	Vending and Hygiene	Low	Hotel construction and operation	Illnesses resulting from improper food handling practices	1	1	2	1	2	**LOW**

					Basic criteria (1-5)			Supplementary criteria (0-3)		
Category	**Value Receptor**	**VR Importance**	**Project Activity**	**Impact Description**	**Severity**	**Extent**	**Duration**	**Cumulative**	**Controversy**	**Impact Significance**
				Negative visual effect on area						
	Aesthetics	Low	Hotel construction and operation	Decreased aesthetic appeal	1	1	1	1	2	**LOW**
	Historical/Archaeological	Moderate	Hotel construction and operation	No historical, archaeological features were uncovered or sites encountered. No artefacts were recovered.	1	1	1	1	1	**LOW**
	Transportation and Traffic	High	Hotel site clearing, construction and operations	Traffic travelling along the main road are not significantly affected Vehicles entering and exiting the hotel property are expected to experience tolerable delays for short periods A Traffic light will increase the delay for vehicles, thus decreasing the Level of Service	4	3	2	3	3	**HIGH**

					Basic criteria (1-5)			Supplementary criteria (0-3)		
Category	**Value Receptor**	**VR Importance**	**Project Activity**	**Impact Description**	**Severity**	**Extent**	**Duration**	**Cumulative**	**Controversy**	**Impact Significance**
	Water supply and consumption	Moderate	Hotel Operations	Burdening of the water supply in the area in the event of drought conditions.	3	4	2	2	3	**MODERATE**
	Health and Safety	Moderate	Hotel site clearing, construction and operations	Occupational Health and safety of workers (accident potential)	2	1	5	1	2	**MODERATE**

8.6 Cumulative Impacts

Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity in an environmentally sensitive area, when added to other existing, planned, and/or reasonably anticipated future ones (IFC 2013). While a single activity may itself result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time or similar time, result in a cumulative impact that may have significant detrimental effects on important resources.

The impacts identified in the Kilgwyn Bay Hotel project can be made more significant when they are considered in conjunction with related impacts of recent past projects, other current projects and probable future projects in the area. An assessment of the cumulative impacts requires consideration of the other plans or projects that may act in combination with the proposed project to cause environmental and socioeconomic impacts. The latter being focused on the more medium to longer term impacts with all future anthropogenic and climatological activities within the immediate or near field study area based on a 2 km zone around the proposed hotel development (refence section 4.0 Definition of Study Area).

An assessment of the cumulative impacts requires consideration of the other plans or projects that may act in combination with the proposed project to cause environmental and socioeconomic impacts. Of note, at present there are several key neighbouring construction projects within the Crown Point to Cove geographic area bordering the western and eastern limits of the impact zone considered within this EIA. This combined with the future operations of the Kilgwyn Bay Hotel Project guides as to the possible cumulative impacts that may alter and affect the natural environment and its surrounding local communities.

The **key drivers for these potential cumulative impacts**;

1. **Crown Point Airport Expansion Project – Construction and Operational Phase.**
2. **Housing and Industrial projects along the Cove coastline – Construction and Operational Phase.**
3. **New potential development of new resorts or tourism facilities up or down current from Kilgwyn Bay- Construction and Operational Phase inclusive of beach works and jetty for increased marine access.**
4. **New Phase of additional development within the geographic limits of the Kilgwyn Bay Hotel Project, inclusive of beach works and jetty for increased marine access.**
5. **Cumulative impact of housing expansion in the Tyson Hall area over time.**
6. **Increased agriculture in neighbouring communities of Tyson Hall and Friendship.**
7. **Cumulative impact on drinking water resource use, public sewage disposal facilities on existing local infrastructure (drainage and roads).**
8. **Cumulative impact of climate change issues e.g. sea level rise over time on hotel operations and the capacity of the wetland to support services of coastal protection and flood reduction along the coastline.**
9. **Cumulative impact of hotel to the local economy over time.**
10. **Increased public and tourist exposure of sensitive species of flora and fauna; focus on turtles nesting on the coastline- squatting, illegal vending and beach users' traffic**

It should be noted that the Crown Point Airport expansion project and Cove Housing developments are currently in Construction Phase and once this transition to Operational Phase then the cumulative impact of the proposed project could be less than anticipated.

The tables below identify and describes the cumulative impacts associated with the proposed Kilgwyn Bay Hotel Project as considered together with other projects in the region present and future; as per key drivers for these potential cumulative impacts **1-10** mentioned above (**refer to Tables 70 – 8-6 and 71 – 8-7**). The cumulative impacts are discussed and detailed within the context of impacts to;

- Biological
- Physical Environment- Marine and Terrestrial;
- Socio-economic environment

Table 70 – 8-6: Future and Continued Construction Projects and Expansions to Current Developments

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
Physical	Drainage and Runoff	**1,2,3,4,5**	Increased and consistent sedimentation and pollution of mangrove forest	An alternative construction drainage plan will have to be developed to control the potential increase in discharge of oil/lubricants, sediment and debris into the mangrove areas, consisting of: - Site grading - Sediment retention basins and other measures for minimizing the transport of sediment - Grease traps and/or oil water separators
	Water Quality	**1,2,3,4,5**	Sedimentation of marine environment from any considered future beach works	- The future developments should utilize sediment control measures such as turbidity barriers/silt screens and should be erected around the entire work area to prevent the dispersion of sediments and contaminants throughout the water column. - A central area will be designated for the storage of chemicals. This area should be lined in order to prevent the leakage of chemicals into the sediment. - Silt fences may also be utilized to prevent siltation. - All boulders used for coastal structures should be washed at a designated area at the quarry before being transported to the site. The boulders should be stored in a designated area away from any fines and mud before being placed in the marine environment. - Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne.
			Pollution of marine environment from fuel, lubricants, hazardous substances from Hotel, construction equipment and current Crown Point Airport Operations	
	Dredging	**2,3,4**	Increased suspended solids, turbidity, BOD and the prolonged reduction in light penetration and dissolved oxygen in the water column	

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
			Suspension of heavy metals from the substrate	- Raw material and equipment should be stored on impermeable hard stands surrounded by berms to contain any accidental surface runoff. - Bulk storage of fuels and oils should be in clearly marked containers (tanks/drums etc.) indicating the type and quantity being stored. In addition, these containers should be surrounded by bunds to contain the volume being stored in case of accidental spillage. - Appropriate minor spill response equipment (for containment and clean- up) will kept on site, including oil absorbent pads and disposal bags. In particular for Airport Operations - In terms of transporting equipment, the paths of the planned roadways will be used, rather than creating temporary pathways just for equipment access. - Raw materials such as marl and sand should be adequately covered within the trucks to prevent any escaping into the air and along the roadway. - Vehicle refuelling facilities must be situated on impermeable surfaces served by an oil trap, run-off collection system. Sediment basins and oil water separators should be constructed. - Turbidity barriers/silt screens are recommended to be used around all dredging activities. These should be placed so as to reduce/contain the resultant sediment plume during these activities. Dredging activities should only occur when these barriers are fully operational, that
			Affect sensitive coastal ecological habitats	

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				is; placed correctly; in calm to moderate sea conditions; and without damage. These barriers are particularly important when operations occur near or may influence sensitive ecosystems and species such as coral reefs and seagrass beds and or filter feeding organisms. The silt screens should encircle the areas and be deep enough to contain the plumes so that plumes will not travel in the direction of the prevailing currents. - Care should be taken to dredge only in approved dredge areas. Dredge areas and a buffer area should be demarcated to avoid accidental dredging in unauthorized areas. - Dredging operations should be continually monitored to ensure equipment and machinery are in good repair and frequently serviced to prevent oil leaks during regular operations.
	Noise	**1,2,3,4,5,6**	Noise nuisance from construction equipment on surrounding residential and educational communities	- Use equipment that has low noise emissions as stated by the manufacturers. - Use equipment that is properly fitted with noise reduction devices such as mufflers. - Operate noise-generating equipment during regular working hours (e.g. 7 am – 7 pm) to reduce the potential of creating a noise nuisance during the night. - Construction workers operating equipment that generates noise should be equipped with noise protection. A guide is workers operating equipment generating noise of ≥ 80 dBA (decibels) continuously for 8 hours or more should

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				use earmuffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.
	Air Quality	**1,2,3,4,5,6**	Dust nuisance from transportation of raw material on surrounding residential and educational communities Fugitive dust effect on construction workers and residential communities	Areas should be dampened every 5-6 hours or within reason to prevent a dust nuisance and on hotter days, this frequency should be increased. - Minimize cleared areas to those that are needed to be used. - Cover or wet construction materials such as marl to prevent a dust nuisance. - Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.
Biological	Mangrove Community	**1,2,3,4,5,6,8**	Any future Loss of mature mangrove forest and less robust mangrove forest- increased board walk and facilities footprints to facilitate hotel expansion etc.	- Mangrove rehabilitation is proposed in select degraded areas. Approximately 8 acres of potential mitigation/compensation areas were found within the property boundary. - Parking, roads and facilities areas alone require 4.33 acres of the 6 acres of dry dead mangrove and secondary forest to be cleared. Discussions will be had with the THA to request a reduction in the number of parking spaces needed. - Use of Solar power generation for an overall net positive reduction in CO2 emissions should be considered.

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				Boardwalk Related Mitigation: - The boardwalk should be constructed in stages (finishing one section and moving on in a continuous buildout plan) and without the use of heavy equipment to reduce the potential impact area. - Construction should not be undertaken during periods of heavy rain/ rainy season. - Construction materials should be natural and blend in with the forest to reduce the visual impact of fauna. The materials should be strong, rust resistant and should not be treated with chemicals which may leach into the environment. - The use of hazardous or toxic substances should not be undertaken in or near waterways. - Older and larger mangrove trees should be avoided
			Natural closing of drainage pathways affecting hydrology within mangrove forest	The tidal creeks/ sluice canals should be maintained with little or no disturbance. It may be beneficial to erect a concrete structure in this location to prevent natural mangrove forest growth which may enclose this vital exchange point.
			Urban sprawl and informal settling in neighbouring mangrove forests	Steps must be taken by the hotel developer and respective agencies to not only conserve the wetlands at the proposed impact site, but also prevent further informal settlement sprawl in other neighbouring wetlands.

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
	Terrestrial Fauna	**1,2,3,4,5,6**	Displacement of the Ducks on site	- Efforts should be made to retain some areas of the wetland habitat for the ducks to continue to occupy. This may include the development of bird sanctuary. - Boardwalk viewing areas should also be created for guest educational purposes and bird watching.
			Displacement of amphibians on site	Efforts should be made to preserve some of the mangrove swamp and trees on the property.
	Coral and sessile fauna	**1,2,3,4,5,6,8**	Species Loss	Coral Relocation and Fish Havens
			Smothering of sensitive nearby coral and reduced light from sedimentation	- Any future construction, the project site should include longer term sediment control and monitoring measures such as turbidity barriers/silt screens and should be erected around the entire work area to prevent the dispersion of sediments and contaminants throughout the water column. These should be placed so as to reduce/contain the resultant sediment plume during the activities. Construction activities should only continue when these barriers are fully operational, that is; placed correctly; calm to moderate sea conditions; without damage. These barriers are particularly important when operations occur near or may influence sensitive ecosystems and species such as coral reefs and seagrass beds and or filter feeding organisms and fish. - Longer term and quarterly frequency monitoring of water quality parameters such as temperature, salinity, pH, Dissolved Oxygen, light irradiance and turbidity in and
			Impaired filter feeding and photosynthesis from prolonged sedimentation	
	Seagrass	**1,2,3,4,5,6,8**	Species loss and habitat fragmentation	
			Temporary shading by floating structures/vessels for recreation purposes	

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
		3,4	Smothering of seagrass blades and epiphytes from sedimentation Reduced light penetration and resulting decrease in photosynthesis Mechanical abrasion from moorings and anchors from any future beach and marine works	around the project area, for the first 3 months during construction. Monitoring can be conducted - fortnightly thereafter. - Conduct sediment dispersal calculation rates on coral reefs and seagrass beds within 200 meters of the proposed beach works sites and at control stations, on a monthly basis, for comparison to background levels. Pre-construction sedimentation rates should therefore also be conducted and used as a baseline for comparison. - All activities should be limited to the minimal working area, and as such reducing the extent of the footprint. No activities and or placement of anchors or materials should be done placed outside the approved area. - Relocation of sensitive species should be done if; they are suitable for relocation (that is suitable substrate, health and over all viability), those species fall within the potential impact area; and if mobile invertebrates are in or around the potential impact area. Sensitive organisms and systems in and outside the impact area include; hard and soft corals, sponges, - seagrass and mobile invertebrates such as urchins, sea cucumbers, starfish and conch. Detailed Seagrass and Coral Removal and Relocation Plans, as well as a Post-Relocation Monitoring Plan, must be prepared for approval by EMA. - Where possible, as little of the natural environment should be relocated or removed. Habitat fragmentation and species displacement should be temporary, with the placement of silt screens, construction materials and equipment as well as general human activity in the area.

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				- Structures placed on the seafloor may cause habitat fragmentation and displace some species, however they may also serve to add ecological volume, providing substrate for organisms to settle and colonize and eventually may serve some ecosystem functions. - Any temporary floating structures and /or vessels should be placed in areas with less sensitive species where possible. Floating structures anchored or moored over seagrass beds or coral colonies should not be left for prolonged time periods as the resulting shading effects may cause deterioration in overall health of the seagrass bed and coral colonies
	Fish and Invertebrates	**1,2,3,4,5,6**	Temporary loss/displacement of fish habitat Clogging of gills from excess, prolonged sedimentation Reduction in food supply as a result of decreased water quality and change in plankton composition	- During construction, the project site should include sediment control measures such as turbidity barriers/silt screens and should be erected around the entire work area to prevent the dispersion of sediments and contaminants throughout the water column. These should be placed so as to reduce/contain the resultant sediment plume during the activities. Construction activities should only continue when these barriers are fully operational, that is; placed correctly; calm to moderate sea conditions; without damage. These barriers are particularly important when operations occur near or may influence sensitive ecosystems and species such as coral reefs and seagrass beds and or filter feeding organisms and fish.

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				- Quarterly monitoring of water quality parameters such as temperature, salinity, pH, Dissolved Oxygen, light irradiance, turbidity and Total Suspended Solids (TSS) in and around the project area should be conducted during construction. - All activities should be limited to the minimal working area, and as such reducing the extent of the footprint. No activities and or placement of anchors or materials should be done placed outside the approved area.
	Sea Turtles	**1,2,3,4,5**	Temporary disturbance/displacement from construction activity, lights and noise	- Attempts should be made to schedule the majority of the beach works (breakwaters, groynes, nourishment etc.) outside of turtle nesting season (May – October). - All staff and workers should be sensitized to the all sensitive ecosystems and species in the area, in particular turtles. The site should be inspected daily for any signs of turtle activity. If a nest is suspected or found, all activity nearby should stop until an expert can determine if there is a nest and how to relocate the eggs. - The stakeholders, proponents and the EMA should develop clear lines of reporting and communication in the event that action needs to be taken. - Silt screens should be used to prevent sedimentation but should be removed promptly along with any other construction debris and material upon completion. - Night-time activities should be limited or avoided when possible. No lights should be pointed out to sea. This may confusion and disorientation of turtles or any other species that maybe affected by lunar activity.

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				- Fixtures in direct line-of-sight from the beach should be shielded down-light only fixtures or recessed fixtures having low wattage "bug" type bulbs and non-reflective interior surfaces. - Fixtures mounted as low in elevation as possible through use of low-mounted wall fixtures, low bollards and ground level fixtures. - Floodlights, up-lights or spotlights for decorative and accent purposes that are directly visible from the beach or which indirectly or cumulatively illuminate the beach shall not be used. - For high intensity lighting applications such as providing security and similar applications shielded low-pressure sodium vapour lamps and fixtures shall be used
Human/Social	Employment	**9**	Creation of direct, indirect and induced jobs	No mitigation required
	Solid Waste	**1,2,3,4,5,6,10**	Increased generation of solid waste	- Skips and bins should be strategically placed within the campsite and construction site. - The skips and bins at the construction campsite should be adequately designed and covered to prevent access by vermin and minimise odour. - The skips and bins at both the construction campsite and construction site should be emptied regularly to prevent overfilling. - Disposal of the contents of the skips and bins should be done at an approved disposal site – and increased frequency- Studdley Park Landfill

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
	Wastewater	**1,2,3,4,5,6**	Contamination of marine environment from accidental spillage of portable toilets	- Provision and maintenance of portable sanitary conveniences for the construction workers for control of sewage waste by a licenced contractor. A ratio of approximately 25 workers per chemical toilet should be used. - Showers should be provided for the workers. - Portable toilets should be located at a distance from the shoreline to avoid discharge into the marine environment in the event of accidental spillage.
	Vending and Hygiene	**9,10**	Illnesses resulting from improper food handling practices	- Provision of adequate supply of potable water. - The monitoring of the various 'cook shops" by public health authorities and the construction management team, to ensure proper hygiene is being followed. - The provision of areas to adequately wash hands and utensils.
			Negative visual effect on area	
	Transportation and Traffic	**1,2,3,4,5,6,10**	Traffic travelling along the through lanes to Friendship and Tyson are not significantly affected during the construction phases	No mitigation required
			Vehicles entering and exiting the hotel property are expected to experience tolerable delays for short periods	

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
			Effect of overweight vehicles on road surface	In order to alleviate road damages, all the weight of trucks carrying construction materials must be determined by scale and overloading is strictly prohibited as per NWA weight limit requirements.
			General Traffic Management	- Construction traffic entering or leaving the site will be scheduled for off peak hours to minimize additional congestion at the intersections and/or disruptions in the regular traffic flow. - Construction next to the highway will be scheduled for off peak hours and adequate traffic management procedures/methods will be put in place. - Adequate covering up of the works to minimize danger to passing traffic. - Erection of signs ahead of the works warning motorists of the construction ahead.
			Accident potential south of Access Road 1	Increased signage in the area to remind motorists to reduce their speed as they approach each intersection.
	Occupational Health and Safety	**1,2,3,4,5,6,10**	Potential for accidental injury of construction workers	- The provision of lifelines, personal safety nets or safety belts and scaffolding for the construction workers (if necessary) - Ensuring that workers wear personal protective equipment (hard hats, reflective vests, safety shoes, eye protection etc.) - Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.
			Fugitive Dust effect on health of construction workers	

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				- Areas should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter days, this frequency should be increased. - There should be onsite first aid kits and arrangement for a local nurse and/or doctor to be on call for the construction site. - Make prior arrangements with local health care facilities such as health centres or the Noel Holmes Hospital in Lucea to accommodate any eventualities - Make prior arrangements with the Lucea Fire Station and Green Island Police Station to accommodate any eventualities. - Material Safety Data Sheets (MSDS) should be stored onsite. - A lead person should be identified and appointed to be responsible for emergencies occurring on the site. This person should be clearly identified to the construction workers. - Trench Excavation • A trench 1.2m or more in depth must have a means of egress (ladders/ stairways/ramps) and should be located at 8m intervals. • Excavated materials must be stored 0.6m or more from the open trench (not to be measured from the crown of the spoil). • Spoil should be placed so that the channels rainwater and other runoff water away from the excavation. • Take precautions regarding Tension Cracks

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				- Tension cracks usually form at a horizontal distance of 0.5 to 0.75 times the depth of the trench. - Sliding or sloughing may occur as a result of tension cracks
	Aesthetics	**1,2,3,4,5,6,10**	Decreased aesthetic appeal of construction site activities	Good housekeeping activities and adherence to other mitigative measures.
			Trucks leaving the construction site have the potential to deposit marl and mud onto the main road, making the main road aesthetically unappealing.	- An area of gravel should be placed on site (just before exiting onto the main road) to help remove mud/marl from truck wheels. - A wheel wash area on site (just before exiting onto the main road) should be implemented to rid wheels of as much mud/marl as possible
	Historical artefacts	**9**	No historical, archaeological features were uncovered. No artefacts were recovered.	No mitigation required

Table 71 – 8-7: Operational Phase – Hotel, Airport, Beach Works, Agriculture and Housing

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
Physical	Drainage and Hydrology	**1,2,3,4,5,6**	Increased flood levels within mangrove forest Flooding of adjacent communities Increased Runoff to drain freely into mangrove forest via increased outfall points	- Enhancement to the mangrove system is proposed by introducing several culvert openings throughout the existing road network within the mangrove. This would promote more free movement of water through the entire mangrove forest, which will improve the storage capacity and provide water to areas currently deprived of water. - Several ponds are proposed within the barren elevated areas in the midst of the mangrove to alleviate any flooding impact on adjacent communities. - The proposed drainage concept will allow rainfall runoff to drain freely into the mangrove via ten outfall points. All the outfall points were set at an elevation higher than the projected flood elevation for the 1 in 50-yr storm frequency, with consideration for climate change.
	Currents	**1,2,3,4,5,6**	Flushing the sluice channels does not significantly change the currents along the project site	No mitigation required

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
			Flushing channel helps to draw out any pollutant and reduce the concentration with the Kilgwyn Bay Mangrove system	No mitigation required
	Sediment Transport	**1,2,3,4,5,6**	Sediment transport regime remained unchanged	No mitigation required
			No significant impact to downdrift shorelines	No mitigation required
Biological	Vegetation	**1,2,3,4,5,6**	Introduction of invasive alien plant species via landscaping activities can result in their proliferation.	Ensure that plants used for landscaping are native/local species. Exotic/unknown plant species should not be used in landscaping.
	Reef Community	**1,2,3,4,5,6**	Hard structures (groynes, breakwaters, jetty) will provide of ecological volume and substrate for colonization and recruitment	No mitigation required
	Fish	**1,2,3,4,5,6**	Hard structures (groynes, breakwaters, jetty) will act as Fish Aggregation Devices (FADs)	No mitigation required

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
	Sea Turtles	**1,2,3,4,5,6**	Alteration of food source from seagrass bed modification	- Artificial lighting should not be placed on the beach. If lights have to be used, turtle-friendly lighting and light positioning (if any) should be used. - Hotel operators should also educate their guests on sea turtle conservation and the correct actions to take if a sea turtle is observed nesting on the beach - Development of a Sea Turtle Monitoring programme which would include tagging and hatchling release. - Increase vegetative protective cover density along coastline- planting of climate resilient trees - Installation of additional groynes- based on a feasibility analysis - An EMA and IMA approved Coastal Management System to be implemented to mitigate coastal erosion and retain a stable beach sand budget - Hotel Developers to support regional and local coastal management and climate change impacts research
			Hard structures act as deterrent from going ashore to nest	
			Noise and lighting act as deterrent from going ashore to nest	
Natural Hazards	Swell Wave Climate- Climate change	**3,4,8**	Wave climate changes- increase surge and intensity	
			Wave climate reduced by breakwaters	No mitigation required
			Swimming areas reduced- increased wave energy	- Installation of additional groynes- based on a feasibility analysis of effect of climate change

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
	Hurricane Waves and Storm Surge- Climate Change	**3,4,8**	Storm surge increase	- Increase vegetative protective cover density along coastline- planting of climate resilient trees - Storm Management plan for the two main tidally controlled Sluice Canals- west and east of the Hotel Development
			Flooding of hotel blocks by storm surge	- Adhere to recommended floor level heights in engineering design - Revised Hydrological and Basin Drainage Plan
	Climate Change	**3,4,8**	Flooding from increased rainfall intensity	Structures and buildings were designed for higher than standard return events
			Siltation of drainage systems and coastal areas	- Drainage plans are fortified with silt traps to reduce the siltation impact to the coastal areas. - Flushing channel to increase the circulation of the area overtime
			Sea level rise and resulting increased storm surge	The floor levels for the property were set to be above the 100-year storm surge events.
			Structural Fatigue from increased storm surge	All foundation structures were also designed to withstand stronger waves that come from more intensive storms.
			Tsunami event	- Hotel Warning System and Evacuation Plan - Collaborating with THA, ODPM, Health Ministry and National Security Agencies to

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				integrate the national Tsunami response plan with that of Hotel Management
	Employment	**9**	Creation of direct, indirect and induced jobs	No mitigation required
Human/Social	Water supply and usage	**1,2,3,4,5,6,7**	Increase burden on the water supply in the area in the event of drought conditions.	It is recommended that various storage and conversation measures be put in place at the hotel such as: - Low flow fixtures - Dual flush toilets - Faucets fitted with aerators - Electronic spigots and flush valves Other operational strategies for reduction of water consumption include: - Do not leave the tap running while cleaning, using buckets for holding water instead - Make sure that all faucets do not leak and are in good repair - Report immediately any leaking or dripping faucet or toilet - Give guests the option of changing linen and towels every two or three days - Use only the minimum required amount of detergent in the laundry - Reuse rinse-water in the first cycle of washing of the next load

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
				- Separate the laundry's hot-water system from the guest room hotel-water system if possible - Hotel guests can be given politely written cards as to how to conserve water in their bathrooms, for example to, shut off water during tooth brushing, shaving, and other unnecessary period - Keep utility bills to track the consumption of water - Purchase and use water-saving equipment always - Establish an effective employee training program about water conservation - Wash food products in buckets, bowls or containers - Use dishwasher with sufficient loads - Make regular inspections of dishwasher pumps for water leakage - Do not use water to defrost or thaw frozen food products, defrost in refrigerator - Recover waste pool water for reuse - Use wastewater effluent for irrigation
	Tourism		Improvement of the tourism product of the country	No mitigation required
	Emergency Response	**1,2,3,4,5,6,7**	Workers and guests may become ill or have accidents. In addition, disasters such as earthquakes, floods, storm	- Have first aid kits located in various sections of the hotel. - Design and implement an emergency response plan.

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
			surge and fires are real possibilities.	- Staff should be trained in CPR and basic first aid. - Arrange for mutual assistance and make prior arrangements with: • Health care facilities, Noel Holmes Hospital and associated doctors and nurses to accommodate any eventualities. • Arrange with other health practitioners to be on call or have an in-house physician/nurse. • Bon Accord Fire Station (additional firefighting units and a fire boat) • Crown Point and Scarborough Police Station (police personnel in addition to the Tourism Courtesy Corp Officers)
	Solid Waste	**1,2,3,4,5,6,10**	Increased solid waste generation	- Provision of solid waste storage bins and skips. - Provision of adequately designed bins and skips to prevent access by vermin. - Monitor beach garbage. - Contracting a private contractor to collect solid waste in a timely fashion to prevent a build-up. - Ensure that the solid waste collected is disposed in an approved disposal site - Retirement Disposal Facility, Studdley Park.
	Transportation and Traffic	**1,2,3,4,5,6,10**	Traffic travelling along the main road are not significantly affected	No mitigation required

Category		Key Cumulative Impact Drivers	Cumulative Impact	Recommended Mitigation
			Vehicles entering and exiting the hotel property are expected to experience tolerable delays for short periods	The assessment revealed that it is not necessary for either intersection to be signalized as the volume of traffic does not warrant the installation. However, the implementation of acceleration and deceleration lanes may decrease the frequency of accidents in the area.
			A Traffic light will increase the delay for vehicles, thus decreasing the Level of Service	

8.7 Residual Impact Significance

The following assessment is designed to allow for the determination of residual impact. A residual impact is the impact that remains following the successful implementation of the recommended mitigation measures within the Environmental Management Plan (**Section 9.0**). Successful implementation of mitigation measures should reduce impact significance values to acceptable levels (i.e. to minor or insignificant, denoting minimal or no impact). Where a reduction in the risk of impact cannot be achieved through the implementation of mitigation measures, additional emergency response procedures are recommended.

Table 72 - 8-8 refers to the Mitigation and Monitoring Plans (MMPs), located within the Environmental Management Plan (**Section 9.0**). It is within the MMP Tables that the mitigation measures reside in detail. This is to ensure they provide an effective tool for the control of environmental impacts (**Figure 128-8.1**).

The proposed mitigation measures cover general good practice approaches to developments of this nature, as well as project specific measures. These mitigation measures and good practice approaches will ensure that impacts are indeed kept to a minimum and therefore should be undertaken.

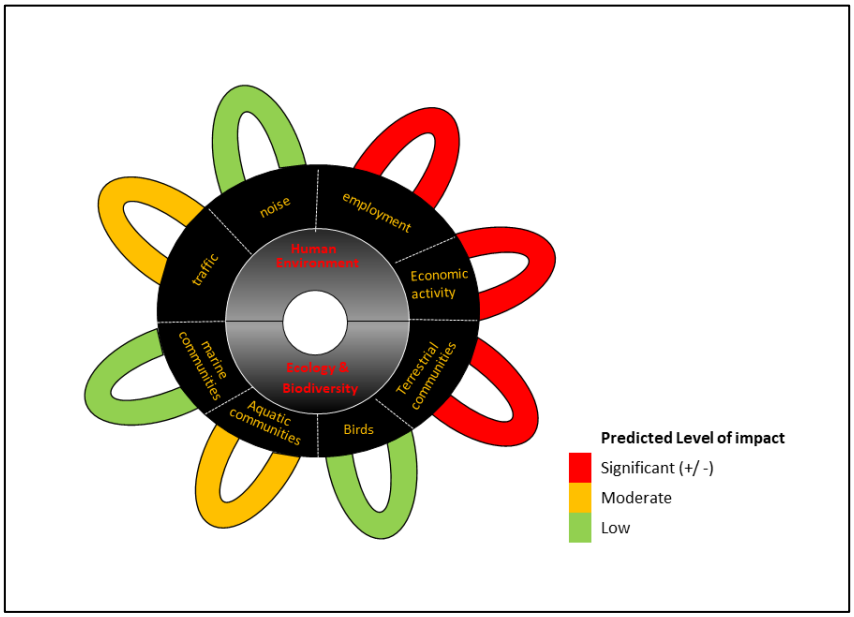

Figure 128 - 8.1: Summary of the Predicted Level of Impact within the Systems

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Table 72 - 8-8: Mitigation Measures and Residual Impact Significance.

VR	Impact	Impact Significance	Mitigation	Residual Impact
Air quality	Indirect impacts of dust on adjacent land users, communities and wildlife Emissions causing a reduction in air quality, which can indirectly affect local communities and wildlife	Moderate	Areas should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter days, this frequency should be increased. ii. Minimize cleared areas to those that are needed to be used. iii. Cover or wet construction materials such as marl to prevent a dust nuisance. iv. Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.	Minor

VR	Impact	Impact Significance	Mitigation	Residual Impact
Noise	Noise and vibration generate from use of heavy machinery during site preparation and construction.	Moderate	Limit construction period to daylight hours. During operation ensure the resort meets with the Noise Pollution Rules Standards for sensitive environments and general area zones Construction workers operating equipment that generates noise should be equipped with noise protection. A guide is workers operating equipment generating noise of >80 dBA *(Refer to* ***Appendix H1 - Typical Construction Equipment Noise Levels)*** continuously for 8 hours or more should use earmuffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.	Minor
Visual	Construction activities altering the aesthetics of the area and increasing light pollution	Moderate	Use of local species of trees and shrubs for landscaping on the resort. The establishment of a monitored mangrove offset area. Maintenance of secondary forest buffers. Use of directed lights as well as amber or red lights for nocturnal species (Refer to **Section 10.0** for appropriate MMP).	Minor

VR	Impact	Impact Significance	Mitigation	Residual Impact
Surface water flow and quality	Alteration of drainage patterns leading to changes in local wetland and salinity characteristics of coastal water. Mobilization of contaminants into wetland and marine water from surface water runoff	High/Major	Installation of silt traps and retention ponds during construction to reduce the risk of transport of contaminants and sediments down-stream to the wetland system and marine environment. Monitoring guidelines and protocols proposed are identified in **Section 10.0**. Use of retention ponds to mitigate flooding and ensure controlled water quality management during resort operations, the use of step-up pumps to move water to wetland sites to maintain hydrological balance and the use of bioswales to manage infiltration rates and surface runoff water quality. Monitoring guidelines and protocols proposed are identified in **Section 10.0**.	Moderate/Minor

VR	Impact	Impact Significance	Mitigation	Residual Impact
Marine water quality	Degradation of marine water quality due to surface water runoff, and the mobilization of marine sediment	Moderate	Installation of silt traps and retention ponds during construction to reduce the risk of transport of contaminants and sediments down-stream to the marine environment. Monitoring guidelines and protocols proposed are identified in **Section 10.0**. These follow EMA WPR, 2019 and USEPA guidelines.	Minor
Bird communities	Destruction / segregation of habitat	Moderate	Use of local species of trees and shrubs for landscaping on the resort. The establishment of a monitored mangrove offset area. Maintenance of secondary forest buffers. Use of directed lights as well as amber or red lights for nocturnal species. Planned monitoring of roosting colonies and bird visitors at the resort. (Refer to **Section 10.0** for appropriate MMP).	Moderate/Minor

VR	Impact	Impact Significance	Mitigation	Residual Impact
Fish and aquatic invertebrate communities	Destruction of habitat and changes to the characteristics of the aquatic environment	Low	The establishment of a monitored mangrove offset area. (Refer to **Section 10.0** for appropriate MMP).	Minor
Other fauna	Destruction / segregation of habitat	Low	The establishment of a monitored mangrove offset area. Maintenance of hydrological wetland connectivity and faunal mobility access via stilled access roadway (Refer to **Section 10.0** for appropriate MMP).	Minor
Terrestrial biodiversity (flora)	Destruction of vegetation and faunal habitat during site construction	High	Use of local species of trees and shrubs for landscaping on the resort. The establishment of a monitored mangrove offset area. Maintenance of secondary forest buffers. (Refer to **Section 10.0** for appropriate MMP).	Moderate

VR	Impact	Impact Significance	Mitigation	Residual Impact
Human Environment	Mangrove Infringement	High	Steps must be taken by the Contractor and respective agencies to not only conserve the wetlands at the proposed impact site, but also prevent further informal settlement sprawl in other neighbouring wetlands.	High

VR	Impact	Impact Significance	Mitigation	Residual Impact
	Traffic Management	High	Construction traffic entering or leaving the site will be scheduled for off peak hours to minimize additional congestion at the intersections and/or disruptions in the regular traffic flow. Construction next to the highway will be scheduled for off peak hours and adequate traffic management procedures/methods will be put in place. Adequate covering up of the works to minimize danger to passing traffic. Erection of signs ahead of the works warning motorists of the construction ahead.	High