Granite Investment LP

ARIEL SANDS Hotel-Condo Cottage Colony Development

ENVIRONMENTAL IMPACT STATEMENT

April 2015



Prepared by Bermuda Environmental Consulting, Ltd



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GRANITE INVESTMENT LP HOTEL-CONDO COTTAGE COLONY DEVELOPMENT, SOUTH SHORE ROAD, DEVONSHIRE BERMUDA

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Bermuda Environmental Consulting, Ltd has prepared this report in accordance with the instructions of Somers Management Limited on behalf of Granite Investment LP, for the titled project.

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1. Non-Technical Summary

1.1 Brief Description of the Proposal

Granite Investment LP will submit an application for *Final Planning* permission to the Department of Planning, for the proposed Ariel Sands Condo-Hotel Cottage Colony development.

This \$90 million development will see the rejuvenation of the former cottage colony into a vibrant 5 star small boutique hotel that provides for 999 year leasehold units, which will also be hotel keys. The proposed site is currently a derelict, brownfield, oceanfront site with a long history as a tourism/hotel venue. Ariel Sands has been operating as a resort in this location since December 1954, and this is the first major renovation of these facilities. At the time of its closure in 2008, there were 47 cottages. The projected opening of the new hotel is the first quarter of 2017.

The proposed development encompasses 13.8 acres of the former Ariel Sands Hotel site which situated on Ariel Drive, off South Road in Devonshire. The site will be redeveloped for a new condo-hotel, providing for privately owned of units, which will also be hotel keys. A total of 44 units are proposed, 26 as single detached villas and 18 in a multi-story building. A total of 74 keys will be available. The main hotel building (Arrivals Building) will be a 5 storey structure (with only 4 storeys above grade on the south elevation) containing 18 condominiums, a 122 cover restaurant and bar as well as a reception area, gym, spa, salon and parking for guests and staff. Spread across the site, are 26 one storey detached villas (nine 2 bedroom and seventeen 3 bedroom), with car and cycle parking adjacent to each villa. Along the eastern part of coastal area of the site is a beach club with a112 cover restaurant and bar with outdoor dining terrace, lounge areas, and a freshwater swimming pool and guest parking. A 10 foot wide service road provides back-of-house access along the east side of the building with staff parking in the basement of the building. In addition the development will provide the necessary supporting infrastructure inclusive of driveways, access and service roads, parking, waste water management, domestic water supply. Although part of a separate planning application, the development also proposes the installation of solar panels on all buildings.

A 6 foot high sea wall is required to retain and define the beach club hard surface amenity areas and pool and has already been approved with a building permit issued. In order to retain and define the southern extent of the beach club dining terrace the sea/retaining wall must be extended another 79 feet. The entire site will be landscaped using some existing trees and plants as well as numerous new plantings adapted to this coastal environment. A phased Woodland Management Plan will be undertaken to enhance the wooded area zoned Woodland Reserve. The southern Agricultural Reserve area will be used for vegetable and flower production, while the one in the northwest corner of the site will be left in an open/grassed state.

1.2 Description of the Impact Assessment Process

The approach and rationale adopted to conduct this EIA is detailed in this document. The guidance offered under the 2008 Bermuda Plan and associated Guidance Notes, as well as UK best practice has been followed.

The proposed Ariel Sands Hotel-Condo Cottage Colony development has been examined both in the larger social and economic context of Bermuda, as well as in the context of the site-specific details. Consultation with regulators, key stakeholders and the neighbours identified areas of concern and topics for further examination. Without exception, everyone consulted expressed support for the project. Each topic identified for further study is examined in detail in its own technical chapter of the EIS with the magnitude of associated impacts evaluated, and mitigation proposed where indicated. This resulted in impacts being classified as:

- Not Significant No need to consider in decision-making; no mitigation required.
- Minor An impact that is significant, to be considered by decision makers, but small enough that management practices may ensure that impact levels remain below significance criteria.
 Moderate An impact that is significant and, if negative, mitigation should
- be considered. If positive such impacts provide justification for the project. Mitigation is likely to affect design and cost.
- *Major* An impact that is significant and in the case of negative impacts, mitigation must be considered. If positive, major impacts provide a strong case for support. Mitigation will alter project design and cost.

By applying this approach, the highest level of significance determined in the current study was Major. For the purposes of this non-technical summary, only those impacts identified at Moderate or Major, and the proposed mitigation for each of these are summarised below. Impacts determined to be minor or not significant are detailed in the relevant chapters in the full EIS.

1.3 Significant Beneficial and Adverse Impacts

The proposed development is projected to create a significant positive impact on Bermuda's economy through approximately \$90 million foreign investment in, and diversification of the Island's tourism product and by creating up to 60 permanent jobs as well as 60 temporary construction jobs in a severely depressed market, thereby providing much-needed economic stimulation. The development will also enhance local recreational opportunities by expanding the entertainment and relaxation offerings for residents and visitors through the proposed range of on-site amenities. The innovative use of ICF for buildings brings a number of benefits, including improved thermal efficiencies.

Additional beneficial impacts will be the use and restoration of a currently disused brown field site as well as the use of demolition debris from the pre-existing buildings for fill outside the Coastal Reserve zone and inundation zone, thereby reducing the need for sourcing material from elsewhere on the island. Historical data indicates that wave inundation to the 15 ft elevation is possible; this largely coincides with the Water Resource Protection Zone in this area. Aside from potential impacts for health and safety and economic impacts, the potential for wave inundation has implications for marine ecology and marine water quality in that storm-derived debris, potentially associated with the beach club building could negatively impact these receiving environments. The innovative use of ICF for building brings a number of benefits, including 9 times greater resilience to wind (up to 250 mph) and improved thermal efficiencies, so vulnerability to storms will be reduced.

The proposal is largely compliant with planning policies set out in the Bermuda Plan 2008, with the exception of various encroachments into setbacks, predominantly to lot lines. There is some further encroachment of development (although under 4 feet in height) and covering 2,453 square feet of the setback of zoned Woodland Reserve (representing 5.5% of the total Woodland Reserve, which covers an area of 44,292 square feet). Encroachment into the Coastal Reserve zone totals 4,350 square feet, representing 11.8% of the total Coastal Reserve area of 36,900 square feet.

Adverse impacts include the draw on the local Government freshwater supply. In an effort to promote the use of renewable energy solutions, some potable freshwater roof catchment is being traded for solar PV installation. Freshwater will therefore be drawn from a combination of onsite water catchment and piped Government water. The siting of the Arrivals Building on the ridge line will present a visual impact on a few neighbouring properties but there is an understanding that the land is zoned for Tourism. The project would inevitably have negative impacts in terms of solid waste production during the construction and fit out of the development, but this can be managed through careful quantity surveys. Construction activities are inevitably high risk in terms of health and safety, and without proper management can have a negative impact.

1.4 Proposed Mitigation Measures

Having identified the potential impacts of the proposed development that are moderate or major in scale, a range of mitigation measures are proposed to minimise the negative impacts. For construction, implementation of best management practices through a CEMP should include; restricting noisy activities to certain hours of operation and ensuring contractors are fully equipped with appropriate health and safety protective measures. The encroachment into the setback of the Woodland Reserve for parking and loss of 5 cedar trees will be offset by the development of a Woodland Management Plan which will detail upgrades to this heavily invaded woodland, and replacement of the lost cedars with at least 36 other endemics to be planted on the property. These plantings will help as buffers to the visual impact of the Arrivals Building for several of the neighbours. Installation of solar PV to reduce energy demand and the use of the ICF building product Nudura, to improve storm resistance, increase thermal insulation, and reduce noise, may in part compensate the inability of the facility to be fully self-sufficient with regards to the provision of freshwater.

1.5 Alternatives Considered

No alternative site locations were considered for this proposed development. The developers already own the land, which has a long history of development and use for Tourism purposes.

In terms of the business model of a Hotel-Condo Cottage Colony, the developers have drawn on experience and believe that this presents the most viable business model.

1.6 Unresolved Issues

There are no unresolved issues, however a lack of confirmed detail in some areas has meant it was necessary to make more qualitative assessments.

1.7 Compatibility with Land Use Plans and Policies

The proposed development is largely compliant with the Bermuda Plan 2008 zoning policies and intents. However, various setback encroachments are required to accommodate the development, as follows:

1. Woodland Reserve: A 15 foot setback is required under the Bermuda Plan. The proposed setback varies with a minimum of 3 feet to Woodland Reserve zone for arrivals building service access road, a retaining wall and parking areas.

- 2. West lot line Tourism Zone: A 10 foot setback is required. The proposed setback for the 12 foot wide roadway and a 4 foot high retaining wall is 5 feet from the lot line.
- 3. North lot line Tourism Zone (Dill Lane residence): A 10 foot setback is required. The proposed 16 foot wide roadway is located 3 feet from the lot line.
- 4. East lot line: A 10 foot setback is required to the lot line where zoned Tourism and 15 feet where zoned Coastal Reserve. The proposed setbacks vary as follows:
 - The proposed 16 foot roadway to accommodate the beach club traffic is located 5 feet from the lot line;
 - The proposed 10 foot-wide service roadway for the beach club back-ofhouse is located 5 feet from the lot line;
 - A portion of the proposed beach club building (2 storey access stairs at 18' high) is located 6 feet from the lot line;
 - > A borehole at 6 feet from the lot line.
 - The beach club dining terrace projects 36 feet into the Coastal Reserve zone and is located 10 feet from the lot line

1.8 Listing of Permits and Approvals

The proposed development will require a number of permits, some prior to construction, some prior to occupancy. These are; Building Permit (under the Planning Act 1974); Construction permit for a controlled plant (under Clean Air Act 1991) (for sewage treatment plant and back up generators); Water Rights permit for all abstraction and disposal wells required under the Water Resources Act 1975; An Operating Licence Issued by the Environment Authority for the backup electricity generator and sewage treatment plant (under the Clean Air Act 1991); Registration of LPG Storage Tank; Certificate of Completion and Occupancy (under Building Code Act 1988); Liquor Licence (under Liquor Licensing Act 1974); Restaurant Licence (under Public Health Act 1949); Discretionary permits include; EIS (under the Planning Act 1974); Conservation Management Plan (under the Planning Act 1974); Protected Species permit (under the Protected Species Act 2003) (for removal of protected plant species (Bermuda cedar); concessions under the Hotel Concessions Act 2000.

Table 1-1 following presents a summary of the moderate and major significant impacts for each affected environment.

MARINE ECOLOGY							
Affected	Construction	Issue	Significance	Avoidance/Mitigation	Monitoring/		
Environment	or Operation		ofimpact		Management Plan		
ME-1	Co	Beach Club siting	(-) Moderate	Use of Nudura for building which is stronger	N/A		
				than cement blocks, thereby reducing likely			
				impact from storms and subsequent impact of			
				debris on marine ecology.			
	-	MARINE WATERS,	WAVE ACTIO	NAND SEDIMENTS			
Affected	Construction	Issue	Significance	Avoidance/Mitigation	Monitoring/		
Environment	or Operation		of impact		Management Plan		
WQ-5	Ор	Wave inundation	(-) Moderate	Building above the 15 ft elevation. Use of	N/A		
				Nudura for building.			
		TERR	ESTRIAL ECO	OLOGY			
Affected	Construction	Issue	Significance	Avoidance/Mitigation	Monitoring/		
Environment	or Operation		ofimpact		Management Plan		
TE-1	Со	Encroachment on site boundary	(-) Moderate	Agreement with neighbours			
		setbacks					
TE-2	Со	Encroachment on Coastal reserve	(-) Moderate				
TE-3	Со	Encroachment on Woodland	(-) Moderate	Implementation of Woodland Management Plan	Woodland		
		Reserve		and planting of endemic trees	Management Plan		
TE-5	Co	Loss of endemic vegetation	(-) Moderate	Implementation of Woodland Management Plan	Woodland		
				and planting of endemic trees	Management Plan		
TE-11	Ор	Conservation Management	(+) Moderate	N/A	<i>N/A</i>		
TE-13	Ор	Control of invasive species	(+) Moderate	N/A	<i>N/A</i>		
WASTE MANAGEMENT							
WM-1	Со	Construction of hotel, villas,	(-) Moderate	Careful calculation of required materials;	CEMP and waste		
		restaurant and pool		cutting of Styrofoam products away from	management plan		
				shoreline.	for operations		
LANDSCAPE AND VISUAL							
Affected	Construction	Issue	Significance	Avoidance/Mitigation	Monitoring/		
Environment	or Operation		of impact		Management Plan		
LV-2	Co/Op	Main building siting	(-) Moderate	The management of the woodland reserve to	N/A		
				encourage high profile plantings may assist in			
				reducing the visual impact to receptors to the			
				north.			

LV-5	Co/Op	<i>Revitalisation of a defunct tourism</i>	(+) Major	N/A	N/A		
	CULTURE AND RECREATION						
Affected Environment	Construction or Operation	Issue	Significance of impact	Avoidance/Mitigation	Monitoring/ Management Plan		
CR-2	Ор	Enhanced recreational opportunities	(+) Moderate	N/A	N/A		
		SC	OCIO-ECONO	MIC			
Affected Environment	Construction or Operation	Issue	Significance of impact	Avoidance/Mitigation	Monitoring/ Management Plan		
SE-1	Со	Job Creation	(+) Moderate	N/A	<i>N/A</i>		
SE-2	Co	Tourism Infrastructure Investment	(+) Moderate	N/A	<i>N/A</i>		
SE-3	Ор	Job Creation	(+) Moderate	N/A	<i>N/A</i>		
SE-4	Ор	Enhanced Tourism Offering	(+) Moderate	N/A	N/A		
		HEA	ALTH AND SA	FETY			
Affected Environment	Construction or Operation	Issue	Significance of impact	Avoidance/Mitigation	Monitoring/ Management Plan		
HS-2	Со	General construction activities	(-) Moderate	Strict adherence to Occupational Safety and Health Regulations (2009)	СЕМР		
HS-5	Ор	Universal Design and accessibility	(+) Moderate	N/A	N/A		
HS-6	Ор	Fire Fighting	(+) Moderate	N/A	N/A		

2 Development Proposal

2.1 Introduction

Granite Investment LP will submit an application for *Final Planning* permission to the Department of Planning, for the proposed Ariel Sands Condo-Hotel Cottage Colony development.

The proposed development encompasses 13.8 acres of the former Ariel Sands Hotel site which situated on Ariel Drive, off South Road in Devonshire. The site will be redeveloped for a new 5 star boutique condo-hotel, providing for privately owned of units (999 year leasehold), which will also be hotel keys. With a projected opening in the first quarter of 2017, a total of 44 units are proposed, 26 as single detached villas and 18 in a multi-story building. A total of 74 keys will be available. All resort hotel amenities will be provided including a beach club with swimming pool and restaurant with dining terrace, as well as a gym, spa, and second restaurant/bar in the main arrivals building. The main hotel building (Arrivals Building) will be a 5 storey structure (with only 4 storeys above grade on the south elevation) containing 18 units, a 122 cover restaurant and bar, a spa and salon and parking for guests and staff.

2.2 Need for the Development

The decline of Bermuda's tourism infrastructure is well documented but with a decline in beds, jobs in the hospitality industry have fallen from 5,261 people in 1980 to 4,385 in 2012. Even in more recent years, the number of rooms has declined from 2,832 (5820 beds) in 2009 to 2,531 (5,243 beds) in 2012 spread over 48 properties. This declining trend is exemplified by the history of the Ariel Sands Hotel Cottage Colony, which closed its doors in January 2008. However, contrasting with this, hotel visitor numbers have risen from 159,739 in 2009 to 166,425 in 2012. This encouraging trend underlines the justification and need for investment and efforts to upgrade the hotel product in order to revive the industry.

The proposed development promises to do just this, with the development of a luxury resort, which seeks to honor the spirit of the original Ariel Sands Hotel and preserve its unique character. The new resort will embrace Bermuda's traditional architecture at the same time as incorporating modern amenities for comfort and ease. The restored beach and enormous salt-water tidal pools will continue to offer a unique

and wonderful experience. The dramatic beach club will house an informal ocean front restaurant/bar as well as a fresh water pool overlooking the beach. The two and three bedroom villas and suites will all have marvelous ocean views and easy access to the beach and beach club. Innovative approaches to energy production and conservation as well as green construction practices will insure the property is both compatible with and respectful of the environment.

2.2.1 Local Policy

2.2.1.1 Tourism facilities

Since the peak years for local tourism in the 1980's, there has been a steady decline in the relative contribution that the hotel industry has made to the Bermuda economy. There is growing appreciation of the challenges faced by local hotel operations and of the critical need for their success to support tourism and international business. This has prompted wide recognition of the need to refresh the Island's hospitality sector and as a result all reasonable proposals to improve the tourism product can be expected to receive strong community support. However, there is similarly widespread appreciation, supported both by legislation and policy, that future development in Bermuda must be undertaken with full consideration of the wider social, economic and environmental impacts.

The Bermuda National Tourism Master Plan (2012) has eight strategic objectives, four of which are directly addressed through the proposed development:

- 1) Build a unique product and create competitive positioning
- 2) Improve quality
- 3) Create new demand and reduce seasonality
- 4) Support business development and attract investment

2.2.2 Existing solution

2.2.1.2 Ariel Sands Cottage Colony

The site of successive development to expand the hotel product, the existing hotel has been closed since January 2008 having suffered declining tourist numbers. Until the recent approval for demolition, the site supported 47 unmanaged and deteriorating cottages scattered across the property, presenting a loss of potential tourist beds and associated revenue, a significant eyesore to the immediate neighbours and a potential site for vermin to become established.

2.3 Description of the main processes including size and capacity, throughput, input and output

The new Ariel Sands Hotel Condo Cottage Colony development is laid out like a traditional hotel cottage colony concept with a main building (5 storeys) containing hotel amenities with low scale, multiple suites in separate buildings/villas (one storey), spread throughout the site (see site plans and elevations filed with DAP1 application). The buildings will be sited, accessed and landscaped in such a manner as to retain a low density of buildings and a high level of open space, as well as achieve the highest level of privacy between units as well as neighbours, while capitalizing on the best sea views wherever possible. Resort style amenities including a beach club (with pool area, restaurant, outdoor terrace and bar), spa, salon, restaurant, bar lounge, pool area, and gym are also proposed.

2.3.1 General Overview

The proposed development is shown on the attached Site Plan and includes:

- > 44 hotel-condo suites/units in total with a total of 74 hotels keys.
- The condo-hotel units are located in the arrivals buildings and as detached villas across the property with 26 units in one storey detached villas (nine 2 bedroom and seventeen 3 bedroom) and 18 units in the arrivals building (fourteen 1 bedroom and four 2 bedroom).
- The arrivals building will be 5 storeys and contain hotel reception, management offices, an 88 seat restaurant with 34 seat bar lounge area, gym, spa, and salon (see Arrivals Building Details below).
- A beach club restaurant with dining terrace and bar (112 seats) and swimming pool (see Beach Club Details below).
- Surface parking for guests, event parking and staff parking (see Site Circulation and Parking Details below).
- Various areas of cutting and filling with retaining walls (maximum expected at 12 feet high, stepped and landscaped) to accommodate detached units and beach club and terrace.
- During construction, temporary use of storage containers, a crushing plant for rubble and cement batching.
- A portion of a sea/retaining wall 79 feet long and 6 feet high along the south edge of beach club dining terrace to tie into an approved sea/retaining wall (approved under application and permit nos. P0434/14 and B0010/15).
- Installation of new infrastructure, including roadway, parking areas, underground site utilities, waste water management and domestic water supply and the installation of solar panels (see Servicing Details/Infrastructure below).
- Flower and vegetables will be grown on the Agricultural Reserve lands adjacent to South Road while the parcel in the north east of the site will remain in an open/grassed state.

- Retention of certain mature trees and new landscaping throughout the property with a mix of appropriately selected site tolerant native species and certain charismatic exotics suited to such a tourism site.
- A Woodland Management Plan will be developed and undertaken for the Woodland Reserve zoned lands.

2.3.2 Arrivals Building Details

The arrivals building will be located on a high point in the north western portion of the site, overlooking the villas, beach and ocean. It will be 5 storeys on the north elevation, and 4 on the south elevation, inclusive of a basement. The maximum eave height will be approximately 109 feet. Its location from the nearest residence on Dill Lane is 80 feet and it is located 36 feet from the west lot line.

Parking for cars and cycles are provided adjacent to the building off of a circular driveway (see Site Circulation and Parking Details below).

The floors of the building are planned as follows:

Basement Level (at grade on north elevation): Reception and Lobby; Administration and Booking office; managers offices; Kids Entertainment Room; Potable Water Tank; Non-Potable Water Tank, Fire Water Tank; storage units for condos; maintenance storage; Electrical and Chiller rooms; Pumps

Level One: spa, salon, fitness centre, restaurant, bar-lounge, laundry service areas and BOH facilities/spaces

Level Two: 7 condos

Level Three: 7 condos

Level Four: 4 condos

Roof Level: Solar Panel Array, Hot Water thermal panels, in selected areas hidden from view.

There are 2 elevators and 2 sets of fire escape stairs incorporated in the design.

2.3.3 Beach Club Details

The beach club consists of two buildings (main club building and a small outdoor washroom/shower facility, all totalling 2,795 square feet), and adjacent outdoor amenity areas including an uncovered dining terrace, fresh water pool (purification details to be determined in concert with the Department of Conservation Services) and hard surfaced lounge areas/decks. The beach club area is enclosed by a sea/retaining wall south of which the beach is located. Access stairs lead to the beach and the existing seawater "pools" along the rocky foreshore. The beach club is a two level building where most of the structure is sub-grade with two storeys showing on the east elevation only at 25 feet grade to eaves. An 18 foot high access stair case in the setback is also located on the east elevation. Existing thick

vegetation is located on the adjacent property and an additional 10 foot wide planting buffer in the setback is proposed. The floor to ceiling height will be 15 feet on the upper level so that the interior has an open feeling. The building is located in the Tourism zone while the dining terrace and some of the deck areas (approximately 4,350 square feet) are located in the Coastal Reserve zone.

The elevation of the dining terrace sits at 14 feet and the pool deck at 12 feet. The beach terrace area will therefore require retention and filling. The majority of the sea/retaining wall along the pool and terrace area was approved and the new portion (79 feet long) is required. The proposed sea/retaining wall will be 6 foot high reinforced concrete wall.

The floors of the building are planned as follows:

Basement Level: non-potable and potable water tanks, pump room, storage areas, parking area, and washroom facilities

Level One: a 52 seat restaurant with small bar area, a 60 seat dining terrace, washroom facilities.

2.3.4 Site Circulation and Parking Details

The site will have access driveways and a network of footpaths connecting the various buildings and for vehicular access including emergency vehicles around the property. On grade car parking will be provided for guests, visitors and villa owners.

The existing access road and entryway (Ariel Drive) is to be maintained as it exists. The current sight line to both the west is 90 feet while to the east is somewhat less.

The circulation roads along the east and west lot lines are 16 feet and 12 feet wide, respectively. The laneways that will service the villas are 8 feet wide with a 2 foot verge on either side to allow emergency vehicles full to access the buildings in a forward direction, in one side and out the other.

The access drive servicing the arrivals building courtyard is 16 feet wide. The courtyard has a sufficient area for a fire truck to execute a 3 point turn around. Parking areas are located adjacent to the building.

Provisions have been made for service vehicles with access lanes to BOH service areas in both the arrivals building (at 16 feet wide) and the beach club BOH at 10 feet wide.

Site parking is provided as follows:

Villa parking - 2 car spaces per unit for 3 bedroom units and 1 car space per unit for 2 bedroom units. All have a single bike space. Spaces are located adjacent to each unit.

- > Arrival Building total parking 50 cars and 49 cycle spaces
- Arrival Building staff parking 10 cars and 20 cycles (5 in BOH and 15 to be allocated and clearly designated for staff in parking lot)
- > Arrival Building spa parking 6 cars and 6 cycles
- > Arrival Building general guest parking 34 cars and 23 cycles
- Beach Club guest parking parking for 14 cars and 13 cycles are provided at the beach club
- Beach Club staff parking 5 cycles in basement of beach club
- Event overflow parking only during events and possible on a valet basis, cars will be parked along the 16 foot eastern roadway (approx. 15 spaces), on the arrivals building lane (approx.10 cars), as well as along Ariel Drive (approx. 15 spaces)

2.3.5 Existing Vegetation and Proposed Landscaping

The site will be landscaped to provide an amenity in itself with grass lawns, trees, shrubs and small hedgerows to give a sense of privacy and outdoor space to the Villas. Existing mature vegetation and endemics will be identified on site and flagged for retention in place or removed and reused if possible. The overall landscaping concepts will be completed by the landscaping consultant prior to filing a DAP 1 application. Consultations with the Department of Conservation Services will be sought as landscaping details progress.

2.3.6 Servicing Details/Infrastructure

A total of 13 boreholes are proposed: 10 for surface run off, 1 for HVAC and 2 for waste disposal to service the sewage treatment plant.

2.3.6.1 Waste and Sewage

The sewage treatment will provide secondary level treatment with a capacity of servicing 200 persons. It is located to the south of the Agricultural Reserve in the north east of the site and meets setbacks to the lot line and Agricultural Reserve. It is 134.5 feet (41m) from the nearest off site receptor. The vent stack is located south of the plant at 3 to 4 feet off grade, and is in excess of 164 feet (50m) from the nearest off site receptor.

Solid Waste Removal will be on a daily basis via a private waste collection company and transported to Tynes Bay. A recycling program will be in place, however with the Government recycling plant will be closing, and it is uncertain at this time what facility will be able to receive such materials.

2.3.6.2 Freshwater

All buildings have roof catch and water tanks for domestic water supply with Government water located at the site to be extended to the arrival building for additional supply and distribution to other buildings are required. The current demand projected for the development is 76,300 GPD, with 33,000 GDP for general use and 43,000 GPD for irrigation needs.

The arrivals building will have a smaller roof catch area than normal due to much of the roof space being dedicated to solar panels. The roof catch will be used to its fullest capacity despite solar panels given that all solar areas on the roof will provide non-potable water for uses on site such as landscaping, and possibly for flushing. Potable water will be collected from the roof parapet areas. The arrivals building has a fire fighting tank capacity of 60,000 US gallons, a potable water tank of 59,400 Imperial gallons and a non-potable tank of 38,900 Imperial gallons.

The beach club will also have less roof catch area for potable water due to solar panels and both potable and non-potable water will be collected. The beach club will have a potable water tank of 14,550 Imperial gallons and a non-potable tank of 6,950 Imperial gallons.

2.3.6.3 Fire Suppression

The arrivals building and beach club will each be fitted with a sprinkler system. The villas will not have sprinkler systems as fire truck access has been provided for and a ring main system with 10 hydrants will be installed. The swimming pool will also provide a freshwater source and there will be relatively easy access to the seawater for fire fighting. The backup generator will serve the fire pump in the event of a power outage.

2.3.7 Construction Timeline

Construction is anticipated to commence in May 2015 for a scheduled opening in the first quarter of 2017.

2.3.8 Operation and Maintenance

Hotel, Restaurant, Beach Restaurant and bar, Spa and fitness centre and swimming pool

Ongoing operations and maintenance associated with the hotel will be those activities typical of such facilities, including arrival and departure of clients and staff, cleaning and re-stocking of supplies, maintenance of restroom and shower facilities, food and beverage deliveries, restocking of supplies, cooking and cleaning, serving of drinks, removal of trash as well as routine plumbing, painting and electrical maintenance. It is planned that laundry services will be provided off-site.

There will be ongoing landscaping and gardening across the whole property as well.

2.3.9 Decommissioning

It should be expected that any development could be demolished and removed in an environmentally-sensitive fashion and the impacts of doing this will be addressed in the EIS.

2.4 Alternative Options

2.4.1 No development

Given that the proposed development is on property primarily zoned for tourism, it is to be expected and indeed intended that development will occur on this site. If the current tourism/recreational facilities being proposed were not to proceed, the substantial economic benefits that could be realised to the community as a whole from a new luxury tourism product would be lost.

2.4.2 Finding an alternative location for the development

Finding another location for the proposed development would involve the applicant trying to secure another suitable property for purchase. Given the limited land availability in Bermuda, the fact that any properties on the market are likely already built on, and the fact that the current property is already zoned for tourism, this is not considered a viable option.

3. The Proposed Site and Surrounding Area and Land Use Zoning Policies

3.1 Site and Surrounding Area

The subject site is a 13.8 acre site situated off South Road (public road) in Devonshire. A two-way estate road (Ariel Drive) provides direct access to the site as well as to Dill Lane where 6 residential detached homes on separate lots are located (on the east side of Ariel Drive), on lands zoned Tourism. These lands were formerly part of the Ariel Sands Hotel property. The site runs between South Road and the south shore coastline with topography that generally rises up from South Road to approximately 65 feet and then slopes down to sea level. While the east site of Ariel drive is occupied by the residences which are quite visible from South Road, the west side is characterized by natural areas in the form of abandoned farmland and a wooded hillside. The site has approximately 650 feet of frontage along South Shore Road; and approximately 1000 feet of coastline, with one main beach.

The majority of the former hotel structures have already been demolished under a demolition permit and demolition is ongoing.

The site is predominantly zoned Tourism in the 2008 Bermuda Plan, but also contains other zonings as follows:

- Coastal Reserve zoning along the coast
- Open Space Reserve (OSR) zoning which runs along the entire front of the site and up the steep wooded hillside visible form South Road
- The western portion of the OSR is also subject to an area zoned Agricultural Reserve (adjacent to the public road)
- > The steep wooded hillside zone OSR is also subject to a Woodland Reserve zoning
- a second area of Agricultural Reserve, also subject to Tourism zoning, is located south of and adjacent to the residential units off Ariel Drive
- A Water Resource Zone runs along the coastal area in a similar configuration to the Coastal Reserve Zoning, but reaches further inland. A small pocket is also located on the Agricultural Reserve lands along South Road, representing a ground water resource.

3.1.1 Uses and zonings adjacent to the east and west lot lines include:

West: Open Space Reserve with Agricultural Reserve and Woodland Reserve overlays towards the north section in line with the subject side's zonings, Residential 2 with two Agricultural Reserve pockets in the central area and a thick band of Coastal Reserve along the coast. The area is occupied by two residential properties on large lots accessed off Devondale Drive (estate road).

East: predominantly Open Space Reserve with Agricultural Reserve and Woodland Reserve overlays abut the east lot line with a small area of Residential 2 zoning. The area is a large private residential estate property (Palm Grove), which contains five residential units.

Across South Road to the north is a Residential 2 area with detached homes (Melville Estate South) with Conservation zoned areas on either side of the estate in the form of Woodland Reserve, Open Space Reserve, Agricultural Reserve and Rural zones. Uses in these areas closest to South Road include very low density detached housing surrounded by wooded areas, farmlands and open spaces.

Figures 3-1 and 3-2 show the location of the subject site within the island context and area context.



Figure 3-1. General Location of Subject Site



Figure 3-2. Location of Subject Site within the South Shore Landscape (1997 aerial photography).

3.2 Subject Site Zoning Policies - Bermuda Plan 2008 Planning Statement

The primary zoning policies applicable to the site under the 2008 Bermuda Plan are summarized below and include the following zones:

- Tourism (Development Base Zone)
- Coastal Reserve zone (Conservation Base Zone)
- Water Protection Area (Conservation Area)
- > Open Space Reserve (Conservation Base Zone)
- Woodland Reserve (Conservation Base Zone)
- Agricultural Reserve (Conservation Area)

In cases where land is subject to both a Development Base Zone and a Conservation Base Zone or Conservation Area, the latter two have priority so that the protection and preservation of the Conservation Base Zones and Areas are the predominant planning objectives (Chapter 3, ZON.4 and .5).



Figure 3-3. Site and Surrounding Zoning - Bermuda Plan 2008

3.2.1 Tourism Policies

Chapter 27 of the Bermuda Plan sets out the objectives and policies for Tourism zones. The objectives of the Tourism Zoning are to: 1) provide for the orderly development, expansion and upgrading of a range of top quality tourism, cultural and entertainment facilities consistent with the operation of a successful tourism industry; and 2) prevent the over-development of sites and to ensure that the massing, scale, design and density of development are compatible with the Bermuda Image and sensitive to the physical characteristics of the site and its surroundings.

Under the Tourism zoning accepted forms of development include hotels and other forms of tourist accommodation including fractional ownership, leases, licenses, and timeshare ownership. Additionally, other forms of development may be permitted as accessory to the principal uses, provided the Board is satisfied that the proposal is for services and/or facilities which are normally accessory to and/or compatible with

the principal use. Residential forms of development may be permitted at the discretion of the Board in accordance with policy TOU.6, which sets of the relevant criteria when proposing residential use.

TOU.6 (1) Residential development may be permitted in a Tourism zone at the discretion of the Board, provided the Board is satisfied that the following criteria are met:

- (a) the proposal has the support of the Minister responsible for Tourism;
- (b) the proposal will not be detrimental to the environment of any
- (c) neighbouring area;
- (d) the proposal complies with the applicable provisions of the Residential 1 zone;
- (e) the proposal complies with the relevant Residential Development Standards specified in Chapter 8, Design;
- (f) adequate access and parking are provided in accordance with the policies of Chapter 11, Transportation and Parking; and
- (g) any proposal which includes a mix of tourism and residential uses on the same site complies with the provisions of sub-paragraph (2).

(2) In amplification of sub-paragraph (1), residential forms of development may be permitted on the same site as a tourism development at the discretion of the Board, provided the Board is satisfied that the following criteria are met:

- (a) the size and physical characteristics of the site are such that residential development can be accommodated without detriment to the environment, character and quality of the tourist accommodation;
- (b) the residential development is self-sufficient in its provision of open space, amenity space and parking space;
- (c) the scale, massing and design of residential development are compatible with the character of the tourism development; and
- (d) the residential development will not be injurious to the amenity or environment of the tourism development by reason of appearance, scale, density, noise or traffic generated.

3.2.2 Agricultural Reserve Policies

The objectives and policies of the Agricultural Reserve Zoning are outlined in Chapter 20 (AGR). The stated objectives are to: 1) to conserve all important agricultural land to support agricultural, farming and horticultural uses; and 2) to conserve agricultural land for its natural and aesthetic value, and for providing a visual and amenity buffer between and within development areas.

Development within the Agricultural Reserve zone is highly restricted to the extent that only buildings and accessory structures directly associated with the agricultural,

farming and/or horticultural use of the land may be permitted, and only provided that the Board is satisfied that the extent of the Agricultural Reserve is such that the development cannot be sited within a development area beyond the boundaries of the Agricultural Reserve (AGR.3).

Agricultural Reserve policies indicate that topsoils and subsoilsis are protected in by planning legislation, under Head of Protection B, Fourth Schedule.

The Plan requires that development be set back a minimum of 15 feet from areas of Agricultural Reserve.

3.2.3 Coastal Reserve Policies

The intent of the Coastal Reserve zoning (Chapter 16, COR) is to provide a buffer or setback between the shoreline and any development taking into consideration wave energy, storm surge and erosion risk as well as the need to preserve the coastal and marine environments from inappropriate development. Minor site works and accessory structures may be permitted for specific purposes and more major facilities can be permitted in the case of facilities associated with a tourism development, including but not limited, to recreational facilities, terraces, beach bars and restaurants.

A setback minimum of 15 feet to lot line is indicated.

3.2.4 Woodland Reserve Policies

The Woodland Reserve policies are outlined in Chapter 19, WDR) and are aimed at protecting wooded areas which are of ecological, aesthetical and functional importance and all forms of development are generally prohibited in this zone.

Woodland Reserve policies indicate that protections for various ecological features are protected by planning legislation, under Heads of Protection A, E and F of the Fourth Schedule.

A setback of 15 is required for all development.

3.2.5 Open Space Reserve Policies

Open Space areas consist of a wide variety of unbuilt areas of different types, sizes and qualities. The overriding consideration is to maintain such areas in an open and natural state. Development is limited to minor site works and accessory structures.

3.2.6 Water Resources Zone

The intent of this is to protect the island's water resources, both inshore (habitat areas and water lenses) and coastal waters. Proposed development is regulated to the extent that it will not cause harm to the water resource. Potential impact items which must be considered include excavation and site preparation works, sewage disposal, management of run-off, swimming pool water disposal and type, form and extent of development proposed.

Water resources are protected in by planning legislation, under Head of Protection E, of the Fourth Schedule.

3.3 Marine Use

3.3.1 Existing and Future Marine Use on and Adjacent to the Proposed Site

There are no known future plans for the marine environment at this site.



Plate 3-1. Site photos showing the general site

4. Planning and Legislative Framework

4.1 Introduction

The nature of the proposed development and its location is considered in the context of the existing environmental baseline conditions. Following initial consultation, desk studies and site visits, the potential impacts of the activities involved in the construction, operation and decommissioning of the proposed project are presented, as a preliminary assessment in preparation for the full EIA.

4.2 Requirement for an EIA/EIS

The Bermuda Plan 2008 details the Planning Application process and the information required to support a Planning Application. Chapter 6 Section ENV.2 (1) states that:

"In the submission of any planning application, the onus shall be on the applicant to provide the Board with sufficient and detailed information as will enable the Board to understand and assess the environmental and planning issues and to satisfy the Board with respect to those matters specified in objectives ENV (1) to (3), and for the avoidance of doubt the Board may refuse any application which provides insufficient information for the Board to make a proper assessment of the proposal." It further states that:

"In amplification of sub-paragraph (1), the information requirements for certain development proposals may be more comprehensive and may need to take the form of an Environmental Impact Statement......"

The Bermuda Plan 2008 states in section ENV.4 that "developments which are likely to require an EIA and EIS include "(c) Major hotel and resort developments."

4.3 Screening

Through a self-screening process based on the above listed criteria and through knowledge of additional conservation protection afforded to Bermuda's natural and cultural environment, Granite Investment LP recognised that a planning application for this proposal would require an EIS.

4.4 The Scoping Process

The EIA/EIS guidelines outlined in the Bermuda Plan 2008 state that the EIS should "assess the potential effects and identify the type, probability, magnitude, extent and significance of the impacts" on "human beings, buildings and man-made features, flora, fauna and geology, land, water, air and climate and other indirect and secondary effects".

Information was gathered through a desk study, stakeholder consultation and site visits to gain a basic understanding of the existing environmental, social and economic conditions, and the potential impacts on these of the construction, operation and eventual decommissioning of the proposed Ariel Sands development. This information was presented in the Environmental Scoping Report, which was finalised on 22nd April 2015. The information in the Scoping Report has been used to guide the focus of this EIA, including highlighting areas where further investigations were required.

4.5 Desk Based Studies

The largest collection of scientifically published documents as well as unpublished technical reports and local studies on the Island's environment are housed at the Bermuda Aquarium Museum and Zoo (BAMZ) library. These documents were searched through the Bermuda Bibliography database, which comprises over 4,000 records.

Key Literature sourced for desk-based studies is referenced in the Bibliography.

Key Datasets reviewed include:

- Terrestrial Vegetation Survey, 1999-2003, Bermuda Biodiversity Project
- Bermuda Species Database, Bermuda Natural History Museum
- Bermuda Cave and Karst Information System
- Island-Wide Public Skink Survey, Bermuda Biodiversity Project

4.6 Stakeholder Consultation

4.6.1 Stakeholder Consultation for Study

The following Bermuda Government officers were consulted for specific information within their area of expertise. Five of these officers attended a briefing session and site visit held on 2 April 2015 representing 5 departments. Subsequent to the site visit, the technical officers provided their feedback by email and a summary of this is included in Appendix 9.2.1.

- Mr J. Tarik Christopher, Principal Engineer (Water), Ministry of Public Works
- Mr. George Shakir, Planner, Department of Planning, Development and Control
- Mr. Peter Drew, Terrestrial Conservation Officer, Department of Conservation Services
- Mr Alan Hunt, Solid Waste Manager, Ministry of Public Works*
- Ms. C. Baxter and Ms. S. Hill, Environmental Health Officers, Department of Health*
- Mr. Keith Masser, Construction and Maintenance Engineer (Highways) Ministry of Public Works
- Dr Nicola O'Leary, Sustainable Development Officer, Sustainable Development Department*
- Mr Kirk Outerbridge, Plant Manager, Tynes Bay Waste Treatment*
- Mr Francis Richardson, PS Ministry of Tourism and Transportation
- Dr. Geoff Smith, Environmental Engineer, Department of Environmental Protection
- Lieutenant Josonne Smith Bermuda Fire and Rescue Service
- Mr Clarkston Trott, Waste Management Section*
- Mr. Keith Simmons, Accessibility Officer, Ministry of Health, Seniors & Environment

Responses to scoping were not obtained from those technical officers/departments noted with an * above. It is anticipated that they will review the DAP 1 application and provide comments at that time.

4.6.2 Focused Stakeholder Consultation in Preparation of the Scoping Report

In additional to the technical consultations conducted above, Bermuda Environmental Consulting, Ltd undertook consultation with the Bermuda National Trust and Bermuda Environmental Sustainability Taskforce (BEST), providing the proposed site plan and a detailed written overview of the project by email on 15th April. Feedback form these NGOs is pending.

4.6.3 Neighbourhood Consultation

A presentation was given to the Ariel Sands neighbours on Tuesday 17th March from 6.30-7.30 pm. The site plan and survey were provided and an overview of the proposal presented. The catchment area for inclusion for this neighbourhood consultation was agreed with the Department of Planning on and is shown in Figure 2-1. Invitations were extended to 34 properties. 17 residents attended.

Subsequent to this, individual meetings were held with the 3 adjacent property owners to the east, north and west on 15th and 16th April to show them more

detailed and updated plans, and advise of the specific setback encroachments proposed along their lot lines.

Figure 4.1. Catchment area for consultation of neighbourhood residences.

4.6.4 Press Releases/Articles

There has been one local press articles in the past 12 months (see Appendix 9.3).

4.7 Site Visits

Bermuda Environmental Consulting Ltd. made site visits to the proposed development site on 4th, 17th, 31st March and 2nd, 13th, 14th, 15th and 21st April 2015. The meeting on 2nd April 2015 was with the Government technical officers listed above.

4.8 Legislation

4.8.1 International Legislation

Relevant international policy and legislation was considered during the course of the EIA and includes:

- UK Overseas Territories Environment Charter (2001)
- United Nations Convention on Climate Change (1992)

4.8.2 Other Local Legislation

Other relevant local legislation considered during the course of the EIA and expanded in the relevant technical chapters includes:

- Summary Offences Amendment Act 2010
- Energy Act, 2009
- Health and Safety at Work Amendment Act 2004
- Protected Species Act 2003
- Hotel Concessions Act 2000
- Clean Air Act 1991
- Building Code 1988
- Waste and Litter Control Act 1987
- Occupational Safety and Health Act 1982
- Protection of Birds Act 1975
- Water Resources Act 1975
- Development and Planning Act 1974
- Liquor Licence Act 1974
- Fisheries Act 1972
- Hotel Licensing and Control Act 1969
- Restaurants Act 1961
- Bermuda Immigration and Protection Act 1956
- Public Health Water Storage Regulations 1951
- Public Health (Food) Regulations 1950
- Public Health Act 1949
- Road Traffic Act 1947

Local plans, documents and guidelines considered in preparation of the EIS includes:

- Bermuda National Tourism Plan, 2012
- Bermuda Energy White paper A National Energy Transition, 2011
- Energy Green Paper. A National Policy Consultation on Energy, 2009
- Bermuda Plan 2008 Planning Statement
- Bermuda Plan 2008 Zoning Maps
- GN106 Environmental Impact Assessment, Department of Planning Guidelines
- The Draft Sustainability Development Strategy and Implementation Plan for Bermuda
- State of the Environment Report, 2005
- Department of Planning Coastal Protection and Development Guidelines, 2004
- Sustainable Waste Management for the Island of Bermuda, 2004
- Bermuda Biodiversity Action Plan, 2003

4.8.3 Permits Required Prior to Construction

Other permits required prior to construction are:

- Construction permit for a controlled plant (under Clean Air Act 1991) (for sewage treatment plant and diesel operated fire pumps)
- An Operating Licence Issued by the Environment Authority for the crusher (under the Clean Air Act 1991)
- Building Permit (under the Planning Act 1974)
- Water Rights will be required under the Water Resources Act 1975 for new abstraction wells.
- Water Rights will be required under the Water Resources Act 1975 for new disposal boreholes.
- Protected Species Permits to remove/relocate protected trees.
- Woodland Management Plan.

4.8.4 Permits Required Prior to Commercial Operation

The need for new permits prior to operation was scoped into the EIA, pending fully detailed infrastructural upgrades.

- An Operating Licence Issued by the Environment Authority for the backup electricity generator, sewage treatment plant and diesel operating fire pumps (under the Clean Air Act 1991)
- Certificate of Completion and Occupancy (under Building Code Act 1988).
- Condominium Licence (under Condominium General regulations 1987)
- Liquor Licence (under Liquor Licensing Act 1974)
- Hotel Licence (under Hotels (Licensing and Control Act) 1969)
- Restaurant Licence (under Public Health Act 1949)

4.9 Consultation in preparation of the EIS

Ongoing consultation was conducted with the following key stakeholders who have already been engaged during the Environmental Scoping, during the preparation of the EIS:

Ongoing consultation was conducted with the following key stakeholders who had already been engaged during the Environmental Scoping, during the preparation of the EIS:

- Department of Planning
- Department of Conservation Services
- Department of Environmental Protection
- Department of Health
- Department of Sustainable Development
- Department of Tourism
- Department of Waste Management
- Fire and Rescue Department
- Ministry of Public Works (Waste Management, Water and Wastewater, Structures, Highways, Tynes Bay Waste Treatment Facility)
- Agricultural Board
- Bermuda Environmental Sustainability Taskforce
- Bermuda National Trust
- Area residents

5. Planning Policy Compliance

5.1 Zoning Policies

The relevant zoning policies applicable to the site under the 2008 Bermuda Plan have been outlined in Section 3.2 and are assessed for proposal compliance below. The site zonings are as follows:

- Tourism (Development Base Zone)
- Coastal Reserve zone (Conservation Base Zone)
- > Water Protection Area (Conservation Area)
- > Open Space Reserve (Conservation Base Zone)
- Woodland Reserve (Conservation Base Zone)
- > Agricultural Reserve (Conservation Area)

Various other development policies from the Bermuda Plan apply relating to walls, cut and fill, parking, design, landscaping which are also assessed below as relates works proposed as part of the subject development.

5.1.1 Tourism Policies

The majority of the site is zoned Tourism. The site is a brownfield site once occupied by a hotel use which included a restaurant with outdoor dining terrace, pool and spa. The proposed development is compliant with the Tourism zone policies as a hotel project being developed on Tourism zoned lands. There are relatively minor and largely non-impactful setback encroachments required to accommodate the proposal; all of which are detailed with rationales and mitigation/compensation proposals below.

The objectives of the Tourism Zoning are to: 1) provide for the orderly development, expansion and upgrading of a range of top quality tourism, cultural and entertainment facilities consistent with the operation of a successful tourism industry; and 2) prevent the over-development of sites and to ensure that the massing, scale, design and density of development are compatible with the Bermuda Image and sensitive to the physical characteristics of the site and its surroundings. These objectives are fully met in the high quality of design and landscaping proposed, the predominantly low scale and low density of buildings on site design, provision of varied amenities for guests in a spa, gym, salon, a beach club facility and two restaurants, one with outdoor seaside dining. The scale and massing of the multi-storey building has been kept to a practical minimum at 5 storeys. In order to keep the resort to a suitable scale for the site and area, while achieving as much privacy as possible for villa units, there are only 44 units and 74 keys (a combination of lock-off suites and main units) spread across 13.8 acres. In terms of site density, the proposed "unit count" yields a density of 3.2 upa which is a very low density, and lower that permitted maximum densities in the surrounding Residential 2 (6 upa) areas. The consolidation of 18

units and a variety of amenities in one multi-storey footprint assists in the retention of open space and landscaped areas. Roadways and hard surfacing are also kept to a practical minimum to enhance area available for landscaping areas.

The Tourism policies allow for various forms of tourism hotel and resort uses and accessory uses which support and are compatible with the principal use. Residential forms of development are also permitted subject to meeting certain criteria set out on TOU.6. Given that condominium hotels are operated and governed in substantially the same manner as hotels and/or resort hotels, and although somewhat of a hybrid between tourism and residential, it is a tourism product. The full range of amenities expected by tourism guests is provided and a known hotel brand will be selected to manage all operations at the facility. As with all other hotel venues in Bermuda, access to the spa/salon and restaurants will open to the general public and also other tourists staying elsewhere. This project offers Bermuda a new type of hotel model where travellers can find a fully equipped home-away-from home setting, which is popular with travellers in many other jurisdictions. Unlike the vacation home rentals, which do occur in Bermuda, guests will have access to range of high calibre resort amenities and services.

The Plan indicates a 10 foot minimum setback from lot lines for development, but relatively minor infringements to the west, north and east setbacks are required as discussed below.

West Setback: The setback area on the west lot line is infringed upon by part of the site circulation road and a 4 foot retaining wall to support a portion of the roadway, both located 5 feet from the lot line. The works are both less than 4 feet high and located at the same grade at the adjacent lands. A 5 foot thick landscape buffer will be installed along the lot line to screen the roadway and wall, and provide privacy for both sites. The proposed infringements were discussed with the landowner to the west who advised there were no concerns and signed the Neighbour Acknowledgement Form, which forms part of the DAP1 planning application.

North Setback: The setback area on the north lot line, adjacent to the southernmost residence on Dill Lane, is infringed upon by part of the site circulation road located 3 feet from the lot line. A 3 foot thick landscape buffer will be installed along the lot line to screen the roadway and provide privacy for both sites. The proposed infringement was discussed with the landowner to the north who advised there were no concerns and signed the Neighbour Acknowledgement Form, which forms part of the DAP1 planning application.

East Setback: The setback area on the east lot line is infringed upon by the following:

- The proposed 16 foot roadway to accommodate the beach club traffic is located 5 feet from the lot line;
- > The proposed 10 foot-wide service roadway for the beach club back-of-

house is located 5 feet from the lot line;

- A portion of the proposed beach club building (2 storey access stairs at 18' high) is located 6 feet from the lot line;
- > A drainage borehole is located 6 feet from the lot line

A landscape buffer which varies form 5 feet to 6 feet thick, will be installed along the east lot line to screen the roadway and building, and provide privacy for both sites. The east elevation sits at the same grade as the adjoining land, and is largely exposed along that side, therefore taller growing plants and trees will be utilized to screen the elevation. There is also a think band of mature and tall (approx.10 feet high) Tamerisk, currently growing on the adjoining land along the area where the setback infringement is proposed. The stairwell has been designed with a flat roof to keep the height as low as possible. The homes associated with the property to the east are far removed to the north of the lot and not near the proposed building.

A meeting was held with the eastern neighbours to review the proposed plans and all items located in the eastern setback. Although generally supportive of the project they did require additional time to review the plans and landscaping intentions, and since the property is owned by a trust, there was a need to meet with the trustees. That meeting is to take place the week of 20 April and a neighbour Acknowledgement letter will be provided shortly thereafter. The reduced setback in the Coastal Reserve for the dining terrace also impacts this neighbour and this is discussed below in the Coastal Reserve section.

The setback infringements are largely minor in nature and can be effectively mitigated with landscaping.

5.1.2 Agricultural Reserve Policies

Development within the Agricultural Reserve zone is highly restricted to the extent that only buildings and accessory structures directly associated with the agricultural, farming and/or horticultural use of the land may be permitted. A minimum of 15 feet setback from areas of Agricultural Reserve zones is required. The proposal does not encroach either of the two areas zoned Agricultural Reserve. The northern parcel along South Road will be put into production and used to grow vegetables and flowers for the hotel. The northern parcel will be left in an open, grassed state. There will be landscaping in the setback, including a "restaurant garden green" which is a name for the green/open space that one drives by on the way to the beach club. It does not serve a function other than to compliment the sequential visitor experience along the vehicular route to the beach club including 'borrowed' views into the open space. Access to the Agricultural lands will remain possible should the need arise to farm the lands at a later date.

The proposal is fully complaint with the Agricultural Reserve policies.

5.1.3 Coastal Reserve Policies

The intent of the Coastal Reserve zoning (Chapter 16, COR) is to provide a buffer or setback between the shoreline and any development taking into consideration wave energy, storm surge and erosion risk as well as the need to preserve the coastal and marine environments from inappropriate development. The policies allow for minor site works and accessory structures may be permitted for specific purposes and more major facilities in the case of facilities associated with a tourism development, including but not limited, to recreational facilities, terraces, beach bars and restaurants. The policies indicate a setback minimum of 15 feet

Approximately 4,350 square feet of the beach club deck and dining terrace are located within the Coastal Reserve zone, along with a 79 foot long sea/retaining wall (an extension to the approved seawall) which will define and retain the south end of the beach club dining terrace. These works represent 11.8% of the overall Coastal Reserve area. Such works to service hotel uses and enhance hotel amenities are permissible and anticipated in hotel developments along the coastline. The beach club dining terrace projects 36 feet into the Coastal Reserve zone and is located 10 feet from the lot line and will be elevated to 14 feet, retained by the seawall. The existing situation is a rocky foreshore area which has no vegetation and has been examined for the presence of skinks and none were detected.

The permitted works outlined in policy (COR.4(1)(d) for hotel amenities are "accessory structures" and cannot necessarily be categorized as "minor siteworks", only insofar as the total area of Coastal Reserve occupied by the works total 11.8% of the total area on site zoned Coastal Reserve. The proposed accessory structures are supplementary to the principle hotel use, provides access to the water in terms views and an organized physical access, protects the site from inundation and is a key amenity for the hotel. In accordance with COR4(3), the beach club buildings have been kept to practical minimums at only 2,795 square feet in size (0.46% site coverage). The beach club structure is single storey in appearance and has a grade to eave height of 15 feet so that the building interior has high ceilings and offers an open feeling for the restaurant space. This is only 3 feet higher than what would be allowed for a residential accessory structure, with much less coastal frontage, on a residential sized lot.

The proposed setback of the dining terrace in the Coastal Reserve is 10 feet versus 15 feet outlined in policies. The 10 feet is consistent with the proposed setback of the beach club building and from a design perspective, it makes sense to continue the terrace alignment at the same setback. This setback area is characterized by a slope area which runs from the 6 foot elevation up to 16 feet at the foreshore. This area will be left largely the same so that plantings atop this feature can better serve as a buffer for both properties. The area will be landscaped with coastal tolerant

species which also provide some visual interest and fullness. An additional 5 feet of setback will not further enhance the situation, serve in meeting any additional purposes of setbacks, and would only detract from the terrace design. The homes associated with the property to the east are far removed located on the north part of the estate and not near the proposed terrace.

The Coastal Reserve policies have been met and mitigation provided where possible impacts are recognized.

5.1.4 Woodland Reserve

The Woodland Reserve policies are aimed at protecting wooded areas which are of ecological, aesthetical and functional importance and all forms of development are generally prohibited in this zone. A setback of 15 is required for all development.

A portion of the parking area, service drive to back-of-house and a 4 foot high retaining wall along that roadway, all associated with the Arrivals Building, are located in the setback area to the Woodland Reserve with 3 feet being the closest point. A Woodland Management Plan is being offered to enhance the area and provide a public gain to offset use of the setback area to this Conservation Area. The Woodland Management Plan will have to be phased to allow removal and growth to occur and not denude the entire hillside creating a visual impact issue. It has been noted that large amount of horticultural waste mixed with trash and some demolition debris has been pushed into the Woodland Reserve area at the top of the slope, west of the existing tennis courts. Phase 1 of the Woodland Management would deal with this area of the site and involve removing waste materials before starting a removal and replacement of trees and plants in that location.

Despite encroachments into the woodland Reserve setback totalling 2,453 square feet are proposed, the works proposed do not cause harm to the Woodland Reserve. Nonetheless, a Woodland Management Plan has been agreed to provide public gain in offsetting lands being developed which were intended to remain in an undeveloped state.

5.1.5 Open Space Reserve Policies

Open Space areas consist of a wide variety of unbuilt areas of different types, sizes and qualities. The overriding consideration is to maintain such areas in an open and natural state. Development is limited to minor site works and accessory structures. There are no setbacks stated for this zone.

No works are proposed in this zone. Pedestrian steps of a suitable form leading from the arrivals building to the South Road bus stop may be contemplated at a later date.

5.1.6 Water Resources Zone

The intent of this is to protect the island's water resources, both inshore (habitat areas and water lenses) and coastal waters. Proposed development is regulated to the extent that it will not cause harm to the water resource. Potential impact items which must be considered include excavation and site preparation works, sewage disposal, management of run-off, swimming pool water disposal and type, form and extent of development proposed.

The freshwater pool, beach club, and some boreholes (drainage and 1 HVAC) are located in the Water Resources zone along the coast. No works are proposed in the Water Resources Area which is located on the South shore Agricultural parcel, and appropriate local farming practices will mitigate against any harm to that water lens. The coastal waters will be protected from negative impacts in a number of ways, including that the development will have a sewage treatment plan to handle waste and pool discharge, as well as bore holes to handle run off. Only clean fill will be placed in areas subject to inundation so that no unacceptable material will end up in the marine environment. A CEMP will help manage construction activities so that no negative impacts result on the coastal waters during construction. Operational management of the freshwater water pool in terms of discharge and chemical treatments, will include all recommendations provided by the Department of Environmental Protection to safeguard the marine environment.

The proposal is compliant with the Water Resource policies and sound operational management practices will ensure no negative impact result to water resources.

5.1.7 Seawall/Retaining Wall

A 79 foot sea/retaining wall is proposed along the south side of the beach club dining terrace, adjoining the previously approved 6 foot high sea/retaining wall. Chapter 10 of the Bermuda Plan sets out policies for Coastal Development including seawalls. Section COA.11 indicates that seawalls may be permitted to provide protection against wave damage. Chapter 8, Design sets out design standards for walls under Section DSN.28. The proposed sea wall proposed along the south edge of the dining terrace at the beach club is required to retain the terrace area at 14 feet and help protect against storm surge/wave action into the beach club area. Given the existing topography being at approximately 8 feet along the south edge of the terrace over an area hollowed out by wave action, a 6 foot high wall is required. It will sit adjacent at grade on the un-vegetated rocky ledge which adjoins the existing salt water pools. The wall will serve as a backdrop to these man-made salt water pools and will be highly exposed to wind and wave action.

Design policies suggest walls exceeding a height of 4 feet should be stepped and planted, or somehow screened to avoid negative visual impacts. In this instance, 6

feet is the practical wall height minimum and the wall will, for the most part not be seen from outside the site, other than in distant views by boaters. The beach terrace nor the manmade pools are natural features and an engineered seawall will not be out of keeping with the planned new setting of a beach club. It can be finished with a natural look if required. No landscaping is proposed given that none currently exists/survives in this highly exposed location now. Any soil bed established for planting would be removed on a very regular basis by wind and wave action making its upkeep, to the high standard that would be required, problematic over the long term.

5.1.8 Cutting, Filling and Rock Cuts

Certain areas as shown on the application plans will be filled and retained in order to gain additional separation between villas and acquire views over top of villas below. Cutting is proposed in some areas. The fill/retaining walls as well as rock cuts throughout the site have been kept to practical minimums and stepped with screen planting in most cases. The proposed walls across the site largely face internal to the site and not exposed to neighbour or public views. No rock cut or wall height will be above 12 feet. All cut material will be reused on site.

5.1.9 Parking/Access/Site Circulation/Transportation

Chapter 11 of the Bermuda Plan outlines policies relating to parking, access, site circulation and transportation.

5.1.9.1 Site Circulation – Vehicular and Pedestrian

The internal roadways serving the development are adequately sized and graded to meet policy standards, as well as allow for emergency vehicle access/egress. The intention is to keep the area as low traffic as possible in terms of private cars by locating the main parking area at the Arrivals Building and using golf carts to deliver guests around the site. No defined pedestrian pathways are incorporated given the low density of buildings and low vehicular traffic program intended for the site, particular in accessing the beach club. The private laneways where villas are located have 2 foot verges on either side of the roadway.

5.1.9.2 Loading Areas

Full service loading areas are provided for in the BOH area at the Arrivals Building. Smaller loading areas are provided at the Beach Club at basement level so that all required deliveries to service this area can be undertaken by smaller vehicles.

5.1.9.3 Site Access and Sightlines

The existing access will remain unchanged. Currently a 90 foot sightline to the west is achieved. To the east, an existing low wall on the neighbouring lands reduces the

sightline to less than 90 feet. It is not possible to alter or mitigate this circumstance and therefore the reduced sightline will remain.

5.1.9.4 Unit and Villa Parking

Since the project is a hotel-condo development where unit owners are likely to reside for part of the year, permission for 26 assessment numbers to obtain cars for the 26 villas will be sought. It is unlikely that all owners will wish to own a car that they only access part of the year and must maintain. Nonetheless, private parking for each villa is adequately provided for with 2 car spaces per unit for 3 bedroom units and 1 car space per unit for 2 bedroom units. All have a single bike space. Spaces are located adjacent to each unit. At 45 car spaces for 26 units the ratio is 1.7 car bays per unit, meeting the parking ratio of 1.25 cars per unit set out in TPT.20. No dedicated parking bays will be provided for the 18 unit in the Arrivals Building.

5.1.9.5 Arrivals Building Parking

The Arrivals Building contains hotel amenities including an 122 seat restaurant and a small spa and salon totalling 1,434 square feet. Hotel guest will arrive/depart primarily by taxi drop off/pick up but local residents will visit the building for spa, salon and restaurant uses.

The Arrivals Building will provide a total of 50 car spaces and 49 cycle spaces, some of which will serve the spa, other spaces for restaurant/general guest use and spaces for staff.

If considered a "shop" under TPT.20, the spa and salon would require 3 car spaces and 3 cycle spaces. Adjacent to the east side of the building are 6 car bays and 6 cycle bays for the salon/spa off site clients which offers adequate parking for these uses.

TPT.20 requires 10 car spaces per 10 seats for restaurant and bar uses. With a 122 seat restaurant and bar area, a total of 12 car and 12 cycle bays would be required. A total 34 car spaces and 23 spaces are provided.

5.1.9.6 Beach Club Parking

The Beach Club contains a 112 seat restaurant and bar area, and under TPT.20 a total of 11 car and 11 cycle bays would be required for guest parking. A small parking lot adjacent to the Beach Club provides parking for 14 cars and 13 cycles.

5.1.9.7 Staff Parking

The proposal provides the following staff parking: 10 cars (Arrivals Building) and 25 cycles (20 at Arrivals Building and 5 at the beach club), and at Beach Club 5 cycle

spaces. The Bermuda Plan does not set out the standards for hotel staff parking. It is anticipated that a hotel of this scale will employ 60 full time staff and during peak shift approximately 70% of staff would be on shift. The spaces should adequately accommodate 42 staff with a total of 30 parking spaces (cycle/car combined) given that some percentage of staff will also be taking public transit and some will be dropped off.

5.1.9.8 Event Parking

There are no particular policies related to event parking, however, good planning requires that no nuisance or negative impacts arise from the proposed use. Given the self-contained site and fact that a plan is in place for overflow event parking, the typical issues of cars parking along public roadways or estate roads creating traffic hazards and disrupting neighbourhoods will not occur. Since part of the event parking plan will impede two-traffic flow on Ariel drive, the hotel operator will communicate with the six landowners that share Ariel Drive and advise of events. Event overflow parking for a total of 40 cars will be provided only during events and possible on a valet basis. The event parking will consist of cars will be parked along the 16 foot eastern roadway (15 spaces), on the arrivals building lane (10 spaces), as well as along Ariel Drive (15 spaces). In conjunction with the existing car and cycle parking spaces for guests, and the fact the spa parking area will be free during evening event, adequate event parking is provided.

5.1.9.9 Landscaping

Chapter 9 of the Bermuda Plan sets out landscaping policies. Existing mature and endemic trees on site have been marked for retention in place or removal and reuse. The current landscape plan depicts all area of the site to be landscaped and the general intent of planting types. A mix of endemic, native and ornamentals, including coastal tolerant where appropriate will be used throughout the site. The intention is to provide lush boundary plantings to screen the property form neighbours and internal plantings so that the access drives are screen from villas and areas around villas are private. Signature landscape trees and features will help define a sense of place, over green views and soften hard-scaping in and around all hard-surfaced areas. In these respects, the proposal complies with the landscaping objective and policies in LSG.2. It is acknowledged that the level of detail currently provided does not does not yet comply with the level of details as set out in LSG.4. The landscape plan will be updated and additional details added based on advice by the regulatory authority, during the course of DAP1 processing.

6. Environmental Impact Assessment

6.1 Introduction and Approach to EIA

In accordance with the Bermuda Plan 2008, an Environmental Impact Assessment (EIA) was conducted as preparation for this Environmental Impact Statement (EIS). The purpose of the EIS is to inform local decision making with regards to the planning application, by identifying the potential impacts of the project activities, including construction, operation and eventual decommissioning and an assessment of their impact on Bermuda's natural, cultural and socio-economic environment, including the ability of the environment to accommodate these. The impact of the environment on the project is also assessed. Measures, which may be taken in order to avoid, minimise, or, if necessary remedy significant adverse affects are proposed.

A critical step in the EIA process is the preliminary identification of likely impacts caused by the development and technical topics that should be scoped in. Table 6.1 shows these.

The EIA takes this process to the next level, by making an assessment of the magnitude (the amount of change created by the project-environment interaction) of these impacts and their significance (the level of change relative to environmental quality objectives). This EIS addresses these impacts in the technical chapters dedicated to specific topics. Each technical chapter provides a statement about the environmental quality objectives established for that subject. The technical chapters have been structured as follows:

- Introduction
- Methodology
- Environmental Baseline
- Assessment of impacts (including cumulative and impact interactions)
- Mitigation measures
- Monitoring plans
- Emergency Response Plan
- Environmental Management

The magnitude of each impact and importance of the receptor is considered in order to determine the significance of the impact. Where possible, accepted methodologies quantitatively define the impacts and levels of significance. However, in some cases qualitative assessments were made. The adopted process detailed below follows accepted industry guidelines for such an approach. Table 6.1. Summary of technical areas scoped in to EIA.

Торіс	Phase	Scoped in/out	Reason			
Marine Ecology	Construction and	In	The presence of West Indian topshells			
	decommissioning		requires signage to advise of their			
			protected status			
	Operation	In	The presence of West Indian topshells			
			requires signage to advise of their			
			protected status			
Marine Water, Wave	Construction and	In	There is potential for runoff during			
Action and Sediment	decommissioning		construction into the marine environment.			
Quality	Operation	In	There is potential for chemicals used to			
			clean the freshwater pool to be released			
			into the marine environment.			
Terrestrial Ecology	Construction and	In	Direct habitat loss, removal of native and			
	decommissioning		endemic trees and plants, loss of bird			
			nests, disruption of feeding/mating			
			behaviour.			
	Operation	In	Potential for food waste to attract vermin,			
			potential noise impact to bird life, potential			
			to improve plantings of native and endemic			
			plants and trees.			
Geology and	Construction and	In	Construction dust may impact neighbouring			
Hydrogeology	decommissioning		rainwater roof catchments. Discovery of			
			significant cave voids. Use of demolition			
			debris in place of fill extracted elsewhere.			
	Operation	In	Potential impacts to resource through direct			
			freshwater use and production.			
			Sustainability of resource.			
Waste Management	Construction and	In	Impact through use of raw materials some			
	decommissioning		of which will be excess to requirements,			
			damaged or used for maintenance; ability			
			of island waste management system to			
			handle waste; hazardous wastes from			
			demolition/ construction. Re-use of existing			
			materials and masonry debris.			
	Operation	In	Impact of municipal and food waste,			
			wastewater and sewage, and hazardous			
			waste generated.			
Air Quality	Construction and	In	Impact from construction dust, noxious			
	decommissioning		vapours, vehicle exhaust.			
	Operation	In	Vehicle exhaust.			
Climate Change, Energy	Construction and	In	Fuel for/carbon emissions from			
and Sustainability	decommissioning	1	construction equipment and vehicles.			

	Operation	In	Vehicular emissions and electricity demand and fuel for vehicles; seawater inundation and storm damage. Potential to generate
			electricity. Use of Insulated Concrete Form for building to improve internal temperature control and reduce noise.
Transport	Construction and	In	Increased traffic movements during
	decommissioning	1	Construction.
	Operation	In	more demand on public transport network by tourists. Parking needs potentially spilling over onto neighbouring residential streets. Access by emergency vehicles. Sight lines. Storm water run-off.
Noise and Vibration	Construction and decommissioning	In	Potential impact from construction equipment to immediate neighbours as well as bird life.
	Operation	In	Potential impact to area residents from traffic and evening entertainment.
Landscape & Visual & Architectural heritage	Construction and decommissioning	In	Temporary views of construction vehicles and site.
	Operation	In	Visual change to the landscape for neighbours, residents and tourists, including lighting.
Culture and Recreation	Construction and decommissioning	In	Construction activities may impact with recreational activities in the neighbourhood.
	Operation	In	The project will provide recreational opportunities for local and visitors.
Socio-economic	Construction and decommissioning	In	Impacts associated with the construction workforce including job creation.
	Operation	In	There are likely to be new jobs created and with increased numbers of tourists, a positive knock-on effect to the local business community.
Health and Safety	Construction and decommissioning	In	Construction activities will have significant health and safety implications for both construction workers and the public.
	Operation	In	Operational activities will have health and safety implications for staff, the public, and guests.

6.2 Type of Impact

An exhaustive list of all the impacts was drawn up for each stage including construction, operation and decommissioning. These impacts are classified according to whether they are **positive or negative impacts.** Negative impacts are those that have a detrimental effect on the environmental resource or receptor, such as habitat loss, increased air emissions, loss of jobs, species decline, traffic disruption, etc. Positive impacts include providing opportunities for investment, creating jobs, training, reducing environmental degradation, providing useful scientific data, etc. Impacts may also be **direct**, or **indirect** (sometimes referred to as secondary impacts). Indirect impacts affect a receptor through a complex pathway, rather than directly.

6.3 Importance of the Receiving Environment

Before the magnitude or significance of an impact can be assessed, it is necessary to determine the importance of the specific environmental receptors. This varies between subjects, and is discussed in detail in the specific technical chapters. But taking account of these variations, the following levels have been applied:

- **High** importance
- Medium importance
- Low importance
- Negligible importance

6.4 Magnitude and Significance of Impact

Magnitude is the amount of change and includes the size of the impact, the extent or geographical area to be affected and the duration, frequency or reversibility. The significance, which refers to the actual effects, is a function of all of these, as well as of the sensitivity of the receptor. Where possible, the impacts have been quantitatively recorded however, in some cases the impacts have been addressed in a qualitative way, as follows:

a) Magnitude

- **Size**. The size of each impact is determined as a function of measurable change from the baseline environmental conditions.
- Duration (Long-, medium- or short term, or episodic impacts and reversibility). Where positive or negative impacts are identified, these are described according to their predicted duration. Short to medium term impacts

are generally considered to be those associated with the demolition and construction phase of the development. Long-term impacts relate to those issues that will have a lasting effect on the site and surrounding area once the development is complete and operational, or has been decommissioned. Episodic impacts may occur during any stage. Reversibility can apply to an impact of any of these predicted durations, but will have particular significance after decommissioning of the development as a whole.

• **Extent (localized, regional, Island-wide or global).** Where positive or negative impacts are identified, these are described according to the extent of their geographical coverage and the size of the population affected.

The magnitude of the impact is assessed according to whether it is:

- *Major*: Considerable impact (by size, extent or duration), which in the case of a negative impact, is in violation of legislation, policy or acceptable standards and extends beyond the local area; for positive impacts, this includes those which benefit the wider community or Bermuda as a whole and even beyond;
- *Moderate*: Some impact (by size, extent or duration) which is significant within the site or surrounding areas;
- *Mild*: Minor impact which may be a short term or very localised impact, with minimal consequence;
- **Negligible**; An impact that does not disrupt the receptor to a degree that affects its integrity.

b) Significance

As previously noted, the actual effects or significance of an impact are a function of the sensitivity of the receptor, and the magnitude of the impact as defined above. The matrix in Table 6-2 shows this.

		Importance of the Receptor					
		High	Medium	Low	Negligible		
	Major negative	Major significant impact	Moderate significant impact	Minor significant impact	Minor significant impact		
mpact	Moderate negative	Moderate significant impact	Moderate significant impact	Minor significant effect	No significant impact		
	Mild negative	Minor Minor significant significant impact impact		No significant impact	No significant impact		
	Negligible	No significant impact	No significant impact	No significant impact	No significant impact		
	Minor positive	Minor significant impact	Minor significant impact	No significant impact	No significant impact		
	Moderate positive	Moderate significant impact	Moderate significant impact	Minor significant impact	No significant impact		
	Major positive	Major significant impact	Moderate significant impact	Minor significant impact	No significant impact		

Table 6-2. Impact significance levels as a function of the importance of the receptor and the magnitude of the impact.

Table 6-3. Levels of Significance

Positive	Negative	Significant change in environmental/ social/ cultural					
Major	Major	conditions occurs, either positive or negative, which is					
significant	significant	likely to have an impact on a national or international					
impact	impact	scale, and/or which violates or supports legislation and					
		policy; typically a non-reversible impact.					
Positive	Negative	Causing either positive or negative change, significant					
Moderate	Moderate	enough to affect the receptor within an extended area					
significant	significant	(but not island-wide), possibly irreversibly but unlikely					
impact	impact	to breach any legislation.					
impact Positive	impact Negative	to breach any legislation. Positive or negative change likely to impact a receptor					
impact Positive Minor	impact Negative Minor	to breach any legislation. Positive or negative change likely to impact a receptor of local interest but not one with a statutory					
impact Positive Minor significant	impact Negative Minor significant	to breach any legislation. Positive or negative change likely to impact a receptor of local interest but not one with a statutory designation. Impact likely to be temporary.					
impact Positive Minor significant impact	impact Negative Minor significant impact	to breach any legislation. Positive or negative change likely to impact a receptor of local interest but not one with a statutory designation. Impact likely to be temporary.					
impact Positive Minor significant impact No	impact Negative Minor significant impact No	to breach any legislation. Positive or negative change likely to impact a receptor of local interest but not one with a statutory designation. Impact likely to be temporary. Environmental/social/cultural conditions may be					
impact Positive Minor significant impact No significant	impact Negative Minor significant impact No significant	to breach any legislation. Positive or negative change likely to impact a receptor of local interest but not one with a statutory designation. Impact likely to be temporary. Environmental/social/cultural conditions may be positively or negatively affected but impact does not					

6.5 Impact Interrelations

Where there is overlap of impacts between the technical chapters, these have been cross-referenced.

6.6 Impact Interactions

Every effort has been made to assess the impacts within the project that react with one another, and other projects under development in the area resulting in an interaction between impacts.

6.7 Cumulative Impacts

Cumulative Impacts are those impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with those caused by the proposed development. Where possible, these are addressed in each technical chapter.

6.8 Natural Hazard Impact

Consideration is not only given to the impacts of the project on the receiving environment, but also of the environment on the project. Natural Hazard Impact is an

essential consideration. The EIS considers the vulnerability of the project site and situation to natural hazard impact. An assessment of the extent to which the project may exacerbate hazard vulnerability is also assessed.

6.9 Mitigation Measures

It is seldom possible to eliminate a negative environmental impact altogether, but it is often possible to reduce its intensity. For each potentially adverse impact, appropriate mitigation measures have been presented. For beneficial impacts, efforts have been made to consider how these can be maximized. In drawing up mitigation measures, alternative options were considered. These may include alternative locations, alternative scales, alternative technology, alternative site layout, alternative operating conditions and alternative approaches for dealing with identified impacts. Consideration of the "no action" alternative is also included.

6.10 Monitoring Plans

A detailed environmental monitoring programme is laid out when necessary for each receiving environment with costs and the rationale. This programme will identify who will undertake the work, the schedule of work, the parameters to be monitored, methodology including standards to be used, evaluation of the results, and the reporting format and frequency. It also identifies the action to be taken if there is evidence of unexpected, adverse impacts.

6.11 Emergency Response Plan

Emergency procedures manuals to deal with fires, accidents, hurricanes, flooding and/or seawater inundation, oil spills and malfunctioning equipment have been prepared.

6.12 Environmental Management

Protocols for environmental management during construction, operation and decommissioning are detailed. The management plan includes the environmental quality objectives, recommended mitigation measures, emergency response plan and monitoring plan to be used during all phases of the project. Awareness and training for project staff, including sub-contractors are also outlined to ensure that all personnel understand the obligations of the development. These are compiled in separate reports accompanying this EIS with considerations given to both construction and operation.

7 Marine Ecology

7.1 Methodology

Baseline data was gathered from desk studies, consultation with technical officers and visual observations from site visits.

7.2 Environmental Baseline

The proposed Ariel Sands development is located on a mixed rocky coastal and beach property. Although there is no direct development into the water, careful consideration of Bermuda's marine ecology is of significance during construction and also during ongoing operations. The development does encroach on the Coastal Reserve, occupying 4,350 s.f. of this, and representing 11.8% of the total Coastal Reserve area of 36,900 s.f.

Bermuda is an oceanic archipelago of 53.7 km² located at the northern fringe of the tropics. At a distance of 960 km from the nearest land (Cape Hatteras, N. Carolina), present-day Bermuda is a low-lying, fishhook-shaped chain of four larger islands surrounded by hundreds of islets. Together these enclose significant inshore basins, and line the south-eastern margin of an extensive (750 km²) but shallow (average depth 10 m) oval lagoon, which is in fact formed by the truncated top of the volcanic pinnacle rising from the deep sea. Thanks to the warm waters of the northerly flowing Gulf Stream, Bermuda has the complete range of tropical marine habitats, including mangroves, seagrass beds and the world's northern-most coral reefs, supporting over 4,600, mainly native species (Sterrer *et al.*, 2004). The majority of the species represented are derived from Caribbean reefs, however, whilst these 'neighbouring' reefs have suffered dramatic declines in their live coral coverage, Bermuda's reefs remain relatively healthy.

That said, local management practices treat the marine ecosystem as a highly stressed, self-sustaining entity, and as such, are generally recognised to be extremely conservative. Since the 1966 enactment of the Coral Reef Preserves Act, there has been complete protection of all attached animals and plants within two substantial areas of Bermuda's shallow waters. Further, in 1978 a protected species order was passed under the Fisheries Act that completely banned the harvest of any coral, stony or soft. With this action Bermuda became, in effect, a coral preserve. Bermuda's fish stocks have suffered a different fate. With steady harvesting pressure over 500 years, it is evident from historic accounts that Bermuda's fisheries are now severely depleted. Certain species are economically extinct, whilst others have been locally extirpated. In 1990, the trap fishery was closed. Three seasonally protected

areas now exist to protect the grouper spawning grounds and there are bag limits imposed on certain species.

A recent report conducted on the Total Economic Value (TEV) of Bermuda's coral reefs (Van Beukering *et al.*, 2010) notes that the immediate threats to the reefs relate to the increasing marine cargo traffic importing goods to the Island and to the changing tourism industry and developments necessary to accommodate larger cruise ships. It calculates that 56% of the TEV (calculated as \$488 million per year to \$1.1 billion per year) is from tourism with the total tourism value of Bermuda's coral reefs per visitor contributing US\$611 per tourist. Although less than visitors arriving by air, cruise ship tourists value the coral reefs at US\$591 per visit. By contrast, 5% of the TEV is for recreation and culture and 0.7% for fisheries.

The proposed Ariel Sands development is located on the southern shoreline of Devonshire Parish. As Bermuda is located on the south-eastern rim of the flat-topped platform formed through erosion of Bermuda's underlying volcano, this shoreline is not protected by significant off-shore barrier reefs and is thus a high energy area exposed to constant surge. This direct exposure to oceanic conditions ensures that the shore is constantly bathed in pristine, low nutrient, oceanic water that supports healthy coral communities and creates clear water conditions. The rocky shoreline of the Ariel Sands property is oriented such that it does offer the main beach area some protection from wave action. There have been no reports of nesting sea turtles (either green turtles or loggerheads) on this beach in recent decades. There are however protected West Indian Topshells along this shoreline. Other than the long-term reduction in fish abundance that has been caused by harvesting pressure, and the presence of persistent plastic debris, the marine environment in the general vicinity of the proposed development can be seen as largely pristine.



Plate 7-1 showing the presence of small West Indian topshells

In spite of the brownfield nature of this site, the vibrant marine communities inhabiting the area are largely composed of protected species, which are both of intrinsic conservation value and also enhance the aesthetic value of this site for hospitality purposes. This creates a situation where it is a clear priority of both developers and regulators to ensure that all reasonable care is taken to eliminate any potential negative impacts on these communities and their habitats.

7.3 Assessment of Impacts

In assessing the impacts of the proposed development, the importance of the marine environmental receptors was taken into consideration. There is a generally accepted hierarchy of importance attributed to natural habitats and species and cultural resources, based primarily on their conservation status. Highest priority is given to those that are internationally important followed by receptors that are of national then local significance.

A preliminary classification of importance may include:

7.3.1 International Importance

- Any species, habitat or cultural resource which is an internationally designated as protected (e.g. World Heritage Site or marine mammal);
- Any species listed under the Protected Species Act 2003, which designates conservation status based on IUCN criteria. Most are endemic species, or internationally-threatened regional species;
- Other endemic species;
- A migratory species of international significance (e.g. listed under the Convention on the Conservation of Migratory Species and Wild Animals, 1983).

7.3.2 National Importance

- A nationally designated site (e.g. Marine Protected Area);
- A locally commercial species;
- An historically important specimen;
- A specimen of scientific or aesthetic interest;
- An alien invasive species;
- An area of priority habitat or a priority species as defined in the Bermuda Biodiversity Action Plan and not given protection elsewhere.

7.3.3 Local Importance

- · Areas of habitat considered valuable within the local context;
- A regularly occurring, locally significant population of a species not considered threatened;
- A frequented local fishing area;
- An historically important specimen.

7.4 Impact Assessment

a) Construction

During construction there is the potential for disruption of the marine ecology of the area through poor management of waste, inadequate storm preparation, and/or other deficiencies that allow for surface run-off to carry sediments and other contaminants arising from construction activities into the ocean. Given the distance between the proposed development and the shoreline these issues should be easily prevented through processes detailed in the CEMP for the project.

The presence of West Indian topshells in the intertidal area is also relevant as this protected species is considered by many as a local delicacy. Although the specimens present are small, there is a potential threat of harvesting during construction.

c) Operation

With no intrusion into the marine environment that is presented by the proposed development, the anticipated operational impacts on marine ecology of the area are minor. The location of the freshwater swimming pool and the need for chemical cleaning of this presents the only real potential threat. Any drain down of the pool must be carefully managed to ensure antiseptic treatments are not flushed into the groundwater.

The presence of West Indian topshells in the intertidal area is also relevant as this protected species is considered by many as a local delicacy. Although the specimens present are small, there is a potential threat of harvesting by visitors. Portuguese Man O' War were also noted on the beach; these present a health and safety threat to construction workers and guests.



Plate 7-2 showing Portuguese Man O' War on the beach at Ariel Sands

Introducing night time lighting into coastal areas such as the proposed development site does bring the potential to interfere with the behaviour of marine organisms. Globally the most notable concern in this regard is the potential of coastal lighting to disrupt nesting behaviour of sea turtles. Whilst at present Bermuda supports no breeding population of sea turtles, carefully planned lighting can reduce impacts to marine communities.

Human activity brings the potential for waste management issues. On balance it is probable that this development will bring more careful management of waste and removal of water-borne debris from the waters and beaches thereby positively impacting this aspect of the local environment.

c) Decommissioning

Decommissioning activities are likely to result in similar impacts to those caused during construction.

d) Impact Interrelations

Impact interrelations that have been considered are; marine water quality, waste management, culture and recreation, tourism, health and safety and socio economic.

e) Impact Interactions

No impact interactions are anticipated.

f) Cumulative Impacts

No cumulative impacts are anticipated.

g) Natural Hazard Impact

The only natural hazard impact related to marine ecology would be the potential destruction and breakup of the beach restaurant during a severe storm, with the resultant debris causing harm to marine species.

The significance of these impacts is presented in the following chart.

MARINE ECOLOGY										
CONSTRUCTION AND DECOMMISSIONING										
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
ME-1	Beach Club siting	Small	Permanent	Constant	Local	(-) Medium	High	(-) Moderate	Marine Water Quality and Wave Action	
		Rationale: The Beach Club facility intrudes 4,350 s.f. into the coastal reserve area (representing a loss of 11.8% of this area) of the rocky shoreline and thus reduces potential habitat for intertidal organisms. However, during site visits no such specimens were observed in the development footprint.								
ME-2	Establish work site boundaries	Small	Short	Episodic	Local	(+) Mild	High	(+) Minor	Health and Safety	
		Rationale: D	efining no-go a	reas for construc	tion workers v	will promote prote	ction of valuable	e specimens.		
ME-3	Interactions with Protected Species	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Socio- economic, Culture	
		Rationale: The intertidal zone adjacent to the development site, particularly near the Beach Club, supports the protected West Indian Topshell. The CEMP will include the need for orienting workers to the protected status of these snails. A no-fishing policy during construction is recommended.							protected West A no-fishing	
<i>ME-4</i>	Waste Production	Small	Medium	Constant	Local	(-) Mild	Medium	(-) Minor	Waste	
		Rationale: U nuisance to r	Rationale: Unless well managed, waste produced on a construction site can be blown or otherwise lost to the ocean causing a nuisance to marine organisms. Actions to manage this will be detailed in the CEMP.							
					OPERATI	ON				
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
<i>ME-5</i>	Interactions with	Small	Permanent	Episodic	Local	(-) Mild	High	(-) Minor	Waste, Tourism	
	Protected Species	Rationale: The intertidal zone adjacent to the development site, particularly near the Beach Club, supports the protected West Indian Topshell. Signage to alert staff and visitors to these species and their importance/protected status is recommended. A food waste management protocol aimed at reducing the potential of harm to protected species is also recommended.								
ME-6	Increased human presence	Small	Permanent	Constant	Local	(-) Mild	High	(-) Minor	Socio- economic, Culture and Recreation	
	Rationale: Human presence does disrupt the behaviour of wildlife. The increased usage of this area will reduce the habitat available for coastal species.							e the habitat		

7.5 Mitigation Measures

Mitigation to protect the West Indian topshells will focus on educating the construction workers and guests on the protected status of this species. Delineating "No-go" areas for construction is suggested to minimise general impacts to the marine environment. Implementing a comprehensive waste management protocol as part of the CEMP, and for ongoing hotel operations is also a recommended mitigation measure. Prohibiting the use of demolition debris in the Coastal Reserve Zone and projected area of storm inundation (see Section 7.0) can also help minimise injury to marine life.

7.6 Monitoring Plans

There is no anticipated need for a marine ecological monitoring programme.

7.7 Emergency Response Plan

In preparation for potential catastrophic events an Emergency Response Plan (ERP) should be been drawn up and integrated into the CEMP. An ERP to deal with hurricanes once the hotel is up and running is also a requirement under the Occupational Safety and Health Act 1982, and this should provide for securing the Beach Restaurant facility. By securing this facility, the potential threat to the marine environment of flying debris will be reduced. The presence and management of Portuguese Man o' War on the beach and in the shallow water must also be incorporated into an ERP.

7.8 Management Plan

A CEMP to stipulate control runoff and hazardous waste management during construction, including accidental oil spills, as well as manage the actions required during construction to minimise the general environmental impacts to the marine environment will be prepared.

8 Marine Water, Wave Action and Sediment Quality

Activities associated with construction and operation of the development will bring the potential for impacts on water, waves and sediment quality along the shoreline of the property.

8.1 Methodology

Baseline data was gathered from desk studies, interviews with technical consultants and site visits.

8.2 Environmental Baseline

Ocean currents around Bermuda are generally weak and variable with speeds ranging from 0.18 to 1.14 knots and are typically deflected to the right of the prevailing wind by 30° to 60° (Thomas and Logan 1992). Subsurface, currents move more slowly at 0.1 to 0.3 knots. On a local scale, less is known about current patterns. Tidal currents flow onto the reef from all directions, with major inflows from the northeast and southwestern edges of the Platform, however, wind flowing from an opposing direction can significantly reduce the magnitude of the flow, enhancing flow from other directions. Flow is therefore the combined effect of a linear relationship between wind and tidal forcing, and at any specific location will be modified by reef structure and proximity to land as well as fetch. Bermuda's mid oceanic location means that it is exposed to long fetch and therefore fairly large waves from any direction.

There is generally extremely low nutrient availability in Bermuda waters, a reflection of the virtually infinite dilution provided by the surrounding, nutrient poor Sargasso Sea. The current proposal does not include any plans for systems that discharge into the ocean.

The location of the Ariel Sands property with its direct exposure to the ocean and the prevailing SW winds, does present quite a high wave energy environment. Largely unbroken oceanic swells arrive directly along this shoreline creating a situation where surge is a constant, and where powerful waves and wind-driven spray are common. Such energy drives environmental conditions and structures biological communities – both in the water and the adjacent terrestrial habitats. In the water the physical power of the waves discourages the establishment of delicate invertebrate and algal communities, causes continual sorting of sediments and, coupled with the low nutrient waters, encourages the growth of massive, primarily domal, reef-forming corals. On land this exposure has driven plant communities toward salt-tolerance,

and presents an on-going threat of erosion and inundation.

Bermuda's coastline has experienced significant erosion, which has been particularly apparent during recent hurricane events, and triggered a coastal erosion study in 2004 (Government of Bermuda, 2004). Storm analysis showed that highest wave heights around Bermuda are from the south and southeast. The rate of coastal erosion will clearly increase with increasing storm intensity and inundation levels are a function of static storm surge and wave run-up. This study identified the south shore as being highly vulnerable to coastal erosion and, with its exposure to large waves, inundation levels are high (Beach: 5.1-9.6m; Flat Rock: 3.3-6.6m; and Low Cliff: 6.9-11.1m; NB: all values are inundation heights above Mean Sea Level). Practical experience has revealed the impact at the Ariel Sands property to be less severe than these inundation levels would suggest. Figures 8-1 and 8-2 reveal the inundation level to the 15 ft elevation during Hurricane Gonzalo in October 2014. "This was consistent with the damage that occurred during Fabian where the old pool deck and salon level were damaged (lots of sand deposited) and they were at elevation 13ft. The upper floor of the main building suffered no damage at all from wave action and was located at elevation 23ft" (K Hodgkins, pers. comm). This 15 ft elevation is largely consistent with the Water Protection Zone, which is defined by a maximum elevation of 13 ft above sea level and within 40 ft of the coastline. It is recognised that this has bearing on the use of construction rubble for fill. There is a requirement that no such rubble be used either in the area zoned Coastal Reserve, or in an area projected to be inundated during storms.



Figures 8-1 and 8-2 showing the extend of salt water inundation to the 15 ft contour during Hurricane Gonzalo in 2014. (*Photos courtesy of K. Hodgkins, OnSite Engineering Services Ltd*)

8.3 Assessment of Impacts

a) Construction

It is not anticipated that onshore activities during construction will have a measurable impact on the nearshore water quality as long as there is recognition of the Water Protection Area in this area and implementation of protocols to ensure appropriate management of any potential for run-off and waste construction debris. Appropriate management measures in the event of a storm during construction will also be presented in the CEMP.

b) Operation

The operation of these proposed facilities are unlikely to materially add to the potential threat of pollution events to the marine environment if appropriately managed. This will include treatment of back wash filters for the freshwater swimming pool as well as draw down procedures that minimise the risk of introducing antiseptics into the groundwater. The planned use of a sewage treatment plant with the resultant grey water directed to irrigation is likely to eliminate detectable sewage impacts. Appropriate management measures for the beach restaurant facility, deck and pool in the event of a storm or hurricane will be prepared as part of an ERP.

The threat of wave inundation during storms is potentially significant given that the beach restaurant sits at an elevation of 14 ft with the deck and pool just below. This is within the Water Protection Zone and the 15 ft inundation level observed during previous storms at the site. The potential for broken debris from these structures in the event of such a storm to negatively impact the marine waters is considered moderate. It should be noted that Nudura, the ICF to be used for building is 9 times more resistant to wind, being capable of withstanding 250 mph winds.

c)

Decommissioning

Decommissioning activities are likely to result in similar impacts to those caused during construction.

d) Impact Interrelations

Impact interrelations exist with Marine ecology, waste and transport.

The significance of these impacts is presented in the following chart.

MARINE WATER QUALITY, WAVE ACTION AND SEDIMENT QUALITY									
CONSTRUCTION AND DECOMMISSIONING									
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations
WQ-1	Uncured cement	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Marine Ecology, Waste
	spill	Rationale: The potential exists for spills of uncured cement during works within the Coastal Reserve zone. Adherence to protocols detailed in the Environmental Management Plan for construction is aimed at minimising any such potential.							
WQ-2	Spills of oil, etc,	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Marine Ecology, Waste
	by accident or equipment malfunction	Rationale: M outlined in th	lechanical equip ne CEMP are int	ment bring the p tended to minim	potential of spi ise any such p	lls. Appropriate n otential.	naintenance and	care of equipmen	t and careful operation as
WQ-3	Runoff carrying	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Marine Ecology
	contaminants into the marine waters	Rationale: During both construction and operation there is potential for rain water runoff to contaminate the natural waters by carrying surface contaminants (dust, sand, cleaning product residues, etc. into the sea). Protocols to limit this risk will be incorporated into the CEMP.							
					OPERA	ΓΙΟΝ			
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations
WQ-4	Pool management	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Marine Ecology
		Rationale: St enabling syst	Rationale: Sterilization agents used in the fresh water pool can be harmful if discharged into the ocean. Management protocols and enabling systems will be developed to ensure that no discharge of this material into the ocean occurs.						
WQ-5	Wave inundation	Medium	Short	Episodic	Local	(-) Moderate	High	(-) Moderate	Health and Safety, Economic
		Rationale: Historical data shows inundation levels during hurricanes up to the 15 ft elevation, which approximates the Water Protection Zone. With the exception of the beach restaurant (14 ft elevation) terrace and pool (12 ft elevation), all other buildings are above 15 ft.							

e) Impact Interactions

No cumulative impacts are anticipated.

f) Cumulative Impacts

Cumulative impacts are anticipated if an engineered solution for improving flushing in the bay is implemented.

g) Natural Hazard Impact

Wave action and sea level rise present obvious threats to any shoreline development.

8.4 Mitigation Measures

Mitigation will focus on proper training of staff and subcontractors according to best practice guidelines.

8.5 Monitoring Plans

No monitoring is anticipated.

8.6 Emergency Response Plan

In preparation for potential catastrophic events such as hurricanes, an ERP will be drawn up and integrated into the CEMP.

8.7 Management Plan

A CEMP will include management action required to address the potential threats to the quality of the nearshore waters.

9 Terrestrial Ecology

9.1 Methodology

Baseline data was gathered from desk studies, interviews with technical consultants and field studies.

9.2 Environmental Baseline

Like most isolated island ecosystems, Bermuda's pre-colonial terrestrial habitats supported a relatively limited floral and faunal diversity (Glasspool and Sterrer, 2009). The low, hilly landscape with freshwater marshes but no streams would have been densely wooded with 15 species of endemic evergreen plants and approximately 150 native plants. A species-poor invertebrate fauna consisting of about 200 native, and 92 endemic species populated the forests and marshes and the only four-legged land vertebrate was the Bermuda Rock Lizard (*Plestiodon longirostris*). Pre-colonial Bermuda was also a breeding colony for a dozen species of land birds (including an endemic subspecies of the White-eyed Vireo, (*Vireo griseus bermudianus*), and at least six species of seabirds.

Permanently settled in 1612, Bermuda now supports a resident human population of about 64,867, with 232,000 visitors a year and the Island has been transformed into a largely suburban landscape. More than 50% of the 53km² land mass is considered developed. Only the coastal habitats remain relatively unchanged.

Terrestrial habitat protection is currently largely enacted through base and conservation zonings designated in the Bermuda Plan 2008, and under the National Parks Act 1986, although specific habitats and some species are protected under the Protected Species Act 2003, whilst bird protection falls under both this and the Protection of Birds Act 1975.

The proposed development site itself comprises an undulating landscape modified through previous development. There are three main natural habitats: sandy beach covering approximately 0.9 acres and rocky coastal (approximately 0.2 acres), both encompassed in the Coastal Reserve zone, and woodland, primarily secondary upland valley totally 2.25 acres, most of which is Woodland Reserve.

For reference, approximately 190 acres of beach and dune habitat, 368 acres of rocky coastal habitat, approximately 330 acres of woodland reserve and 735 acres of agricultural land (of which 360 acres are actively farmed) remain in Bermuda.

Incidental sightings of the critically endangered Bermuda Rock Lizard (*Plestiodon longirostris*) in the near vicinity of Ariel Sands at Devonshire Bay suggest that this

species is a possible inhabitant of the coastal habitat. In light of the fact that a demolition permit was already issued for Ariel Sands for much of the property, and the fact that the only remaining area likely to support skinks is the south eastern shoreline, skinks surveys were confined to this area as agreed with the Department of Conservation Services. No skinks were found. No live specimens of the protected, critically endangered *Poecilozonites* sp. snail were found either.



Figure 9-1 shows the layout of areas surveyed and referenced in the following text and figures.

The Woodland Reserve lies primarily on the upland rise of the property south of the South Road and was not surveyed as part of this EIS as there is no intended development with the exception of the loss of 5 cedar trees in the setback of the Woodland Reserve (see Figure 9-2, Area 1). Here the land rises to a ridge. From this point, extending down the southern flank of this rise, the land has been historically developed and currently comprises some tarmac pathways as well as the demolition rubble from the previous development. A significant stretch of woodland (Areas 2 and 3, Figure 9-2) does extend to the west side of the property from the ridge, dropping off into a valley. This woodland is heavily invaded with Mexican pepper, fiddlewood, casuarina, Chinese fan palm and allspice forming the main canopy, and the aggressive wedelia, asparagus fern, morning glory and castor oil plant dominating the understorey. Other plants observed are fennel, star of the veldt, life plant and nasturtium, along with St Augustine grass. This neglected wooded areas support very few plants of substantive landscaping value, with the notable exception

of the white cedars and two bay grapes near the western boundary. There are a number of other bay grapes located along this boundary as it extends seaward. Most are small but from attractive screening for the neighbouring properties. It is required that due to encroachment into the setback of the Woodland Reserve for parking, a Woodland Management Plan will be prepared.



Figure 9-2 shows Areas 1 and 2 referenced in the text.

There are 8 protected endemic Bermuda cedars and 4 Bermuda Palmettos scattered throughout the property. Few of these would be considered significant specimens based on the Department of Conservation Services criteria. However, of the 5 cedars already mentioned that will be lost to development, one is significant. All protected species require a permit for removal, translocation or destruction. In the latter instance, this is typically granted on condition of planting the same or alternative protected species in other areas. There are also some non-protected Darrell's cedars.



Figure 9-3 shows Area 3 referenced in the text.

Bay grape, pittosporum, silver buttonwood, West Indian almond, sago palm, bird of paradise and tamarisk are other species that have been used and remain on the property that are very well suited to the salty and windy coastal conditions of the seaside. Some present significant specimens and should be retained if at all possible. Aloe is another hardy, attractive and very useful plant that is observed. Hibiscus and Oleander have also been used in hedgerows to provide a splash of colour. The latter is better suited to salty conditions. Other significant ornamental plants on site include Norfolk Island pine, black ebony, Canary Island date palms, Royal palms and an impressive stand of coconut palms lining the back of the beach enhancing the tropical feeling of the property. Vegetation along the rocky shoreline is virtually non-existent, with the exception of seaside goldenrod, endemic Bermudiana and Spanish bayonette. There is some sea rocket on the beach. (See Figures 9-4 to 9-6)



Figure 9-4 shows Area 4 referenced in the text.


Figure 9-5 shows Area 5 referenced in the text.

Located in near the eastern boundary, a small woodland (Area 6) supports two magnificant Bay grapes as well as two cedars, one which is toppled and the other, a young Darrell's cedar.



Figure 9-6 shows Area 6 referenced in the text.

9.3 Environmentally Sensitive Areas

The proposed development encompasses protected areas of open space reserve and coastal reserve. There are also two areas of agricultural zoned land, which are not being actively farmed. The larger of these lies just to the west of the South Road entrance to the property; the other is sandwiched between the borders with the 6 residential properties currently on the land and the neighbours to the east.

9.4 Terrestrial Protected Species

Under the Protected Species Act 2003 species have been classified as per IUCN criteria according to the level of threat they face: critically endangered, endangered or vulnerable. This classification takes into account their global distribution, their population size and local distribution, the level of threat to their habitat and natural or man-made factors, which may influence their survival. It cites as an offence the "take" of any listed species, which includes to "injure, disturb, harass, kill, capture and collect and, in relation to any protected species of plant, includes to pick, break, cut, uproot, destroy, damage and remove". A number of species listed under the Act, have been documented on the Ariel Sands property and their distribution has been shown in Figures 9-2 to 9-6. These are discussed in the following text.

9.4.1 Flowering Plants – Level 3:

9.4.1.1 Bermuda cedar (Juniperus bermudiana)

As a level 3 protected species, it is an offence to wilfully damage, destroy, injure, disturb, uproot, fell or kill them. A few specimens of mature and seedling cedars were found across the property, most notable of which are 5 specimens, one significant, located in the area of the proposed parking area by the new Arrivals Building. As compensation, a minimum of 36 endemic trees will be planted on the property, some most likely in the Woodland Reserve.

9.4.1.2 Bermuda palmetto (Sabal bermudiana)

4 healthy Bermuda palmettos were observed at the Ariel Sands property on the few remaining pockets of land in the ongoing demolition programme. Again, as a level 3 protected species, it is an offence to wilfully damage, destroy, injure, disturb, uproot, fell or kill them, but it is worth noting that palmettos can be successfully moved and replanted with a permit. A programme of re-plantings should be considered within the Woodland Management Plan

9.4.2 Bermuda Rock Lizard (Skink) (Plestiodon longirostris) (Level 1)

Despite previous surveys showing the presence of skinks in the neighbouring areas (Devonshire Bay), no skinks were trapped during the 3-day survey conducted from $13^{th} - 15^{th}$ April 2015 (see Appendix 22.5). Nevertheless, given these previous sightings, a precautionary approach should be taken and particular attention must be given to development of a comprehensive waste management plan to prevent possible entrapment of skinks.

9.4.3 Poecilozonites snails (Poecilozonites circumfirmatus)

Widely believed to have become extinct, live specimens of the critically endangered, endemic and protected Poecilozonites snail, were found in 2002 at a single location along Bermuda's south shore. This prompted a wider, island wide survey in 2002 but random searches during the current survey did not reveal any living specimens within the proposed development area. This species was therefore not considered further.

9.4.5 Birds – Level 1

9.4.5.1 White-eyed Vireo (Vireo griseus bermudensis)

A white-eyed vireo, an endemic sub-species which is protected under the Protected Species Act 2003 as well as the Protection of Birds Act 1975, was seen on the property. The vireo is adaptable and is known from garden habitats and a dedicated planting programme with suitable native species could also provide more suitable habitat for nesting and enhance the vireo's food supply within the development area.

9.4.5.2 White-tailed Tropicbird (*Phaethon lepturus catesbyi*)

The protected White-tailed Tropicbird, which is listed as vulnerable under the Protected species Act 2003, numbers around 2,000 nesting pairs, which represents a decline of up to 25-50% from estimated numbers in the 1960's and 1970's. Tropicbirds nest in the rocky cliffs especially along the south shore but the Ariel Sands property does not have the elevation to provide attractive nesting areas.

9.4.5 Other Bird Species

The Protection of Birds Act 1975 prohibits the "take of a protected bird by any method whatsoever; or the take of the egg of a protected bird", where "take" includes "capturing, killing or destroying". Exceptions are made only for the common crow (*Corvus brachyrhynchos*), starling (*Sturnus vulgaris*), kiskadee (*Pitangus sulphuratus*) and house sparrow (*Passer domesticus*).

Under the Act, the "Minister may authorize control or destruction of protected birds if the Minister is satisfied that for the protection of agriculture and fisheries, public health or public safety it is expedient to control or destroy any bird or species of bird which is a protected bird, he may authorise the conservation officer or any other officer of the Department to take such measures for such control or destruction as the Minister may approve". There are 22 resident bird species (including the white-eyed vireo mentioned above), 47 species of regular migrants and over 250 species of recorded vagrants. According to Dobson (2002), breeding birds observed over the south shore of Bermuda (see Appendix 22.2.4) include white-tailed tropicbirds, eastern bluebirds, and a suite of warblers during the fall migration. Of these, 3 bird species are listed under the Convention of Migratory Species (see Appendix 22.2.3). Gulls and terns may also be seen along the shoreline and further out to sea, whilst various migratory shearwater species can be seasonally observed. The rocky coastal does not have sufficient elevation to support nesting longtails. Eastern Bluebirds (*Sialia sialis*) were also observed in the more managed garden areas of the property.

From these lists, it is apparent that there is also the potential for landscape management plans to be developed which target bird friendly plants.

9.3 Assessment of Impacts

In assessing the impacts of the proposed development, the importance of the terrestrial environmental receptors was taken into consideration. There is a generally accepted hierarchy of importance attributed to natural habitats and species and cultural resources, based primarily on their conservation status. Highest priority is given to those that are internationally important followed by receptors that are of national then local significance.

A preliminary classification of importance may include:

9.3.1 International Importance

- Any species, habitat or cultural resource which is an internationally designated as protected (e.g. World Heritage Site or marine mammal);
- Any species listed under the Protected Species Act 2003, which designates conservation status based on IUCN criteria. Most are endemic species, or internationally-threatened regional species;
- Other endemic species;
- A migratory species of international significance (e.g. listed under the Convention on the Conservation of Migratory Species and Wild Animals, 1983).

9.3.2 National Importance

- A nationally designated site (e.g. Marine Protected Area);
- A locally commercial species;
- An historically important specimen;
- A specimen of scientific or aesthetic interest;

- An alien invasive species;
- An area of priority habitat or a priority species as defined in the Bermuda Biodiversity Action Plan and not given protection elsewhere.

9.3.3 Local Importance

- Areas of habitat considered valuable within the local context;
- A regularly occurring, locally significant population of a species not considered threatened;
- A frequented local fishing area;
- An historically important specimen.

9.4 Impact Assessment

a) Construction

Possible potential impacts from construction activities to the terrestrial ecology include direct removal (plants), habitat loss (plants, birds) and injury (plants and West Indian topshells). On-site storage of potentially toxic materials can present a threat from leakage, whilst dust pollution, typically within a 150m radius unless winds are exceptionally high, can settle on vegetation and affect its growth rate. Noise and light pollution can also affect animal, and particularly bird life.

b) Operation

Possible operational impacts to Bermuda's terrestrial ecology will be permanent loss of habitat, chemical pollution, entrapment and the impacts of noise and light pollution. Traffic collisions with wildlife are also possible. There is also the potential of foodstuff from the hotel to attract vermin.

d) Decommissioning

The anticipated impacts from decommissioning are similar to those resulting from construction.

e) Impact Interrelations

Impact interrelations exists with marine ecology, waste, sustainability and air quality.

f) Impact Interactions

There are no impact interactions with regards to this development.

g) Cumulative Impacts

Cumulative impacts may be anticipated if there are further developments on the South Beaches property. These may include more habitat loss, as well as more active management of the property leading to more plantings of native and endemic plants and trees.

e) Natural Hazard Impacts

Wave action and sea level rise present obvious threats to any shoreline development.

The significance of these impacts is presented in the following chart.

	TERRESTRIAL ECOLOGY								
	CONSTRUCTION								
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations
TE-1	Siting –	Small	Permanent	Constant	Local	(-) Medium	High	(-) Moderate	
	encroachment on site boundary setbacks	Rationale: A potential for	ccess roadways creation of bird	encroach on bou and native vege	indary setback tation habitat.	ts thus limiting the	e potential wood	ling of property bo	oundaries and thus the
<i>TE-2</i>	2 Siting –	Small	Permanent	Constant	Local	(-) Medium	High	(-) Moderate	
	encroachment on coastal reserve	Rationale: The as a buffer zet	he restaurant dec one and coastal l	ck and seawall c habitat.	onstitute signi	ficant encroachme	ent into the coas	tal reserve area re	ducing the value of this
TE-3	TE-3 Siting –	Small	Permanent	Constant	Local	(-) Medium	High	(-) Moderate	
encroachment woodland rese setbacks	encroachment on woodland reserve setbacks	Rationale: Parking lots extend into the setback zone for the woodland reserve portion of the land reducing the potential value of this area as habitat. It is anticipated that a conservation management plan for the woodland reserve will be required as compensation for this encroachment.							
<i>TE-4</i>	Site clearance,	Medium	Permanent	Episodic	Local	(-) Mild	High	(-) Minor	Sustainability
	excavation and storage/use of fill	Rationale: Site clearance and associated loss of biota has largely been accomplished prior to ecological surveys. As a brownfield site that has been extensively re-worked there is little of ecological significance remaining on site. The reuse of demolition debris as fill will reduce the need for construction materials brought to site.							
TE-5	Loss of endemic	Small	Permanent	Constant	Local	(-) Medium	Medium	(-) Moderate	
	vegetation	Rationale: A removal of the	t least 5 Bermud nese will require	la cedars will be compensatory	lost during th plantings in ac	e development of cordance with the	this site. As the guidance of DC	se are level 3 Prot	ected Species the
<i>TE-6</i>	Noise	Small	Medium	Episodic	Local	(-) Negligible	Medium	Not significant	Noise and vibration
		Rationale: Noise can disturb native fauna. However, no significant populations of animals of concern are known from the immediate area of construction activities.							
<i>TE-7</i>	Dust	Small	Short	Episodic	Local	(-) Negligible	Medium	Not significant	Air quality
		Rationale: D	ust can settle on	plants and com	promise their l	health.			
TE-8	Waste Production	Small	Medium	Constant	Local	(-) Mild	Medium	(-) Minor	Waste
		Rationale: U vermin. Acti	nless well mana ons to manage tl	ged, waste prod his will be detai	uction on a con led in the CEM	nstruction site can IP.	cause the entar	glement of organi	sms and/or attract

	OPERATIONS									
	Activity	Size	Duration	Frequency	Extent	Magnitude of	Importance	Significance	Impact	
						Impact	of Receptor	of Impact	Interrelations	
TE-9	Garbage and Food scraps	Small	Permanent	Constant	Local	(+) Mild	High	(+) Minor	Waste	
		Rationale: A across the sit	Rationale: Active implementation of operational protocols established to ensure appropriate standards of maintenance and hygiene across the site will eliminate the attraction of vermin and the risks that litter can pose to wildlife.							
TE-10	Increased human presence	Small	Permanent	Constant	Local	(-) Mild	High	(-) Minor	Socio-economic,	
									Culture	
		Rationale: H	Rationale: Human presence does disrupt the behaviour of wildlife. During the years that the site was unused it has likely provided a							
		haven for wi	haven for wildlife somewhat removed from human activity. Re-establishing the hotel function brings noise, light and potential							
		chemical inp	uts to this recent	tly dormant site						
TE-11	Conservation	Large	Permanent	Constant	Local	(+) Moderate	High	(+) Moderate		
	Management	Rationale: A	Rationale: A conservation management plan to promote the success of native species throughout the Woodland Reserve zone has							
		been propose	been proposed as remediation to the planned incursions into protected zonings and brings the potential to more than offset any							
		biodiversity	loss incurred as	a result of the p	roposed develo	opment.				
TE-12	Control of	Medium	Permanent	On-going	Local	(+) Moderate	High	(+) Moderate		
	invasive species	Rationale: O	Rationale: One of the main threats to Bermuda's terrestrial ecology is the proliferation of invasive plants and animals. The potential							
		to manage th	is site to remove	e/control invasiv	ve species brin	gs significant ben	efit.			

9.5 Mitigation Measures

Mitigation will focus on training all contractors to recognise and avoid all protected species, delineating an area on the shoreline to prevent construction workers from trampling or dislodging West Indian topshells, implementing a Woodland Management Plan to include replanting of protected native and endemic species and culling of invasive plants.

9.6 Monitoring Plans

No monitoring plans are anticipated.

9.7 Emergency Response Plan

In preparation for potential catastrophic events such as hurricanes or pollution events, an ERP should be drawn up and integrated into the CEMP.

9.8 Management Plan

A CEMP that includes management action required to address the management of the proposed development and its impact on the terrestrial environment should be developed. The Bermuda Plan also notes that "proper maintenance and management of important flora and fauna, woodland, natural habitats and amenity areas, will be encouraged by requiring the submission of a Conservation Management Plan (CMP) for any development proposal located within a nature reserve, coastal, agricultural or woodland reserve conservation area, or within a park or open space reserve. A Woodland Management Plan will be prepared for the Woodland Reserve.

10 Geology and Hydrogeology

10.1 Methodology

Baseline data was gathered from desk studies and interviews with technical consultants.

10.2 Environmental Baseline Studies

The extinct volcano from which Bermuda originated has acquired a surface topography of solidified calcareous sand dunes of which five distinct formations have been identified. Each has different characteristics. The proposed development lies primarily on one of the mid-age geological formations, Belmont.

This limestone veneer means that there is no natural surface freshwater water or streams. As a result, Bermuda's main freshwater source is rainfall and Bermudians have traditionally relied on rainwater roof catchments from which falling rain is directed to underground storage tanks, with tank size determined by roof catchment area. As rainfall is relatively evenly distributed throughout the year this approach has generally worked although larger, sub-divided houses, hotel developments, the hospital and businesses typically depend on groundwater and treated seawater distributed by pipelines and water "truckers" to supplement their rainwater roof catchment systems. 10% of the population is currently supplied by the water industry. There are four fresh ground water lenses located in the younger limestones with as much as 10 m of freshwater floating on top of the seawater. The lenses are in Somerset, Port Royal and St. George's, whilst the larger central lens is in Pembroke and Devonshire. Combined these provide up to 9.1 million litres/day. They are protected under the Bermuda Plan 2008 as Water Resources Protection Areas, which states "ground water must be protected as a public resource used for the licensed production of drinking water, irrigation, and for non-potable household purposes in the case of private wells". The Water Resources Act 1975 provides the primary legislative framework for this groundwater protection.

Groundwater abstracted from the more than 3,500 private household wells in Bermuda also makes a significant contribution to Bermuda's water supply. A seawater reverse osmosis plant, operated by Bermuda Water Works, produces 2.275 million litres of fresh water per day from seawater. A desalination plant adjacent to the Tynes Bay incinerator, adds a further 2.275 million litres/day capacity.

Improper disposal of waste onto the land surface or into cesspits, soakaways and drainage boreholes can result in contamination of the ground water. As the proposed development has a need both to draw on Government water, and to drill for new

abstraction wells and disposal wells to accommodate the freshwater pool, sewage treatment plant and HVAC, the Water Resources Act has significant bearing.

The proposed development will have traditional water storage tanks associated with water catchment on the roof for all buildings. Potable water from roof catch will be reduced by the installation of solar panels and with a current projection of 76,300 GPD required for all uses to service the development, the use of Government water to supplement potable water is anticipated. The expected breakdown of water demand is shown in Table 10-1. The intention is to collect and use both potable and non-potable water so that all captured water resources are utilized; with non potable grey water being used for irrigation.

In addition to the increased needs for water that the proposed new hotel condo development and its facilities will require, the development site lies close to residential properties, which rely on roof catchment of rainwater for their freshwater supply. The impacts of construction dust/contamination of these must therefore be considered.

Landscaping requirements are challenging to estimate as there are no baseline crop evapotranspiration (ETo) rates calculated for Bermuda, and demand will vary significantly according to the vegetation planted.

10.3 Assessment of Impacts

a) Construction

Construction activities may result in a break into a cave void, which if over 1m³, requires work to cease and the void to be reported to the Department of Planning. Construction will also create airborne pollutants, particularly with use of a crusher, which could settle on the roof catchments of neighbouring residential areas and pollute these critical catchment surfaces.

There will also be significant freshwater needs during construction, which will have to draw off piped water, which services the development site. Activities will include dust suppression, cleaning (site and equipment), ground works such as grouting, drilling, cement mixing, as well as the provision of temporary restroom facilities.

There will inevitably be an unquantifiable amount of dust created at the construction site, which may, in unfavourable wind conditions, settle out on nearby roofs thereby potentially contaminating water catchments. This will be assessed during construction by regular site inspections. The management of dust will be detailed in the CEMP.

b) Operation

The proposed hotel-condos, villas, restaurants, bars, spa and pool will have significant freshwater demands. Tank storage has been designed in accordance with the Planning policy. The Arrivals Building will have three storage tanks; 1) of 60,000 gallons for fire fighting; 2) one of 59,400 gallons for potable water, and 3) one of 38,900 gallons for non-potable water collected from those roofs with solar PV installations. The Beach Club will have storage capacity for 14,550 gallons of potable, and 6,950 gallons of non-potable water.

The anticipated freshwater demand is shown by unit in Table 10-1. Roof catchment will need to be supplemented by Government Water. It should be noted that laundry will be taken off site.

	No. of	No. of	No. of	Total Gallons
	units	gal/pers/day	persons	
Villa (L)	17	75	6	7650 US GPD
Villa (S)	9	75	4	2700 US GPD
1 Bed Apt	14	75	2	2100 US GPD
2 Bed Apt	4	75	2	600 US GPD
Spa				300 US GPD
Restaurant	1	45	116	5220 US GPD
Admin			50	630 US GPD
Beach Club	1	30	128	3840 US GPD
Gym				4960 US GPD
Salon				600 US GPD
Kids Club				100 US GPD
Housekeep				600 US GPD
Pool Top Up				500 US GPD
Utilities				500 US GPD
Sub-Total				30300 US GPD
Added Capacity				10%
Total				33330 US GPD
Irrigation (growing in)				43000 US GPD
Total with irrigation				76330 US GPD

Table 10-1. Preliminary estimate of anticipated water useage. (Courtesy of A. Stones, Onsite Engineering Services Ltd)

Without a completed landscaping plan, it is difficult at this stage to know what the watering demands will be, however it is anticipated that salt tolerant natives and endemics will be planted in high numbers to reduce such maintenance impacts.

There will be a requirement for licenses under the Water Resources Act 1975n for 13 boreholes: 10 for surface run off, 1 for HVAC and 2 for waste disposal to service the sewage treatment plant.

The proposed development also requires excavation of an as yet undetermined quantity of rock and soil/sand. Excavated material will be kept and re-used on site. This material will be supplemented in areas outside the Coastal Reserve and inundation area with pre-existing demolition rubble.

c) Decommissioning

Decommissioning activities will cause similar impacts to construction, although there will be less demand for freshwater and no requirement for fill.

d) Impact Interrelations

Impact interrelations exist with noise, waste management, health and safety, climate change and sustainability and marine water quality.

e) Impact Interactions

There are no identified impact interactions.

f) Cumulative Impacts

It should be noted that the proposed development will have a cumulative impact on freshwater resources if demand is placed on Government piped water.

g) Natural Hazard Impact

Hurricanes and drought will be the two most significant natural hazards impacting the proposed development. Given the proposed timing of the construction and the use of piped Government water during this phase neither is considered to pose a major threat to water management during construction. During operation, drought may impact freshwater demand.

The significance of these impacts is presented in the following chart.

			G	EOLOGY A	AND HYDI	ROGEOLOGY				
			CONS	TRUCTION	AND DE	COMMISSION	NING			
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
GH-1	Dust contamination of existing water	Small	Short	Episodic	Local	(-) Mild	High	Not Significant	Health and Safety, Air Quality, Terrestrial Ecology	
	catchments	Rationale: The construction of the proposed development will create dust emissions, which could potentially impact adjacent water catchments. However, these are quite distant given the location of the footprint and as much of the demolition work is already completed, the amount of dust generated is not likely to be significant.								
GH-2	Reuse of demolition	Small	Short	Episodic	Local	(-) Mild	High	(+) Minor	Terrestrial Ecology, Sustainability	
	debris	Rationale: Much of the fill used on site will come from demolition debris and material excavated during site preparation. This will dramatically reduce the amount of quarried material used to accomplish the development. Given the shortage of quarried material locally, this is considered to be positive.							eparation. This will f quarried material	
GH-3	Increased Water	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Sustainability	
	Usage	Rationale: T	he construction	of the proposed	development	will place a direct	demand on mains	-supplied water.		
				0	PERATIO	NS				
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
GH-4	Increased potable water	Small	Permanent	Constant	Local	(-) Mild	High	(-) Minor	Health and Safety, Sustainability	
	<i>usage</i> Rationale: It is intended that the new development will rely on a mix of roof catchment for freshwater supplementer supplied by mains. This will increase demand on the centralised (Government) water distribution systems. Daily p demand is estimated at 33.330 GPD, and 43.000 GPD non-potable.							ented by water ly potable water		
GH-5	Increased	Small	Permanent	Constant	Local	(-) Mild	High	(-) Minor	Sustainability	
	groundwater usage	Rationale: A for final disp	Rationale: Abstraction wells will be used for air conditioning coolant. New boreholes will be established for waste water runoff and for final disposal of sewage treatment effluent.							
	I for final disposal of sewage treatment effluent.									

10.4 Mitigation Measures

The main mitigation measure will be the collection and use of potable water from the roofs and use of grey water for irrigation. Other mitigation will concern water conservation measures including low flow faucets, showerheads and water closets. Dust management during construction through watering or the erection of wind barriers is written in to the CEMP.

10.5 Monitoring Plans

Regular site inspections to survey the settlement of construction dust on neighbouring roofs will be conducted as part of the CEMP.

10.6 Emergency Response Plan

Given that the site will have back up from the piped Government system, an ERP for hydrogeology is not considered necessary.

10.7 Management Plan

A Water Management Plan will be prepared.

11 Waste Management

11.1 Methodology

Baseline data was gathered from desk studies and interviews with technical consultants and other like business models. Where local data was unavailable, data has been gathered from the US and UK.

11.2 Environmental Baseline

Local capacity for waste management and how equipment may be recycled or reused will be given consideration in the context of the Ministry of Public Works waste management regulations regarding general waste, compost, recycling and hazardous waste. Anticipated wastewater volume and quality (untreated versus treated) from the proposed development is estimated.

Like all small islands, disposal of solid waste products in Bermuda presents a significant challenge and is tackled through a comprehensive waste management system. Most of the solid waste is municipal in nature, produced from residential (approximately 34%) and commercial sources (approximately 66%). There is little manufacturing or industrial waste. 81,000 tonnes of garbage were produced in 2011, representing a decline over preceding years. Nevertheless, Bermuda has one of the highest global waste generation rates. This includes construction, dredge, and spoil waste as well as some hazardous waste.

The Ministry of Public Works is responsible for waste management which is undertaken at: the Tyne's Bay Incinerator, where 55,400 tonnes is incinerated annually (Government of Bermuda, 2012); the Materials Recovery Facility at the Government Quarry in Bailey's Bay; the Airport landfill facility where 10,000 tonnes of material is landfilled; and the Marsh Folly Composting Facility where 15,000 horticultural waste is processed annually. Most of these facilities were previously at or near full capacity (Government of Bermuda, 2005a), a shrinking population has resulted in less waste being processed in recent years. Recycling of bottles and aluminium cans is non-mandatory but 155 tonnes of TAG (120 tonnes tin, 35 tonnes aluminium) are shipped overseas annually. Hazardous waste including batteries (430 tonnes), fluorescent tubes (50,000), paint (48,000 gallons) and chemicals are shipped from the Hazardous Waste Facility at Sallyport in Dockyard to hazardous waste processing plants in North America at a cost of approximately \$0.5 million per year. Waste oil (85,000 gallons) is shipped abroad for recycling or fuel blending.

Baseline data from the US for per person trash generation in a restaurant is 4.9 gallons. In the UK, it is estimated that 1.34 gallons of food waste is generated per person in a restaurant. There is no specific data available for Bermuda.

The Ministry of the Environment and Planning undertakes oversight of wastewater and sewage treatment. Most of the sewage is "benign" domestic sewage rather than toxic, and disposal is typically through discharge into household soakaways or cesspits. This disposal system relies on the natural capacity of microbial communities and the limestone rock to filter and chemically breakdown organic matter into solubles, which are relatively harmless when they mix with the groundwater.

The Environmental Authority sets the effluent standards including limits for suspended solids, BOD, chlorine residual, oil and grease, bacteria and nitrate reduction targets. The Authority also seeks to ensure that for all new developments, there is no further discharge into the inshore waters.

The Water Resources Act, 1975 provides for prosecution of anyone polluting public water and seawater.

Finally, consideration must be given to storm-water run-off, which may sweep pollutants from traffic exhaust, rubber tyres, paints, solvents and oil, as well as silt or topsoil.

11.3 Assessment of Impacts

a) Construction

The construction of the Arrivals building, Beach club and dining terrace, spa, restaurants, bars and swimming pool will require use of a quantity of raw materials as well as the importation of equipment and parts, a proportion of which will become:

- Excess to requirements;
- Damaged;
- Packaging waste;
- Used for temporary works; and
- Used for maintenance purposes.

These materials will remain as inert, non-hazardous or hazardous wastes, which require management, treatment and disposal in accordance with local legislation and or international best practice.

Wastewater and sewage will also be generated during construction activities, with up to 60 construction workers on site, and there is a small potential for run-off during onshore construction, which will need to be managed to protect the near shore waters.

Routine maintenance of the construction equipment will generate waste products including hazardous materials, which will need to be disposed of following locally legislated protocols.

Site clearance in preparation for construction is involving the removal of significant quantities of building rubble and vegetative debris. This material will be used where possible on the site (but not in the Coastal Reserve or areas of likely inundation). Significant quantities of vegetative debris have already been removed from the ground to allow a comprehensive, tailored landscaping plan. Some of this material has been pushed into the Woodland Reserve. This will need to be removed.

b) Operation

The operation of the proposed development will produce municipal and food waste, and waste from ongoing maintenance, including that generated from routine maintenance of service vehicles including boats. These materials will be a mix of inert, non-hazardous or hazardous wastes as well as sewage and wastewater, which will require management, treatment and disposal in accordance with local legislation and/or international best practice. No data is available to determine the anticipated volumes of the various waste types.

An estimated max flow rate of 29,502 gallons sewage/day will be processed through a secondary waste water treatment plant (see Table 11-1). Odours can be an impact from such systems so the system is designed to ensure sufficient aeration, and a suitably located and elevated vent stack.

C)

Decommissioning

Decommissioning of the facility may generate considerable waste including construction waste, depending on whether the building is demolished, and consideration should be given as to how materials may be recycled or reused. However, given the recent improvements in the recycling of materials and the ongoing efforts globally to improve our usage of traditionally wasted resources, the impact of decommissioning on waste management is relatively hard to predict. It is anticipated that the efficiency with which materials are recycled will improve dramatically over the life of this facility and that most of the "waste" produced upon decommissioning will be effectively repurposed.

	No. of units	No. of gal/pers/day	No. of persons	Total Gallons
Villa (L)	17	75	6	7650 US GPD
Villa (S)	9	75	4	2700 US GPD
1 Bed Apt	14	75	2	2100 US GPD
2 Bed Apt	4	75	2	600 US GPD
Spa				300 US GPD
Restaurant	1	45	116	5220 US GPD
Admin			50	630 US GPD
Beach Club	1	30	128	3840 US GPD
Gym				4960 US GPD
Salon				600 US GPD
Kids Club				100 US GPD
Housekeep				600 US GPD
Pool Top Up				0 US GPD
Utilities				0 US GPD
Sub-Total				26,820 US GPD
Added Capacity				10%
Total				29,502 US GPD

Table 11-1. Preliminary estimate of anticipated sewage volumes. (Courtesy of A. Stones, Onsite Engineering Services Ltd)

d) Impact Interrelations

Impact interrelations with regards to waste management include water quality, marine ecology and health and safety.

e) Impact Interactions

There are no impact interactions.

Cumulative Impacts

f)

Cumulative impacts with regards to waste must include the removal of existing waste from the development site. There has been recent/ongoing removal of considerable quantities of construction rubble and vegetative debris. The latter is being managed onsite as far as possible but some has been pushed into the Woodland Reserve.

g) Natural Hazard Impact

Hurricanes and severe storms during periods of unusually high tides may challenge waste management during both construction and operation. The location of waste receptacles in secure locations is essential.

The significance of these impacts is presented in the following chart.

	WASTE MANAGEMENT										
	CONSTRUCTION AND DECOMMISSIONING										
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations		
WM-1	Construction of hotel, villas,	Medium	Short	Episodic	Local	(-) Moderate	High	(-) Moderate	Terrestrial Ecology, Sustainability		
	restaurant and pool	Rationale: will be de should be materials. of the mat Also, the l single use use of poly this will b	Rationale: Site clearance will result in significant quantities of construction rubble which will be reused on site. Horticultural debris vill be delivered to Marsh Folly for composting, although it is noted that some has been pushed into the Woodland Reserve which hould be removed. The furnishings and fittings required for the development will be shipped with substantive amounts of packing naterials. These single use materials cannot be locally recycled and will become waste delivered for incineration at Tynes Bay. Many of the materials used in furnishing such facilities are high value and delicate making reduction in packaging an unrealistic option. Also, the building of this facility requires the use of numerous individually packaged components, materials that need to be cut to fit, single use formwork, etc. Inherent in this is the production of waste. Additionally modern Bermudian construction often involves the use of polystyrene in roofing and detailing. This requires shaping or trimming on site. Careful management of waste is essential and his will be detailed in the CEMP.								
WM-2	Waste from contractors	Small	Short	Episodic	Regional	(-) Mild	High	(-) Minor	Terrestrial Ecology, Sustainability		
		Rationale: by the pro	There will be solution of suitab	mall amounts of le receptacles ar	f regular waste d systems.	e, food waste and	sewage generated	l by the contractor	rs, which can be managed		
WM-3	Waste water disposal	Small	Permanent	Episodic	Local	(-) Mild	High	Not Significant	Terrestrial Ecology		
		Rationale:	There will be s	some waste wate	r from constru	iction activities su	ich as washing eq	uipment and cem	ent vehicles.		
WM-4	Hazardous waste generated.	Small	Permanent	Episodic	Local	(-) Mild	High	(-) Minor	Terrestrial Ecology, Health and Safety		
		Rationale: spills, and appropriat	There will be v paints and adhe te operating pro	vaste oil and gre esives. Their dis cedures. This wi	ase from mair posal can be n 11 be detailed	ntenance of the co nanaged through t in the CEMP.	nstruction vehicle the placement of a	es, as well as the pappropriately secu	potential of accidental ired receptacles and		
				-	OPERAT	ION					
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations		
WM-5	Solid Waste	Small	Permanent	Constant	Regional	(-) Mild	High	(-) Minor	Terrestrial Ecology,		

									Sustainability, Health		
									and Safety		
		Rationale	: A waste mana	gement plan will	be developed	to ensure timely	removal of waste	, to avoidance of a	accumulation of waste and		
		productio	n of unpleasant	odours.							
WM-6	Sewage	Small	Permanent	Constant	Local	(-) Mild	High	(-) Minor			
		Rationale	Rationale: Although an increase in total sewage production is anticipated as a result of the proposed development it is projected that								
		this will b	e processed three	ough the propose	ed secondary t	reatment facility.					
WM-7	Hazardous waste	Small	Permanent	Episodic	Local	(-) Mild	High	(-) Minor	Terrestrial Ecology,		
	including oils,								Health and Safety		
	oil filters,	Rationale	Rationale: There will be waste oil and grease from servicing of the backup generator and sewage treatment plant, as well as the								
	batteries.	potential	accidental spills	. Their disposal	can be manage	ed through the pla	cement of approp	priately secured re	ceptacles.		

11.4 Mitigation Measures

Contractors should carefully calculate in advance the types and quantity of supplies needed during construction to minimise wastage.

The building of the proposed development requires the use of numerous individually packaged components, materials that need to be cut to fit, single use formwork, etc. Inherent in this is the production of waste. Additionally modern Bermudian construction often involves the use of polystyrene in roofing and detailing. Coupled with the use of ICF, this requires shaping or trimming on site. Careful management of waste, particularly at a potentially windy waterfront site such as this, is required.

Waste dumpsters will be housed on the ground level underneath the building in a secure location; it may be refrigerated. Recycled trash will be separated as part of the operating waste management policy. Trash will be collected from site daily by a private service.

A waste water treatment plant to accommodate an estimated max flow rate of 29,502 UD GPD will be located to the east of the site. Odour control will be managed by the appropriate location of the vent stack. Grease traps will be installed where appropriate to catch restaurant sink waste. Oil and hazardous waste spills represent significant issues during construction and contingency plans will be detailed in the CEMP and associated Incident Management File.

11.5 Monitoring Plans

Monitoring of the sewage effluent and abstraction wells may be required to ensure effluent quality meets standards.

11.6 Emergency Response Plan

In preparation for potential catastrophic events, Incident Management Files will be included in the CEMP.

11.7 Management Plan

Oil and hazardous waste spill prevention and general waste management during construction will be detailed in the CEMP.

12 Air Quality

12.1 Methodology

Baseline data was gathered from desk studies and interviews with technical consultants and other like business models. Where local data was unavailable, data has been gathered from the US and UK.

12.2 Environmental Baseline

As air quality issues were not raised during consultations conducted as part of the scoping exercise and as background data on the most likely contaminants raised during construction (dust) do not exist, it was proposed that no further studies of air quality were conducted. However, recognising that absence of data or foresight does not preclude real impacts, issues of air quality will be dealt with through mitigation and management plans.

As an isolated oceanic island, Bermuda's air quality is generally very good; nevertheless it is affected both by local air emissions as well as those derived from long-range transport of pollutants from continental landmasses including North America and Africa. This is visually evidenced by the Saharan dust, which enriches the colour of our local soils. Air quality has important implications for human health and for the health of both terrestrial and marine ecosystems. Climate change is a globally recognised problem, which has been attributed to the increase in emissions of greenhouse gases, primarily carbon dioxide (CO_2) , which is most notably released through the burning of fossil fuels.

Development and operation of the proposed development will inevitably impact local air quality to some extent and these impacts should be addressed. Airborne particles are classified by size, as Table 12-1 illustrates and are either from: 1) primary sources, that is, sources that emit or blow them directly into the air (e.g. from chimney stacks, dust from storage areas, spoil heaps, emissions from buildings (ventilation), emissions from road surfaces, vehicles, materials handling, construction sites, wind dust, sea spray); or secondary sources, formed when substances in vapour form react in the atmosphere (e.g. from the oxidation of sulphur and nitrogen oxides, which form nitrates and ammonium salts. These are usually less than 10 µm in diameter and originate from combustion and natural sources). The scale of the impact is related to the distance of the receptors to the source (see Table 12-2). Beyond 150 m, dust nuisance is considered unlikely, although this will be contingent on weather conditions. Larger particles (generally those over 30 µm) emitted to the air by construction activities at or very close to ground level will tend to settle at source. Smaller particles will tend to travel over greater distances before being deposited.

Particles designated PM_{10} are a serious health concern as they can cause problems to the respiratory and cardiovascular systems. Such particles can also carry adhered carcinogenic compounds into the lungs. Other airborne particles triggering respiratory problems (allergic reactions and asthma) include pollen.

Pollutant	Example	Definition		
Suspended particle matter	Sand, soil, salt	All airborne particles		
Nuisance dust	From building, quarrying	Particles that soil buildings etc.		
Aerosol	Industrial smoke, seawater	Particles suspended in gas		
DM.	Sea salts, mineral dust,	Particles less than 10µm in		
PIVI ₁₀	pollen	diameter		
DM	Vahiela axhausta	Particle less than 2.5µm in		
F 1V12.5		diameter		
Smoko	Industry bonfires	Particles less than 15µm in		
SHICKE	industry, boinnes	diameter		
Black smoke	Industry	Dark particulate matter		
Inhalable	Those larger than 4 µm	Particles which may be		
particles	diameter	breathed in		
Respirable	Those smaller than 4 µm	Particles which penetrate		
particles	diameter	deep into the lung		

Table 12-1. Size classification of airborne particles

Duration of		Distance from site						
dust raising	<20 m	20-50 m	50-100 m	100-150 m				
activity on-site	Likelihood of complaint							
> 12 months	Very Likely	Very Likely	Likely	Potential				
			-	Likelihood				
6-12 months	Very Likely	Likely	Likely	Potential				
			-	Likelihood				
< 6 months	Very Likely	Likely	Potential	Not Likely				
		-	Likelihood					

Table 12-2. Likelihood of complaints by distance. (Upton & Kukadia. Measurements of PM_{10} from a Construction Site: A Case Study. 2002).

The primary sources of locally generated emissions are BELCO, the Tynes Bay Incinerator, vehicular exhausts as well as a few other point sources. Gas and diesel vehicles mainly exhaust carbon dioxide (CO₂) and water vapour, however fuel which is not completely burnt results in 'Products of Incomplete Combustion (PICs), which include unburned hydrocarbons and altered hydrocarbons, carbon

monoxide (CO) and particles (normally in the $PM_{2.5}$ category). In addition the high temperatures and pressures of combustion engines result in nitrogen in the air being oxidised to nitric oxide (NO) and nitrogen dioxide (NO₂). Prior to the introduction of unleaded gasoline, lead was also a major pollutant, however local lead levels have decreased dramatically. Nitrogen oxides and hydrocarbons are linked to ozone formation/smog, whilst sulphur and nitrogen may contribute to acid rain. For example, typical emissions from a modern two-stroke engine, (g/k/Wh) are: Nitrogen - 6,200; Oxygen - 1,100; CO₂ - 500; Water - 200; NOx - 17; Sox - 13.6; Particulates - 0.6; HC (soot) - 0.4; and CO - 0.4. The cruise ship industry has also been an occasional cause of problematic local emissions.

In 1991, the Bermuda Government enacted the Clean Air Act and in 1993, the Clean Air Regulations, designed to regulate open burning, storage of hazardous chemicals and industries emitting gas and particulates considered as pollutants. Ambient air quality standards (AAQS) were developed to protect the portion of air which is nearest to the emission and that the general public has access to (but excluding air inside any building or other structure). Licenses are required for facilities emitting pollutants (including generators), and the standards have been set for nine air pollutants (see Table 12-3) so that any air contaminant should not exceed the relevant maximum limit specified. Additionally, a limit has been placed on plume opacity, which must not exceed 20% over a period of six consecutive minutes in any one-hour period. It should be noted that as most of Bermuda's freshwater resource is collected on the roofs of houses, air pollution presents a significant threat to this resource.

Air Pollutant	Annual Arithmetic Mean	24 hour Average	l hour Average
Sulphur Dioxide (ppb)	11	57	172
Hydrogen Sulphide (ppb)	-	3	10
Nitrogen Dioxide (ppb)	32	106	213
Hydrogen Chloride (ppb)	-	27	-
Ozone (ppb)	31	-	81
Carbon Monoxide (ppb)	-	-	13
Suspended Particulates (μ g/m ³)	60	100	-
Inhalable Particulates (μ g/m ⁴)	30	50	-
Lead (μg/m ⁵)	-	50	-

Table 12-3. Bermuda's Air Quality Standards

Indoor air pollution is also a factor that must be considered, especially in Bermuda where high humidity leads to mould and fungal issues within buildings.

Air emissions are also closely tied to climate change, which is discussed later. However, it should be noted that Global Warming Potential (GWP) is a convenient index that can be used to assess the relative global warming effect of different gases. For example, CO_2 has a GWP of 1 whilst CH_4 has a GWP of 23 over a hundred years.

12.3 Assessment of Impacts

Likely receptors within a 150 m radius of the construction work have been mapped to determine the significance of the impacts arising from nuisance dust during construction and decommissioning activities using the criteria in Tables 12-2. These are illustrated in Plate 12-1, and reveal that 12 residential properties fall within, or partially within this radius. With prevailing south-westerly winds, it is the 6 residences already on the Ariel Sands property that are most likely to be affected. If conditions warrant, period site visits will be conducted to visually assess the level of impact.



Figure 12-1. 150m radius for potential construction dust.

a) Construction

Construction activities during development will inevitably generate dust (eg. from excavation work to chipping, hammering drilling, grinding of concrete, cement, wood and masonry), which if it forms a deposit on adjacent surfaces (work surfaces within the facility as well as nearby property and vehicles) will be considered a nuisance. If it settles on neighbouring roofs, it will be considered a more serious pollutant. Likewise, any protected plants in the area could be impacted by excessive amounts of settling airborne pollutants, however most of the protected species on site are to be removed.

Noxious vapours from any oils, glues, thinners, paints, treated woods, plastics, cleaners or other hazardous chemicals used will also contribute to air pollution. Vehicle exhaust from gas and diesel engines (vehicles, construction equipment and boats) consisting of soot, sulphates and silicates, all of which readily combine with other toxins in the atmosphere, will also be generated, increasing the health risks of particle inhalation. Diesel is also responsible for emissions of carbon monoxide, hydrocarbons, nitrogen oxides and carbon dioxide.

Residential properties with water collection on their roofs within 150 m of construction activity are generally considered to be most sensitive, although the longer the duration of the activity, the more likely the emissions are to be considered a nuisance. Weather conditions must also be factored in, and windy conditions may extend the nuisance zone.

b) Operation

Air pollution caused during operation of the proposed development is likely to be largely limited to exhaust emissions from staff transport to and from the site, tourist scooter rentals, taxis servicing visitors, and from the operation of service vehicles. Electricity requirements will also place a demand on BELCO and contribute to their overall emissions, whilst emergency use of an on-site generator, will also have an impact, and will need to perform according to US EPA emissions guidelines, based on the relevant Tier level. The exhaust silencer will be critical grade or higher. Other equipment or materials that may be used on a regular basis may release VOC's including photocopiers and printers, furnishings, cleaning supplies and paints.

The Waste Water Treatment Plant (WWTP) also has a vent stack. This has been located in consultation with the Department of Environmental Protection to try and ensure that odours do not impact either neighbouring properties or guests to the Ariel Sands Hotel-Condo Cottage Colony development.

c) Decommissioning

Decommissioning will result in many of the same emissions as construction.

d) Impact Interrelations

There are impact interactions between air quality, health and safety, geology and hydrogeology waste management and terrestrial ecology.

e) Impact Interactions

There are impact interactions between air quality, health and safety, geology and hydrogeology and terrestrial ecology.

f) Cumulative Impacts

Cumulative impacts will arise primarily from the addition of more exhaust fumes from vehicular traffic (boat, car and airplane) to existing levels, as well as associated exhaust from greater electricity demand from Belco.

g) Natural Hazard Impact

There is no natural hazard impact in relation to air quality.

The significance of these impacts is presented in the following chart.

	AIR QUALITY									
	CONSTRUCTION AND DECOMMISSIONING									
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
AQ-1	Dust Production	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Health and Safety, Hydrogeology, Terrestrial Ecology	
		Rationale: The c production and i within the 150 n	construction incl its impact on nei n radius.	uding use of a cr ghbouring prope	rusher will cre erties and criti	ate dust emissions cal terrestrial recep	s. Ongoing monito ptors may be requi	ring and managin ired. 12 neighbou	g/reducing dust ring properties fall	
AQ-2	Exhaust from construction equipment	Small	Short	Episodic	Local	(-) Mild	High	Not significant	Health and Safety, Hydrogeology, Terrestrial Ecology, Climate change	
		Rationale: Altho any key receptor are expected to r	ough mechanised rs and is likely to result from well-	l equipment will o dissipate to pra maintained cons	be used thround the best of the struction best of the second struction struction struction best of the second struction structio	ghout the construct ectable levels before ment.	ction process, exh ore impinging in r	aust production w eceptors. Further	ill be relatively far from reductions of emissions	
AQ-3	Noxious	Small	Short	Episodic	Local	(-) Mild	High	(-) Minor	Health and Safety	
	vapours	Rationale: The c	construction of th	ne facility will c	reate noxious	vapours (from glu	es, paints, etc.). A	ppropriate use of	personal protective	
		equipment wher	e necessary to en	nsure worker sat	PERATIO	adopted.				
	Activity	Size	Duration	Frequency	Extent	Magnitude	Importance of	Significance	Impact Interrelations	
						of Impact	Receptor	of Impact	*	
AQ-4	Vehicle Exhaust	Small	Short	Episodic	Local	(-) Mild	High	Not	Health and Safety	
		Rationale: Trans	sportation of visi	tors and supplie	s will create e	missions as will th	ne use of BELCO-	provided electrici	tv.	
AQ-5	Unpleasant sewage vapours	Small	Permanent	Episodic	Local	(-) Mild	High	Not significant	Waste management	
		Rationale: Prope any malodours i	er management of s the resort itself	of the proposed s f, strong inheren	sewage treatm t incentive for	ent facility is critic proper operation	cal to avoiding un exists. The location	pleasant odours. A	As the main receptor of satisfactorily located.	
AQ-6	Unpleasant odours from	Small	Permanent	Episodic	Local	(-) Mild	High	Not significant	Waste management	
	waste	Rationale: Prope the interests of r	er waste manage nanagement to e	ment is critical t nsure this aspec	to minimising t of the operat	odours. Again, as ion is well service	the primary recep d.	tor is the resort fa	cility, it is inherently in	

12.4 Mitigation Measures

Dust mitigation will be implemented to reduce this nuisance factor. This will include actions such as stabilizing stock piles of soil and other loose material (eg through wetting or covering), and possible erection of wind barriers if conditions warrant. Ensuring adequate ventilation of enclosed areas during construction will also be necessary. Mitigation of air quality impacts during operation of the facility will also include ensuring adequate ventilation and air flow within the enclosed building structures, and operational practices in accordance with licensing requirements (e.g. generator), as well as encouraging service vehicles and guests and to switch off their engines when idle. After consultation with the department of Environmental Protection, the location of the vent stack for the WWTP has been determined based on best practice and experience of such systems in Bermuda.

12.5 Monitoring Plans

Regular inspections of nuisance dust of the potential receptor impact zone will be made during the construction and decommissioning phases of the proposed development if conditions warrant, and in response to any complaints. It is not anticipated that further monitoring will be required.

12.6 Emergency Response Plan

It is not anticipated that any aspect of the proposed development will generate the need for an ERP with regard to Air Quality.

12.7 Management Plan

A CEMP that details procedures to control dust and debris, minimise noxious vapours and promote proper maintenance of construction equipment during construction to reduce fumes, is recommended.

13 Climate Change, Energy and Sustainability

13.1 Methodology

Baseline data was gathered from desk studies and interviews with technical consultants in order to evaluate the energy and material demands of the proposed project in the context of information gathered on Bermuda's carbon footprint, current emissions and the implications of international emissions targets under the Kyoto Protocol to Bermuda.

13.2 Environmental Baseline

As a tourist-driven operation, and given extension of the UK's ratification of the Kyoto Protocol to Bermuda, climate and climate change must be considered both from the perspective of the project's impact on them (greenhouse gas emissions), and of the changing scenarios presented by global climate change, (eg. rising sea levels and coastal erosion) which are particularly significant issues on the viability of the proposed development. Bermuda's tourism product has attempted to broaden its seasonal boundaries, which have been driven by the local climate.

Bermuda's climate is sub-tropical, despite its northerly latitude. From May-October, whilst the prevailing winds are south- westerly, the 'high' sets up and deflects summer storms forming west of the island northwards giving us predominantly light south-easterly summer breezes. However, in winter, Bermuda is far enough north to be influenced by the westerlies, which bring strong northerly gales and cooler weather atypical of the truly sub-tropical regions to the south (Anderson *et al.*, 2001). Coinciding with the seasonality of the Bermuda-Azores high is the tropical storm season, which officially runs from 1st May to 30th November. On average, one hurricane approaches Bermuda every year, and a severe hurricane can be expected every 4-5 years.

Under the International Panel for Climate Change (IPCC) projections, Bermuda falls under the North American region with temperatures expected to rise between on average by 3.6°C over the next century (2.8°C-4.3°C). Annual rainfall precipitation is expected to increase on average 7% (5%-10%), however downfalls may be expected to be less frequent but heavier. Additionally, higher sea surface temperatures may result in a more permanent El Nino-like state, reducing the frequency of hurricane formation, but possibly causing more intense hurricanes. Less frequent storm activity may increase winter storm

activity in order to ensure transfer of tropical heat pole ward. The history of storm activity at the Ariel Sands site has guided the design of the proposed development.

Whilst there is some disagreement over recent annual rates of local sea level rise, this has been in the order of 2-3 mm over the past century. However, in the future, a rise of 0.59 m as predicted by the IPCC by the end of the century means that 186.6 ha of Bermuda's existing landmass would be inundated (Glasspool, 2008). At worst, sea level rise is now predicted to be up to 2 m by then end of the century. Parts of Bermuda are already subject to regular flooding and the impact of such sea level rise on seawater inundation of the proposed development site has been considered (section 8.0).

Given Bermuda's size, it might be reasonable to make the assumption that the Island has also not contributed significantly to global Greenhouse Gas levels (GHG's). However, recent calculations suggest that per capita carbon contributions are 11 tonnes carbon/year, or 15th highest in the world (Worboys, 2009). Nearly 100% of these total emissions come from the energy sector. Of these, about two thirds are from electricity generation and one third from local transportation. Not factored in to this is that most construction materials need to be manufactured and imported to Bermuda furthering adding to our actual carbon footprint. In 2008, Bermuda accepted the United Kingdom's ratification of the United Nations Kyoto Protocol and is now committed to reducing levels of GHG emissions before 2012 by 8% from 1990 levels.

Sustainability is reasonably defined as the ability to meet the needs of the present generation, without compromising the ability of future generations. In the context of the current proposal, sustainable practices should take into consideration environmentally responsible and resource efficient design, construction, operation, maintenance and decommissioning of the hotel and marina. Practices that ensure efficient energy use, water efficiency, careful sourcing of materials and resources and high indoor environmental quality can all contribute to greater sustainability. The Agricultural Strategy currently being developed must be taken into consideration with regards to the zoned agricultural land. Consideration of transport and general site selection are also an important consideration. Many of these have been considered elsewhere in this report.

Despite a full commitment to the incorporation of all reasonable resource efficiency measures, the proposed development will have significant energy requirements that must be assessed in the context of the current supply. Bermuda's electricity consumption has declined from a peak of 656,083 kWh in 2009, to 606,354 in 2012. Demand is fairly equally split between residential usage (42.8%) and commercial usage (49.6%) with 7.6% for other uses (Government of Bermuda, 2009). 97% of the Island's energy is provided and distributed by the Bermuda Electric Light Company Ltd., (BELCO); the remaining 3% (1.2 MW) is generated through the Bermuda Government's mass burn incinerator at the Tynes Bay Waste Treatment Facility.

Small-scale renewable options are becoming more widely incorporated into local buildings, but this has to be finely balanced with the desire to maintain the "Bermuda Image". Coupled with energy saving measures integrated into building design and appliances, these provide a significant means of reducing Bermuda's dependence on oil and greenhouse gas emissions. In 2009, the Government introduced various changes to the Customs Tariff to encourage the importation of products that produce or use energy in a more sustainable manner.

13.3 Assessment of Impacts

There is no standard, nor policy document, nor history of assessing the impacts of local developments specifically with regard to climate change and this has not been raised during scoping consultations. However, based on the desk study data, some assessments can be made.

a) Construction

All construction equipment and materials that need to be imported will contribute fossil fuels through their manufacture and transport to the Island. One tonne of freight shipped by sea from the East Coast of the US to Bermuda results in 0.032 tonnes of emission (http://timeforchange.org/co2-emissions-shipping-goods). The use of ICF (probably Nudura, which stacks efficiently and is extremely light weight) will help reduce fossil fuel production from shipping.

Operation

b)

Ongoing operation of the proposed facilities will require electricity for lighting, refrigeration, cooking, water pumps and air conditioning, whilst there will be fuel demands for service vehicles and transport. Additionally, guests may rent scooters, hire taxis or take bus rides, which will all increase the impact carbon emissions.

However, by far the most significant contribution to emissions will be the air travel undertaken by tourists coming to the Island to use the proposed facilities. Some basic data exists for emissions allowing general calculations to be made. A return flight from London to Bermuda for example has been estimated to result in 1.53 tonnes of carbon emissions per passenger; New York to Bermuda return, 0.8 tonnes (http://www.climatecare.org).

Energy usage is projected to be 560 kWh. Installation of Solar PV is intended, with the aim of providing up to 20 % of the projected energy demand. The use of Nudura as the building material will also realise energy

savings as it has a thermal resistance of R22, compared with the value of R2 for concrete building block.

Other aspects of increased efficiency will be better use of the zoned agricultural land. This will form part of the landscaping plan.

c) Decommissioning

Vehicular emissions from local transport and construction equipment will be the primary impact from decommissioning activities. Efforts to recycle component parts will help to offset these.

d) Impact Interrelations

Impact interrelations exist between climate change, energy and sustainability, and air quality, waste management, transport and water and hydrogeology.

e) Impact Interactions

There will be no impact interactions.

f) Cumulative Impacts

Carbon emissions from the proposed development will definitely be cumulative. Management efforts to reduce these will be addressed in the CEMP.

g) Natural Hazard Impact

With regards to the impacts of climate change on operations, there will be some related to visitor cancellations due to projected stronger storm activity. However, given the location of the proposed development, rising sea levels and increased storm/hurricane intensity present the main threat.

13.4

Mitigation Measures

Mitigation measures will include careful calculation of quantities of materials required for construction so there is no wastage, use of ICF for building which is composed of a high percentage of recycled material, use of solar PV and LED's where appropriate, and water collection from the roof. LED fixtures are suggested for all outdoors spaces, including landscape and site lighting.

Other mitigation measures will involve those already discussed under air quality to ensure vehicular emissions during construction and operation are kept to a minimum and waste is recycled where possible.

With regards to the impacts of climate change on the development itself, mitigating against the impact of hurricanes on visitor arrivals is impossible. As

far as rising sea levels are concerned the development has been determined that realistic inundation levels are likely up to the 15 foot elevation. Nudura, the ICF to be used for building is 9 times more resistant to wind, being capable of withstanding 250 mph winds.

13.5 Monitoring Plans

It is not anticipated that the impacts on climate and climate change will be sufficient to warrant a monitoring plan. However, it is anticipated that during operations, management may implement energy audits to better manage energy usage.

13.6 Emergency Response Plan

It is not anticipated that an ERP will be required.

13.7 Management Plan

The CEMP will promote resource efficiencies during construction of the proposed facility.
14 Transport

14.1 Methodology

Data was collected through a desk study and a 90 minute peak day, peak hours traffic survey. This was complemented with data from a desk study.

14.2 Environmental Baseline

14.2.1 Road Transport - General

In 2012 there were 4847,367 registered vehicles on the Island, down from 48,367 in 2011. The decrease is for across all vehicle classes. Private cars number 21,707, whilst motorcycles and scooters number 14,887. In the 2010 census, 44% of the working population travelled by car, 28% by motorcycle, 7% by bus, 3% by ferry and 6% on foot.

Bermuda has 599 km of roads of which 209 km are public and the rest are private estate roads or unnamed roads. Most are narrow and there are restrictions placed on the maximum car size, weight and engine size. Exceptions are given to accommodate the construction and container shipping industry. Most container ships berth in Hamilton meaning that containers have to be distributed from there by road. Movement of large construction vehicles is potentially dangerous and tends to be undertaken outside of peak rush hours.

According to industry sources, approximately 10%-15% of cruise visitors rent livery cycles, which is substantially lower than the 30%-40% of hotel visitors that are estimated to rent cycles. The cruise lines discourage their visitors from renting cycles, citing safety and liability issues, and prefer their visitors to take organised bus, taxi or water sport tours, or to use public transport.

14.2.2 Marine transport - General

Approximately 400-600 ships and 1,000-1,200 yachts arrive in Bermuda on an annual basis and berth in St. George's Harbour, Hamilton Harbour or Dockyard. Container ships primarily berth in Hamilton alongside the container docks. The visiting yachts anchor in various locations and typically stay 3-5 days, but all dock temporarily in St. George's in order to clear H.M. Customs.

Locally, there are 10 ferries operating on four ferry routes, Hamilton-Paget-Warwick, Hamilton-Somerset/Dockyard, Hamilton-Rockaway Southampton and Hamilton-St. George's/St. David's.

Overall, the Department of Marine and Ports estimated a 30% increase in watercraft in Bermuda between 1995-2005. In 2004, there were 182 registered fishing vessels, and 32 charter fishing boats. Private boats numbered 6,834, charter boats, 75, rentals boats, 124 and jetskis (both private and rentals), 569.

14.2.3 Air transport - General

The F.L. Wade International Airport is located on St. David's Island and is regulated and operated by the Department of Civil Aviation, in accordance with the operational and safety standards set by the International Civil Aviation Organisation (ICAO), the U.S. Federal Aviation Administration and the U.K. Civil Aviation Authority. In 2011, there were 236,038 air arrivals, of which 18% were business visitors, and 16% were visiting family and friends.

14.2.4 Parking and Road Traffic - Specific

The principle objective of the parking standards is to ensure that, in assessing development proposals, appropriate consideration is given to the accommodation of vehicles attracted to the site. Proposals should not prejudice road safety or significantly inconvenience the flow of traffic. In assessing the parking provision in association with development, it is expected that developers provide appropriate access to the site and demonstrate that there is adequate provision of space within the site, for parking, manoeuvring, loading and unloading to fulfil the operational requirements of the proposed development. The latter details have been outlined and assessed under Section 5.1.9, Planning Policy Compliance and data for and assessment of road traffic implications are provided below.

14.2.5 Traffic Survey

The Traffic Impact Statement (TIS) policies in the Bermuda under Chapter 11, TPT2 indicate such studies may be required where development proposed is over 50,000 square feet in GFA or the characteristics of the site and particulars of the proposal justify such a study. Given that the recommended contents of a TIS are quite comprehensive and are impractical for certain situations including this former hotel brownfield site with relatively few units and keys proposed, a much scaled down approach was adopted, as follows:

- (a) Defining the impact area and road type and quality;
- (b) Characterization of baseline road situation traffic, based on 1 peak day/time traffic survey;
- (c) Estimation of traffic generation attributed to the project (operational); and
- (d) Determination of impacts

The traffic count was done in the vicinity of the project site access/egress (Ariel Drive) between the hours of 5:00-6:30 on Friday 17th April 2015.

14.2.5.1 Assumptions and Methodology

Given that it is likely that the maximum vehicle useage on and around the site will be for accessing the bars/restaurants, the peak day and timeframe was selected based on two premises:

- 1) Week day typical peak rush hour time period: 5pm to 6:30 pm; and
- 2) It is expected that local residents and tourists would be likely to attend such a facility in greatest numbers for Happy Hour and/or dinner on a Friday evening.

The area of most potential impact was defined as the immediate area around the Ariel Drive site access, including that section of South Road, as well as Brighton Hill Road (located on the north side of South Road, just east of Ariel Drive). Both roads are public roads with a full two way traffic widths and unimpeded by any visual or physical obstructions within the impact area.

Major traffic streams numbers (not broken down by vehicle type) were captured to give an accurate picture of the traffic situation that currently exists. These included the movements noted in the table below and general observations were also made about queue lengths and wait times.

Traffic Streams	5-5:30pm	5:30-6pm	6-6:30pm	Total Vehicle Count for 90 Minutes
South Road - westbound	217	214	201	632
South Road - eastbound	308	294	241	843
Northbound on Brighton Hill from West	37	38	44	119
Northbound on Brighton Hill from East	33	28	20	81
South on Brighton Hill to West on South Road	34	30	36	100
South on Brighton Hill to East on South Road	57	49	47	153
Total Vehicle Count by 30 Minute Interval	690	653	589	1932

14.2.6 Traffic Survey Summary

Table 14-1. Results of Traffic Survey conducted on 17th April 2014.

Queuing and Wait Times: The traffic movement during rush hour was unimpeded, with very little wait times (under two minutes) to make turning movements across through traffic (west bound on South Road from Brighton Hill and north bound from South Road onto Brighton Hill). Queues to make such turns never exceeded 4 vehicles.

14.3 Assessment of Impacts

Based on the above data, the following assessment about transport was made regarding the proposed development.

a) Construction

Road transport of shipping containers from the Hamilton docks to the subject site may cause some potential road safety hazards. The development site is large enough to serve as a staging area for construction so that containers may be parked here without causing any disruption to residential traffic and parking. Construction vehicles may cause localised traffic disruption whilst in transit during the construction period, but this is a temporary impact.

b) Operation

There will be increased road traffic during operations as a result of visitors, including residents, tourists on rental bikes, taxis, and service vehicles for delivery of supplies and ongoing maintenance, as well as staff. However, given the exodus of approximately 7,000 residents over the past few years, road traffic has declined on the Island and the additional vehicles that will be travelling along the South Road to the property are not considered to present a significant impact. The Traffic Survey above indicates the road quality and network in this location this area is good, and is more than adequate to handle the current traffic burden. It does not appear to be at capacity.

Increased traffic to the site will be as a result of staff and guest arrivals. In terms of projected traffic generation to the site it should be noted that due to shift work, it is likely that staff will not be utilizing the roads at the same peak times as the 9 to 5 working public or arriving during weekend peak service times when guests are arriving to for restaurant services. Given a full time staff number of 60 and an estimated 70% being needed during peak shifts, up to 42 staff may arrive in and around the same time to site. This is a worse case scenario given that different sections of the hotel will have different shift patterns. Allowing for a maximum of 42 staff, and assuming 44% travel by car, and 28% by cycle (72% rely on personal vehicles), an additional 30 vehicles would be arriving at the site, with the majority arriving in off peak times. Guests arriving to the small spa by vehicle will be small in number and also be arriving and leaving at various intervals during the day. The 26 villas may have cars associated with them, however this is a relatively small number of additional cars, and 1) it is unlikely that all villa owners will wish to have a car; and 2) such guest/owners would be unlikely to be residents needing to drive during peak morning or evening rush hour times. Off-site guests arriving to access the bars and restaurants, as well as times when events (e.g. weddings) are planned will create the most traffic. As noted

above the main conflict time would be Fridays between 5 pm and 6:30 when weekday rush hour may conflict with peak time to visit the restaurants on site. If both restaurants were at full capacity of 234 persons, and the parking standards were used to guestimate vehicles (1 cycle and 1 car bay per 10 seats) a total of 47 vehicles would be present. Full capacity at both restaurants would be rare, but if this type of scenario arises during peak rush hour on a Friday, not all would arrive simultaneously and this would allow for absorption by the existing capacity in the road network at this location. Events are likely to bring larger numbers of vehicles to the site in a concentrated period. Some delay in traffic movement would be expected if such an event occurs during the peak day/hours timeframe, or on other weekday rush hours times. However, since large events will be occasional in nature, the situation will not create unacceptable negative impacts.

Although the proposed project will generate additional traffic in the area, no special provisions will have to be made to accommodate this anticipated increase.

The only impact on air travel will be the increase in the number of arrivals and departures. However, given the decline in air arrivals over the past few years, this is unlikely to over-extend the existing facilities at the airport.

Marine traffic will not be affected.

c) Decommissioning

Road traffic impacts during commissioning would be similar to those arising during construction.

d) Impact Interrelations

Impact interrelations exist between transport, noise, health and safety, air quality, marine ecology, recreation and climate change.

e) Impact Interactions

There are no impact interactions.

f) Cumulative Impacts

Any additional traffic on the road or water as a result of this project could be considered cumulative, but given declining numbers of road users in recent years, cumulative transport impacts are not deemed significant.

g) Natural Hazard Impact

Natural Hazard impact is not deemed relevant to transport.

The significance of these impacts is presented in the following chart.

]	FRANSPO	RT				
				C	ONSTRU	CTION				
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
TP-1	Materials transport - importation	Small	Short	Episodic	Regional	Negligible	Medium	Not significant	Climate Change, Energy and Sustainability	
		Rationale: importatio	Some construct n of these mater	ion materials w ials is not expe	ill be importe cted to challer	d via container shi nge the local transp	p. Given Bermud portation capacity	la's current economic	c downturn, the	
TP-2	Material transport - local	Small	Short	Episodic	Local	(-) Mild	Medium	(-) Minor	Climate Change, Energy and Sustainability, Health and Safety, Noise	
		Rationale: Supplies for the construction are to be delivered to site by road with some material effect on roads and terrestrial traffic.								
TP-3	Personnel transport	Small	Short	Episodic	Local	Negligible	Medium	Not significant	Climate Change, Energy and Sustainability, Health and Safety, Noise	
		Rationale:	Construction pe	ersonnel and sup	oplies transpor	rt will be by road.				
TP-4	Parking	Small	Short	Episodic	Local	Negligible	Low	Not significant		
		Rationale:	There is ample	parking space of	on the site for	worker and constr	uction vehicles.	·		
				C	PERATIC	ONS				
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations	
TP-5	Car and Bike Parking	Medium	Permanent	Episodic	Local	(-) Mild	Low	Not significant		
	-	Rationale:	It is planned that	at adequate park	king is provide	ed on site to meet	he demands creat	ted by the new facilit	ty.	
TP-6	Increased traffic on South Road	Small	Permanent	Episodic	Local	(-) Mild	Medium	(-) Minor	Climate Change, Energy and	

									Sustainability, Noise	
		Rationale: vacant, it	Whilst it is clea is projected that	r that the propo the traffic creat	sed facilities w ed will form a	ill bring more cl small proportion	ients to the site, w of the traffic tran	hich for the last seven siting this roadway.	eral years has been	
<i>TP-7</i>	Increased air travel	Small	Permanent	Episodic	Regional	(+/-) Mild	Medium	(+/-) Minor	Climate Change, Energy and Sustainability	
		Rationale: Increased hotel usage is the ultimate goal of the development and that is likely to drive increases in air travel. This has a negative impact from some perspectives, but this can also be seen as a positive impact economically and also by increasing the viability of air routes serving the island. Hence although this can cause congestion it can also promote capacity to deal with that congestion.								

14.4 Mitigation Measures

Specific mitigation measures for transport during construction will seek to minimise disruption by construction vehicles during peak traffic periods and switch off idling engines to reduce noise.

14.5 Monitoring Plans

No monitoring plan will be required.

14.6 Emergency Response Plan

It is not anticipated that an ERP regarding transport will be required.

14.7 Management Plan

The CEMP will outline any requirements needed to minimise the impacts of traffic during construction, which may include restricting construction vehicle access on the main road at certain times.

15 Noise and Vibration

15.1 Methodology

Baseline data was gathered from desk studies and interviews with technical consultants in order to evaluate the levels of noise. Vibration was not raised during stakeholder discussions but it is recognised as a potential impact.

15.2 Environmental Baseline

Predicted construction and operational noise and vibration output is based on industry standards for the type of work and equipment employed.

a) Noise

Noise can be defined as "unwanted sound", and sound results when an object sets in motion a wave or pattern of waves though vibration or turbulence in the medium in which it is present (e.g. air or water). The wave or wave pattern may continue into another medium that will transmit it, so for example sound in water may continue into the air if there is sufficient energy. This energy is "heard" and perceived as sound when it comes into contact with the eardrum. The sound level or amplitude of the sound waves is measured in decibels (dB). The speed or frequency of the waves is measured in terms of cycles per second (Hz).

The audible sound range for humans is approximately 0-120 dB, whilst people are most sensitive to sound at frequencies of the order of 1 to 4 kHz. At lower or higher frequencies the ear is much less sensitive, therefore humans are more tolerant of these frequencies although high frequency sounds are also more harmful than low frequency. However, the impact of noise on humans is a function not only of the level and frequency, but also of its persistence. Persistent, high-level sounds are more damaging. The adverse effects of noise, which include sleep disruption, impaired quality of life, and general health impacts, as well as direct hearing loss, can be cumulative with prolonged or repeated exposure.

Construction Activity	Actual Measured Average L _{max} ^b at 50 feet
Vibratory Pile Driver	101
Impact Pile Driver	110
Jackhammer	89
Compressor	78
Concrete mixer truck	79
Concrete Pump truck	81
Welder/Torch	74
Backhoe	78

Table 15-1. Noise levels for various activities (Washington StateDepartment of Transportation 2013).

Various legislation are relevant to noise sources associated with the proposed development on land. Under the Road Traffic Act, 1947 it is an offence to drive a vehicle on a road when the vehicle is in such a condition as to cause unnecessary noise, vibrations, smoke or smell, whilst the Motor Car (Construction, Equipment and Use) Regulations, 1952 (under the Motor Car Act, 1951) place controls on: excessive noise from defects or faulty packing of loads of motor cars or trailers; excessive noise due to a lack of care; and the unnecessary use of car horns. The Regulations require the stopping of motorcar engines when stationary to prevent noise. Similarly, the Auxiliary Bicycles (Construction, Equipment and Use) Regulations, 1955, sets a maximum standard of noise permitted in relation to any auxiliary bicycles. The Occupational Safety and Health Regulations 2009 limits daily sound level exposure to 85 dBA Lex or 135 dBA peak sound pressure level. This provides for powers to require operators of machinery emitting excessive noise to wear ear protectors. However, there is no legislation currently in place to control noise from mechanical or industrial equipment, boats, home appliances or quarrying operations. Finally, under the Summary Offences Amendment Act 2010, any noise, made between 0000h - 0600h, which is more than 100 feet from the source, and annoys more than 2 people, is an offence.

b) Vibration

In addition to being an annoyance to people, and at higher levels affecting their activities, vibration, defined as regularly repeated movement of a physical object about a fixed point, can cause structural damage in buildings and affect vibration-sensitive machinery or equipment. Vibration is measured as peak particle velocity (ppv) expressed in millimetres per second (mm/s).

Vibration standards cover those dealing with human comfort and those dealing with cosmetic or structural damage to building. Research shows that humans tend to have an annoyance threshold far lower than any building's susceptibility to damage, whilst the effect of weather on building structures is generally far more significant than construction vibration.

Typical daily sources of vibration include traffic and construction activities such as blasting, pile-driving and demolition and these impacts are also relevant underwater. Vehicle speed and weight, type of vehicle suspension, and the roughness and rigidity of the surface all affect the vibration amplitudes and therefore their impact. Amick and Gendreau (2000) summarized the main categories of vibration as:

- *Continuous random vibration:* Most excavation and static compaction equipment falls into this category and vibrations may cover a wide frequency range.
- Random vibration due to single impact or low-rate repeated impact: Pile driving, blasting, the use of a drop ball, and a "pogo-stick" type of compactor all result in this type of vibration, which leads to the soil "ringing" from the sudden dynamic loading.
- *High-rate repeated impact:* Typified by the jackhammer, which generates vibrations at the frequency of impact.
- *Single-frequency continuous vibration:* Vibratory pile driving, pile extraction, and vibratory compaction are the main construction sources for this type of vibration.

Waves generated from the source propagate outward through the ground, and are attenuated in the soil over distance and by damping effect. For example, soft and saturated soils transmit vibrations more readily than sandy, dry ones. Meanwhile, rock readily transmits vibrations.

No local legislation regulates vibration levels. As an example from overseas, the California Department of Transportation has set an "architectural damage risk level" for continuous vibrations (peak vertical particle velocity of 5 mm/sec or 0.2 in/sec) or, one tenth of the maximum "safe" level of 50 mm/sec for single events. British Standards 7385 state that that there should typically be no cosmetic damage if ground-borne vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above.

Construction Activity	Typical Ground Vibration Level
Vibratory roller	Up to 1.5 mms @ 25m
Hydraulic rock breakers	4.5 mm/s @ 5m, 0.4 @ 20m, 0.1 @
	50m
Compactor	20 mm/s @ 5m, <0.3 mm/s @30m
Pile driving	1-3 mm/s @ 50m depending on soil
	conditions and piling technique
Bulldozer	1-2 mm/s @ 5m, 0.1 @ 50m
Truck traffic (smooth	<0.2 mm/s @ 20m
surface)	
Truck traffic (rough	
surface)	<2 mm/s @ 20m

Table 15-2. illustrates the typical vibration levels measured during construction activities.

Table 15-2. Vibration levels for various activities

15.3 Assessment of Impacts

There is the potential for impact from noise and vibration from the proposed development. The extent to which changes in noise levels due to construction activities constitute significant effects depends on the absolute levels of ambient and construction noise, as well as the magnitude, duration, time of occurrence and frequency of the noise change. It should be noted that prior approval for demolition of the existing buildings on the site has meant that much of the major construction noise is nearing completion.

a) Construction

There are a number of shore side construction activities, including installation of site services, interior refurbishments, and construction equipment such as a crusher that will generate noise and vibration on a localised level. Given the proximity of the neighbouring properties both on the Ariel Sands property and immediately to the east and west, the potential impact of these activities must be considered. Table 14-1 above lists those activities most likely during construction and the noise levels generated within 50 feet of the point source. The Occupational Safety and Health Regulations 2009 limits daily sound level exposure to 85 dBA Lex or 135 dBA peak sound pressure level. These levels will apply to the in-water pile driving for the dock and land-based foundations, but all other anticipated construction activities fall below this decibel range.

Allowed to be unprotected	At this noise level
Up to 8 hours	90 dB
Up to 4 hours	95 dB
Up to 1 hour	105 dB

Table 15-3. OSHA guidelines regarding hearing protection.

However, 1 in 5 people exposed regularly to 90 decibels will lose some hearing.

Levels of disturbance may also be assessed based on the duration of the impact. The proposed construction project can be considered medium term.

Level of Disturbance	Duration of Impact				
Short	1 month				
Medium	1-6 months				
Long	> 6 months				

Table 15-4. Level of disturbance based on duration of project.

In terms of the duration of the overall construction process for this project, the level of disturbance would be considered long term. Various factors reduce noise, and one of these will be the hillside, which will provide a sound barrier for area residents north of South Road.

Transport of imported equipment and construction materials from Hamilton will have a noise impact that applies further afield. Additionally, activities such as staff transport will all contribute potentially irritating noise, however these are accepted noises within the community.

b) Operation

Noise levels generated during operation will include voices, music and road traffic on land, as well as various services including trash collection. These are all accepted noises within our society, but must be managed to ensure conformity with local regulation such as the Public Health Act 1949 and Summary Offences Amendment Act 2010. It should be noted that the intended use of ICF as a building material, is anticipated to dampen noises generated within the buildings.

c) Decommissioning

Decommissioning activities will generate some of the same types and levels of noise and vibration as those generated during construction.

d) Impact Interrelations

Impact interactions that could be considered with regards to noise and vibration include health and safety, culture and recreational and terrestrial ecology.

e) Impact Interactions

There are no impact interactions that could be considered with regards to noise and vibration.

f) Cumulative Impacts

Cumulative impacts will arise in so far as the noises generated through construction and operation will add to existing background noise. No other major construction activities are known in the vicinity for the proposed construction period. However, the physical nature of this location and the surrounding hillside, will largely shield neighbouring properties from significant noise.

g) Natural Hazard Impact

Natural hazards will not impact noise and vibration.

The significance of these impacts is presented in the following chart.

	NOISE AND VIBRATION										
			CON	STRUCTIO	N AND DE	COMMISSIO	NING				
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations		
NV-1	Site clearance and excavation	Medium	Short	Episodic	Local	(-) Mild	High	(-) Minor	Health and Safety, Terrestrial Ecology, Culture and Recreation		
		Rationale: Most this development residential recept impacts on reside for activities invo	of the site has t. Additionally tors which is a ents with a cor olving noise le	been cleared of , the surroundin nticipated to fur nplaints registry vels exceeding a	pre-existing b g area is not h ther reduce no /hot line; defin accepted safe	uildings thereby d eavily developed v vise impacts. The C ned hours and day levels.	ramatically reduc with a fair distanc CEMP will details s of operation; etc	ing the site prepa e between constru- s means to protect c. Contractors wil	ration work required for uction sites and most contractors and reduce l wear hearing protection		
NV-2	Construction machinery and vehicles	Medium	Short	Episodic	Local	(-) Mild	High	(-) Minor	Health and Safety, Marine Ecology, Culture and Recreation		
		Rationale: The u minimise the imp	se of power to pact of this noi	ols and mechani ise, the CEMP c	sed equipmen alls for actions	t including a crush s to minimise the a	ner, are a clear sou amount and durati	arce of construction of noise created	on noise. In order to ed through these sources.		
NV-3	Material selection	Small	Permanent	Constant	Local	(+) Mild	High	(+) Minor	Health and Safety, Sustainability.		
		Rationale: The seconstruction thus	election of nov s reducing nuis	el construction	materials (ICF ted.	F) brings the poten	tial of a substantiv	ve reduction in us	se of power tools during		
NV-4	General site activity	Small	Short	Episodic	Local	Negligible	High	Not Significant	Culture and Recreation		
		Rationale: Contr order to reduce n the site complain	actors will brid toise impacts of the registry.	ef their staff rega on the neighbour	arding the sense hood. The effe	sitivity of the site t ectiveness of this v	to excessive noise will be confirmed	e production and v and/or managed	will manage the site in through monitoring of		
				(PERATIC	ONS					
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations		
NV-5	Hotel operations and	Small	Permanent	Constant	Local	Negligible	Medium	Not significant	Culture and Recreation		
	mechanical equipment	Rationale: As the Quiet operations the facility's clie	e hotel operatio will be a drivi nt base, there	on is planned on ing criterion dur is strong incenti	the condo-ho ing mechanica ve for effectiv	tel concept succes il equipment select e noise control du	s requires the creation and as the pri ring operation.	ation of a quiet, re mary receptors o	elaxing atmosphere. f any disturbing noise are		

NV-6	Service and	Small	Permanent	Episodic	Local	(-) Mild	Medium	(-) Minor	Culture and recreation			
	Maintenance	Rationale: Regul residents.	Rationale: Regular services such as trash collection and horticultural management will create noise which may impact nearby area residents.									
NV-7	Restaurant and	Small	Permanent	Episodic	Local	(+) Mild	Medium	(+/-) Minor	Culture and recreation			
	bar-generated noise	Rationale: This can be both a positive and negative impact depending on perspective and levels of noise generated. However, as the closest residential receptors are within the operational control of the facility clearly encourages self-policing of excessive noise. Further, nuisance noises from such sources are regulated under the Summary Offences Amendment Act 2010.										
NV-8	Material Selection	Small	Permanent	Constant	Local	(+) Mild	Medium	Not significant	Culture and recreation			
	Rationale: The materials selected for construction provide a high degree of sound insulation. It is anticipated that this will limit transmission of any sounds created within buildings.											

15.4 Mitigation Measures

Given the proximity of the proposed construction to sensitive receptors (the adjacent residential area), minimizing and managing the production of noise through this activity is recognised as a priority. Best practice guidance on noise and vibration management and mitigation is therefore being adopted. The most significant noise impacts will be from rock excavation and crushing. All work will be scheduled in accordance with local regulatory guidelines covering noise, including re-scheduling of works to avoid unsociable hours, public holidays or weekends and ensuring that vehicles are switched off when stationary to avoid irritation to humans. Contractors will wear sound protection for activities exceeding accepted safe levels. Operational impacts will largely be related to entertainment noise. The restaurants and bars will be managed according to local standards regarding noise. The use of ICF for building will help dampen noise. The Nudura product expected to be used has a Sound Transmission Class rating of 50, which makes the product "totally inaudible".

15.5 Monitoring Plan

A noise and vibration monitoring plan will not be required however the ongoing operations will be required to conform to the regulations outlined on the Summary Offences Amendment Act 2010.

15.6 Emergency Response Plan

No Emergency Response Plan is anticipated with regard to noise and vibration.

15.7 Management Plan

The CEMP will detail efforts to minimise the impacts of noise.

16 Landscape and Visual

Whilst not raised as a concern during stakeholder consultations, the proposed development will have a visual impact on the surrounding landscape and this warrants consideration.

16.1 Methodology

Baseline data was gathered from architectural drawings, site visits and building elevations scaled into area photographs from key vantage points.

16.2 Environmental Baseline

Bermuda's gently rolling hillsides, south shore vistas, hedgerow-lined roadsides and colourful sub-tropical vegetation create a distinctive image. Maintaining the aesthetic beauty of the Island and the Bermuda Image is considered critical not only to the health of the natural ecosystems, but also to the economy, especially tourism and international business. Preservation of this image therefore forms an important component of the aims of the Bermuda Plan 2008 and must be given full consideration in assessing the proposed development.

The subject site has a long history of tourism use having been occupied by the Ariel Sands Hotel from 1984 to 2008. Since 2008, the site has not been actively used and therefore became somewhat overgrown, with many buildings in disrepair and derelict.

The proposed development will be similar in built form to what previously existed across most of the site, which was a collection of cottages/suites in low/scale one storey structures spread across the site, as well as rooms and amenities in a larger 2 storey structure. This area will now contain a total of 26 villas, generally larger in floorplate than the previous structures, but low scale at one storey and spread across the site. The landscaping will be more lush and dense than previously, and a beach club will be located along the coastal area. All these proposed works are located on the southern side of the highest raise in the land and oriented to the sea – not visible from the public road and the majority of the residences in the area. These works will be visible to the most adjacent neighbours but lot lines will be screened with planting. The development team has engaged with neighbours who are aware of the visual expectations of a site zoned for Tourism. All neighbours have indicated either support or no concerns regarding the proposal.

The Arrivals Building located at the site's high point in the north western portion, will have the most visual impact from within and outside the site as it presents 5

storeys on the north elevation, and 4 on the south elevation. The maximum eave height will be approximately 109 feet, and is located 80 feet from the nearest residence on Dill Lane, and 36 feet from the west lot line.

It should also be recognised that construction activities may present a temporary visual disturbance, which must be considered. Light pollution during construction and operation is another potential impact.

16.3 Assessment of Impacts

The proposed development will change the current visual nature of the area and property both during construction, and in the longer term, particularly the as depicted in Figures 16-1 - 16-5.

a) Construction

There are a number of construction activities and associated equipment that will temporarily affect the local landscape. Whilst largely shielded from the road by the Woodland area and existing terrain, the most immediate neighbouring properties will have direct views from various vantage points into the site. Existing landscape buffers on the neighbouring lands will screen some of the site and the need for hoarding will be determined as part of the CEMP.

b) Operation

The completed facility will change the existing visual environment, when viewed from both the land (primarily from Dill Lane residences and the residential area across South Road), as well as from the water. The existing wooded hillside minimizes the overall visual impact and breaks up the massing of the Arrivals Building, as does the existing uphill slope into the site (see Figures 16-1 to 16-5). Visual impacts from residential properties across South Road on the hillside are deemed mild given the overall distance away and thick woodland screening which exists. This woodland will also be subject to a Woodland Management Plan, which will improve its quality. Visual impacts from residential properties on Dill Lane are deemed moderate given the close proximity of a structure of this size, which will likely be visible from some part of each residential property. Visual impacts from the neighbour on the eastern side of the development site are considered mild as the much of their areas of use and occupancy are well removed from the Arrivals Building, as are the dining terrace and beach club stairs which are located in the eastern setback. Landscaping buffers along the setback areas and retention of the existing sloping topography adjacent to the dining terrace will assist in screening the beach club from these neighbours.

The visible impacts from the sea are not considered consequential given the low scale of most structures and the significant distance of the Arrivals Building from the coast, with the 4 storey elevation on the southside and intervening landscaping and structures.

c) Decommissioning

Decommissioning is likely to cause the same temporary visual impacts as the construction activities.



Plate 16.1. Locations of Points where Visual Impact Images 16.2 – 16.5 were taken (Courtesy of C. Burns, OnSite Engineering Services Ltd)



Plate 16.2. Visual Impact of Development from Location A



Plate 16.3. Visual Impact of Development from Location B



Plate 16.4. Visual Impact of Development from Location C



Plate 16.5. Visual Impact of Development from Location D

d) Impact Interrelations

There are no impact interrelations with regards to landscape and visual.

e) Impact Interactions

The only impact interaction that could be considered with regards to landscape and visual is with socio-economic impacts and any potential influence on the land valuation of properties whose outlook will be impacted. However, this could be countered by the fact that currently the development site is derelict and as such this may have had a detrimental affect on property prices, so the proposed development will result in an improved site.

f) Cumulative Impacts

No cumulative impacts are anticipated.

g) Natural Hazard Impact

Natural hazards will impact the landscape and visual impact if they cause property destruction. The most likely hazard in this regard is a hurricane or storm, but the inclusion of a seawall to raise the development up to 14 feet will reduce the threat from storm surge.

	LANDSCAPE AND VISUAL											
	CONSTRUCTION AND OPERATION											
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations			
LV-1	Construction	Medium	Short	Episodic	Local	(-) Mild	High	(-) Minor				
		Rationale: A	large proportion	of both the con	struction activ	vities and the prop	osed developme	ent will not be visi	ble from off-site.			
LV-2	Main building	Medium	Permanent	Constant	Local	(-) Medium	High	(-) Moderate				
	siting	Rationale: The main building has been sited on the highest part of the property such that it is visible from South Road and residue developments to the north and west. It also has a high visual presence when viewed from the neighbouring condominiums. The management of the woodland reserve to encourage high profile plantings may assist in reducing the visual impact to receptors to north.										
LV-3	Beach Restaurant	Small	Permanent	Constant	Local	(-) Medium	High	(-) Minor				
	siting	Rationale: The Beach Restaurant has been sited such that it is visible from neighbouring properties but only presents a significant visual presence to the one property immediately to the East.										
LV-4	Site Boundary	Small	Short	Constant	Local	(-) Medium	High	(-) Minor				
	encroachments	Rationale: The creation of circulation roads within the boundary setbacks on both the east and west margins of the property compromises the potential for plantings to screen the development from neighbouring properties.										
LV-5	Revitalisation of a	Medium	Permanent	Constant	Local	(+) Medium	High	(+) Major	Socio-economic			
	defunct tourism property	Rationale: D move.	Rationale: During neighbourhood consultations it was clear that the restoration of the site as a tourism facility was seen as a positive move.									
LV-6	Low profile style	Medium	Permanent	Constant	Local	(+) Medium	High	(+) Minor				
	of villa design	Rationale: The reduces the v	ne low profile de isual impact wit	velopment prop hin the site.	osed over the	majority of the sit	te is not visible f	from most off-site	receptor sites and			

NV-6	Service and	Small	Permanent	Episodic	Local	(-) Mild	Medium	(-) Minor	Culture and recreation		
	Maintenance	Rationale: Regul	Rationale: Regular services such as trash collection and horticultural management will create noise which may impact nearby area								
ML 7	Dantana and and	Small	Damaganant	Enicodio	Legal		Madium		Culture and accession		
IN V - /	Restaurant ana	Small	Permanent	Episodic	Local	(+) Mild	Medium	(+/-) Willor	Culture and recreation		
	bar-generated	Rationale: This c	an be both a p	ositive and nega	tive impact de	epending on persp	ective and levels	of noise generated	d. However, as the		
	noise	closest residentia	closest residential receptors are within the operational control of the facility clearly encourages self-policing of excessive noise. Further,								
		nuisance noises f	from such sour	ces are regulate	d under the Su	immary Offences	Amendment Act 2	2010.			
NV-8	Material	Small	Permanent	Constant	Local	(+) Mild	Medium	Not	Culture and recreation		
	Selection							significant			
	Rationale: The materials selected for construction provide a high degree of sound insulation. It is anticipated that this will limit transmission of any sounds created within buildings.								this will limit		

16.4 Mitigation Measures

Mitigation measures will be focused on those that address the temporary disruption of the construction activities to the local landscape and visual amenity. These will include scheduling of construction where possible to avoid weekends and public holidays and the high tourist season, and possible erection of construction screens to minimise the visual impact to neighbours. Longer term, landscaping will play a significant role in screening the development from the adjacent neighbours. Efforts to shield lighting will also be incorporated, for example using downward directed lighting throughout the site.

16.5 Monitoring Plan

There will be no monitoring plan with regards to visual and landscape impacts.

16.6 Environmental Response Plan

An ERP is not relevant with regard to landscape, heritage and visual impacts.

16.7 Management Plan

The CEMP will outline the details needed to minimise the temporary construction impacts to the visual landscape and key receptors.

17 Culture and Recreation

17.1 Methodology

Desk studies and consultations with local stakeholders were conducted to assess current use of the area for recreational and cultural activities.

17.2 Environmental Baseline

Bermuda has a diverse and rich cultural history, which includes both land-based and maritime activities and traditions, therefore the impact of temporary or long-term activities undertaken as part of the proposed development must be considered on these.

a) Architectural Heritage

Bermuda's traditional architectural style is one of the island's most distinguishing features, and the Island features many durable buildings of historic importance. Early development on Bermuda was strongly tied to agricultural and maritime activities with most of the early structures sited on the shoreline of protected harbours and bays, or inland near fertile planting land. Other than fortifications aimed at deterring attack by hostile naval forces, virtually no early construction occurred along the south shore. In more recent times, with a modern economy centred on tourism, the Ariel Sands site was occupied by a cottage colony style development. These cottages have been completely razed and the site cleared. Today no historically or culturally significant structures are evident on the site with the exception of the Statue of Ariel in the water.

b)

Recreation and Watersports

On an island as small and densely populated as Bermuda that enjoys a benign climate and warm waters, water-related recreational activities are both culturally and economically important. During the summer the Island's spectacular beaches are heavily used and, reflecting the community's strong ties to the ocean, there are nearly 7,000 registered boats, over 5,000 of them motorised. From family outings to organised races and regattas, Bermuda's coast and near shore waters provide popular recreational venues for the local population.

Many of the Island's beaches are publically owned and open to access by all, and although all "land" below the high water mark is so designated, the public have no legal right to cross privately held land to access beaches. The Ariel Sands property has long been an example of such privately held land and as such there is no recent history of public usage of these beaches. There are however, 6 residences on the Ariel Sands property that enjoy rights of access to the beach. Although the rejuvenation of tourism activities will not compromise their rights, the owners and/or residents of these properties may be affected to some degree.

c) Tourism

It is arguably true that the provision of services to the tourism industry is deeply embedded in the culture of many Bermudians. As a result there are many stakeholders who have a high level of interest in the future of the Ariel Sands property. It is anticipated that there will be great support for optimising the degree to which the proposed development provides support for tourism.

d) Leisure

The provision of new restaurants, bars, a spa, salon and swimming pools on this beautiful site will provide a welcome upgrade to current offerings in the area, and will expand the range of leisure options available to residents and visitors to the Island.

17.3 Assessment of Impacts

A qualitative assessment of the impacts of the development on local recreational and cultural activities has been undertaken.

a) Construction

As the site is quite removed from the South Road, and serviced by a longestablished roadway, it is anticipated that construction activities are unlikely to adversely impact the recreational activities of the area residents to any great extent. Some nuisance noise impact to the adjacent residents is expected and details of how these will be managed will be included in the CEMP.

b) Operation

Operational activities of the spa, salon, swimming pool, restaurants and bars in terms of their impact on culture and recreation must be assessed both from the impact they will have on other activities in the area, as well as the offerings they will add in these regards. For example, although the concept of a spa requires and encourages a level of serenity, the operation of the facility will inevitably increase the level of noise created and at night, the illumination of the area, which in turn may have an impact on the recreational pursuits currently enjoyed by area residents. The nearest restaurants and bars are at Collectors Hill, some distance away, so it is unlikely that the new facilities at Ariel Sands will significantly impact these. The nearest spa and salons are in Hamilton. Thus the proposed venue provides more options for area residents as well as visitors from further afield.

c) Decommissioning

Activities undertaken as part of the decommissioning of the facility will have similar impacts to those involved in its construction.

d) Impact Interrelations

Impact interactions between culture and recreation and noise, transport and marine ecology exist in so far as recreational activities may increase operational noise levels and the impact on neighbours, and in water activities may adversely impact the marine ecology in the area. These will be managed during construction through the CEMP and during operation, by compliance with the Summary Offences Amendment Act 2010 governing nuisance noise and the Protected Species Act 2003 and Fisheries Act 1972.

e) Impact Interactions

There may be an impact interaction between culture and recreation and socio-economic impacts in so far as socio-economic benefits of the project may lead to more people in the community participating in recreational activities at the proposed new development.

f) Cumulative Impacts

Given the proposed location of the development, no significant negative cumulative impacts are anticipated.

g) Natural Hazard Impact

Natural hazards will impact the recreational aspects in so far as storms and hurricanes will disrupt swimming and beach activities and possibly the beach restaurant and bar. For the most part these will be temporary disruptions, unless the impact from a storm is sufficient to damage the beach and/or the natural salt water and new fresh swimming pools.

The significance of these impacts is presented in the following chart.

	CULTURE AND RECREATION												
	CONSTRUCTION AND DECOMISSIONING												
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations				
CR-1	Noise	Small	Short	Episodic	Local	Negligible	High	(-) Minor	Noise				
		Rationale: Neighbouring recreational activities might be impacted by construction noises. Project management has indicated a willingness to share key contacts with neighbours so that noise impacts are specifically avoided if a neighbour is planning a special event during working hours. A complaints register will be established and certain work activities may be restricted to acceptable hours during normal work days.											
	Activity	Sizo	Duration	Encouronau	UFERA	Magnituda of	Importance	Significance of	Impost Internelations				
	Activity	Size	Duration	rrequency	Extent	Impact	of Receptor	Impact	Impact Interrelations				
CR-2	Enhanced	Small	Permanent	Constant	Local	(+) Moderate	High	(+) Moderate	Socio-economic				
	recreational opportunities	Rationale: The residents and	he proposed faci visitors.	lity will provide	additional rec	creational opportur	nities, and will en	hance the range of o	offerings available to				
CR-3	Noise	Small	Short	Episodic	Local	Negligible	High	(-) Minor	Noise				
		Rationale: N noise manage	eighbouring recu ement is a requir	eational activiti ement for succe	es might be in ess. All activiti	npacted by noise at les will be subject	t the facility. How to compliance wi	vever, as the facility th the Summary Of	v is residential in nature fences Act.				

17.4 Mitigation Measures

It is anticipated that most of the mitigation efforts will focus on ways of scheduling construction, operational and decommissioning activities so that they do not clash with major cultural and organised recreational activities in the area. This will involve consultation with the local stakeholders and neighbours.

17.5 Monitoring Plans

Ongoing liaison with stakeholders will be conducted to assess any user conflicts or concerns.

17.6 Emergency Response Plan

An ERP is not relevant with regard to culture and recreation.

17.7 Management Plan

The CEMP will address the ways in which cultural and recreational impacts will be managed during construction.

18 Socio Economic

18.1 Methodology

A basic desk study was undertaken to assess Bermuda's current socioeconomic environment.

18.2 Environmental Baseline

Bermuda is an affluent and modern economy, an upscale tourist destination, and one the largest offshore financial centres of the world. It also has an excellent infrastructure. With a GDP of \$5.5 billion in 2012, or \$84,381 percapita, Bermuda boasts one of the highest values of GDP per capita in the world.

However, the current global economic downturn, coupled with decades of declining tourism, has significantly affected all segments of the Bermudian community and according to the Bermuda Department of Statistics (2103), GDP fell by 1.4% in 2012, which, when adjusted for inflation translated into a 4.9% decline in economic activity. The hospitality sector, an industry that holds promise for many in the local workforce has proven particularly vulnerable with many layoffs and business closures. Activity declined 6.4% in this sector, whilst a decline of 11.8% was experienced in the construction industry. Forecasts for 2103 were similarly dire as shown in Table 18-1 (http://bernews.com/2013/08/report-bermuda-could-shed-up-to-2400-jobs).

Sectors	2013	2012	Change	% Change
Construction	1,675	2,257	-582	-25.8%
International Companies	3,400	3,867	-467	-12.1%
Business Services	3,320	3,708	-388	-10.5%
Hotels	2,200	2,428	-228	-9.4%
Retail	2,625	2,786	-161	-5.8%
Public Administration	4,160	4,298	-138	-3.2%
Agriculture & Fisheries	508	599	-91	-15.2%
Financial Intermediation	2,420	2,508	-88	-3.5%
Transport & Communications	2,100	2,176	-76	-3.5%
Manufacturing	680	753	-73	-9.7%
Wholesale/Motor Vehicles	1,280	1,348	-68	-5.0%
Other Community & Personal Services	2,075	2,132	-57	-2.7%
Restaurants & Bars	1,900	1,957	-57	-2.9%
Real Estate & Rental Services	480	490	-10	-2.0%
Electricity Gas & Water	400	386	14	3.6%
Education, Health, Social Work	3,800	3,750	50	1.3%
Total	33,023	35,443	-2,420	-6.8%

Table 18-1. Change in jobs by sector in the Bermuda market between2012 and 2013.

Combating this trend by stimulating foreign investment in tourism infrastructure is without question, one of Bermuda's top priorities. This proposal, which responds to, and builds on that priority, is clearly directly aligned with Bermuda's socio-economic agenda.

18.3 Assessment of Impacts

The proposed development at Ariel Sands will positively impact the Island, by: creating up to 60 jobs (of which 20% will be part-time) for bar and restaurant staff, spa and beauty therapists, landscape gardeners, cleaners, etc; promoting Bermuda as a premier, upmarket tourist destination; and stimulating the economy with foreign investment (approximately \$90 million) and visitation. It is anticipated that this will encourage other associated businesses such as entertainment, art, retail outlets, building maintenance and cleaning services, wholesale food suppliers, taxis, scooter rentals, and watersports related operations (Scuba diving and boating).

a) Construction

Local construction firms will undertake all construction activities associated with the proposed development, so the project will generate up to 60 construction jobs.

b) Operation

As noted above, there will be increased employment in the order of 60 jobs resulting from the operational phase of the development and it is anticipated that qualified Bermudians can undertake all the jobs.

Additionally, development of this site will have knock-on positive impacts to the local community by significantly improving what is currently a derelict site and removing the various unsociable behaviours have been a reported problem on the site. In so doing, it may also improve property values in the area.

c) Decommissioning

Local contractors will undertake decommissioning activities. Clearly, closing of the facility will lead to job losses.

d) Impact Interrelations

There is overlap between socio-economic impacts (especially in terms of job creation) with transport, noise and health and safety.

e) Impact Interactions

There are no impact interactions.

f) Cumulative Impacts

There are no negative cumulative impacts with regard to socio-economic impacts, but clearly this investment in tourism will have a positive knock-on effect to other areas of the economy.

g) Natural Hazard Impact

If a hurricane was to permanently damage the continued operations of the facility, then feasibly all jobs could be lost and these economic losses would be serious.

SOCIO-ECONOMIC											
CONSTRUCTION AND DECOMMISSIONING											
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations		
SE-1	Job Creation	Medium	Short	Constant	Regional	(+) Moderate	High	(+) Medium	Transport		
		Rationale: With Bermuda's current high rate of unemployment, and the loss of jobs in the construction industry, job creation during construction is of significance. The proposed development promises to create up to 60 jobs during construction.									
SE-2	Tourism	Medium	Permanent	Constant	Regional	(+) Moderate	High	(+) Medium			
	Infrastructure Investment	Rationale: Upgrades to Bermuda's tourism infrastructure has long been identified as a high priority issue. The proposed development reflects a \$90m investment in Bermuda's tourism infrastructure.									
OPERATIONS											
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations		
SE-3	Job Creation	Medium	Permanent	Constant	Regional	(+) Moderate	High	(+) Medium	Transport, Culture and Recreation		
		Rationale: With Bermuda's current high rate of unemployment, job creation is of critical importance. Although staffing levels have not been finalised, it is estimated that up to 60 full and part-time positions will be created.									
SE-4	Enhanced	Medium	Permanent	Constant	Regional	(+) Moderate	High	(+) Medium			
	Tourism Offering	Rationale: The new facility will expand the range of options available to visitors to the Island.									
SE-5	Increased tourism	Small	Permanent	Constant	Regional	(+) Mild	High	(+) Mild	Transport		
	spending	Rationale: The proposed development promises to increase visitation and spending by visitors to Bermuda.									

18.4 Mitigation Measures

Mitigation efforts will focus on ways of encouraging and expanding the beneficial impacts including exploring the potential synergies with the other sectors of the community, as well as service providers. However, this is not explored any further in this EIS.

18.5 Monitoring Plans

No monitoring plans will be required.

18.6 Emergency Response Plan

An ERP is not relevant with regard to socio-economic impacts.

18.7 Management Plan

There will be no Management Plan with regard to socio-economic impacts.
19 Health and Safety

19.1 Methodology

Given the fact that humans naturally view the world from an anthropocentric perspective, considerations of health and safety are inherently viewed as of extreme priority. As a direct result of this, our society is governed by a detailed suite of laws, standards, codes and policies that aim to ensuring the safety of people. These define many of the details of construction from issues of structural integrity to avoidance of trip hazards or food handling standards. A full impact analysis detailing all the ways in which accidents could occur and the numerous standards and laws that are applied in order to mitigate these risks would be pedantic and unhelpful and for that reason is not attempted here. However, there are aspects of the proposed development that pose significant risks and these are detailed below.

It should be noted that a critical component of ensuring health and safety on such a project is the sensitivity of all participants to the potential of risk arising from changing conditions. As such it is inappropriate to consider any list of risk parameters created prior to construction to be remotely exhaustive. An adaptive approach in which all participants are charged with responsibility for identification and mitigation of risk is essential. A culture of risk management is required.

It is also of importance to recognise that this impact assessment must find all elements to be significant as failure to manage Health and Safety risks can be catastrophic. However, if risks are appropriately identified and managed the actual resultant impact can be minimised to become insignificant – that is the clear objective.

Baseline data of the potential health and safety concerns for the various industry activities involved in the proposed development has been prepared from existing resources and local regulatory guidelines as laid out under the Safety and Health Act 1992, the Occupational Safety and Health Regulations 2009, the Public Health Act 1949, the Public Health Food Recommendations 1950 and the Hotel and Licensing Control Act 1969.

19.2 Environmental Baseline

Under Bermuda's Occupation Safety and Health Act 1982 and Health and Safety at Work Amendment Act 2004, employers have a duty to ensure the health, safety and welfare of all employees. Employers are required to develop procedures and policies to ensure a safe work environment and through the establishment of Health and Safety Committees comprising workers and management, to engage employees in the active management of risk and to document incidents and actions taken. Regulations govern a broad range of topics including, but not limited to, pressure systems, fire precautions, construction site safety, etc. Also of relevance to the proposed development is the Building Code 1972. The restaurant and spa are required to meet all licensing requirements. Accessibility to emergency assistance must also be determined. The nearest Bermuda Fire and Rescue Service Station is in Hamilton approximately 8 minutes away, whilst the King Edward VII Memorial Hospital is also approximately 5 minutes away.

19.3 Assessment of Impacts

A qualitative evaluation has been presented for this assessment. There are a number of activities involved in the proposed project that present potential health and safety issues during construction, operation and decommissioning. Some of these relate to the labour directly connected to the development, but also to operational aspects for guests and visitors, as well as the wider public, including neighbouring residents. Many of these will be addressed at a later stage of development.

a) Construction

In terms of construction workers, the movement and operation of construction vehicles, handling of suspended loads, electrical generation, handling of hazardous materials and use of power tools are examples of activities that will be undertaken that pose direct risk of injury along with creating vehicle emissions, noise, dust, fumes, vibration and other potentially harmful challenges during construction. Additionally, transport of materials and equipment from the Hamilton Docks or other staging areas to the construction site may also present a safety issue for other road users.

The seasonal appearance of Portuguese Man O' War on the beach presents a potential threat to construction workers and they should be fully informed about the dangers of touching them.

Operation

b)

There will be inherent health and safety hazards associated with ongoing operations that could impact both guests and staff. These include a wide range of issues from avoiding slip or trip hazards, to safe food handling, effective sanitary and bulk waste management along with occasional need to handle hazardous materials, fuel, oils, paints, printer cartridges, etc. during operational and/or maintenance activities. These elements should in part be managed through a comprehensive waste management plan. Under the Occupational Safety and Health Act 1982, there is also a requirement for companies to undertake risk assessments and report all incidents.

Fire and electrocution also present possible health and safety hazards. Regulatory compliance and best practice has been adhered to with regards to fire access, with the roadways designed wide enough to allow the fire service vehicles through, as well as the installation of fire hydrants and a 60,000 gallon tank under the arrivals building providing water for fire fighting. The swimming pool and ocean also provide accessible for fire fighting.

With a swimming pool on the property, appropriate safety measures must be incorporated. The seasonal appearance of Portuguese Man O' War on the beach presents a potential threat to visitors and they should be fully informed about the dangers of touching them.

Universal design of and accessibility to all the Arrivals Building and Beach Restaurant has been incorporated. Two Disability Parking spaces have been provided in the main parking area by the Arrivals Building, but not near the Beach Restaurant. Universal design of and accessibility will be provided in some of the villas, but which has yet to be determined. Vehicular traffic is being concentrated around the Arrivals Building with provision of golf carts to transport visitors to the Bach Restaurant. There is currently no provision for pedestrian pathways to the side of the main entrance road (Ariel Drive).

c) Decommissioning

Activities undertaken as part of the decommissioning of the facility will have similar health and safety impacts to those involved in its construction.

d) Impact Interrelations

Impact interrelations between health and safety exist with noise, transport, waste management and air quality. These will be managed during construction through the CEMP, and during operation, by compliance with various regulatory standards discussed in the different technical sections.

e) Impact Interactions

There are no impact interactions.

Cumulative Impacts

Cumulative impacts are not really considered significant with regards to health and safety for this development, although it could be argued that if the venue attracts more tourists to Bermuda, then the chance of more health and safety issues rises.

g) Natural Hazard Impact

Natural hazards such as hurricanes and flooding will have a very significant potential impact on impact health and safety both during construction and operation. Clear operational guidelines must be in place. An Incident Management file will be included in the CEMP. The Plan itself will provide a framework for these.

HEALTH AND SAFETY									
CONSTRUCTION AND DECOMMISSIONING									
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations
HS-1	Visitor safety on site	Small	Short	Constant	Local	(-) Moderate	High	(-) Minor	Noise, Transport, Air Quality, Waste
		Rationale: Public access is not permitted onsite but nevertheless, the potential for visitors to unintentionally walk into a dangerous situation during construction exists. The site is largely fenced in and measures will be implemented to ensure that the construction site remains closed to unauthorised persons. These will be detailed in the CEMP.							
HS-2	General construction activities	Medium	Short	Constant	Local	(-) Moderate	High	(-) Moderate	Noise, Transport, Air Quality, Waste
		Rationale: Construction sites are inherently hazardous (e.g. transport and equipment accidents, chemical spills, noxious vapours etc) and measures will be implemented to ensure a safe environment for those working on-site. These will be detailed in the CEMP.							
HS-3	Emerging risk	Medium	Short	Episodic	Local	(-) Moderate	High	(-) Minor	Noise, Transport, Air Quality, Waste
Rationale: A construction site is a dynamic and rapidly changing environment. All contractor potential risks and to speak up if they have concerns.						rs should be enco	uraged to look out for		
			ê	<u> </u>	OPERATI	ONS			
	Activity	Size	Duration	Frequency	Extent	Magnitude of Impact	Importance of Receptor	Significance of Impact	Impact Interrelations
HS-4	Security and	Medium	Permanent	Episodic	Local	(-) Moderate	High	(-) Minor	Transport, Waste
	<i>visitor safety</i> Rationale: There are inherent health and safety issues associated with the operation of public facilities. Appropriate levels of ligroadways and in the ground level parking area will minimise safety issues, whilst the route for traffic flow through the property clearly delineated. Cars and bikes will be concentrated at the main Arrivals Building with golf carts provided to transport visitor Beach Restaurant. There is as yet no designated pedestrian route up the main driveway (Ariel Drive)							priate levels of lighting on bugh the property will be to transport visitors to the	
HS-5	Universal	Medium	Permanent	Constant	Local	(+) Mild	High	(+) Moderate	Transport
Design and accessibilityRationale: Universal design of and accessibility to all the Arrivals Building and Beach Restaurant has been incorp Parking spaces have been provided in the main parking area by the Arrivals Building, but not near the Beach Restau of and accessibility will be provided in some of the villas, but which has yet to be determined.							incorporated. Two Disability Restaurant. Universal design		
HS-6	Fire Fighting	MediumPermanentEpisodicLocal(+) ModerateHigh(+) ModerateTransport						Transport	
	Rationale: Access routes have been designed to accommodate Fire Services vehicles. A ring of hydrants is designed for, whilst the arrivals hall has a 60,000 gallon tank that can be used for fire fighting. The swimming pool and ocean are also available water sources.								

19.4 Mitigation Measures

Strict adherence to Occupational Safety and Health Regulations (2009) as well as ongoing training of workers will likely be the most effective type of mitigation. Fire precautions and the necessary Fire Service access will be ensured in accordance with regulations. The access road can accommodate the Bermuda Fire Service vehicles. The swimming pool will provide a freshwater source and there will be access to seawater for fire fighting.

Relevant staff will be CPR and First Aid certified. Regular maintenance schedules of all pertinent equipment will also be required.

Strict food handling procedures will be implemented and all staff trained appropriately, in compliance of the Public Health (Food) Regulations 1950.

19.5 Monitoring Plans

Health and Safety monitoring will be in accordance with local Health and Safety regulations. All accidents or dangerous occurrences will be reported to the Government Health and Safety in accordance with the law.

19.6 Emergency Response Plan

An Emergency Response Plan should be prepared specific to emergencies involving personal accident, fire etc. Where sub-contractors are engaged, this will be undertaken in consultation with them. This ERP will be integrated into the recommended CEMP.

19.7 Management Plan

A management plan which addresses health and safety issues in accordance with local health and safety regulations impacts should be developed. Health and Safety incidents should be recorded as they occur giving details of what transpired, how the situation was handled and the eventual outcome, in accordance with existing legislated requirements. Management should review these reports at regularly scheduled Health and Safety meetings to assess ways in which safety can be improved. In the event of a serious emergency, an immediate evaluation should be undertaken, and if necessary operations suspended until a safe solution can be implemented.

20. Contact Details and Qualifications

20.1 Granite Investment LP

This development is being proposed by Granite Investment LP, of;

Address: 21 Ariel Drive, Devonshire DV 07 Telephone Number: (441) 236-1010

20.2 Somers Management Limited

Somers Management Limited is managing the project. Their contact details are:

Contact: Mr. Kevin Petty Telephone Number: (441) 236 4001 e-mail: kpetty@logic.bm

20.3 Bermuda Environmental Consulting, Ltd.

This submission has been prepared by Bermuda Environmental Consulting, Ltd., who will undertake the Environment Impact Assessment and prepare the EIS. They will also undertake all required surveys with the exception of massing studies. Their contact details and qualifications are as follows:

Contact: Mr. Jack Ward and Dr Anne Glasspool Address: P.O. Box FL 487, Flatts, Bermuda FL BX Telephone Number: (441) 400 5990 e-mail: jack@environmentbda.com or annie@environmentbda.com

20.3.1 Mr. Jack A. Ward, B.Sc. (Hons) M.Sc.

Bermudian born Mr. Ward recently retired from an extensive career with the Bermuda Government to become an environmental consultant. With over 30 years progressive experience working as a biologist, resource manager and promoter of environmental sensitivity he has acquired extensive knowledge of Bermuda's biological and regulatory environment. As the first Director of the Department of Conservation Services he directed the development of plans and legislation to protect Bermuda's unique natural heritage and participated in the review of all relevant development planning policy and environmental protection legislation developed during his tenure in that position. Of particular relevance to the present project, he participated in and directed the review of all development planning applications and environmental impact statements forwarded to the Department of Conservation Services for comment during the 8 years in which he was Director. During this period he also served as a Ministry representative to the Marine Resources Board, the Board of Agriculture and the International Coral reef Initiative. He is Chairman of the Bermuda Underwater Exploration Institute, Deputy Chair of the Environmental Coalition of Organisations (ECO) and a Director and Chief Environmental Officer of Bermuda Environmental Energy Sustainability Group Ltd. He is President of Bermuda Environmental Consulting, Ltd.

20.3.2 Anne F. Glasspool B.Sc. (Hons) M.Sc. Ph.D. C.Env. MCIEEM, MIEMA, LEED AP O+M

Dr Glasspool is a Bermudian Chartered Environmentalist with an M.Sc. in Fisheries Biology and Ph.D. in Marine Biology and 25 years experience in the environmental sciences. She led the award winning Bermuda Biodiversity Project from its inception in 1997 until 2008, building and managing a network of scientists researching Bermuda's natural environment. She has undertaken numerous species-specific studies and has authored the protected species recovery plan for Bermuda's cave species and the Bermuda skink, as called for under the Protected Species Act 2003. In 2000, she also took the lead in promoting coordinated community-based conservation action through the development of the Bermuda Biodiversity Strategy and Action Plan and has advised on local policy development. She is increasingly focused on the development and application of integrated environmental management solutions and EIA's. An experienced facilitator, Annie has served on management, research, advisory and education committees for various NGO's and the Bermuda Government and currently sits on their Marine Resources Board as well as the Energy Working Group. She is Director of Operations and Project Development of Triton Renewable Energy Ltd, Chief Sustainability Officer of Bermuda Environmental Energy Sustainability Group Ltd., and Vice President of Bermuda Environmental Consulting, Ltd.

20.3.3 Christine Rickards BA MSc MCIP RPP

With an MSc in Planning and professional accreditation with the Canadian Institute of Planners since 1994, Christine brings 23 years of planning experience to our team. She has expertise in both the private and public sector, in forward planning policy development, preparation and submission of development applications, regulatory processing of applications, EIA review, project management, expert witness statements, and budget preparation and management. She has worked in Bermuda for 16 years and was the Senior Development Control Officer at the Bermuda Department of Planning for over six years, leading a team of 6 planning officers reviewing development applications and providing recommendations to the Development Applications Board. She also managed the Development Services Applications team guiding them in functions related to front end application vetting and client services. Christine was responsible for processing the more complex planning applications and played a pivotal role in progressing the understanding, requirements and need for EIA work on projects and technical requirements that needed to be met with regards to EIA preparation.

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22. Appendices

22.1 Information to be included in an EIS (from the Bermuda Plan 2008)

	ENVIRONMENTAL IMPACT ASSESSMENTS AND ENVIRONMENTAL IMPACT STATEMENTS
Append	ix 2: Information to be included in an Environmental Impact Statement
Introdu	tion
This che of an El particul project.	cklist is intended to be used as a guide for preliminary discussions on the scope 5. The precise information that should be included in an EIS will depend on the ar project and it is unlikely that all the items listed will be relevant to any one
The mai	n components of an EIS
Every El	5 should contain 3 main components of information:-
(1)	A description of the proposed development
(2)	A description of the alternatives considered
(3)	A description of the proposal site and its surrounding area
(4)	An assessment of effects and identification of impacts
(5)	An identification of mitigation measures
In addit Details	on, every EIS should include a non-technical summary.
Diction of	
(1) A de	scription of the proposed development
The EIS residue	should include a full description of the proposed development and identify the and emissions that are expected.
(a) Des	niption of the proposed development
	he purpose and objectives of the proposed development
	the characteristics of the development (including its size, scale, massing, height,
	nature and design) and the land-use requirements during the construction and
3	operational phases, and after use where appropriate (including traffic, access etc)
. 1	he main characteristics of the production and operational processes of the
	sevelopment and the type and quantities of raw materials, energy, water supply
1	and other resources to be consumed
(b) Res	dues and emissions
	he types, quantity, composition and strength of expected residues and
- 2	missions (including discharges to water, emissions to air, noise, vibration, light,
3	neat, radiation, sewage, waste matter, storm water and other deposits/residues
	o land and soil) and the rate at which these will be produced

 the methods used to make estimations of the residuals and emissions and the proposed methods of treatment for the waste and residual materials

(2) A description of the alternatives considered

The EIS should include a description of the main alternative options considered and the main reasons for the choice of site and proposal.

(a) Alternatives

- alternative sites for the proposal (where these are practicable and available) and the main environmental advantages and disadvantages of these
- · alternative uses for the site including the 'do nothing' option

ENVIRONMENTAL IMPACT ASSESSMENTS AND ENVIRONMENTAL IMPACT STATEMENTS

- alternative processes, designs and operating conditions and the environmental implications of these
- the reasons for the final choice of site and proposal (taking into account the environmental effects)

(3) A description of the proposal site and its surrounding area

The EIS should include a full description of the existing conditions on the site and in the immediate surrounding area, including the existing regulatory and policy framework.

(a) The Site

- the area of land affected by the proposed development clearly shown on a map and the different land uses of the site and surrounding area clearly demarcated
- the affected site and any potential effects occurring away from the site (including dispersal of pollutants, traffic etc)

(b) Baseline conditions

- baseline data on aspects of the environment as it is currently and as it could be expected to develop if the project were not to proceed
- baseline data on the characteristics and relative abundance, quality and regenerative capacity of those aspects of the environment likely to be significantly affected by the proposed development, including the following:
 - o landscape and topography
 - o flora and fauna (habitats and species)
 - soil (agricultural quality, geology and geomorphology)
 - water (water courses, water bodies, shoreline including the type, quantity, composition and strength of any existing discharges)
 - air (climatic factors and air quality)
 - population (proximity and numbers)
 - o existing land uses
 - architectural and historic heritage, archaeological sites and features, and other material assets
 - recreational uses
 - o any other relevant environmental features

(c) Regulatory framework

- the site's regulatory framework in particular the site's land use planning zonings and policies
- other relevant legislation

(4) An assessment of effects and identification of impacts

The EIS should assess the potential effects and identify the type, probability, magnitude, extent and significance of the impacts.

(a) Identification of potential effects

- Effects on human beings, buildings and man-made features
 - change in population arising from the development, and consequential environmental effects

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ENVIRONMENTAL IMPACT ASSESSMENTS AND ENVIRONMENTAL IMPACT STATEMENTS

Traffic Impact Assessment/Statement should be submitted as part of the EIS – see Traffic Impact Assessment/Statement guidance note)

- effects of the development on buildings, the architectural and historic heritage, archaeological features, and other human artefacts, e.g. through pollutants, visual intrusion, vibration
- Effects on flora, fauna and geology
 - o loss of and damage to habitats and plant and animal species
 - loss of and damage to geological, palaeontological and physiographic features
 - other ecological consequences
- Effects on land
 - physical effects of the development including change in local topography, effect of earth-moving on stability, soil erosion etc.
 - effects of chemical emissions and deposits on the soil of the site and surrounding land
 - land use and resource effects (e.g. quality and quantity of agricultural land to be taken, effect on surrounding land uses, waste disposal etc.)
- Effects on water
 - o effects of development on drainage pattern in the area
 - effects on ground water, inland water bodies, coastal waters or other water bodies
 - effects on water quality from pollutants, waste etc.
- Effects on air and climate
 - level and concentration of chemical emissions and their environmental effects
 - o particulate matter
 - o offensive odours
 - o any other climatic effects
- Other indirect and secondary effects associated with the project
 - effects from traffic (road, water, air) related to the development
 - effects arising from the extraction and consumption of materials, water, energy or other resources by the development
 - effects of other development associated with the project e.g. new roads, utility services, accommodation
 - effects of association of the development with other existing or proposed development
 - secondary effects resulting from the interaction of separate direct effects listed above
- (b) Type and probability of impact
 - whether an impact is positive or negative; cumulative; short, medium or long term; permanent or temporary; direct or indirect
 - where the operational life of a development is expected to be limited
 - the effects of decommissioning or reinstating the land
 - the probability of the impact
- (c) Magnitude, extent and significance of impact
 - the size of each impact as the predicted deviation from the baseline conditions, during the construction phase and during normal operating conditions, and in the event of an accident when the proposed development involves materials that could be harmful to the environment
 - the extent of the impact (geographical area and size of the affected population)

Ref: GN306

ENVIRONMENTAL IMPACT ASSESSMENTS AND ENVIRONMENTAL IMPACT STATEMENTS

- the duration, frequency and reversibility of the impact
- the methods used to predict impact magnitude
- estimates of impacts recorded in measurable quantities with ranges and/or confidence limits as appropriate
- the significance of all impacts which remain after mitigation (assessed using the appropriate national and international quality standards where available) with the assumptions and value systems used to assess significance justified and the existence of opposing or contrary opinions acknowledged
- any gaps in the required data identified to estimate the magnitude of the main impacts

(5) An Identification of mitigation measures

The EIS should identify means of avoiding, reducing or mitigating potential negative impacts. The EIS should also demonstrate how the development's impacts and the effectiveness of mitigation measures will be monitored once in operation, and should include contingency plans to deal with unforeseen negative impacts.

(a) Mitigation measures

- mitigation measures for all significant adverse impacts which may include site planning, technical measures (e.g. pollution control and treatment), aesthetic and ecological measures (e.g. mounding, tree planting, landscaping, measures to preserve particular habitats or create alternative habitats, recording of archaeological sites, measures to safeguard historic buildings or sites etc)
- mitigation methods (including modifications to the project, compensation, alternative facilities, pollution control etc)
- an assessment of the likely effectiveness of mitigating measures including an indication of where the effectiveness of mitigation measures is uncertain or depends on assumptions about operating procedures, climatic conditions etc.

(b) Commitment to mitigation

- · details of when and how the mitigation measures will be carried out
- (c) Monitoring programmes and contingency plans
 - monitoring programmes to monitor the effectiveness of a mitigation measures and to enable the adjustment of mitigation measures as necessary particularly where uncertainty over impact magnitude and/or effectiveness of mitigation exists
 - contingency plans and preventative measures to deal with unforeseen impacts or accidents to ensure that if environmental problems occur, appropriate action is taken to rectify them as a matter of urgency.

22.2 Species Listed for Protection under Local and International Legislation

22.2.1 Terrestrial and marine fauna listed or gazetted for listing under the Protected Species Act 2003, which were observed during this study or have been documented along south shore locations in the vicinity of the proposed development.

Common Name	Species	Classification (as per IUCN criteria)
White-tailed Tropic Bird	Phaethon lepturus catesbyi	VU (D1+2)
White-eyed vireo	Vireo griseus bermudianus	VU (D1+2)
Bermuda Skink	Eumeces longirostris	CR (B1,B2b,c,d,e)
Bermuda cedar	Juniper bermudiana	VU
Bermuda palmetto	Sabal bermudana	VU

22.2.2 Marine fauna listed or gazetted for listing under the Fisheries Protected Species Order 1978, which were observed during this study or have been documented along south shore locations in the vicinity of the proposed development.

West Indian Topshell Cittarium pica

22.2.3 Bird Species listed in either Appendix II of the Convention on the Conservation of Migratory Species and Wild Animals 1983, which were observed during this study or have been documented along Bermuda's south shore in the vicinity of the proposed development.

Common Name	Species	CMS Appendix
Common Tern	Sterna hirundo	11
Ruddy Turnstone	Arenaria interpres	11
Hawks, eagles, kites		
and harriers		

22.2.4 List of bird species protected under the Protection of Birds Act 1975, which have been recorded in the recent literature in the vicinity of the proposed development, inclusive of Ariel Sands

Species	Status
White-tailed Tropicbird	Breeding
White-eyed Vireo	Breeding
Common Tern	Breeding/Migrant
Mourning Dove	Breeding
Gray Catbird	Breeding
Northern Cardinal	Breeding
Eastern Bluebird	Breeding
Yellow-crowned Night Heron	Breeding
Ruddy Turnstone	Migrant
Yellow Warbler	Migrant
Prothonotary Warbler	Migrant
Yellow-rumped Warbler	Migrant
Palm Warbler	Migrant
Yellow throated Warbler	Migrant
Ovenbird	Migrant

22.3 Bermuda Rock Lizard (skink) data

22.3.1 Skink Distribution Data Collected between 1998-2005

The most recent island-wide studies of Skink distribution patterns in Bermuda undertaken by the by the Bermuda Biodiversity Project and Kitson between 1998-2005 are summarized by Parish below (Kitson, unpublished). Skinks have been confirmed within 0.5 km of the proposed Development Site.



Distribution of skinks reported island-wide between 1998-2005.

22.4 Protected Species Survey Permit



Physical address: 17 North Shore Road, Hamilton Parish, FL 04, Bermuda

Mailing address: P.O. Box FL 145, FL 8X, Bermuda Phone: (441) 293 2727

Fax: (441) 293 6451

Website: www.conservation.bm

22.5 Skink Survey Data

22.5.1 Location of skink traps for survey conducted 13th-15th April 2015



22.5.2 Description of trap locations

Trap #	Site Description			
Trap # 1	Under rocky ledge, north west facing			
Trap # 2	Wedged under rock on south side of elevated rocky ledge			
Trap # 3	Under rocky ledge, south east facing			
Trap # 4 Propped against vertical south face of ledge				
Trap # 5	In 'bowl' under seaoxeye			
Trap # 6	On north side of ridge under ledge			
Trap # 7	In seaoxeye on north bank of ridge			
Trap # 8 In seaoxeye 20 feet behind ridge along lot line with neighbours t				
	east.			



Plate 22-1. Showing position of skink traps

22.5.3 Weather descriptions during survey period (taken from Bermuda Weather Service)

"With building high pressure over the area on the 13th, no precipitation was recorded. An upper-level cloud layer broke for only 2.0 hours of sunshine through the day. The high was 71F/21C with a low of 64F/18C. High pressure held on the 14th with an early trace of rain on moderate east winds. The high reached 73F/23C with a low of 64F/18C and 10.2 hours of sun. As the surface high moved further east on the 15th, a fair-weather ridge held over the area with another above-normal high of 74F/24C and a low of 67F/20C on moderate southerly flow. There were 6.7 hours of sunshine.

Date 13/04/15	Bait traps	Check 1	No. of skinks	Check 2	No. of skinks	Check 3	No. of skinks	Check 3	No. of skinks
Trap # 1	1010	1108	0	1204	0	1306	0	1400	0
Trap # 2	1014	1110	0	1204	0	1307	0	1401	0
Trap # 3	1017	1112	0	1205	0	1307	0	1401	0
Trap # 4	1022	1113	0	1205	0	1308	0	1402	0
Trap # 5	1024	1113	0	1206	0	1309	0	1402	0
Trap # 6	1028	1114	0	1208	0	1310	0	1403	0
Trap # 7	1028	1114	0	1208	0	1310	0	1404	0
Trap # 8	1030	1115	0	1209	0	1311	0	1405	0
Date 14/04/15	Bait traps	Check 1	No. of skinks	Check 2	No. of skinks	Check 3	No. of skinks	Check 3	No. of skinks
Trap # 1	1040	1143	0	1241	0	1347	0	1447	0
Trap # 2	1042	1144	0	1242	0	1348	0	1449	0
Trap # 3	1044	1144	0	1243	0	1348	0	1450	0
Trap # 4	1045	1145	0	1244	0	1349	0	1451	0
Trap # 5	1047	1146	0	1244	0	1350	0	1452	0
Trap # 6	1049	1147	0	1245	0	1350	0	1453	0
Trap # 7	1050	1147	0	1246	0	1352	0	1454	0
Trap # 8	1054	1149	0	1246	0	1353	0	1455	0
Date 15/04/15	Bait traps	Check 1	No. of skinks	Check 2	No. of skinks	Check 3	No. of skinks	Check 3	No. of skinks
Trap # 1	1041	1152	0	1248	0	1346	0	1452	0
Trap # 2	1042	1152	0	1249	0	1347	0	1453	0
Trap # 3	1044	1152	0	1250	0	1347	0	1459	0
Trap # 4	1045	1153	0	1251	0	1348	0	1500	0
Trap # 5	1047	1154	0	1251	0	1349	0	1502	0
Trap # 6	1049	1155	0	1252	0	1349	0	1501	0
Trap # 7	1050	1156	0	1252	0	1350	0	1503	0
Trap # 8	1053	1158	0	1253	0	1352	0	1505	0

22.5.4 Trap data for survey conducted 13th, 14th and 15th April 2015.

22.6 Bermuda Biodiversity Project Snail Data

22.6.1 Data from 2002 Island-wide Survey of *Poecilozonites circumfirmatus* by Lines. Live snails have been confirmed within 0.5 km of the proposed Development Site.

Survey Site	Data of ourway	Proconco/obconco
Alpha Island		Flesence/absence
Aguarium	26/6/02	None found
Cave Mouth at Walsingham	7/8/02	Dead specimens
Cooper's Island	7/11/02	None found
Coral Beach Gardens	18/07/02	Dead specimens
Coral Deach Gardens	10/07/02	live recently dead
		long dead and fossil
Coral Reach Nature Reserve	18/07/02	specimens
	10/01/02	live recently dead
		long dead and fossil
Devonshire Bay	17/7/02	specimens
Doctor's Island	24/7/02	None found
East of Seymour's Pond	25/7/02	Dead specimens
Eta Island	7/4/01	None found
Governor's Island	27/06/01	None found
Hall's Island	21/00/01	None found
		live, recently dead
		and long dead
Happy Valley Road	7/8/02	specimens
Higgs Island	27/06/01	None found
Hinson Island	24/7/02	None found
Hungry Bay	7/8/02	None found
Hungry Bay Lane	7/10/02	None found
lota Island	7/4/01	Dead specimens
Lambda Island	24/7/02	None found
Ports Island	24/7/02	None found
Rabbit Island		Dead specimens
Railway Trail/ Penhurst Park	22/7/02	Dead specimens
		live, recently dead,
		long dead and fossil
Spittal Pond	28-9/6/02	specimens
Theta Island	7/4/01	None found
Walsingham	7/2/02	Dead specimens
West of Seymour's Pond	25/7/02	Dead specimens
Jenning's Rd./Mosquito Hill	27/6/02	None found