

Annexure 1: Environmental & Oceanographic Assessment Report on Sand Accretion

Republic of Mauritius

2018

New Mauritius Hotels Ltd. Paradis Beachcomber Resort & SPA



Environmental & Oceanographic Assessment Report on Sand Accretion



26 September, 2018



Our Reference: F3/VK/1809/26/01

Your Reference:

26 September, 2018

The Chief Operations Officer
New Mauritius Hotels Ltd.
Beachcomber House
Botanical Garden Street
Curepipe

Attention: Mr Jean Louis Pismont

Dear Sir,

**Environmental & Oceanographic Assessment Report on Sand Accretion- Paradis
Beachcomber Resort & SPA**

New Mauritius Hotels Ltd. has appointed Delphinium Ltd. to carry out an environmental and oceanographic assessment of sand accretion occurring at the southern boundary of Paradis Beachcomber Resort & SPA at Le Morne on 27 June, 2018.

The objective of this report is to take cognisance of the existing features of the “bras de mer” separating Ilot du Morne from Le Morne Peninsula in order to propose appropriate measures required to reestablish the normal water circulation in the area.

1. Context

2.1 Introduction

Paradis Beachcomber Golf Resort & Spa is adjacent to Dinarobin Beachcomber Golf Resort & Spa, a neighbouring Beachcomber hotel of the same category. Both resorts share their facilities and create undeniably, one of the island's greatest attractions in terms of quality and variety.

The resort has four restaurants and it offers an extensive choice of complimentary land and water sports plus the opportunity to play on three championship golf courses in the vicinity including its very own 18-hole international golf course. The hotel also has a golf academy welcoming beginners and seasoned golfers alike and a Spa which provides the perfect setting to soothe the body and mind.

2.2 Hotel Features

The characteristics of Paradis Beachcomber Golf Resort & Spa are listed as follows:

- The resort is ideally located on Le Morne Peninsula, with the lagoon on one side and a spectacular golf course on the other, against the backdrop of Morne Brabant Mountain, a UNESCO World Heritage Site
- A spectacular 18-hole par 72 championship course located within the spacious grounds of the resort, along with its own Golf Academy.
- A Spa Beachcomber, a world of rejuvenation to spoil all the senses.
- 13 comfortable and spacious private Villas.
- A wide range of complimentary land and water sports for guests of all ages.
- A choice of 8 restaurants on the peninsula, 4 of them at the adjacent Dinarobin Beachcomber, a same category hotel.
- A Kids Club specially designed for children with a swimming pool; free of charge for children between 3 and 12 years old*.
- Privileged access to 4 other golf courses: Mont Choisy Le Golf, Heritage Golf Club, Tamarina Golf Estate and Avalon Golf Estate.
- Helicopter transfers and tours available from the hotel.
- Access to all the facilities at the Dinarobin Beachcomber.

2.3 Bras de Mer du Paradis

Paradis Beachcomber Golf Resort & Spa is equally famous for its coastal channel (“bras de mer”) which separates Ilot du Morne from Le Morne Peninsula at the southern end of the hotel as indicated in the following satellite photograph.



The aforementioned “bras de mer” therefore forms a the body of water separating the mainland from Ilot du Morne with a free circulation of sea water depending on the tidal phase. The following satellite photograph which has been taken on 28 May, 2013 illustrates the presence of boats, confirming the sea water circulation and depth.



However, the said “bras de mer” has been subject to heavy sand accumulation during the recent winter months, obstructing the free flow of water and preventing boat access as can be seen in the following photograph.



The complete obstruction of the entrance of the “bras de mer” can be witnessed in the following drone images which has been captured by Delphinium Ltd. on 12 June, 2018 at 10h10 and 10h16 respectively.



2.4 Scope of Works

New Mauritius Hotels Ltd. has therefore appointed Delphinium Ltd. to carry out an environmental and oceanographic assessment of the “bras de mer” located at the southern limit of Paradis Hotel at Le Morne to remedy the situation on 27 June, 2018.

The said environmental & oceanographic survey comprises *inter alia* of:

- The environmental and oceanographic assessment of Le Morne lagoon area including the coastal geomorphology and bathymetry, wave and current dynamics and marine biodiversity features
- A study of the geomorphology, historical evolution of the “bras de mer” bathymetry, and adjoining coastline based on satellite, aerial and drone photographs
- Description of the causes of coastal erosion and accretion and sediment budgets
- Assessment of the accretion, bathymetry, sediment characteristics, bathymetry, granulometry, and the current and wave patterns
- Quantification of the quantity of sand to be displaced
- Proposals for the equipment and methodology to be used to reestablish the free flow of lagoon water between Ilot du Morne and Le Morne Peninsula.

2.5 Conclusion

It is therefore necessary to carry out urgent remedial works in order to reestablish the free flow of water between Ilot du Morne and the mainland in order to prevent any flooding of Paradis Beachcomber Golf Resort & Spa hotel facilities before the coming cycling season in order to avoid any irreversible damages to the adjoining hotel rooms and infrastructure accordingly.

3. Environmental & Oceanographic Characteristics of Le Morne

3.1 Introduction

The following sections provide a description of the environmental and oceanographic characteristics of Le Morne including the geomorphology, bathymetry, wave and current dynamics and marine biodiversity.

3.2 Coastal Geomorphology and Bathymetry

The near shore of Le Morne peninsula is very shallow due to accretion of fine sand and silt.

The beach at Le Morne peninsula is predominantly sandy. Distance of the reef from shore varies from 900m at Pointe Pêcheurs and Pointe Sud Ouest to nearly 1.5 km for the outer reef south of Riu Hotel. There are two passes in that region; namely Passe L'Ambulante and Passe du Sud. These passes are however difficult to manoeuvre during heavy seas.

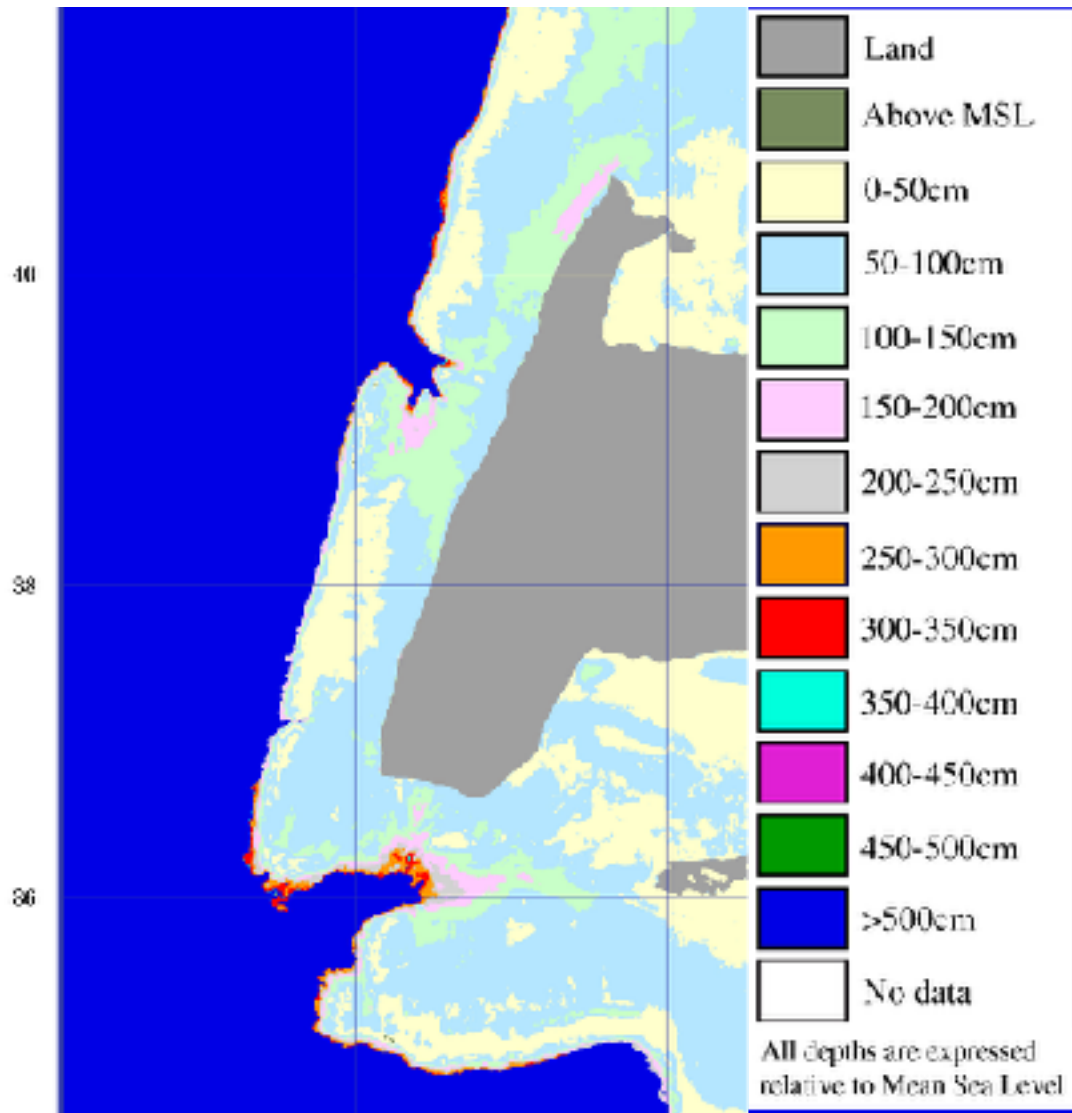
Patch corals are developed quite extensively opposite the St Regis Hotel and this extends in the north direction to-towards Passe L'Ambulante. The Pointe Sud-Ouest region is poorly colonised with coral colonies. However Macro algae, mainly sargassum and Turbinaria are the dominant bottom features. The lagoon floor is denuded of sand, which is mostly Pleistocene rock. The beach is steep strongly suggesting the wave climate in that region. South of the Riu Hotel there is a patch of calcareous substrate colonised mostly with sea grass, coral colonies and algae. The channels in that region however, have a higher percentage of coral colonies, with varying degrees of impact from fine sediment and fishing practices.

The eastern beach is sandy until the foot slope of Le Morne Mountain. However this beach is under influence from near shore silting and extensive sea grass bed. Sea grasses regularly get washed up the beach. The outer reef south of Le Morne peninsula has a high percentage cover of macro algae. Coral cover on the outer slope shows marked increase on the west reef of the peninsula.

The following aerial photograph and bathymetric map illustrate the general geomorphology of Le Morne area.



Aerial photograph indicating the salient lagoon geomorphology features of Le Morne lagoon and passes, including Passe de l'Ambulante which faces “Bras de Mer” du Paradis



Bathymetric map of Le Morne Lagoon indicating the geomorphological features of the lagoon area in front of Le Paradis and Dinarobin hotels.

3.3 Wave and Current Dynamics

Waves

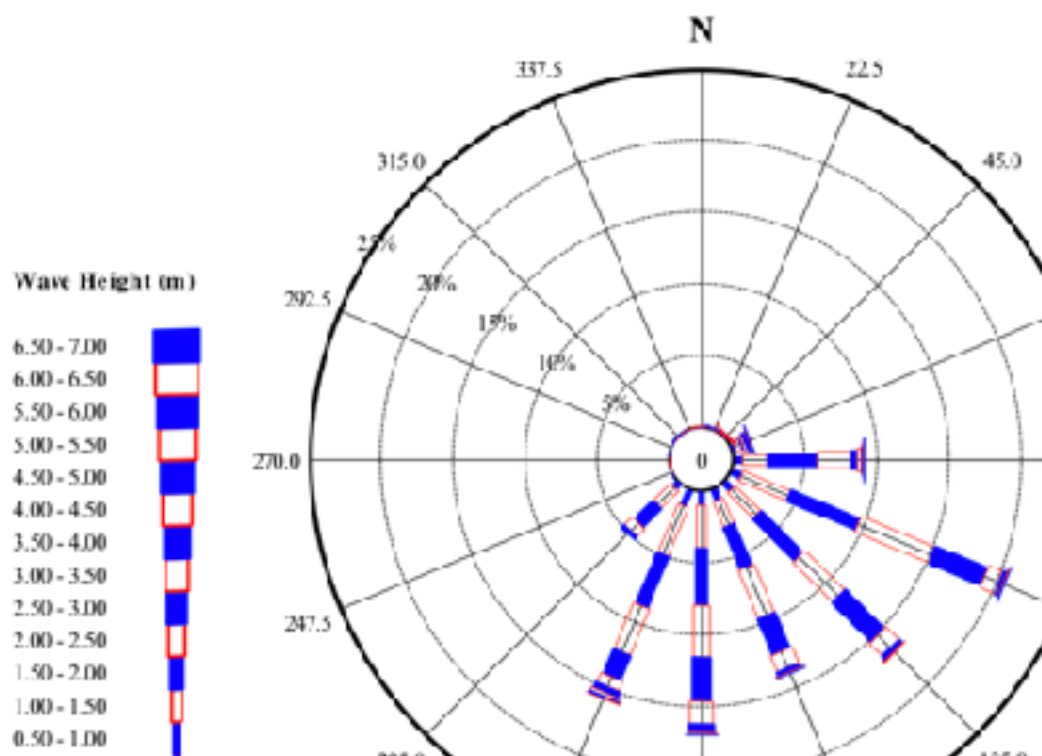
Mauritius has a very severe wave climate. This is a result of waves generated by cyclones, extra-tropical cyclones in more southerly latitudes, and by the Southeast trade winds.

As these waves approach the shore they are transformed by the nearshore bathymetry through the following processes:

- Refraction as waves bend towards the shoreline on the reef front and flat;
- Shoaling as waves steepen and crests become larger moving into shallow water;
- Breaking over the reef front and reef flat dramatically reduces wave height;

- Friction losses across the wide shallow lagoon, particularly across areas of patch reef;
- Wave setup is generated and sustained inshore of the breaking zone as wave momentum is transferred shoreward;
- Wave runup occurs as the waves finally break on the beach;
- Wave overtopping of the shore occurs where the beach crest is low, and/or when the waves and water levels are high.

At Le Morne, southwesterly swell waves (most likely generated by southern latitude extra-tropical storms) refract as they approach shore. The waves can also be seen to be shoaling as they refract with the wave crest becoming sharper and more distinct. The most dramatic change in the waves is the reduction in wave height (and apparently period) as the waves break and lose energy over the reef front and reef flat. This is the most important part of the wave transformation process, and spares the beaches of the reef-lagoon-beach system from the full brunt of the severe deepwater wave climate. The waves also undergo significant refraction as they pass over the reef such that the wave direction inside the lagoons is almost normal to the reef orientation. Waves can also be seen to penetrate and radiate (through diffraction) into the lagoon at two large passes. However, the effect of the waves reaching the shore, even from these large passes is relatively localised. The following wave height rose indicates the height of the waves offshore of Le Morne peninsula.



Wave Characteristics at Le Morne

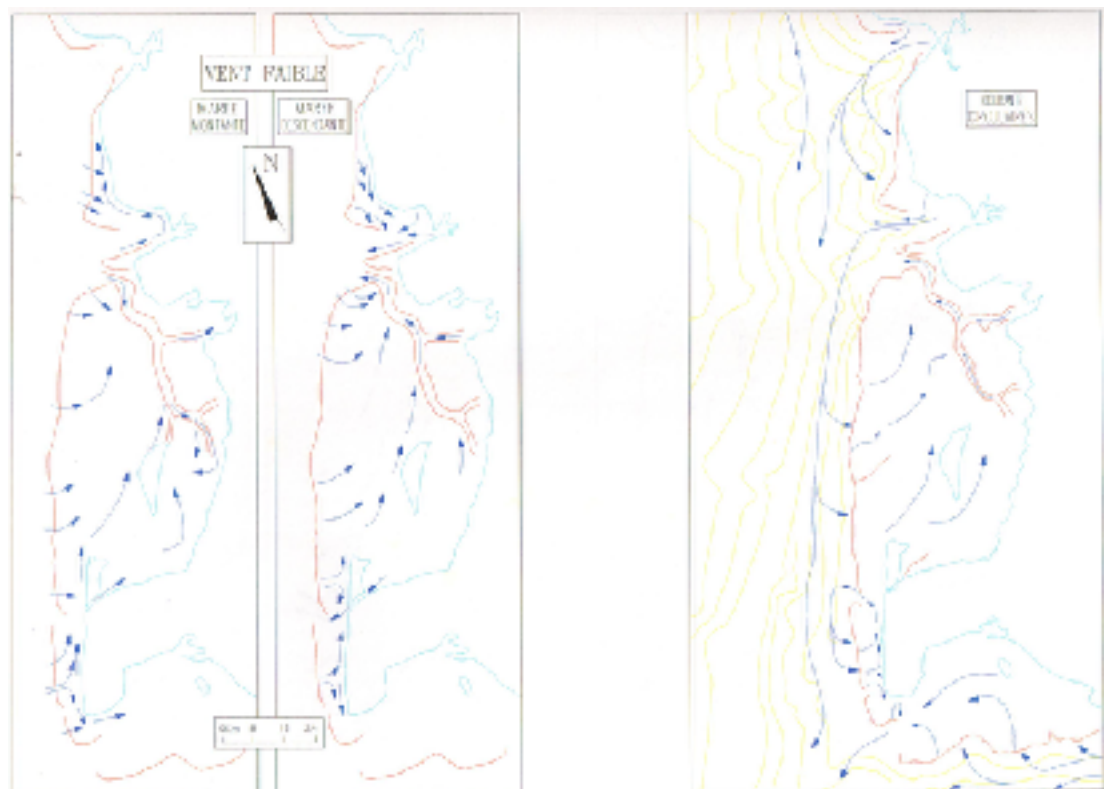
Currents

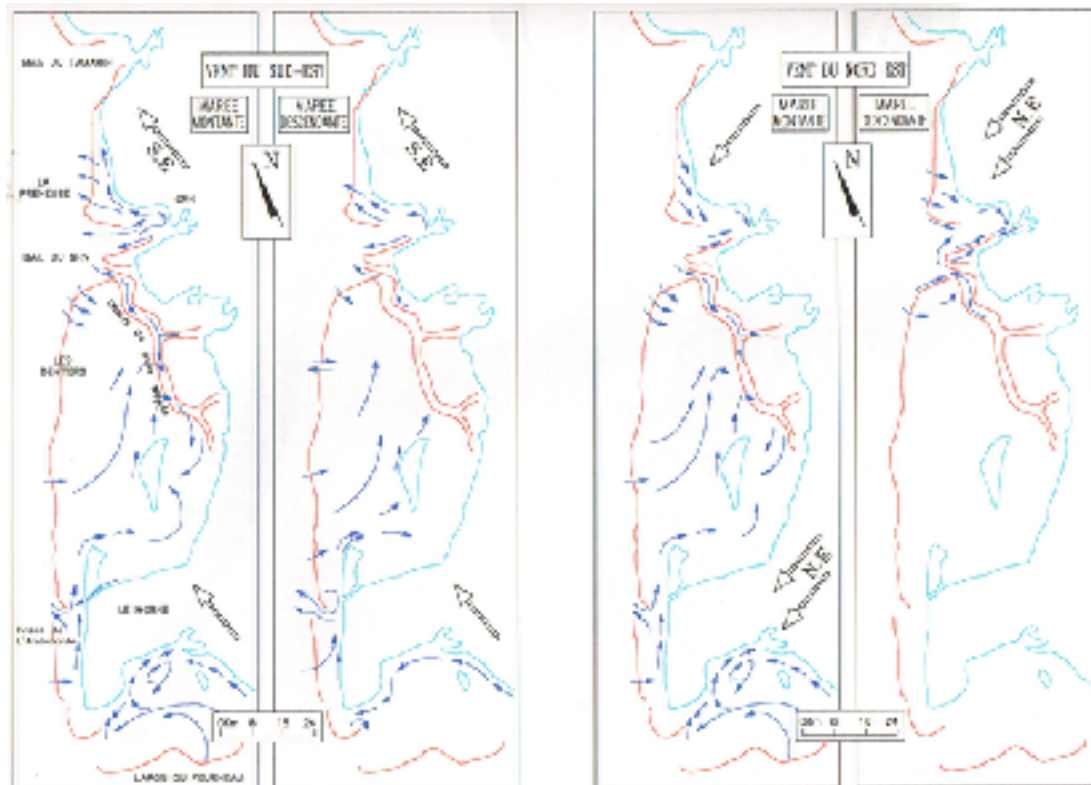
Current patterns within a lagoon are the result of a combination of factors:

- Return flow, within the lagoons and out through the passes, of water that was “pumped over and through the reefs by wave action;
- Wave-generated currents as the waves move across the lagoon towards the shore and along the shore: and
- tidal ebb and flood currents.

Wind, reef overtopping and tide-induced currents result in flows that generally do not exceed 20 cm/s, except in close proximity to passes. The existing current measurements are typically only in the order of 1 to 5 cm/s along the shore. Such velocities are too low to transport sediments. The threshold for sand movement is about 30 cm/s. The existing measurements were generally carried out under “fair-weather” conditions (low wave heights in the lagoons) and are more representative of average tidal and return flows. These “secondary currents” do not represent the current velocities and directions under storm conditions when wave-generated currents dominate the sediment transport processes. Therefore these secondary currents do not lead to wide scale changes in the beaches and are less important in generating sand transport, particularly during cyclones when wave-generated longshore currents can be in the range of 50 to 100 cm/s.

The following graphs illustrate the variations of the current directions at Le Morne depending on the wind and tidal conditions:





3.4 Marine Biodiversity

The back reef area is a sediment veneer over hard ground, characterised by a fleshy algae/holothurian/urchin community. Especially abundant were *Turbinaria* and *Sargassum*. There was an abundance of urchin spines in the sediment. It is interesting that this area supports the largest diversity so far of boring sponges: *Cliona orientalis*, scattered *Aka coralliphagum*, and papillae of at least two more species of *Cliona*. The sediment on this pavement is rapidly moving shoreward.

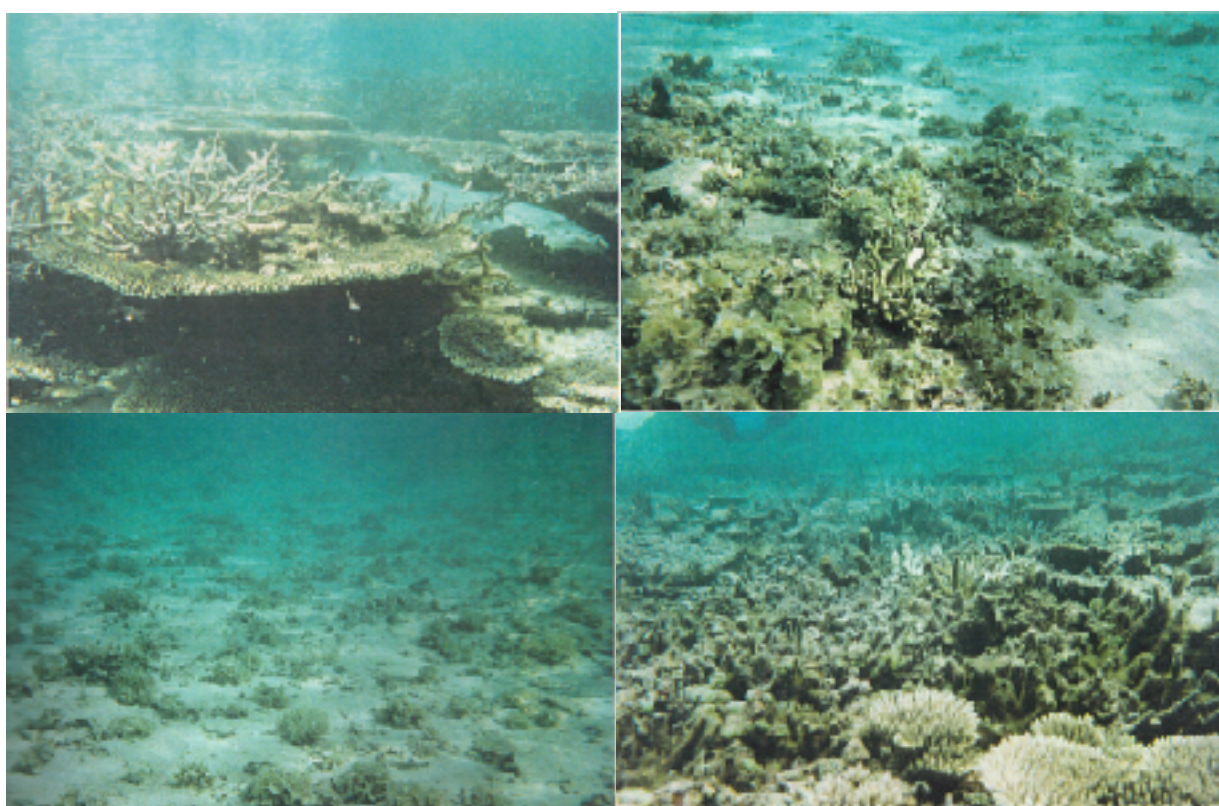
In the lagoon proper, there is widespread development of patch reefs largely formed of *Acropora hyacinthus* (table coral). Heads of *Porites* to 1 m are common, and are sometimes overturned. Branched coral rubble is common. There is some suggestion that parts of the table corals have died back within the last three to four years -- central regions of these corals are frequently dead and covered with CCA.

Although all the fish were fairly small, there was excellent density and diversity. Members of at least 10 families were observed, including damsels, goatfish, butterfly and angelfish, *Dascyllids*, squirrelfish, Moorish Idols, parrotfish, coral fish, triggerfish and *Balistids*. On calm days, these patch reefs would be wonderful tourist attractions for snorkellers. Several concrete blocks were encountered, that had obviously been used as anchors and abandoned or lost. These were covered by CCA and algal turf, but no coral spat could be seen.

This is an extremely dynamic area. Approximately 100 m offshore one of the hotels was encountered an overturned colony of table coral more than 2 m in diameter. Ripple marks indicate shoreward transport of sediment, with the lee side offshore and the stoss sides onshore. Sediment could be observed moving shoreward with every surge episode.

At places along the present coastline, there are submarine outcroppings of calcareous substrate, elevated perhaps a half m above the sands and only a few m from the beach. Putting some of these observations together, it appears as though the shelf/reef-flat at Le Morne is developed on a pre-existing ancient reef surface (probably the last Pleistocene). It is a bypassing zone: sediment produced by the reef moves quickly over the hardground, to the beach.

The transect shows high live coral cover with *Acropora hyacinthus* as the dominant species. *Acropora formosa* is the next abundant species. Live coral cover was estimated at more than 60% from the representative transect surveyed. Fish is abundant and diverse. Urchin population was generally low, less than 20 per 150 square kilometres of reef surveyed. Generally the coral habitat and its associates looked very healthy as illustrated in the following photographs:



The number and type of marine biodiversity species (excluding corals) found during our survey at Le Morne comprised of the following species:

Surgeon 6 , Domino >70, Labridae 10, Scaridae 8, Cocher 2, Chaetodonts 12 , Holocentridae 10, Chromis >100 , Goat fish 10 , Dascyllus >100, Algae- caulerpa lentiifera, Urchins <20.

The type of coral species found during our survey at Le Morne comprised of the following species: *Acropora austera*, *Porites lutea*, *Montipora efflorescens*, *Acropora tenuis*, *Platygyra daedalea*, *Acropora digitifera*, *Hydnophora exesa*, *Favites halicora*, *Goniastrea retiformis* and *Pavona varians*.

The following table and graphics summarise the marine biodiversity characteristics of Le Morne lagoon biotope:

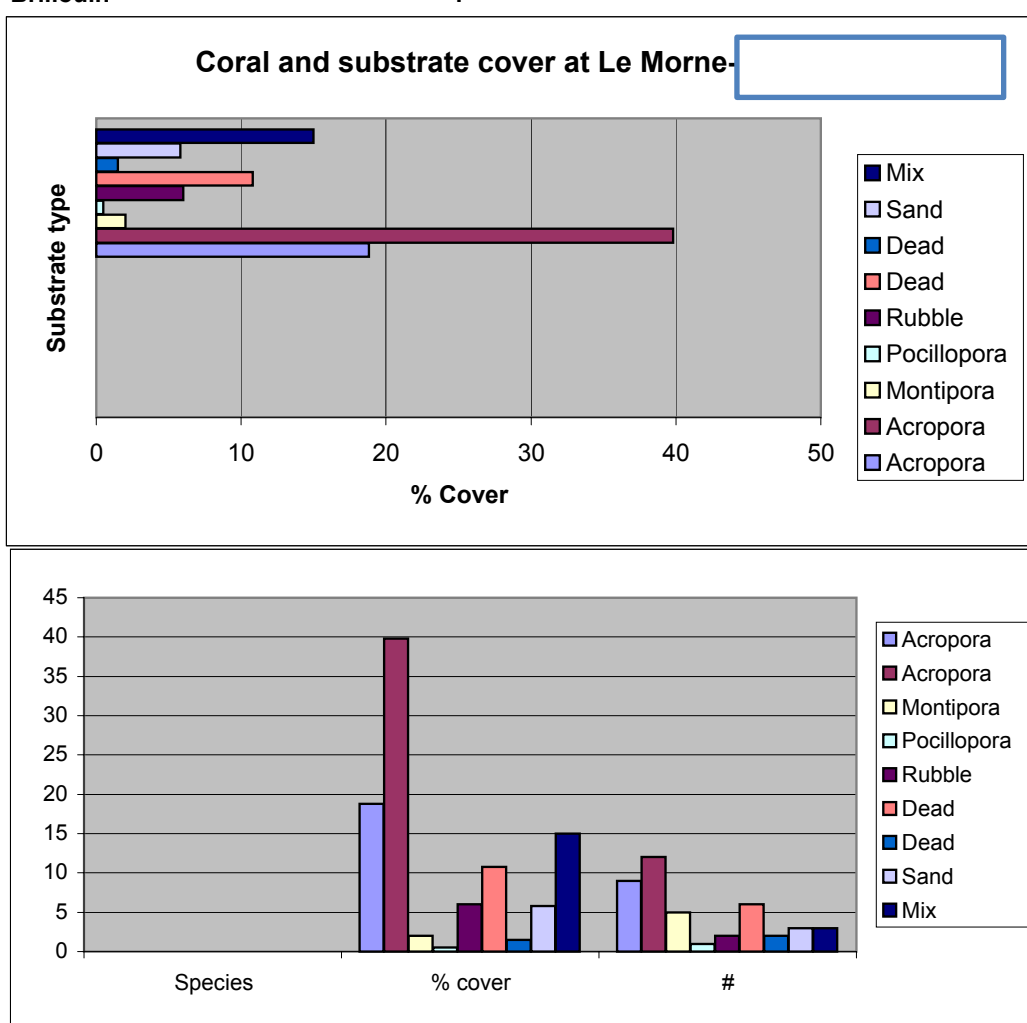
LINE TRANSECT SURVEY AT LE MORNE- COASTAL EROSION STUDY

Genus	Species	% cover	#
Acropora	formosa	18.8	9
Acropora	hyacinthus	39.8	12
Montipora	sp	2	5
Pocillopora	damicornis	0.5	1
Rubble		6	2
Dead	plate	10.8	6
Dead	standing	1.5	2
Sand		5.8	3
Mix		15	3

Shannon diversity 0.5

Evenness 0.36

Brillouin 1



3.5 Conclusion

Le Morne lagoon has specific environmental and oceanographic characteristics linked to its geomorphology and bathymetry, including the presence of two major passes: L'Ambulante and La Prairie and a minor pass One-Eye which play an important role in the general hydrodynamics and marine biodiversity of the area.

4. Sand Accretion between Ilot du Morne and Le Morne Peninsula

4.1 Introduction

Delphinium Ltd. has been able to witness the sand accretion which has blocked the free passage of water in the “bras de mer” located between Ilot du Morne and Le Morne Peninsula as illustrated in the following photograph.

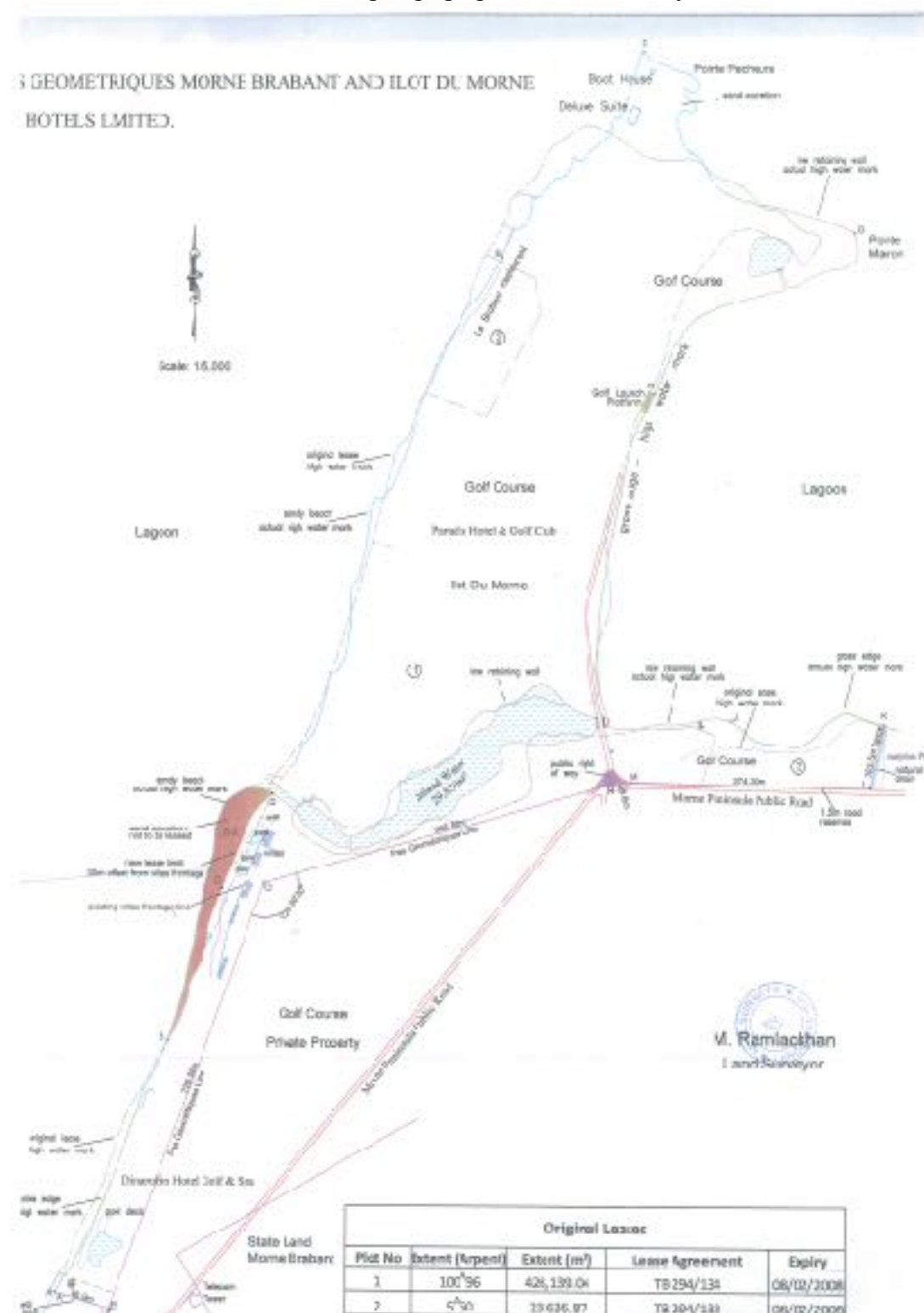


This situation may pose a direct risk to the infrastructures of New Mauritius Hotels Ltd. on both sides of the said “bras de mer” during climatic events such as high wave and storm surges periods.

The following sections describe the specific features of Bras de Mer du Paradis and the recent conditions which may have led to this situation.

4.2 Ilot du Morne

“Bras de mer du Paradis” situated between Ilot du Morne and Le Morne Peninsula, in-between two portions of State Land which are both leased to New Mauritius Hotels Ltd. as illustrated in the following Topographical Land Survey Plans.



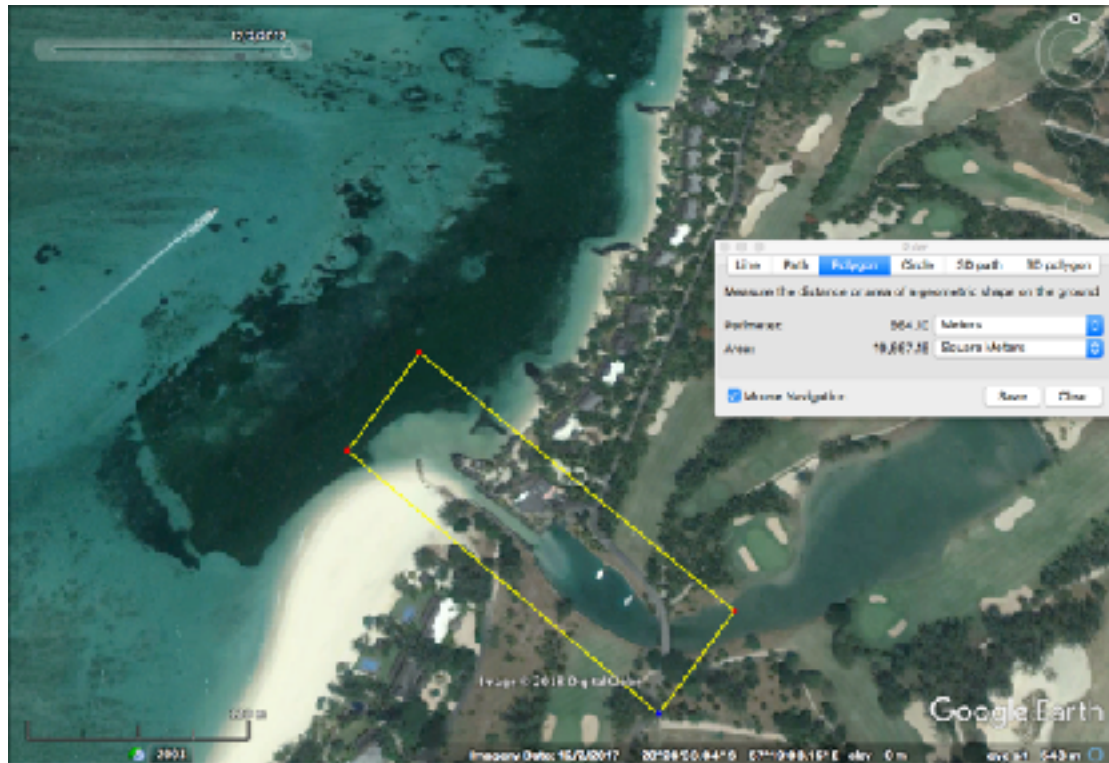
Topographical Land Survey Plan indicating the location of “Inland Water”



Topographical Land Survey Plan indicating the location of the “bras de mer” between Ilot du Morne and Le Morne Peninsula.

4.3 Study Area

The environmental and oceanographic assessment of the entrance of the “bras de mer” covers a perimeter of 664.10 metres and a sea area of 19,667.18 m² as indicated in the following satellite photograph.

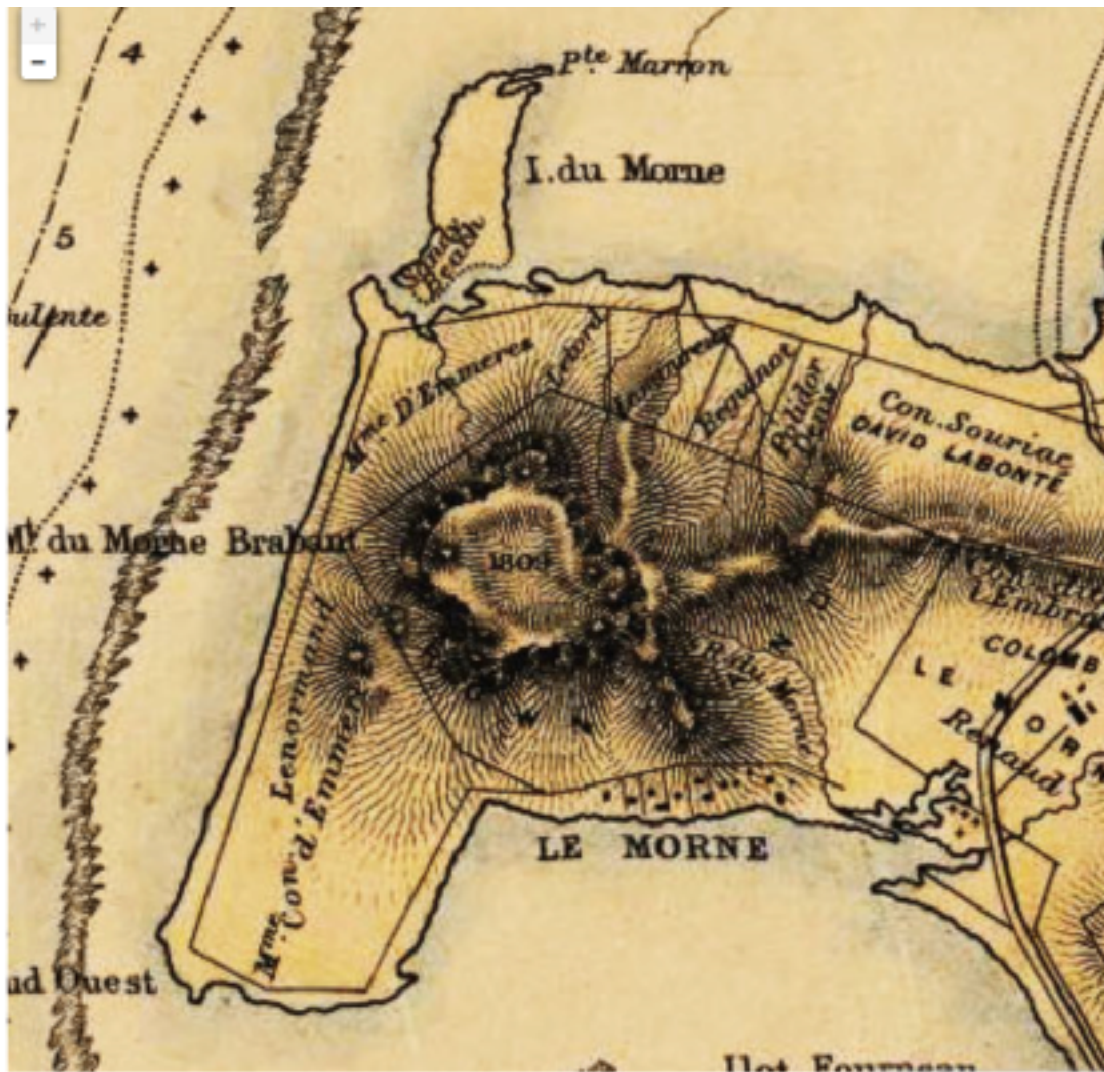


Area of Environmental and Oceanographic Survey

4.4 Historical Evolution of “Bras de Mer du Paradis” Bathymetry

The historical evolution of the “bras de mer” and adjoining coastline can be constructed using a series of historical maps, satellite photographs taken between 2000 and 2017 and drone footages taken on 10 June, 2018 as illustrated hereafter.

Ilot du Morne was already visible as a separate islet detached from the mainland (Le Morne Peninsula) in the Descubes Map of Mauritius of 1880, an extract of which is provided hereafter for ease of reference.



Descubes Map of Mauritius (1880)



Satellite Image taken on 4 March, 2000 (partial)



Satellite Image taken on 14 January, 2003



Satellite Image taken on 4 April, 2009



Satellite Image taken on 23 December, 2010



Satellite Image taken on 23 March, 2013



Satellite Image taken on 2 December, 2017

The aforementioned images confirm that the gradual sand obstruction at the entrance of the “bras de mer” separating Ilot du Morne from Le Morne Peninsula has accelerated with years and that it occurred between 2 December 2017 and June 2018 when the following drone footage was taken.



Drone Image taken on 10 June, 2018

4.5 Causes of Coastal Erosion and Accretion and Sediment Budgets

Sediment budgets are completed to develop a better understanding of the movement of sand through a coastal system from original source to final sinks. The process of completing a sediment budget consists of balancing all sources and sinks and can help to highlight critical processes associated with erosion/accretion along beaches.

In a healthy reef-lagoon-beach system, there is only one source of beach sand and that is the lagoon corals and associated community. The sand production rate for lagoon corals is estimated as 5 kg/m²/year. Because of the presence of the Pleistocene reef hard bottom across most lagoon beds, the sand cover across the lagoon bed is thin and does not represent a significant reserve of sand.

Sand transport directions are a result of a complex pattern of waves breaking over the reefs and moving to shore, waves propagating through the passes, return flow currents passing within the lagoons and out through the passes and tidal ebb and flood currents.

The sand makes its way from the lagoon coral sources to the shore along “streamer” like pathways clearly visible from air photos. Where these “streamers” are reef and shore normal, the primary driving force is the onshore transport associated with the non-linear orbital motion of low steepness waves. At some locations the streamers bend away from the shore normal either due to wave refraction or a steady current often associated with close proximity to a pass where there is a net offshore flow.

Storm and cyclone generated waves are the dominant forces that cause erosion and transport sand, both alongshore and offshore.

Sources and sinks associated with long-term shoreline erosion and accretion are determined through shoreline change analysis, utilising recent and historic photos registered in GIS.

Sand dunes are an important part of the littoral budget. Dunes trap windblown sand, store excess beach sand and serve as natural erosion buffers for shorelines during severe storm events. Healthy dunes are vital to the health of the beach-lagoon system. Dredging sand from the lagoon and excavation of the dunes removes sand from the sediment budget causing a deficit and subsequent erosion. In October 2001 the Government banned lagoon sand mining.

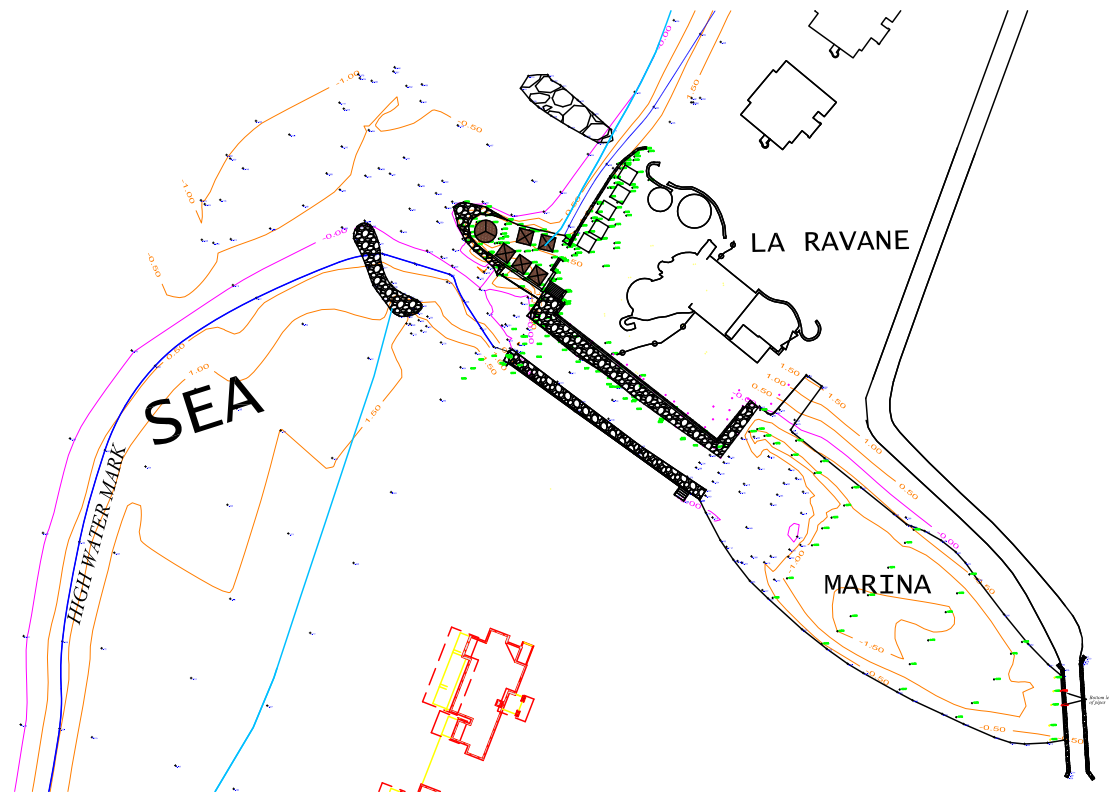
Therefore, in summary, the sediment budget for the reef-lagoon-beach system consists of sand production from the lagoon corals and associated communities, onshore transport to the beach, movement of sand along the shore (mostly during cyclones, sometimes with net shoreline erosion/accretion) and eventual flushing and permanent loss through passes to offshore sand deposits in water depths of 10 m or more. At some locations, temporary sinks on the lagoon bed and onshore exchange from deposits outside the reef may complicate this system.

It is therefore necessary to determine the bathymetry, sediment granulometry, the current patterns at the entrance of the “bras de mer du Morne” as well as the recent wave characteristics in the area in order to assess the scientific reasons behind this recent sand accretion which has blocked the free passage of sea water.

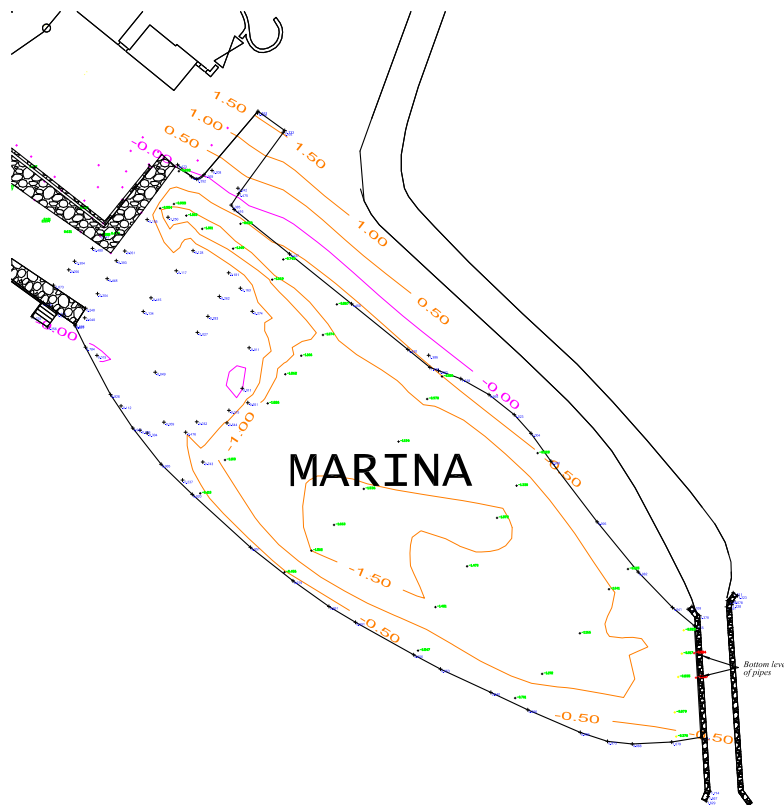
4.6 Accretion and Sediment Characteristics

Bathymetry

The following bathymetric plans confirm the sand accumulation at the entrance channel and within the “bras de mer”..



Bathymetric Map of “Bras de Mer du Paradis” and Surroundings indicating the clogging of the Water Passage between Ilot du Morne and Le Morne Peninsula

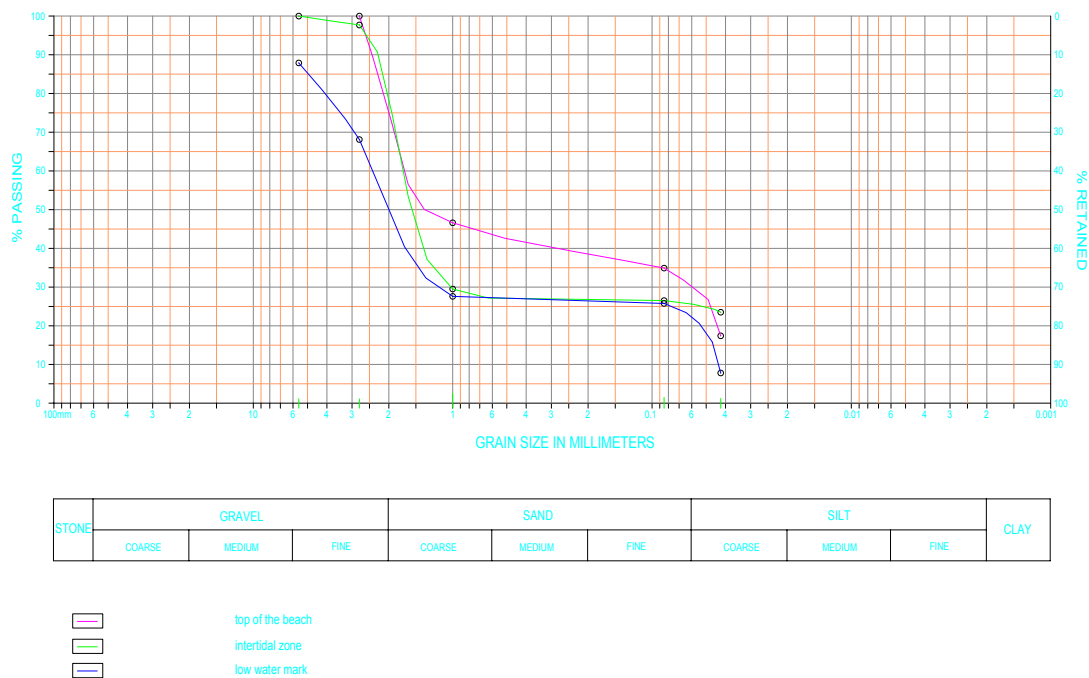


Detailed Bathymetric Map illustrating the Progressive Sand Accretion

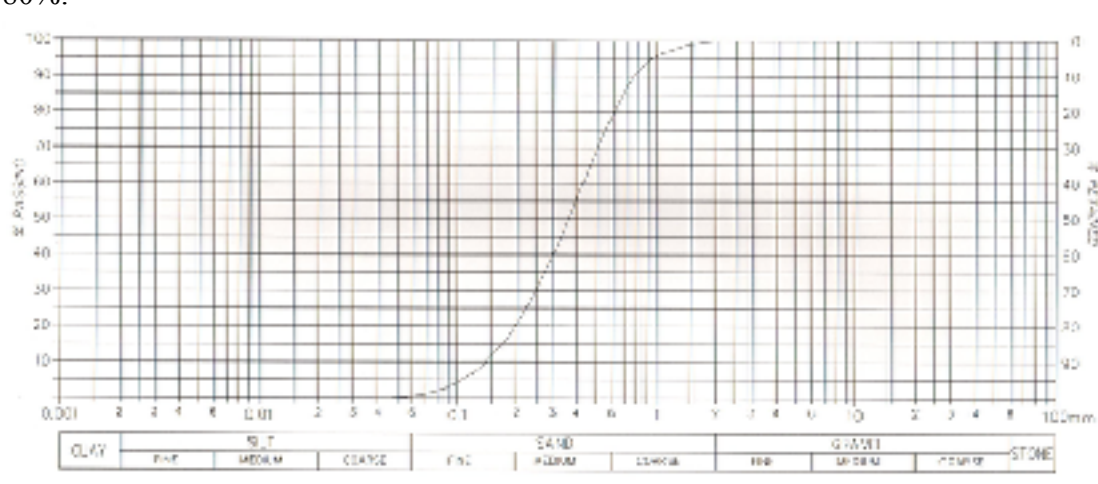
Granulometry

Three samples have been taken in order to determine the type of sediments which have accumulated in Le Morne area. Granulometry sieving tests have confirmed that the sediments at Le Morne are mostly composed of sand as indicated in the following size distribution graphs drawn up from the said sieving tests carried out on three sand samples taken at the top of the beach, in the intertidal zone and at the low water mark.

In fact, according to these graphs, the foreshore is a near well-graded curve. However the profiles for the intertidal zone and the low water mark are gap graded. Coarse sand is retained at 70% whereas the fore shore has comparatively less of coarse with 55% retained at 1.00 mm.

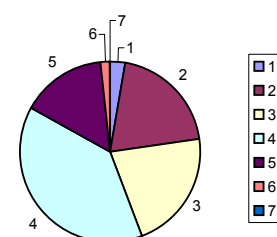


The following graph illustrates slightly finer sand granulometry characteristics of another sample as one moves towards Paradis Hotel, coarse sand being retained at 80%.



The detailed composition of the sand at Le Morne is provided hereafter:

1	2	3	4	5	6	7	8
Urchin Spines	Coral	Mollusc	CCA	Forams	Gorg. Spicules	Clastic s	Sponge Spicules
7	52	55	100	40	4	0	0



Current and Wave Patterns

The expansive shelf/reef-flat at Le Morne appears to be developed on a pre-existing ancient reef surface (probably the last Pleistocene). Within the lagoon formed by the shelf/reef-flat, a large sand spit, anchored by Le Morne Brabant, extends some 4 km from its northerly tip (Paradis Resort) to its southerly tip (Le Morne public beach at Pte Sud Ouest). Sand transport directions along the westerly side of the spit are variable and are a result of a complex pattern of waves breaking over the reefs, waves propagating through the passes and currents passing within the lagoons and out through the passes. This is particularly evident at the southwest tip (Le Morne public beach) where the influences of the major pass to the south-southwest, Passe de la Prairie, and the blind pass (“One-eye” Pass) offshore of the southerly portion of the St Regis result in currents southwards from the St Regis, along the west shore, and westwards from the Riu Resort, along the south shore, keeping the public beach, at the southwest tip, in a very dynamic balance. Further to the north, along the west shore, nearshore current is nearly always in a northerly direction, irrespective of the wind direction and the tidal movements.

These current and wave patterns explain the general south to north sand movement on the beach facing Passe de l’Ambulante.

4.7 Conclusion

The sand accretion between Ilot du Morne and Le Morne Peninsula has occurred recently, blocking the free flow of water in a once ”bras de mer” separating an islet from the main land. This obstruction needs to be removed as soon as possible by taking the appropriate urgent remedial measures in order to allow the free flow of water and to avoid any water buildup and consequential damages which may result therefrom linked to climatic events, especially during the coming cyclonic season.

5. Quantification and Methodology

5.1 Introduction

The urgent removal of the recent obstruction preventing the free flow of water between Ilot du Morne and Le Morne Peninsula requires a quantification of the volume of sand to be displaced as well as an appropriate environmentally friendly sand displacement equipment and methodology.

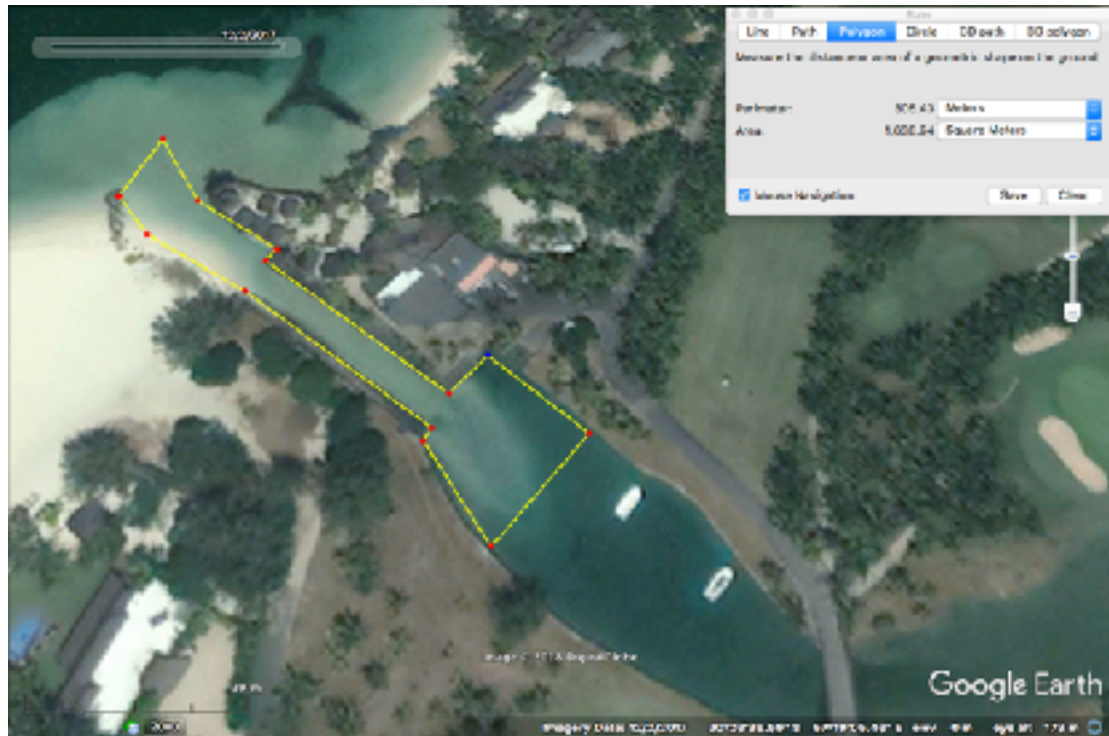
5.2 Quantification

The volume of sand to be displaced can be estimated using the bathymetric maps which have been drawn up to determine the surface affected by sand accretion to be multiplied by the average depth of sand to be displaced in order to achieve the previous minimum depth of 1.5 metres below Mean sea Level.

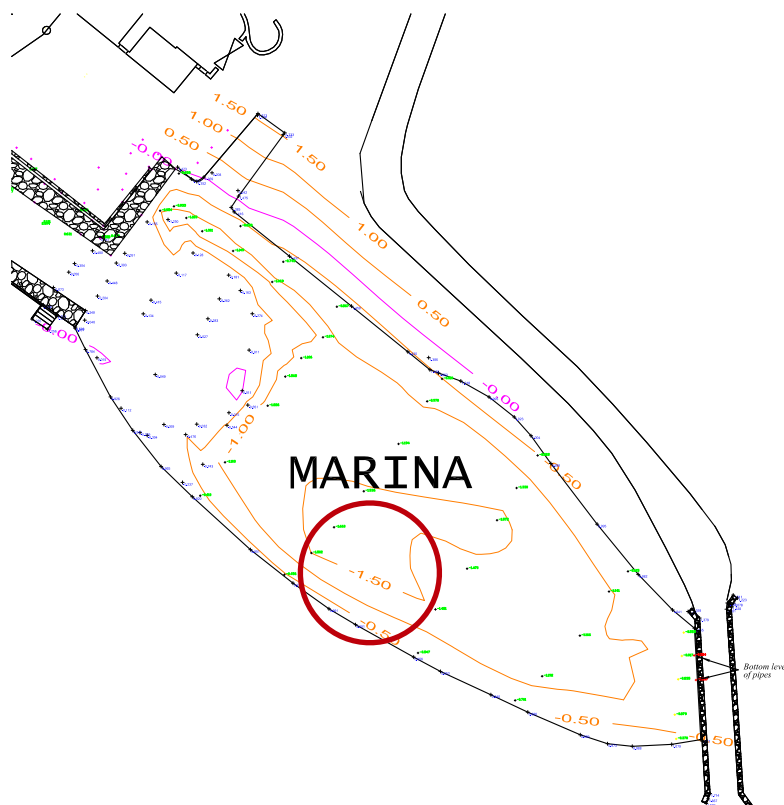
The following satellite image depicts the characteristics of the entrance of the “bras de mer” and Paradis Marina in 2008. The said entrance was not obstructed at that time, allowing the free flow/circulation of lagoon water between Ilot du Morne and Le Morne Peninsula.



The surface area of sand to be displaced can be estimated using the most recent satellite image. The following image which has been combined to the bathymetric map has allowed us to estimate that sand will have to be displaced over an area of 1638.94 m².



The bathymetric study confirms that the original depth of the “bras de mer” at this location was 1.5 metres Below Mean Sea Level as indicated in the following map.



The maximum volume of sand to be displaced can therefore be estimated at:
 $1,638.94 \times 1.5 = \mathbf{2,458.41 \text{ m}^3}$.

It is understood that the sand which will be displaced to reestablish the free flow of water between Ilot du Morne and Le Morne Peninsula would not be removed but only displaced to a close location on the beach of the villas of Paradis Beachcomber Resort & SPA located less than 75 metres away.

5.3 Equipment and Methodology

Various environmentally sustainable methods may be used for the removal of the sand obstruction from the entrance of the “bras de mer” in order to reestablish the free flow of water, including the use of a dredger and a backhoe loader. The advantages and disadvantages of each methodology may be estimated as follows.

Dredger

Delphinium Ltd. has contacted Amazonia Dredging Services which uses a dredger with a long hose pipe in order either to pump sea water and flush the sand away, or to suck the sand and transfer it directly through a flexible pipeline to another location.

The preliminary costs estimated for such an operation are MUR 50,000 + VAT per day plus mobilisation and demobilisation costs of MUR 130,000 + VAT according to the said supplier.

The advantages of this methodology and equipment are linked to the efficient displacement of sand from the “bras de mer” to the beach in front of the villas of Paradis Beachcomber Resort & SPA less than 75 metres away using a single flexible pipe and the speed of the intervention.

Backhoe Loader

Delphinium Ltd. has equally contacted Prime Plant Company Limited which can supply a backhoe loader for the said works provided there is a sufficient access on the shores of the “bras de mer” in order to have access to the site.

The costs linked to such equipment are estimated MUR 8,000 + VAT per day plus MUR 12,000 + VAT for the transportation costs of the equipment from Coromandel to the site.

The advantages of this methodology and equipment are linked to the relatively lower cost of the operation.

Both Amazonia Dredging Services and Prime Plant Co. Ltd. have confirmed their availability to carry out those works as soon as possible pending the approval of their financial offers which will be submitted after a site visit has been carried out. The said site visit has been scheduled on Thursday 27 September 2018 at 9h.

5.4 Conclusion

It is highly recommended that New Mauritius Hotels Ltd. removes the recent sand obstruction which prevents the free flow of water between Ilot du Morne and Le Morne Peninsula in order to avoid any potential flooding and damage to its property during the coming cyclonic season.

It is estimated that **2,458.41 m³** of sand will have to be displaced from the entrance of the “bras de mer du Paradis” to the beaches of Paradis Beachcomber Resort & SPA located less than 75 metres away from the site.

Two methodologies are available for the said operation: a dredger and a backhoe loader, each of them having advantages and disadvantages. In fact, the costs of the backhoe loader may be lower, whereas the speed and efficiency of a dredger may lead to quicker results.

The legal advice of ENS Africa Ltd. will have to be sought concerning the contents of the letter which Delphinium Ltd. proposes to draft and submit to New Mauritius Hotels Ltd. in order to inform the authorities concerned, including the Ministry of Social security, National Solidarity, and Environment and Sustainable Development, about the intention of the company to carry out urgent remedial works accordingly.

6. Conclusion

The environmental and oceanographic survey which has been carried out by Delphinium Ltd. in the context of the sand accretion preventing the free flow of sea water between Ilot du Morne and Le Morne Peninsula has confirmed the following:

- Le Morne lagoon possesses unique environmental and oceanographic characteristics which have been described in this report
- The “bras de mer” situated between Ilot du Morne and Le Morne Peninsula has been obstructed by sand accumulation due to the recent winter swells and it represents a potential threat to the infrastructure of Paradis beachcomber resort & SPA due to potential flooding hazards with the coming cyclonic season
- The said obstruction representing a volume of sand not exceeding **2,458.41 m³** needs to be displaced from the current location to a conspicuous location less than 75 metres away on the beaches of the villas of the Paradis Beachcomber Resort & SPA
- The methodology and equipment to be used, either a dredger or a backhoe loader, needs to be carefully selected in order to ensure that no harm is caused to the marine environment
- The Ministry of Social security, National Solidarity, and Environment and Sustainable Development needs to be informed of the proposed works by virtue of a letter to be drafted by Delphinium Ltd. and legally vetted by the legal advisor of New Mauritius Hotels Ltd., namely ENS Africa Ltd.

Thanking you in anticipation and remaining at your disposal for any further information or clarification which you may require.

Yours Faithfully,



Vassen KAUPPAYMUTHOO
Delphinium Ltd.