SILHOUETTE ISLAND RESORT
a Joint Venture between
UNIVERSAL ENTERPRISES (PVT) **Ltd**
and
SILHOUETTE ISLAND LODGE

CONSTRUCTION & OPERATION OF A BEACH RESORT

Silhouette Island, Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

April 2005

S.I.G.M.A. - Ove Arup & Partners
Consulting Engineers
Port Louis, Mauritius

SILHOUETTE ISLAND RESORT
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ENVIRONMENTAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

1 Silhouette Island, about 15 km off the N.W. of Mahé, carries on its eastern side, Anse La Passe with a very shallow lagoon, and presently hosting a small touristic undertaking, the Silhouette Island Lodge. Activity at Silhouette falls under the jurisdiction of **IDC**, the para-statal body of the Republic of Seychelles, that is responsible for the development, management and control of Government-owned islands, and whose policy is aligned with the strategy of sustainable tourism and development of the Seychelles Islands. It is in that context that the Silhouette Island Spa Resort Project has been conceived by **Silhouette Island Resort** - a Joint Venture between **Universal Enterprises** (Pvt) Ltd and **Silhouette Island Lodge.** On an 11-hectare site, which has been profoundly modified from its original state by human activity and presently housing:

- The Lodges, which will be phased out to be replaced by the proposed undertaking object of the present EIA report
- derelict poultry farm buildings and pig sties, partly dismantled
- residential units for the Silhouette villagers and a school attended by the villagers' children

2 The Silhouette Island Resort Project has been the object of a feasibility study in the context of the Seychelles Tourism Industry, and in particular of its up-market segment. According to the Project Brief, it will aim at the release on the Seychelles Tourism Market of 116 keys on a Site that is not exploited to its full touristic potential. Guests' activity will be centred on leisure, health and sports, with the provision of, *inter alia*:

- a Main Restaurant, a Grill, a Speciality Restaurant, a Pizza Garden and a Tapanyaki Island
- a Main Bar and Beach Bars
- a pool
- a Fitness Centre and two tennis courts
- a Spa
- a off-site Diving school and water sports centre
- a off-site Creole Boutique, Art Gallery and Café

There will also be conference facilities consisting of a conference room seating up to 100, but which can be partitioned into two smaller 40-seats units.

3 The Project also caters for the reorganisation of the Silhouette Island Village, as a number of the present IDC villagers, presently dwelling on the aforesaid 11-hectare Anse La Passe site, will have to be displaced to allow the construction of the Resort. Thus, the following will have to be removed from their present location:

- the school and the teachers' residence
- a number of staff residence units and sundry other buildings
- the school playing field

Moreover, as the Resort will require some 240 extra staff for its proper operation - it is expected that about 30 out of the present 130 Silhouette villagers will be employed in the Resort -

residential quarters will have to be constructed at Anse La Passe, no alternative Site being available.

4 The Project will imply electrical, mechanical, civil and structural engineering activity in connection with the construction of, *inter alia*, the following residential, administrative and managerial project components:

- 116 guest rooms, distributed in 52 No 'Beach Villas', 4 No 'Interconnecting Beach Villas', 10 No 'Beach Pool Villas', 6 No 'Beach Villas with Plunge Pools', 26 No 'Garden Villas', 10 No 'Garden Pool Villas', 4 No 'Interconnecting Garden Villas' and 2 No 'Presidential Villas'
- the Public Area housing the Guest Reception Desk, the Management offices, the Main Bar, the Main Restaurant, the Speciality Restaurant, the Pizza Garden, the Tapanyaki Island, the Grill, the kitchen and ancillary stores
- a Fitness Centre and tennis courts
- the Spa
- the General Manager and resort executive, senior and junior staff residences
- the new village to relocate the displaced villagers, with a new school, teachers headquarters, village shop and sports facilities
- Plumber, mechanical and electrical workshops, positive and negative storage, non-food storage
- Landscaping works including in particular, the transformation of existing unattended swamps into water features for the new Resort

5 Engineering activity will also be involved in the provision of all the following service and utility infrastructure:

- The Sewerage System, a dual Grey Water/Black Water system, which will comprise a collector network complete with manholes and lift stations, serving the entire complex, including the Staff Quarters and the village
- A potable water system will be supplied from Modular Reverse Osmosis desalination plants, and also from tapping from existing water courses, storage and filtration system, with adequate water storage capacity
- An electricity supply system comprising 4 No 725kVA diesel-powered units in sequential link and sound attenuating enclosures, complete with control switch gear, individual day diesel tanks and bulk diesel tank to supplied from the IDC supply ship and protected against fire and spillage
- A two-chamber solid waste incinerator for the safe disposal of combustible waste, eventually dried sludge from the WWTP and hazardous wastes from the Health Unit; non-combustible wastes resulting from sorting-out at source (metal, glass) will be conditioned in a refuse compactor and hauled to Mahé for disposal. A stand-by incinerator unit will also be provided.

6 The Project will also involve the construction of ancillary buildings necessary for the running and operation of the Project, namely the Service Building, which will include:

- workshops and the maintenance stores for the various individual trades
- House-keeping store, the Laundry, the air-conditioned linen store, the general store and its A/C office, the R/O Desalination Plant, etc...

7 Pursuant to the administrative procedure currently in vigour in Seychelles the Project has been officially presented to the National Inter-ministerial Committee (NIC) chaired by the President of the Republic, in 2004.

Application has been made in conformity with Article 6 of the Town and Country Planning General Development Order (1971). Notice of Conditional Outline Permission for Development has been granted to the Proponent. A preliminary Project Scoping Exercise in the process of the preparation of the EIA Documentation has been carried out in November 2004. Following submission of the Scoping Report Terms of Reference were issued the Division of Environment on the 15th January 2005 for the preparation of a full EIA Report. They are attached hereto.

10 The Environmental Impact Assessment has been conducted by **SIGMA Ove ARUP & Partners**, Associated Consulting Engineers as per the aforesaid Terms of Reference. In particular, potential negative impacts were identified, at Conceptual, Construction and Operation phases in connection with:

- the setting out on Site of the proposed Resort Buildings with respect to set-back from HWM
- additional burden on the limited water resources of Silhouette
- the generation of sewerage and waste water from builders staff, the Guests and Hotel Staff residential units and the Silhouette Village
- the generation of hazardous, organic and non-organic solid wastes from the builders staff, the Guest and Staff residential units and the Silhouette Village
- the generation of stack gases from the generator sets
- the spillage of hydrocarbons from equipment, as well as storage facilities
- the nocturnal flood lighting and noise on the natural behaviour of protected terrestrial and marine fauna (turtles, birds, ...)
- the relocation of the existing Silhouette Settlement moved to make room for the undertaking

In the impact matrix below, the impacts generated by the interaction of conceptual, constructional and operational activities on the Natural (physical) Land and Marine Environment, the Built Environment, the Social and Economic Environment of the Project is summarised. Pertinent remarks on the issues associated with the said activities, and the mitigation of these impacts are also given.

Measures that have been proposed to mitigate these impacts will form part of all contractual documentation pertaining to the construction of the Complex.

An Environment Management Plan as well as an Action Plan has been proposed as part of the EIA.

Patrick **HAREL** M.Sc, D.U.S., Ph D.
SIGMA - Ove ARUP & Partners

PROJECT STAGE	ACTIVITIES	Natural Environment	Built Environment	Social Environment	Economic Environment	REMARKS
I Conceptual	Silhouette Resort Siting					Site heavily influenced by human activity. Mitigating measures proposed
	IDC Village relocation					An IDC issue not yet finalised. No assessment made; to be addressed by IDC.
	Resort Staff Accommodation					-Ditto-
	Resort Architecture					Adapted to local style Approved by Authorities. Conforms to Planning Guidelines
	Resort occupancy of Site					Dense. Likely to impact on beach stability
	Staff & IDC Architecture					An IDC issue not yet finalised. No assessment made; to be addressed by IDC.
	Set-back from High Water Mark					Agreed with Authorities to accommodate site density. Impact identified
II Construction	Building & Professional					
	Production of Effluents					Mitigating measures proposed for on-Site disposal
	Production of Solid Waste					Mitigated by safe disposal and on-Site incineration
	Hydrocarbon Spillage					Mitigation measures proposed, with a Contingency Plan from SEYPEC.
	Noise generation					Partly mitigated
	Power Consumption					Unavoidable, mitigated by power savings
	Atmospheric Emissions					Partly mitigated, NOx & CO_2 not controlled
	Water Consumption					Mitigated by production of potable water through implementation of R/O plant
III Operation	Effluents from Resort, Staff, R/O					Mitigating measures proposed
	Production of Solid Wastes					- Ditto -
	Hydrocarbon Spillage					- Ditto -
	Noise Generation					Partly mitigated by silenced generating sets
	Flood Lighting					To be mitigated
	Atmospheric pollution					Partly mitigated, NOx & CO_2 not controlled
	Employment					

LEGEND (Colour Code): **Low -ve Impact**: **Moderate -ve Impact**: **High -ve Impact**: **Positive Impact**:

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Chapter 1: Project Brief, Promoter, Legal Background

1.1 The Project

The Resort Project proposed on Silhouette Island will ultimately release 106 more keys on the Seychelles Tourism Up-Market in a single development phase. Besides full-board accommodation, guests will enjoy speciality restaurants for varied gastronomy, bars and games room, for leisure and will have access to fitness and land and water sport activities.

The layout plan of the proposed Silhouette Island Development at Anse La Passe on the East coast of the Island, is reproduced in Figure 1.1.1. A detailed description of the Resort, its components, facilities and associated infrastructure follows below.

The junior, senior and executive Resort staff to be moved to Silhouette Island will be accommodated in the Quarters to be erected also at Anse La Passe.

1.2 Project Site Location

1.2.1 The Anse La Passe Site

Silhouette Island is the 3rd largest in size of the Seychelles Archipelago, lying about 15km due WNW of Beau Vallon Bay, Mahé. With reference to the Ordinance Survey map (1993) of Silhouette Island, settlements on Silhouette Island are indicated at Anse La Passe, Anse Grande-Barbe, Anse Mondon, Belle-Vue and Anse Lascars.

Anse La Passe, on the eastern coast of Silhouette, however is the most important settlement. Besides the Silhouette Island Lodge, a small touristic complex, Anse La Passe also hosts a resident population of some 130 whose activity falls under the aegis of **IDC**, and with a village life organised around a school, a dispensary, etc.

Activity of the local residents is mainly associated with:

- staffing of the Silhouette Island Lodge
- limited farming/plantation considering the local agro-climatological constraints; industrial chicken farming and pig raising, now derelict, were once carried out on Silhouette
- the running of a small eco-tourism shop
- a giant tortoise and Seychelles terrapin conservation unit animated by Ron **GERLACH** who currently studies the giant tortoises as well as other species of the important floral and faunal life on Silhouette

The Ordinance Survey map also reveals that Anse La Passe has the following general characteristics

- it is backed inland by about 11ha of flat dunar sand formation at the bottom of steep granite formations rising to 621m AMSL at Mont Pot-à-Eau
- it faces a shallow fringing reef flat over more than 2km, with a width between 300 and 450, bordered seaward by breakers opened at three passes, La Passe, Passe Mince and an unnamed pass
- it carries a landing jetty, the only one of the Island, now replaced by a rubble-mound protected landing station dredged into the reef flat a few years ago

Information in complement of the Ordinance Survey map and concerning that portion of the Anse La Passe settlement earmarked for the implement of the new 106-key Resort, has been compiled by Alain **SAVY,** sworn land surveyor, and is reproduced in Figure 3.1.3.1.1 hereinafter.

1.2.2 Alternative Site for Resort

A priori, from the foregoing, Anse La Passe is the most propitious site on Silhouette Island for the implementation of the proposed Resort. Reasons being, *inter alia*:

- the existing landing station, unique on Silhouette an essential item in the access strategy for the implementation and operation of any resort of the size proposed
- the fact that the site is already a man-developed site, having once hosted chicken and pig farming
- the presence of a comfortably wide reef flat, albeit shallow.
- the fact that from the guest accommodation point of view, the site with its present Seychelles Island Lodges, and vast abandoned built spaces, is grossly under exploited

None of the other settlements display similar characteristics, although, Anse Grande Barbe appears of sufficient extent to host a 100-key development.

It is therefore certainly for those reasons that Anse La Passe became the largest settlement in Silhouette and that the **DAUBAN** family, once owners of the Island, erected their "grand'case" there; and also most probably for the favourable exposure of Anse La Passe to the monsoons and the wave regimes. This will come out later in the course of the acquisition of the baseline data on the physical and natural environment.

Hence there is no alternative site on Silhouette for the successful implementation of the proposed 106-key Resort. This is in response to Clause 2 of the Terms of Reference issued by the Ministry of Environment and Natural Resources.

1.2.3 The Resort Staff Village & IDC Staff Relocation Site

Anse Lascars was initially earmarked for the construction of the Resort Staff Village and for the relocation of those IDC staff compelled to move away from Anse La Passe.

Anse Lascars lies due S of Anse La Passe, also facing East, beyond Pointe Varreur and Pointe Ramasse Tout, and extends between the latter and Pointe Zeng Zeng.

Anse Lascars has a coastal plain backed by the granite slopes rising steeply to Mont Poule Marron and Mont Laurent (> 310mAMSL), but faces a reef flat of width varying between 150 to 250m.

According to the said Ordinance Survey map, Anse Lascars was hosting a small settlement in 1978. None is mentioned in the more recent NPTS Report on Silhouette.

1.2.4 Alternative Site for Staff and IDC Village

Space-wise, Anse Lascars, with 6.3 ha deemed available for the development of the Village, appears to be the right choice.

However, it is on average about 1.5km from the proposed Silhouette Resort and such a distance will have to reckoned with in the context of:

- sharing of utilities (potable water, electricity ,sewerage, solid wastes) and services in common with the proposed resort
- more remote school facilities, imposing longer transit times to school children residing in the Anse La Passe IDC Village
- more remote Dispensary facilities
- Village-resort transit facilities, namely inasmuch as transit times, adverse weather conditions are concerned, although the landing facilities at Anse La Passe are midway between the Resort and the proposed Village Site

These issues and the stakeholders concerns must have been carefully weighed by IDC in their decision-making process. The Anse Lascars Site has therefore been abandoned, and the Promoters have opted for Anse La Passe.

1.2.5 EIA Aspects of Staff & IDC Village

The implementation of the resort staff accommodation and the relocation of the IDC villagers remain essentially an issue internal to IDC. Site location and setting out, floor layouts have been tabled, but no engineering documentation has been submitted within the framework of the present EIA.

Consequently, only the services and infrastructure requirements imposed by the Resort Staff Village and the IDC relocation will be considered in the context of the EIA, namely:

- power requirement
- potable water requirement
- production of wastewater
- production of solid wastes

1.3 The Promoter

The Promoter is **SILHOUETTE ISLAND RESORT** (hereinafter referred to as **SIR**) a Joint Venture between **UNIVERSAL ENTERPRISES** (Pvt) **Ltd** (hereinafter referred to as **UEL**), of the Republic of Maldives, with **SILHOUETTE ISLAND LODGE** of Seychelles.

ISLAND DEVELOPMENT CORPORATION (**IDC**) of Seychelles is the 'landlord', the lessor of the Site and the Project Facilitator.

The legal and postal addresses of **SIR** are:

Registered Address:	**Postal Address**:
	Room No 8
Victoria	Kingsgate House
Mahé, Seychelles	Victoria
	Mahé, Seychelles

1.3.1 SILHOUETTE ISLAND LODGE (SIL)

SIL is a Seychelles registered company in charge of the operation of the existing touristic undertaking at Silhouette. **SIL** is represented by Mario and Ornella **LAPOLLA**, of Providence Industrial Estate, Mahé, Republic of Seychelles.

1.3.2 UNIVERSAL ENTERPRISES (Pvt) Ltd (UEL)

UEL is a Maldives-based Company, formed and registered in 1972 in the Maldives. It is the largest resort chain there and has been one of the pioneers of the Maldivian tourism industry.

The legal and postal addresses of **UEL** are:

Registered Address:	**Postal Address**:
	39 Orchid Magu
Malé, Maldives	Malé
	Republic of Maldives

1.3.3 ISLAND DEVELOPMENT CORPORATION (IDC)

IDC is a para-statal body of the Republic of Seychelles, responsible for the development, management and control of Government-owned islands, and in particular of the various Silhouette settlements.

IDC thus:

- provides support in terms of shipping (*via* three ships) and air links (*via* three aircrafts) for the purpose of supplying the islands and maintaining rapid communication links
- monitors fishing and reforestation of coconut plantations in the Outer Islands

In fact, **IDC**'s policy is aligned with the strategy of sustainable tourism and development of the Seychelles Islands.

1.4 Architecture and Technical Services

1.4.1 The Project Architect

The Project Architect is Harry **TIRANT**, Oceangate House, Room 104, Victoria, Mahé, Seychelles. He will be responsible for the production of detailed architectural documentation of the Guest Accommodation and Public Spaces of the Silhouette Resort.

1.4.2 The Environmental Engineers

SIGMA - Ove Arup & Partners, Associated Consulting Engineers, of 19 Church Street, Port Louis, Mauritius, have been appointed Environmental Engineers. They will work in association with Dr Alan **SAMSOON** for the sewerage treatment plant. They are familiar with the EIA procedure in vigour in Seychelles, having successfully prepared EIA's for St Anne Resort, Platte Island Resort, Poivre Island Resort and Port Launay.

1.4.3 The Civil & Structural Engineers

They will be appointed in consultation with the Project Architect.

1.4.4 Mechanical & Electrical Engineers

IDC will generally be responsible for the provision of services, namely potable water, electricity, solid waste and sewerage. **IDC** technicians will be responsible for the design, and execution of all mechanical and electrical engineering works.

1.5 Legal, Regulatory and Institutional Framework

1.5.1 Official Presentation

The Project has been officially presented to the National Inter-ministerial Committee (NIC) in 2004.

The Project was approved, subject to:

- submission of a Full EIA Report, according to Terms of Reference by the Pollution Control and Environmental Impacts Division of the Ministry of Environment, and the issue of the EIA Licence
- approval of the Plans by the Planning Authority of the Ministry of Land Use and Habitat

1.5.2 Clearance for Development

Application has been made in conformity with Article 6 of the Town and Country Planning General Development Order (1971).

Notice of Conditional Outline Permission for Development has been granted to the Proponent.

1.5.3 The Scoping Exercise

A scoping exercise was carried out on 28 September 2004 at Division of Environment, Ministry of Environment, in regards to the proposed touristic development at Silhouette Island. Acknowledgement of such and a review of the issues discussed in the course of that meeting are embodied in letter MENR/PCEI/EIA - Silhouette Island Resort dated 27th January 2005 and attached hereto.

1.5.4 The EIA: Class & Terms of Reference

A Full Environmental Impact Assessment has been requested in conformity with the provisions of Clause 5(1) of the Environmental Protection Act {Act 9 of 1994}.

The Terms of Reference for the EIA have been issued per letter ME/PCEI/EIA/EA917/02 of the 29th April 2003. They are attached in Appendix B hereto.

Terms of Reference for a Full EIA as laid down in the **EIA Guidelines** - *Projects for Tourism*[1], have also been consulted.

All the impacts, mitigating measures and other environmental matters addressed at pre-Scoping, and in the official reaction to it being dealt with in the EIA.

[1] **ATLAS des Zones d'Environnement Sensible des Seychelles**. **Gouvernement des Seychelles**. *Ministère des Affaires Étrangères du Plan et de l'Environnement. Division de l'Environnement* 1996. **Coopération Française**.

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Chapter 2: Outline Description of Project and Utilities

2.1 The Tourist Complex

Reference is made to the Site layout of Figure 1.1.1, tabled by the Project Architect and to the Architect's Project Brief attached in Appendix hereto.

2.1.1 Guest Accommodation

The Guest Accommodation in the Silhouette Resort Project adds up to 116 rooms (232 beds) and will comprise the following units:

- 10 individual 'Beach Pool Villas' with one double-bed room
- 6 individual 'Beach Villas with Plunge Pool' with one double-bed room
- 10 individual 'Garden Pool Villas' with one double-bed room
- 52 individual 'Beach Villas' with one double-bed room; 2 pairs of inter-connecting villas
- 26 individual 'Garden Villas' with one double-bed room; 2 pairs of inter-connecting villas
- 2 'Presidential Villas' each with 2 double-bed rooms

Typical floor plans of the aforementioned various individual guests accommodation units are given in the Architect's Project Brief referred to in the foregoing.

In particular, they all contain sanitary equipment (WC, bidet, bathtub, shower and lavabos) that will all be connected to the wastewater collection network.

2.1.2 Guest Facilities

The Guest Facilities are regrouped in a 'Public Area' Complex where the Main Reception Desk and the Front Office are also located. The Guest facilities will include:

- the main restaurant seating 4x68 guests, with its kitchen and sanitary facilities
- the main pool with a timber-decked pool bar, with sanitary facilities for ladies and gentlemen
- the main bar, and the so-called North Beach Bar and South Beach Bar
- the Speciality restaurant
- the Grill
- Conference facilities
- Kids' Club
- the Pizza Garden
- the Tapanyaki Island

The layout of the above Guest Facilities can be seen in Figure 1.1.1 and all the architectural details of the various units are in the Architect's Project Brief.

2.1.3 Guest Health and Sports Facilities

Sports Facilities to the Guests will include:
- an off-site boat house fully equipped for diving and water sports, with showers and toilets,
- 2Nos Tennis courts attendant to a Fitness Centre equipped with modern and fully monitored training equipment
- A Spa

2.1.4 The Staff Quarters and Silhouette IDC Village

The Site Layout for the Junior and Senior Resort Staff quarters, and the Executive Staff quarters, is shown in Figure 2.1.1

Accommodation is provided for:
- 240 junior staff complete with single-bed, WC, showers and Kitchenette
- 8 double-bed and 8 single-bed quarters for Senior Staff, complete with WC and showers
- 8 apartments for Executive Staff, complete with WC and showers

No detail is available concerning the IDC Staff Relocation scheme, which as mentioned in the foregoing, remains an internal IDC issue.

2.1.5 Resort Storage & Technical Infra-structure Complex

For the proper operation of the Tourist Complex and the Silhouette Village, storage and technical workshops will be provided in a Technical Complex. No details are available in the context of this EIA, but the Back-of-House facilities, should comprise the following, fully connected to the sewerage collector network:
- Storage Facilities
- Repairs & Maintenance Workshops
- Laundry & Housekeeping

2.2 Utilities

The utilities scheduled in support of the proposed Silhouette Island Resort and associated Staff Village and IDC Staff Village activity will be under the responsibility of the IDC and will include the following:

2.2.1 A Sewerage System

2.2.1.1 Sewer Collection and Type of Treatment

The Sewerage System will comprise:
- Two separate collector networks, one for grey water and one for black water complete with manholes, buffering septic tanks and lift stations
- For black water, an activated sludge treatment to tertiary level, with no provision for Phosphate removal, de-nitrification deemed to be achieved by MBBR's
- For gray water, a treatment to tertiary level *via* MBBRs

2.2.1.2 Location of Sewer Treatment Plant

The sewer treatment plant will be located as indicated in Figure 2.2.1

No details of network layout of the collector networks (or networks), of lifting stations, connection manholes, buffering tanks etc are available. But the collector network is deemed to serve:

- the Guest accommodation units and all the aforementioned components of the Guest Facilities and the Public Area
- the Administrative Building
- the Junior, Senior and Executive Staff quarters
- the IDC Village
- the filter backwash from the fresh wate4 plant
- leachate from the waste platform at the incinerator unit

2.2.2 Potable Water Supply

2.2.2.1 Sources of Supply

Potable water will be supplied:

- During normal rainy season, by tappings from Grande-Rivière at the existing off-take works, and eventually from River Mondon, when the aforesaid catchment flows are sufficiently high to be tapped and to maintain aquatic life downstream of the tappings. IDC will proceed with daily gaugings of the River Mondon flows during the forthcoming S monsoon to decide whether they are worth tapping and mobilising for consumption by Residents, IDC villagers and hotel staff.
- During dry season, when the natural catchment flows of Grande-Rivière and River Mondon are too low, by Modular Reverse Osmosis desalination plant from IDROMAR, Italy, with two modules, each at the nominal rate of 100m^3/d and water storage facilities destined to the guests, IDC villagers and staff

Sea-water will be supplied to the R/O units *via* a series of 4 beach wells on the foreshore, to be located at the Southern end of the Resort, according to the IDC Brief on water supply to the Project, attached in appendix hereto.

2.2.2.2 Site Location of Project Water Works

The location of the Reverse Osmosis Plant, and of the plant for filtration, sterilisation and storage of Grande Rivière waters is shown in Figure 2.2.1

The location of the beach wells for supply of sea water to the R/O units is to be identified.

The brine will be rejected at sea at the far southern end of the IDC Village, also according to aforesaid IDC brief.

2.2.3 Electricity Supply

Electricity supply to the guest, staff and residents will be a conventional LT system comprising:
- 4 Nos 725kVA diesel-powered CATERPILLAR units in sequential link and sound attenuating enclosures
- Control switch gear
- Individual day tank

2.2.3.1 Location of Diesel Power Plant

The location of the new Power Station and presumable diesel storage tank is indicated in Figure 2.2.1.

2.2.3.2 Diesel Supply and Storage

A 250m^3 bulk diesel tank built on a reinforced concrete bunded area fitted with a sump and of containing capacity 10% in excess of the 275m^3.

Diesel will be pumped from the IDC supply ship to the bulk storage at the Power Plant *via* a pipeline to API or other acceptable standard, scheduled to run from the landing station and inland towards the main diesel storage.

2.2.4 Solid Waste Disposal

Solid waste produced over the island will be disposed of as follows:
- sorting out at source into combustible and non-combustible (metal, glass) waste
- collection in bins from various sources
- incineration of combustible waste at the incinerator plant to be constructed
- compaction of non-combustible metal waste prior to hauling back to Mahé for disposal
- collection of hydrocarbon wastes for safe disposal
- burying of incinerator ash

2.3 Landscaping works: fresh water pond

No details, except the emplacement and extent of the fresh water pond to be implemented in lieu of the so-called 'farm pond' are available.

In particular, no details have been tabled of the apportionment of Grande-Rivière waters between:
- its present exit to sea
- the intended water feature pond that will need to be supplied to cancel seepage, infiltration and evaporation losses
- the potable water supply of the Resort and Village complexes

2.4 Alternative to the Project

No alternative exists to the project when it is taken in its entirety. The alternative would therefore be a do-nothing policy.

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Chapter 3: Initial State of Land Environment

3.1 The Project Site

3.1.1 The Silhouette Resort Site Location

The project site is located at Anse La Passe, on the east coast of Silhouette Island, as shown in Figure 1.1.1.

Inasmuch as the Silhouette Resort is concerned, the project layout plan fits in an area already deeply modified from its original state by the presence of:

- the bungalows of Silhouette Island Lodges
- parts of the **IDC** settlement, namely the school, teachers residences, playground
- derelict pig and chicken farming activity

Alain **SAVY** has plotted these various buildings on his topography map, as pointed out in the foregoing.

Since the DAUBAN Grande Case is to be rehabilitated under the Silhouette Resort Project, it should normally be part of the surveyed Project Site. However no survey has been carried out to date.

3.1.2 Site Description

The general appearance of the Site of Figure 2.1.1 is that it is almost a flat plain except for marshes carved into it by:

- natural meanders of Grande Rivière on its way to sea and behaving like a marsh when its mouth is sealed by tidal (and wave driven) movements of sand
- the so-called farm marsh, which is also supplied with water via the farm channel from Grande Rivière

The La Passe marshes play an important role in the ecology of Silhouette and they will be described in detail hereunder.

Vegetation is clearly influenced by the presence of man. In fact the Site has been heavily deforested. Its floral status will be discussed below.

The DAUBAN Grande Case is a magnificent specimen of a case créole and not far from it are:

- the Tortoise Research Centre animated by Ron GERLACH and his team;
- the DAUBAN marsh near the DAUBAN Family Mausoleum (bearing a striking resemblance to La Madeleine Church facade in Paris), not related to the Grande-Rivière marshes, but nevertheless one of the La Passe marshes

3.1.3 Site Geomorphology

The Anse La Passe Site is made up of about 11ha of flat dunar sand formation at the bottom of steep granite formations rising to 621m AMSL at Mont Pot-à-Eau. The sand formation is bounded by a fairly linear coastline of sandy beach facing a shallow fringing reef flat over more than 2km, with a width between 300 and 450, bordered seaward by breakers opened at three passes, La Passe, Passe Mince and an unnamed pass.

The coastline at places displays signs of erosion.

3.1.4 Topography

Information in complement of the Ordinance Survey map and concerning that portion of the Anse La Passe settlement earmarked for the implement of the new 116-key Resort, has been compiled by Alain **SAVY** sworn land surveyor, and is reproduced in Figure 3.1.4.1.

According to M Alain **SAVY**:

- The problem encountered by the Topographers whilst working on Silhouette is that there are only two survey control points on the island and neither has been levelled. As such there are no benchmarks available to tie in to MSL or CD.
- The only organisation that could assist is the Brigade Hydrographique des Seychelles who could place tide gauges on Silhouette and thereafter transfer the levels to a land benchmark from which the topographer could then tie in his survey and determine the correlation between our levels and MSL or CD. Once this is obtained the correction could be applied to all levels on the database the whole model re-contoured at the interval of 500mm.
- This entails additional survey work and time to achieve those results but it is possible.

3.2 Climatic Characteristics of Site

3.2.1 Wind Regimes

Wind measurements are not made systematically at Silhouette Island.

The Site is exposed to the sea, inasmuch as waves are concerned, and wind data may be of general relevance to the Project. To that effect, *Voluntary Observing Ship* (VOS) wind data obtained from **SADCO**[2] are proposed. The data set covers 0º to 10º S and 50º to 60º E for the period 1960-1992.

The seasonal and annual wind climate may be summarised as follows:

SEASON	PREDOMINANT DIRECTION	MEDIAN SPEED	SPEED @ 10% EXCEEDANCE
Winter (June-August)	72% SE-S	7.5 m/s	12.5 m/s
Spring (September-November)	60% SE-S	5 m/s	10.0 m/s
Summer (December-February)	42% NNW-NNE	4.0 m/s	9.0 m/s
Autumn (March-May)	Less unidirectional	3.0 m/s	7.5 m/s

[2] **SOUTH AFRICAN CENTER for OCEANOGRAPHY**. See **SCHNEID ISRAELITE & PARTNERS**: *Frégate Island Harbour Proposal*. February **1995**.

Continuous recordings of wind data for one complete year at the Airport (amplitude and direction sampled very 15m) have been communicated on the 18th March, unfortunately of 'hard support'.

Although Silhouette is quite remote, Anse La Passe and the Airport are likewise facing E generally, and backed by rising slopes. The purpose of the data would be to simulate with the US EPA ASCT 3 numerical model, the atmospheric dispersion and concentrations of gaseous effluents from the incinerator as well as from the diesel-powered generating sets. This to make up, to a first approximation, the absence of HVAS analysis equipment on Silhouette and probably in Mahé.

3.2.2 Rainfall Regime

Monthly rainfall totals have been gauged at La Passe for the last three years, and the data entered in Table 3.2.2.1 below has been communicated by Ron **GERLACH**.

Table 3.2.2.1: Monthly Precipitation at La Passe for 2002, 2003 and 2004.

Season	Months	2002	2003	2004
	Dec	249.5	541.0	554.0
Summer	Jan	610.0	422.5	523.5
	Feb	365.0	160.0	271.0
	Mar	253.5	81.5	227.5
Autumn	Apr	179.5	298.0	196.5
	May	49.5	281.0	71.0
	Jun	30.0	129.0	72.0
Winter	Jul	12.0	322.0	27.0
	Aug	35.5	16.0	51.5
	Sep	303.0	19.0	99.0
Spring	Oct	192.5	247.5	274.0
	Nov	142.0	65.0	304.0
	TOTAL	2 422.0	2 582.5	2 671.0

The data displays a certain amount of variability, but assuming the gaugings are correct, the winter months (SE monsoon regime) are certainly the driest.

Unfortunately data concerning the number of rainy days, the duration/height of precipitation is not available. These would have allowed a numerical approximation of flows generated by the catchment of Grande-Rivière, so vital for the maintaining of ecology.

3.2.3 Temperature Regime

Monthly means have been gauged at La Passe for the last three years, and the data entered in Table 3.2.3.1 below communicated by Ron **GERLACH**.

Table 3.2.3.1: Monthly Temperature averages at La Passe for 2002, 2003 and 2004.

Season	Months	2002	2003	2004
	Dec	26.6	25.9	26.5
Summer	Jan	26.6	26.2	26.4
	Feb	27.1	27.3	26.3
	Mar	27.4	27.7	26.9
Autumn	Apr	27.9	27.5	27.1
	May	27.2	27.6	27.2
	Jun	11.6*	26.5	25.7
Winter	Jul	18.1*	25.4	25.0
	Aug	25.4	25.5	25.8
	Sep	21.7*	26.3	25.8
Spring	Oct	26.7	26.5	25.8
	Nov	26.5	26.4	26.9

Note*: it would seem that the 2002 data carry some discrepancies.

3.3 Anse La Passe Site Hydrology

Anse La Passe is crossed by Grande Rivière on its way to sea, as it lies at the bottom of the river catchment area.

There is no systematic gauging of the natural flows of the river, apart from data concerning diverted in pipes for human consumption measure by Ron **GERLACH** and also by the Public Utilities Corporation (PUC) of Seychelles, in January 2004.

According to the PUC survey, the flow in the supply pipe off the off-take weir across Grande Rivière, averaged ~ 35m^3/h over a sampling period of 10h.

This value certainly cannot be extrapolated beyond the wet summer months, with reference to Table 3.2.2.1 above. What is basically missing is the systematic daily gauging that would best describe the behaviour of the catchment over a whole seasonal cycle.

The Grande Rivière catchment response to rainfall is rapidly reviewed hereunder using numerical modeling and standard rainfall intensity/ frequency curves for Seychelles.

3.3.1 Grande Rivière Catchment

Topographical details of the catchment have been borrowed from the Silhouette Ordinance Survey Map. It is shown in Figure 3.3.1.1.

3.3.2 Numerical Flood Flow Simulations

Details of the computation are attached in Appendix A hereto.

What is remarkable, and expected, is that the concentration times and flood duration times are very short. Thus for a rainfall 1 h duration, with an intensity/frequency of occurrence typical of Seychelles, the following results have been obtained for various return periods:

Table 3.3.2.1: Peak Flows of Grande Rivière for typical Seychelles rainfall characteristics

Return Period	2 years	10 years	25 years	50 years
Peak Flow	3.1 m^3/s	15.8 m^3/s	25.5 m^3/s	32.7 m^3/s
Concentration time	< 10 min	< 10 min	< 10 min	< 10 min

The time-evolution of flows (hydrographs) induced by a 1h rainfall of intensity depending on return periods is illustrated in Figure 3.3.2.1. It is seen therein that the 'die-off' time is relatively short.

Direct consequences are that the flows are for their major parts, lost to nature (percolation to water table, direct evacuation to sea, etc,) without being harnessed for future uses (potable consumption and irrigation).

3.3.3 Water Quality

The report submitted on the water quality on Silhouette Island[3] is, unfortunately not conclusive.

3.4 Flora of the Project Site

3.4.1 Floral Diversity and Sensitivity

Whereas the forests of Silhouette Island are the most intact of all the Seychelles Group, generally, the floral aspect of the La Passe Site bears the signs of influence of human activities and must have lost virtually all of its original vegetal cover. The Site is, nowadays, inhabited only by the small **IDC** settlement and the vegetal cover is profoundly marked by the presence of:

- the Settlement buildings (school, residential plots, ...)
- the Silhouette Island Lodge
- the derelict chicken and pig farming activity
- farming plots with various plantations of food crops and fruits

No detailed floral survey has been carried out, but in the course of the visit to Site, the following tall canopy species have been identified.

- filao (*Casuarina equisetifolia*),
- takamaka (*Calophyllum inophyllum*)
- badamier (*Terminalia catappa*)
- Laffouche (*Ficus* spp.)
- Calice di pape (*Tabebuia pallida*)

[3] Sangeeta **ATHWAL**: An Investigation into the Water Quality on Silhouette Island.

Trees observed include, but may not necessarily be limited to:
- Pyé Koko (*Cocus nucifera*)
- lattanien, of which endemic species lattanien lat (*Verschaffeltia splendida*) and lattanien fey (*Verschaffeltia borsigianum*)
- palm trees, of which numerous varieties
- zamalac (*Syzigium* spp.)
- bwa-casan (*Barrintonia asiatica*)

More specific reference is made by Ron **GERLACH** to zones extending above the flat coastal plains of the Site.

Between the 15 and 30mAMSL contours, is to be found "mixed coastal vegetation", a mixture of agricultural and introduced tree and plant species.

R. **GERLACH** considers that the aforesaid 'mixed coastal vegetation' zone would act as a barrier between the generators and the secondary forest above the 30-m contour[4].

The constituents of the mixed coastal flora are:
- Bananas (*Musa* sp.)
- Guava (*Psidium guajava* and *P. littorale*)
- Papaya (*Papaga Carica*)
- Cinnamon (*Cinnamomum zeylanicum*)
- Manioc (*Manihot esculenta*)
- Coconut (*Cocos nucifera*)
- Albizzia (*Paraserianttthus falcataria*)
- Pinapple (*Ananas comosus*)
- Badamier (*Terminalia catappa*)
- Cashew (*Anacardium occidenta*le)
- Mango (*Mangifera indica*)

Above the 30m contour the vegetation is secondary forest but contains important stands of endemic plants as well as most of the above plants:
- Takamaka (*Callophylum inophyllum*)
- Moirinda (*Morinda citrifolia*)
- Latanier millepattes (*Nephrosperma vanhoutteanum*)
- Latanier feuille (*Phoenicophorium borsigianum*)
- Bois dur blanc (*Tarenna sechellensis*)
- Bois dur (*Canthium bibractiatum*)

Typical vegetal cover to the coastal strip along the sand dune or back beach will comprise of the following species:
- *Scaveola sericea*, "Veloutyé" in Vernacular, growing in thickets on the coastal dune
- *Tournefortia argentea*, "Veloutyé Blanc" in Vernacular
- *Ipomea pes-caprae*, "Batatran" in Vernacular, a creeper
- *Sophora tormentosa*, "Bwa chapelet" in Vernacular

[4] This is purely subjective. And it is precisely to account for the presence of such typical flora that it would be interesting to simulate the atmospheric dispersion of pollutants such as NOx, SOx, etc., usually responsible for 'acidification of the atmosphere. Still, the response of endemic flora and fauna such as to be found in Silhouette, to the emission of these gases, is probably not known and should be the object of monitoring.

These dune vegetal covers are propitious for marine turtle habitats and essential for the protection of the back-beach.

Ron **GERLACH**[5] has underlined the existence of *Hevea brasiliensis* (rubber trees) in the vicinity of La Passe, a type of tree whose very open canopy leaves little or no protection to ground layers leaving them exposed to the heating and drying effects of sun and wind. He suggests that *Terminalia catappa* (badamier) be planted instead to provide ideal growing conditions for and allow the reafforestation with rare native lowland species such as *Mimusops sechellarum*, *Barringtonia asiatica*, *Heriterea lottoralis*, *Hernandia nympheapholia*, *Hibiscus tiliaceus*, *Thespesia populnaea* and *Rothmannia annae* (present on Silhouette until 1909).

3.4.2 Floral Species to be protected

The back-beach vegetation and the endemic flora inventoried above should be preserved.

3.5 Fauna of the Project Site

3.5.1 Faunal Diversity and Sensitivity

Faunal diversity on Silhouette is quite remarkable. It includes:
- Invertebrates of which extensive surveys have been carried out between 1997 and 2004.
- Vertebrates (Amphibia, Reptiles, Mammals, Birds)

The faunal population of the La Passe Site is reviewed hereunder.

3.5.1.1 Land Birds

The avifauna of Silhouette is relatively low in species diversity. None of the endangered birds of Seychelles are definitely known to occur on the island. Despite this the bird life is of interest, due primarily to the importance of indigenous birds. Thus Silhouette hosts in abundance the following land-birds:
- Seychelles kestrels (*Falco aerea*)
- Seychelles Bulbuls (*Hypsipetes crassirostris*)
- Seychelles Sunbirds (*Nectarinia dussumieri*)
- Seychelles Blue pigeons (*Alectroenas pulcherrima*)
- Moorhens (*Gallinula chloropus*) to be found in the Main marsh
- Black crowned night herons (*Nycticorax nycticorax*)

These species may most probably be encountered on the sandy plain of Anse La Passe behind the littoral zones. There the following introduced land-bird species are also to be found:
- Indian maynah (*Acridoteres tristis*), often blamed to be predators and responsible for the decline of indigenous land-bird populations, although on Silhouette they do not appear to be a cause for concern
- Tourtrel Koko, "tourterelle striée" (*Geopelia striata*) very common

[5] The Management and Conservation of the La Passe Marsh. Silhouette.

- cardinal or Magagascar fody (*Foudia madagascariensis*) very common
- Madagascar turtle dove (*Streptopelia picturata*) that appear to be the hybrid form *S.p. picturata x rosea*, the *S.p picturata* having seemingly displaced the endemic *S.p. rosea*; there is no evidence that thus has any effect on the ecology of the sub-species and the turtle dove can now be considered as an indigenous taxon, not threatened on Silhouette
- Feral pigeon (*Columba livia*) very common at La Passe, and which do not seem to have interfered with any indigenous species in Mahé for example, but which nevertheless should be monitored

It is worth mentioning the introduced Barn owl (*Tyto alba*) of which there is a resident population on Silhouette, grouping only a few birds on as many as 10 territories, amongst which Anse La Passe does not figure.

3.5.1.2 Sea Birds

The following birds can be encountered and identified on the littoral strips of Silhouette:

- Payenke, or yellow-bill "paille-en-queue" (*Phaeton lepturus*)
- Green-back herons (*Butoroides striatus degens*)
- Fairy terns (*Gygnis alba*) breed in low numbers and most of the other terns occur as non-breeding seasonal visitors
- Grey heron (*Ardea cierea*)

3.5.1.3 Invertebrates

Extensive surveys of Invertebrates have been carried out between 1997 and 2004. Invertebrates found on Silhouette include:

- **Nemertines**, with the terrestrial nemertine *Geonemertes arbicola* endemic to Silhouette
- **Annelids**: the leeches are represented in particular by two Silhouette endemic species, *Idiobdella seychellensis* and *I. daubani*, seemingly abundant in the damper forests
- **Terrestrial Molluscs** of which Silhouette supports a greater number than any other island in the Seychelles. It is worth mentioning that *Pilula mahesiana* and *Imperturbatia perelegans* are uncommon and that *Edentuliona moreleti* and an undescribed spocies of *Imperturbatia* have not been recorded since 1972, but studies on this group are apparently under way
- **Arachnida**, with 41 species of spiders recorded, but due to the lack of extensive surveys of this group in Seychelles, it is not possible to evoke endemism. Several species of giant predatory mite *Holothyrus* spp are endemic to Silhouette. And only one arachnid is known to be rare in Seychelles: it is the small endemic scorpion *Lychas braueri* that has only been recorded from Silhouette in recent years.
- **Myriapoda**, of which the distinctive species of chilopod, the giant centipede *Scolopendra subspinipes* occurs in coastal areas, and most probably at Anse La Passe, and is not menaced. The giant millipede *Scaphiostrepsis seychellarum* is also very common in forest areas. The pill millipede *Sphaeroterium forcipatum*, is not uncommon in the montane forest of Silhouette, which can be considered as the stronghold of the species.
- **Insects**: the insect fauna of Silhouette contains many uncommon to rare species and one rare species, endemic to Silhouette is the "stick insect" *Carausius scotti*, that depends upon the birds nest fen, *Asplenium nidus*, for its dietary requirements. Numerous specimens of the species, believed to be extinct in 1990, have been inventoried since then and the stick insect is seemingly not in danger.

3.5.1.4 Vertebrates

- **Amphibia**: the amphibian fauna of Silhouette is of particular importance, as the island hosts 9 of the 11 species found in Seychelles, 8 of which are endemic to Silhouette.
  - **Caecilians**: 4 caecilian species are recorded from Silhouette, rarely seen and with very little knowledge of their status. *Grandinsonia alternans* is common at places other than La Passe.
  - **Frogs**. *Ptychadena mascariensis* occurs in all the marshes around the coast, including those of Anse La Passe, and they are fairly common. *Nesomantis thomasseti* is rare on Silhouette (still rarer on Mahé), but no accurate census has been made

- **Reptiles**: Silhouette hosts 15 of the 17 terrestrial and fresh water reptiles of Seychelles
  - **Chameleon**: the tiger chamaleon *Chameleo tigris* is common in forest areas and not endangered
  - **Geckos**. The introduced Pacific house gecko *Gehyra multilata*, will occur commonly only in houses of settlements, and therefore in those on Anse La Passe. The bronze house gecko, *Ailuronyx sechellensis* is rare in Silhouette: it was even believed extinct there until its relocation in 1990. Ron **GERLACH** has identified the presence of 3 specimen at La Passe.
  - **Snakes**. The burrowing blind snake *Ramphotyphlos braminus* is likely to have been introduced, around La Passe but it apparently has not been recorded recently. No conservation measures are required for the widespread Seychelles wolf snake *Lycognathus seychellensis*. The Seychelles house snake *Lamprophis geometricus* is rarely encountered but data concerning it is rather too scarce to assess necessity for conservation measures.

  - **Tortoises**. Aldabra giant tortoise *Dipsochelis dussumieri* are conserved at La Passe, where they are the object of observation, monitoring and protected reproduction. Recently two living specimens of *Dipsochelis hololissa* have been discovered in the gardens of a hotel in Seychelles. The Nature Protection Trust of Seychelles envisaged captive breeding programme for the species with tha iam of reintroducing them to Silhouette Island.

  - **Turtles**. The hawksbill *Eretmocherlys imbricata* has been reported to nest on Silhouette beaches; 25 females used these beaches for nesting every year from 1980 to 1983[6]. The green turtle has not been observed on Silhouette since the early 1900's.

3.5.1.5 Mammals

This group is represented in Silhouette by the Seychelles sheath-tailed bat, *Coleura seychellensis silhouettae*. Ron **GERLACH** reports that a very important roost has been identified above the Grande Case at La Passe. This roost is of major conservation importance. Whereas the Oxford University Silhouette Expedition 1990 failed to locate any roosts around Mt Dauban, Mt Pot-à-Eau and at Gratte-Fesse.

[6] Dr Jane A. **MORTIMER** 1984: *Marine Turtles in the Republic of Seychelles*. **IUCN**.

3.6 Fauna and Flora of Wetlands and Marshes

The wetlands and marshes play a particularly important ecological role in Seychelles and those that occur at Anse La Passe deserve particular attention.

3.6.1 Marsh Characteristics

Reference is made to Figure 3.6.1.1, the following distinct marshes can be identified, namely:

- the DAUBAN tomb marsh, 190 m^2, with its own water supply sources;
- the IDC guest house channel, carrying stagnant water, 190 m^2;
- the main marsh, 300 m^2, forms part of the estuary of Grande-Rivière;
- the farm marsh 170 m^2, supplied off Grande-Rivière;
- the reed pool 15 m^2

3.6.2 Marsh Habitats

The habitats identified within the aforesaid marshes are:

- Mangroves, predominantly *Rhizophora mucronata*, *Acrostichum aureum* and *Derris trifoliata* lining the Main Marsh
- Reeds, *Typha javanica* in small beds at the extremities of streams
- Mud deposits, with less than 5% under vegetal cover
- Free-surface water, with no overhanging vegetation.

3.6.3 Marsh Water Supply

The La Passe Main Marsh in fact forms part of the estuarine meanders of Grande Rivière through the sandy coastal plains.

Its supply from the river is perforce whatever is left downstream of potable and irrigation water diversions. In fact, agreement must be reached on what flow levels would be most appropriate for:

- the effective maintaining of aquatic ecology in the marshes;
- the making good of evaporation and seepage losses to water table

Ron **GERLACH** has communicated the following data:

Table 3.6.3.1: Water supply from Grande-Rivière to Main Marsh

Consumer Zone	Flow Rates (ℓ/s)	
	July/August	December
To Main Marsh	0.5	41
Main Marsh losses	0.5	49.1

Evaporation losses assuming an annual average of 7mm/d, would amount to about 0.3 ℓ/s.

Renewal rate to ensure good quality of marsh water, can be estimated at 4.7 ℓ/s, assuming renewal of the marsh contents (~500m^3) once a day.

So that any diversion weir across Grande Rivière should allow a systematic downstream flow of not less than 5 ℓ/s TO BE CONFIRMED by RON **GERLACH**.

3.6.4 Marsh Fauna

J. **GERLACH** carried out the marsh fauna survey in December 1993 and the count of each species per m^2 is reproduced in Table 3.6.4.1 hereunder.

3.6.4.1 Silhouette Terrapins

To the above marsh fauna must be added the Silhouette endemic terrapin *Pelusios castanoides*, not common, to be found at La Passe in the fresh water marshes. It must be noted that *P. subniger parietalis* has recently been reintroduced in Anse Grande-Barbe.

Terrapin specimens are considered to be very rare on all the Seychelles Islands, their populations declining as the marshy habitats they require are drained. Their conservation on Silhouette is of great ecological importance.

3.6.4.2 Mosquitoes

Mosquitoes have not been the objects of a specific study in Silhouette Island. However, their presence in conspicuous. Referring to previous cases[7], the genera to be found would be:

- *Aedes albopicus* whose larvae develop in small natural habitats like, *inter alia*: Hollow tree trunks, bamboo, sheathing leaves axillae, empty coconut shells; they are also found in artificial habitats made up of empty bottles, tins, cans, old tires etc and similar objects that have been dumped. The eggs laid by these species have a considerable lifetime, being able to survive in dry conditions for weeks if not months. Larvae will live in saline waters, in crab holes, or in other humid parts.
- *Culex pipiens quinquefasciatus*: the *Culex* larvae develop mainly in perennial or temporary ponds.

[7] **SIGMA - Ove Arup & Partners** and **CAREX Environnement**: Entomological Survey at Port Launay. May 1999.

Table 3.6.4.1: Species Counted (No/m²) and observed in December 1993 in the La Passe marshes

GROUP	*Species*	**Counts** (No/m²) **in Anse La Passe Marshes**						
		Dauban	Main	Main (back)	Guest House	Farm (flooded)	Farm (mud)	Farm (channel
Molluscs	bivalves		60	670				
	Syncera nitida			10				
	Terebralia (mangrove)		1 160	10		400		
	Melanoides (fresh water)	30	observed			200	240	560
	Neritilia (fresh water)		observed					
Echinoderms	Ophiuroidea		observed					
	Holothuria		observed					
Crustaceans	Malacostraca		observed					
	Sesarma			observed		observed	observed	
	Cardisoma						observed	
	Uca annulipes							
	Amphipoda	10						
	Isopoda		observed	530				
Insects	Diptera	70						
	Mosquito	20						600
Fish	*Muglidae* spp (mullet)		0.011	0.003				
	Lutjianus gibbus (snappers)		0.071	0.003				
	Sphyraena sp (barracuda)		observed	observed				
	Monodactylus (sap-sap)			0.037				
	Ophicara (goby)		0.014	observed				
	Periopthalmus (mudskippers)	observed	observed	observed	observed	observed	observed	
	Oreochromis (tilapia)		0.149	0.033	observed			
	Fry		9.429	0.333				
Amphibians	Ptychadena							300

It must be noted that:

1. Upon the occurrence of marsh overflowing conditions, the main marsh act as an open channel flowing freely to the sea until such times as tidal sans movements seal it up again. When open channel flow conditions, fish will move to and from the sea;
2. The counts and observations of Table 3.6.2.1 are already more than 10 years old, but it will be taken here that they retain their entire initial meanings.

3.7 Closure

From the foregoing, it can be concluded that, from the point of view of terrestrial ecology, the existing natural environment, has already undergone profound and irreversible modifications since the early settlements on the Island.

Therefore, the implementation of the Hotel and ancillary buildings, at construction and operation phases, will not impact the terrestrial environment if:

- endangered or rare species floral and faunal and their habitats, namely the wetlands and marshes of Anse La Passe are protected
- the hotel and ancillary activities are conceived to eliminate biological, physical and chemical pollution of the environment

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Chapter 4: Initial State of Marine Environment

4.1 Introduction

Whereas, according to the NPTS, the terrestrial environment of Silhouette has been receiving no official protection, the waters around Silhouette have been protected since 1987 by the creation of the Silhouette Marine National Park

The Anse La Passe lagoon is therefore protected by the 1987 Marine Park status.

The geophysical base-line data of the La Passe lagoon have been acquired during the mission at Silhouette Island between 25 September and 2 October 2004. Data acquired then are *inter alia*:

- bathymetry
- beach slopes
- thickness of seabed sediment cover
- wave regimes

The following data still needs to be acquired:

- the beach sediment granulometry, which as to be determined in Seychelles, importation of beach sediments to Mauritius foe analysis being strictly regulated
- benthic and ichthyologic populations of La Passe lagoon, necessitating marine biologist specialist intervention, not in the terms of reference of the Consultancy Services for the EIA preparation

The marine base-line data acquisition has been limited to geophysical and hydrodynamic data, for which the Consultants are competent, biological diversity and sensitivity being excluded as not forming part of the Terms of Reference for the EIA. The data acquisition exercise has been judged necessary in view of possible land built environment / marine environment interactions that could lead to:

- enhanced beach erosion resulting from insufficiency of set-backs of Resort Buildings agreed by the Authorities
- exposure of Resort Buildings to wave attacks and possible increased vulnerability necessitating the erection of beach walls
- induced erosion by sea-wall effects

At present EIA level, no detailed lagoon works have been defined and submitted to the Authorities by the Promoters for Administrative Clearance that would be mandatory for such types of Works.

4.2 Bathymetry

The bathymetry map of La Passe lagoon, along 1 800m of sea frontage is given in Figure 4.2.1. All levels are referred to 1.01m above Chart Datum (Lowest Astronomic Tide). The datum points of reference are indicated in the Figure. They are:

Datum Point	Eastings	Northings	Elevation AMSL
Pier	306110.05	9504099.68	2.25m
Cross	306411.55	9504143.16	3.16m

Bathymetry survey was performed during the last week of September 2004. The tide level at several periods of time was recorded to determine the MSL, with reference to the official tide chart. All survey points have then been reduced to this MSL to generate the bathymetry contour of the lagoon.

On average, under Mean Sea Level conditions, the lagoon over the entire project frontage is relatively shallow, as can be seen in the said Figure 4.2.1.

From the sea bathing experience point of view, only under high tide conditions will the lagoon be satisfactory.

4.3 Lagoon Geomorphology

4.3.1 General observations

The lagoon facing the Silhouette Project Site is over 1 800m long but varies in width between 160 and 200m from the MSL on the shoreline to the fringing reef seaward.

The main geomorphology units encountered are:

- a sand dune formation, extending from the base of the granite formation, carved at two well defined locations by runoff from the granite slopes, and on which the future development will be implemented
- a sand beach with variable slopes, betraying erosion at places, with the back each covered with veloutiers, coconut trees, takamaka and other 'traditional' back beach vegetation of Seychelles
- a shallow lagoon covered a priori with sand *cum* coarse coral debris, with virtually no grass meadows and or coral fields, *i.e.*, apparently, at least, of low ecological sensitivity and diversity

4.3.2 Sedimentology

The sand deposits on the seabed of La Passe lagoon have been studied as part of the investigation programme of the Mission. Thus the thickness of the sediment cover to the seabed has been assessed with a view to estimating availability *in situ* of eventual beach recharge material as well as the best-adapted seabed re-profiling methodology in a strategy of improving the local bathing experience.

4.3.2.1 Thickness of Seabed Sediment Deposits

Using the familiar jetting technique, the thickness of the sediment deposit to the seabed has been determined along 6 observation transects located in Figure 4.3.2.1.1 referred to in the foregoing.

The results of these observations are embodied in the longitudinal sections of Figure 4.3.2.1.2, where the relative shallowness of the deposits can be appreciated.

A direct consequence is that, if required, beach recharge material will have to be found elsewhere, namely by pumping from some conspicuous sand deposits at a few meters depth just of the external slopes of the reef flat.

4.3.2.2 Compact Substratum to Reef Flat

With reference to the jetting technique used, the thickness was measured when the tube had sunk to refuse on a more compact substratum, whose exact nature and characteristics still remain to be confirmed. This could not be done during the mission, as no excavator was available.

Thus the obstacle to deeper penetration of the tube could be:

- either a layer of coarse to very coarse rubble, probably the case when referring to the dredging works carried out to the harbour (to be confirmed, as no EIA documentation for the construction of the harbour was made available)
- or beach rock or coral flagstone

As the EIA for the Harbour Works was not made available to the Consultant, it is recommended to proceed with a few observation pits excavated at low tide within any intended dredging zone. The findings will be essential to the definition and cost estimate of any lagoon improvement works, should such works be given administrative clearance

4.3.2.3 Sediment Grain Size Analysis

This parameter is of importance for assessing:

- beach stability under prevailing wave regime or exposure to wave attacks
- the presence of silt the source of turbid plumes and beach contamination

Analysis of grain size for samples of sediment on the beach and in the near-shore zone however has not been carried out. The initial intention was indeed to grab samples and have them analyse in Mauritius. But importation of samples of minerals is strictly regulated.

It is therefore recommended to have the sediment samples analysed in Seychelles. The Promoter to make provision for sampling and analysis in Seychelles as part of preliminary Site Base-line data acquisition of the Environment Monitoring Plan.

Inasmuch as the presence of fines or the risk of generating turbid plumes during lagoonar works is concerned, one important point must be made. During the jetting experiments, no fines were expelled from the seabed in turbid plumes, which means that fines (silt) were not present to any appreciable extent at least where the jetting was carried out.

As an estimate, the mean grain size diameter, $D_{50\%}$ should be of the order of 300μ, but this will have to be established by analysis.

4.4 Beach Stability Status

Beach stability will depend *inter alia*, upon:
- the average grain size of the beach sediments
- the amplitude of incident waves and their angle of incidence (almost perpendicular as the beach front is almost parallel to the fringing reefs and the reef flat almost of uniform depth to a first approximation)

The functional relationship between grain size and stable beach slopes is expressed in Figure 4.4.1[8], for exposed, moderately protected and protected beaches.

Thus, the relation

$$\mu \in \,]2.50,\, 3.50[\Rightarrow \beta \in \,] 9,\, 11[$$

inferred from the said Figure should be verified for Silhouette.

At Silhouette, the grain size would be on average 300μ and the beach can be considered relatively well protected by the shallow reef flat and beach slopes of the order of 9-10% should be observed. And observations made at Silhouette during the mission there, albeit a very isolated set, more or less confirm the foregoing.

Observation Transect	Average Slope	Convexity
# 01	~ 11%	slightly concave up
# 03	~ 11%	ditto
# 04	~ 10%	ditto

It would be worth while carrying out a detailed analysis of the sediment granulometry from representative samples grabbed withi:
- the beach itself
- the nearshore zone
- the eventual borrow zones off the external slopes

Further N at sections 5 and 6, there is virtually no beach. It will be noted that there, the reef flat is narrower, deeper and the beach is not surprisingly more exposed to wave attacks.

The implications are, inasmuch as the future development is concerned, as in many other places in Seychelles:
- very little beach space at high tide
- possibility of a dynamic wave regime at high tide with waves reaching almost 1m in amplitude, rendering the bathing experience rather more agitated than comfort would require

[8] *Ex* **Oceanographical Engineering**, Prof Robert L. **WIEGEL**.

4.4.1 Possible Resort / Beach Interactions

Although all precautions will be taken to preserve the back beach vegetation, yet, the presence of intensified human activity such as treading on the beach, beach combing etc, could lead to interactions rendering the beach more vulnerable to wave induced erosion of beaches. And the eventual exposure of beach villas to destruction by wave attacks.

In such cases, it is usual to resort to the implementation of beach walls to protect expensive built structures. Beach walls, unfortunately, are wave-reflective structures and will tend to accelerate sediment transits, with pronounced down-drift scouring at wall ends.

4.5 Wave Climate

4.5.1 General Qualitative Observations

At Silhouette, the tide was high in the afternoon on Sunday 26th September. Waves of amplitude of the order of 0.75 to 1m were observed reaching the shoreline with a period of 3 sec; whereas beyond the reef flat waves were estimated at 1.5m amplitude or more, with a period of 10 seconds. The observation point was in front of the first two bungalows of the hotel presently on Silhouette.

This information is insufficient statistically, but it shows that the wave spectrum in the open sea is substantially modified by the fringing reef into a spectrum conditioned by the shallowness of the reef flat.

4.5.2 Wave Data

No wave monitoring is carried at Silhouette Island. To obtain information on the general Wave Climate, it is therefore necessary to turn to **SADCO**[9] for wave data collected by Voluntary Observing Ships (VOS) in the zone extending from 0º to 10ºS and 50º to 60ºE for the period 1960-1992.

Waves generated by the predominant wind-fields can be characterised on aggregate as follows in function of the seasons.

4.5.2.1 Winter Waves

Average wave direction: 75% occurrence from S to SE
Average wave height: 75% occurrence at 1.80m
Maximum wave height: 10% occurrence in excess of 3.0m
Average wave period: 3/4 sec

The impact on Site of the SE Monsoon ("vent d'suète") is indirect, through diffraction around the S tip of Silhouette as the Site is oriented facing due NE.

[9] South African Center for Oceanography. See **SCHNEID, ISRAELITE & Partners**: *Frégate Island Harbour Proposal*. February 1995.

4.5.2.2 Summer Waves

Average wave direction: 45% occurrence from NNW to NNE
Average wave height: 75% occurrence at 1.10m
Maximum wave height: 10% occurrence in excess of 1.9m
Average wave period: 6/8 sec

The impact on Site of the N Monsoon is direct, as the Site is oriented facing due NE.

4.6 Wave Simulations

Waves propagating over the reef flat under spring high tide conditions have been simulated numerically using the bathymetry of the reef flat and the following ocean wave inputs at level of the fringing reefs:

- Direction: due E
- Amplitude: not more than 1.50m
- Period: 4sec

The results are shown in Figure 4.6.1 and it can be seen therein that waves of 1.0m amplitude can indeed reach the shoreline under appropriate high tide conditions. This is the case, in particular just N of the river mouth, precisely where erosion has been most marked and devastating recently.

4.7 Marine Fauna and Flora

4.7.1 Ichthyologic Communities

No systematic survey of the ichthyologic communities has been carried out in the lagoon. Fish, probably *Mulidae* sp., could be observed trapped in the Grande-Rivière Estuary.

4.7.2 Benthic Communities

Concurrently with the bathymetry of the reef flat, the mapping of its grass cover was executed. However no systematic specialised biological survey has been carried out.

4.7.3 Turtles

Silhouette Island is known to be frequented by Hawksbill Turtles *Eretmochelys Imbricata* which nest there.

A turtle frequentation map of Silhouette Island has been requested of Dr **MORTIMER**, but not yet obtained.

4.7.3.1 C.I.T.E.S Convention and Wildlife Protection Regulation

Silhouette Island naturally falls under the provisions of the **C.I.T.E.S.** convention signed by Seychelles 1977.

In 1981, all the turtle species were included in Schedule I of the said convention specifying all the species menaced.

On the 11th July 1994, a new Regulation for the Protection of Wild Animals, therefore concerning turtles, was enacted, fixing at the 11th January 1995 the limit date for liquidation of turtle carcasses stocks. It is accordingly, since then, illegal to disturb, capture, wound, fish, kill, sell, purchase, receive or own any turtle or turtle egg whatsoever.

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ENVIRONMENTAL IMPACT ASSESSMENT

Chapter 5: Project Built Environment

5.1 Local Human Settlement

The local human settlement at Anse La Passe concerns about 130 persons employed under **IDC** contract, in the small local tourism undertaking, the Silhouette Lodges, and in the Tortoise Research Center

The La Passe community life is organised around:

- a school, its sports ground and school staff residences, lying within the Site earmarked for the implementation of the new resort
- a dispensary, a community center, volley-ball pitch and residential units, off the Project Site

5.2 Regional Human Activities

5.2.1 Farming

Poultry and pig farming were once carried out on a relatively large scale at Anse La Passe. Derelict farm buildings still bear testimonial to the pre-1996 period when those farms were still running.

Their demolition will pose the problem of disposal of demolition waste, mainly concrete with metal frames.

5.2.2 Fishing

Fishing seems to be carried out on a small scale ("pêche artisanale") as the presence of deep sea fishing craft was not observed.

5.2.3 Tourism

Tourism, at present, is centered on the Silhouette Island Lodge with its 12 chalets and not more than 30 rooms.

Catamarans have been seen stationed off the reef flat with visitors to Silhouette, its small tourist shop and trekking paths up the granite slopes.

5.3 Local Public Utilities and Infra-structure

5.3.1 Water Supply

Potable water is supplied from a tapping off Grande Rivière, at a dam some 35mAMSL. Off-take rates from Grande Rivière, recorded by J. **GERLACH**[10], are given hereunder.

Table 5.3.1: Uses of Water from Grande-Rivière at Anse La Passe

Consumer Zone	Flow Rates (ℓ/s)	
	July/August	**December**
To storage tanks:	31.5	78
• Potable water	14.4	20
• Irrigation water	16.8	17
To Main Marsh	0.5	41
Main Marsh losses	0.5	49.1

It is obvious that in the dry season, nearly all (99%) the Grande Rivière flows are diverted for human consumption and irrigation. Virtually noting is left for sustaining aquatic life in the Main Marsh.

5.3.1.2 Availability of Water

The quantity of water produced from Grande Rivière apparently suffices for the requirements of the IDC population, although residual flows to the Marsh are insufficient with reference to the foregoing.

The values entered in Table 5.3.1 call for the following remark. Potable water diversions reach a minimum of 14.4 ℓ/s, but it is not specified whether:

- this is a continuous gravity flow from river to the fiber-glass reservoir of capacity of the order of $10m^3$;
- there is overflowing at the reservoir, with overflows returning to the river

This is important. Considering the present **IDC** population, the presence of hotel operators and clients, the entire population supplied off Grande Rivière does not exceed 200 to a reasonable order of magnitude. If the daily *per capita* potable water consumption is set at 250ℓ/d, a daily volume of $50m^3$ would be required to supply the consumers, which is in accordance with the figure of $50m^3$ advanced by **IDC**. This is equivalent to a continuous 24h flow of 0.5ℓ/s.

The flow value 14.4ℓ/s entered in Table 5.3.1 above needs to be correlated to the rainfall regime that has generated it, and generally, the flow estimates must therefore be verified or at least clarified.

If the new resort is implemented, the potable water consumption as established by IDC in the Potable Water Supply brief, will be:

[10] J. **GERLACH**: The Management and Conservation of the La Passe Marsh, Silhouette. Nature Protection Trust of Seychelles.

Consumers	Population	Daily Rate	Daily Volumes
IDC Staff	100	300 ℓ per capita	30 m^3
Resort Guests *cum* Staff		1.5-2.5m^3/room	175-300 m^3
		Daily Total	205-330 m^3

In other words, a net continuous flow of the order of ~4.0 ℓ/s would be sufficient to fulfill the water requirements of the entire La Passe settlement including the new resort.

However, the absence of any trustworthy time recording of the Grande-Rivière flows does not permit to affirm with certitude that the natural flows of Grande Rivière would be sufficient without having to resort to desalination.

At the same time, during heavy rainfalls, and with reference to the foregoing, most of the flows induced by appreciable rainfalls appear to be lost, because of the 'flash' nature of the floods and the absence of regulation works of suitable capacity to cope with the supply of requirements

5.3.2 Sewerage Network

There is no operational sewage network at Silhouette Island.

Residents' premises are probably connected to septic tanks with absorption pits.

5.3.3 Electricity Supply

Electricity is supplied to Silhouette Island residents from a group of 3/150kVA diesel-powered generator sets.

5.3.4 Solid Waste

The solid waste collected is disposed of at an agreed dumping ground.

5.3.5 Communications

5.3.5.1 Sea Links

As stated in the foregoing, La Passe is the only settlement on Silhouette that has a sheltered landing station that has recently been dredged to some -6.0m re MSL. It has the following dimensions:

- Length: 185m
- Width: 60m

The harbour is protected by parallel rubble-mound groynes extending seaward 160m across the lagoon from the shoreline and the entrance channel normally reaches the external slope. However, recent observations show that the entrance channel is being slowly filled by sand deposits originating most certainly from the La Passe reef flat.

This landing station will be the main guest passenger link with Mahé.

5.3.5.2 Air Links

Only helicopter links are operational; there is no landing strip on Silhouette, but a small helipad close to the Silhouette Island Lodge.

5.3.5.3 Road network

An un-surfaced path network exists, inter-connecting the various components of the **IDC** settlement on which a tractor can circulate.

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ENVIRONMENTAL IMPACT ASSESSMENT

Chapter 6: Economic Environment of Project

6.1 Tourism in Seychelles

The context into which the Project is inscribed has been the object of a thorough analysis by HVS International[11], from which the following is largely inspired. Tourism is currently perceived as a vital industry to the Seychelles' economy. It is estimated to supply the largest part of the GNP and has certainly been the major driving force of the national economy for the last 20 years.

6.1.1 Arrival and Tourism Statistics

The Monthly/Annual tourist arrival statistics detailed in Table 6.1.1.1 hereunder may be used to illustrate how tourism evolved in Seychelles from 1990 to-date.

Table 6.1.1.1: Arrivals in Seychelles[12].

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TOTAL	103 770	125 018	145 923	152 129	149 763	153 212	157 093	159 941			
VISITORS		120 716	130 995	130 070	128 258	124 865	130.046	129 762	132 246	122 038	120 765
LEISURE					111 061			116 669	117 103	109 718	108 149
%TOTAL					86.6%			88.6%	88.5%	89.9%	89.6%
Bed Nights	1 048 077	1 146 802	1 270 264	1 339 721	1 346 709	1 298 596	1 352 479	1 349 625	1 375 460	1269 195	1 192 360

The above general arrival statistics, is published by the Management and Information Systems Division, Republic of *Seychelles* (**MISD**)[13] and the Statistical Bulletin[14], like

- leisure/holiday purpose as % of total arrivals registered at Seychelles International Airport
- average length of stay, which ranges between 9 and 11 days from 1998 to 2004
- countries of origin

The statistics of Table 6.1.1.1 call for the following comments:

- the number of tourists in 2003 has been dropping to its 1998 level instead of rising
- the number of bed nights likewise appears to have dropped substantially

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[11] Proposed Resort Hotel, Ile Plate, Seychelles. Feasibility Study and Valuation Report. May 2002. HVS, Singapore.
[12] *Statistical Bulletin*, **Central Bank of Seychelles**, Directorate of Civil Aviation, Seychelles.
[13] **Republic of Seychelles.** *National Income and Expenditure* 1996. The Management and Information Systems Division, 1998 Edition.
[14] **Republic of Seychelles**. *Statistical Bulletin*. **National Accounts**: 1998 No1.

6.1.2 Contributions to Foreign Currency Earnings

Economic Indicators from the **MISD**[15] have been reproduced in Table 6.1.2.1 hereunder to highlight the part played by Tourism in the National Seychelles Economy.

Table 6.1.2.1: Tourism Arrivals and Receipt in Seychelles

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
TOURISM Receipts (x 10^6SR)	466.2	524.5	612.5	583.6	596.2	656.7	662.2	712.4	681.0	
TOURISM Receipts (US$xE+6)	98.0	105.5	121.8	111.0	111.7	115.0	113.0	128.6	126.1	
***Per capita* TOURIST RECEIPT** (SR)	3 862	4 056	4 708	4 549	4 773	5 051	5 094	5 397	5 580	
TOURIST Arrivals (x 1 000)	120.7	131.0	130.1	128.3	124.9	130.1	129.8	132.3	122.1	114.6
Visitor nights (x 1 000)	1 147	1 270	1 334	1 347	1 299	1 353	1 350	1 376	1 269	1 192
Hotel bed occupancy (%)	52.8	57.4	56.3	53.1	52.5	53.0	52.0	51.0	51.0	

A priori, visitor nights after having reached a peak in 2002 are declining rapidly to levels attained in 1996.

This performance of the Tourism Industry must be appreciated in the local economic environment characterised by indicators detailed in Table 6.1.2.2 below.

Table 6.1.2.2: Historic & Forecast Economic Indicators in Seychelles

Economic Indicator	HISTORIC									FORECAST	
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Real GDP % Change	4.90	4.60	5.50	2.90	1.40		1.50				
Govt. Expenditure US$E+6	282	326	369	335	293	278	386	296			
Inflation Rate (%)	-1.10	0.60	2.70	6.30	6.30	6.00	0.50	3.3	5.0		
Exports US$E+6	41.25	69.46	90.01	108.83	129.70	163.0	180.8	225.3			
Imports US$E+6	378.65	340.40	382.90	433.76	341.29	473.8	418.1	419.9			
Budget Deficit (%GDP)*	-9.20	-12.60	-23.70	-12.70	-9.70	-9.40	-16.3	+7.1			
FDI US$E+6	38	53	53	55	24						
Exchange Rate (1US$/SRs)	4.97	5.03	5.26	5.34	5.71	5.86	5.48	5.40	5.50		

The entries of Tables 6.1.2.1 and 6.1.2.2 call for the following comments:

- The FC receipts of Table 6.1.2.1 are related to FC purchases by banks and hotels
- The Budget Deficit estimates and forecasts of Table 6.1.2.2 are those of the IMF and EIU
- The GDP growth of Table 6.1.2.2, presented by the Seychelles Central Bank displays an evident tendency to slow down significantly
- Upon the combined effects of decreasing tourist arrival, visitors nights as from 2003, the contribution of tourism to the Seychelles economy will have a lesser positive impact

6.1.3 National Strategies for Tourism

6.1.3.1 The 1990-1994 National Development Plan

Amongst the strategies of the 1990-1994 National Development Plan[16], the main goal was to continue increasing tourism contributions to the country's foreign exchange earnings, whilst focusing on upper segment tourism. And one of the major sector objectives was *to preserve the*

[15] **Management and Information Systems Division**: *National Income and Expenditure*. **1998 Expenditure**.
[16] **Republic of Seychelles**. *National Development Plan* 1990-1994

unique and exceptional quality of Seychelles tourism product and touristic environment, by controlling the tourism bed count for Mahé, Praslin and La Digue…

The Seychelles Government's accommodation policy for the Tourism Sector then aimed at improving the existing stock of accommodation and to expand the number of beds within a well-defined tourism development timetable. Thus the bed count has evolved to the present state from published statistics reproduced in Table 6.1.3.1.1. It is to be noted that in the latest MISD Statistical Bulletin, Large Hotels, up to 2001 were characterised by ">25 rooms" whereas since then the definition is "> 50 rooms".

Table 6.1.3.1.1: Growth Rate of the Tourism Indicators to Date.

	2000	**2001**	**2002**	**2003**	**2004**
Total Bed count	5 000	4 940		4 930	5 010
Large Hotels (>50 rooms)	2 110	2 030		1 850	1 810
Other Hotels - Mahé	850	870		800	760
Other Hotels - Islands	2 040	2 040		2 280	2 440
Bed Occupancy rates (%)	53%	52%	51%	51%	

The data of Table 6.1.3.1.1 seem to indicate that the bed occupancy shows a tendency to stagnate at the level of 51% in 2002 2003. Further examination of the MISD publications (September 2004) would show that in the first 6 months of 2004, the occupancy in terms of bed-nights in the so-called large hotels in Mahé dropped from 166 700 for the corresponding period in 2003 to 151 100 in 2004. The same drop tendency is observed over the same period for resorts outside Mahé: 201 000 in 2003 against 198 700 in 2004.

6.1.3.2 The 2001-2010 Tourism Master Plan "Vision 21"

"Vision 21", issued early 2002, highlights various constraints currently experienced by the Seychelles Tourism Industry, and makes recommendations for the future growth and development of the industry. Challenges and targets that have been identified in "Vision 21" are reviewed hereunder.

6.1.3.2.1 Challenges in "Vision 21"

The following challenges have been identified and highlighted in "Vision 21":

- The perception of Seychelles as offering limited "value for money" compared to other less expensive destinations, makes the improvement of the quality of tourist facilities and travel packages a high priority
- The improvement of airport infrastructure for international (and eventually domestic) arrivals is likewise a top priority considering that air aces to Seychelles is limited for some existing and potential tourist markets
- The provision of greater diversity of attractions and activities so as to compete more effectively with an increasing number of destinations for a specialised niche market, and to increase revenues from tourism. The promotion of eco-tourism in Seychelles will play a major role in ensuring that sustained tourist development is given high priority

- An acute shortage of qualified and well-trained personnel is currently felt in several areas of the tourist industry. High priority will be given to the difficult task of recruiting and retaining motivated and qualified people in the industry

6.1.3.2.2 Targets in "Vision 21"

The following issues have been targeted in the Seychelles' Tourist Development Plan:

- Tourism should be expanded gradually, with facilities, services and infrastructure being developed to a higher level and more activities made available to tourists
- Tourist markets should be broadened to include more national origins and both general and special-interest tourists; accessibility should be improved to reach more market areas
- Daily expenditure per tourist should be increased through the addition of more value-added tourist facilities in the country, with a view to enhancing economic benefit to the Seychelles
- Tourism should be developed on a sustainable basis and not exceed carrying capacities; the unique land and marine environment and cultural heritage of Seychelles should continue being protected and conserved
- Seychellois should continue being sensitised to the importance of tourism and providing good service standards to tourists, and given opportunities to work in tourism at all levels.

6.1.3.1 Tourism Act - Hotel Investment Promotion Act (IPA) status

As part of the Government policy in promoting the development of the Tourist and Hotel sectors, in order to induce the development of quality hotels, a special ten-year IPA status can be granted to existing and proposed five-star hotels.

6.1.4 "Vision 21" and Growth Predictions

Tourism should be expected to grow within its own Limits of Sustainability, which is often defined with reference to the deterioration of the Environment, but which may also depend upon the human and other resources available.

The Visitor Arrival Targets set out in the 1990-1994 NDP are reproduced hereunder in Table 6.1.4.1, where they are compared with the arrivals actually observed over the same period. Forecasting is obviously a delicate task.

The target forecasts for 1994, recalled in Table 6.1.4.1 hereunder, have never been achieved, even at horizon 1999.

Table 6.1.4.1: Target Forecasts for Tourist Arrivals in the 1990-1994 NDP

	1990	1991	1992	1993	1994
1990-1994 NDP Target forecast	93 407	106 208	114 969	124 023	131 088
Actual Arrivals	103 730	90 050	98 547	116 180	109 901

The new - indicative - targets set out in "Vision 21" are:

Indicative Targets	**Target Horizon: 2010**	**Reference Horizon: 2000**
Total Tourist arrivals	168 000	130 046
Visitors Nights - Total	1 684 4707	1 352 478
Visitors Nights – High Yield	277 580	
Visitors Nights – Low Yield	1 406 890	
Beds – Total	7 100	5 000
Beds – High Yield	1 170	359
Beds – Yearly increase 2001-2005	300 p.a.	---
Beds – Yearly increase 2005 2010	100 p.a.	---
Receipts per night – High Yield	518US$	351US$
Receipts per night – Low Yield	142US$	
Tourist Earnings US$xE+6	344	108.7

Furthermore, the frequently set question of tourist carrying capacity is a very complicated function *inter alia* of:

- Size and composition of the host country population
- Development policy and strategy
- Volume and category of tourists
- Topography and size of the host country
- International and internal accessibility, Infrastructure, etc.
- International events and market demand for the Seychelles Resorts

With reference to Figure 6.1.4.1, the measured growth of tourism seems to have somewhat diverted from the target set out in Vision 21 for 2010, namely 168 000 arrivals. It is true that the Fishermen Cove has been phased out for refurbishment (November 2003 - June 2004) and Barbarons likewise (June 2004 - June 2005). But on average there were 180 more beds available in June 2004 than in June 2003

6.1.4.1 Comparison with Performance of other Beach Destinations

Data available from the World Tourism Organization for a number of Island States in the Caribbean, Indian Ocean and Pacific Ocean, for the years 1990, 1995 and 1997.

In particular, the evolution of tourism in Seychelles may be compared with the evolution observed in Island destinations of similar size (in order of magnitude) as in Table 6.1.4.2.

Table 6.1.4.2: Tourist Arrivals in Various Island States

COUNTRY	**LAND AREA**	**1990**	**1995**	**1997**	**2000**	**2001**	**2002**
Antigua & Barbuda	440 km^2	206 000	212 000	232 000	237 000		
Barbados	431 km^2	432 000	442 000	472 000	545 000	507 000	498 000
Cayman Is.	260 km^2	253 000	361 000	381 000	354 000	334 000	303 000
Curaçao	544 km^2	208 000	232 000	209 000	191 000	205 000	218 000
St Lucia	616 km^2	138 000	230 805	248 000	270 000	250 000	253 000
US Virgin Is.	352 km^2	463 000	454 000	411 000	607 000	592 000	553 000
Maldives	298 km^2	195 000	315 000	366 000	467 000	461 000	485 000
Seychelles	**453 km^2**	**103 770**	**120 716**	**130 070**	**130 000**	**130 000**	**132 000**

The data of Table 6.1.4.2 would suggest that Seychelles, on the basis of direct land area comparison, is about 100 000 tourists late on other destinations of similar sizes. But this is not so straightforward as it should be borne in mind that Seychelles is a collection of islands of various sizes, with widely varying accessibility. The comparison is extended to the host populations, as per Table 6.1.4.3.

Table 6.1.4.3: Population in various Island States[17]

COUNTRY	LAND AREA	1990	1995	1997	2000	2001	2002
Antigua & Barbuda	440 km^2	62 000	63 181	63 739	66 422	66 970	67 448
Barbados	431 km^2	257 000	258 136	258 756	274 540	275 330	276 607
Cayman Is.	260 km^2	27 000	33 625	36 153	34 763	35 227	36 273
Curaçao	544 km^2	198 000	151 448	155 411	150 000	150 000	150 000
St Lucia	616 km^2	151 000	147 250	150 630	156 260	158 178	160 145
US Virgin Is.	352 km^2	110 000	96 900	97 240	120 917	122 211	123 498
Maldives	298 km^2	206 000	261 900	280 391	301 475	310 764	320 165
Seychelles	**453 km^2**	**70 000**	**75 304**	**77 139**	**79 326**	**79 715**	**80 098**

Seychelles in so far as population is concerned, lies between Antigua and US Virgin Islands, where the tourist arrivals are 2 to 3 times more important, but lags significantly behind the Maldives, also an archipelago, where the number of tourists is about 4 times that observed in Seychelles.

If the host populations are also taken into consideration, then another parameter such as the tourist-to-population ratio (ρ), as suggested by **CLEVERDON**[18], may be brought in and this parameter for the same countries entered in Table 6.1.4.3, is given in Table 6.1.4.4. Population is important when hotel staffing is considered.

Table 6.1.4.4: Tourist-to-Population Ratios in various Island States

COUNTRY	LAND AREA	1990	1995	1997	2000	2001	2002
Antigua & Barbuda	440 km^2	3.323	3.555	3.640	3.568		
Barbados	431 km^2	1.681	1.712	1.824	1.985	1 841	1.800
Cayman Is.	260 km^2	9.370	10.852	10.539	10.183	9.482	8.353
Curaçao	544 km^2	1.051	1.532	1.345	1 273	1.367	1 453
St Lucia	616 km^2	0.914	1.567	1.646	1.728	1.581	1.580
US Virgin Is.	352 km^2	4.209	4.685	4.227	5.050	4.844	4.478
Maldives	298 km^2	0.945	1.203	1.305	1.549	1.483	1.515
Seychelles	**453 km^2**	**1.482**	**1.603**	**1.686**	**1.639**	**1.631**	**1 648**

It is tempting to look for a correlation between the Tourist-to-Population ratio and the size of the territory, for island destinations. But Tourist Arrivals in beach destinations depend strongly on many other parameters such as:

- the facility, frequency and cost of access, air or otherwise
- the quality to price ratio

[17] World Facts

[18] **CLEVERDON STEER** Consultants in Travel Tourism and Leisure: *Tourism Development Impact Assessment and Policy Formulation for Mauritius*. **Final Report**. **Vol 1**. July 1992.

- the environmental and ecological value of tourist sites
- the coastal perimeter available for tourism development
- global events, natural, political or otherwise

Just for the sake of illustration, the average Tourist-to-population ratio has been plotted against territorial area for various beach destinations in Figure 6.1.4.1.1.

6.2 The Project and the Tourist Policy of Seychelles

The decision to provide for additional accommodation is clearly spelt out as one of the main objectives of "Vision 21", particularly as the development program will be in focus with the high quality, up-market, environmental-respectful image of the Seychelles destination advocated by the Government of Seychelles.

6.3 Socio-economic Considerations

6.3.1 Economic Considerations

With reference to the paths followed by Island Destinations of similar size and population see § 6.1.4 -, it appears that Seychelles is probably “lagging” by some 30 to 50 000 annual arrivals.

With reference to the international context of Island destinations, a saturation or limiting Tourist-to-Population ratio of 2.0 may be suggested, leaving the Seychelles Tourism Industry in a state of growth/development for some years to come.

With reference to National Economy - see § 6.1.2 -, it appears that an increase of 20 to 30% in the number of tourist arrivals may efficiently contribute towards achieving equilibrium to the Balance of Payment.

The Silhouette Resort Project fits in that context. It will provide 116 rooms at Five-star standard, and under the dynamic management and marketing of the experienced Proponent, will attract between 4 000 and 5 000 additional arrivals in the Upper Segment Category, thereby contributing positively to restore the Balance of Payment.

6.3.2 Employment

Statistics for employment generated by Tourism in Seychelles, are given in Table 6.3.2.1.

Table 6.3.2.1: Statistics of tourism-generated employment (all sectors) in Seychelles

FORMAL EMPLOYMENT IN	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
• Hotels	3 179	3 161	3 388	3 128	3 390	3 816	3 819	3 778	
• Restaurants (autonomous)	458	447	447	509	477	475	530	518	
• Tourism related transport	1 124	1 147	1 131	1 207	1 223	1 467	1 531	1 558	
ARRIVALS	120 716	98 547	116 180	109 901	120 716	130 955	130 070	128 258	124 865
BEDS	4 340	3 880	3 960	4 240	4 340	4 490	4 940	4 780	4 930

In may be useful to separate direct Hotel staff from external Restaurant staff. In comparable Island destinations, the Restaurant personnel would represent about 10% of the Hotel & Restaurant staff.

In Table 6.3.2.1, the "staff-to-bed ratio" tends towards 0.80 in Seychelles.

But this ratio is very much a function of the status of the Hotel. In the case of the Silhouette Resort, the ratio staff to bed ratio announced by the Promoter, is 1:1. On that basis, the new Resort, with 232 beds, should generate employment:

- Directly for at least 232 Hotel staff.
- Indirectly for Tourism-related sectors

6.4 Project Justification

6.4.1 From the Economic Point of View

The socio-economic *space* of Seychelles can easily accommodate the Project. This is borne out of the facts exposed earlier, that:

- The Seychelles Tourism Industry must be maintained in such an expansion phase as to allow the achievement of the 168 000 annual arrivals targeted in "Vision 21" for 2010
- Tourism is vital to Seychelles for solving the Balance of Payments problems and for Foreign Currency earnings
- Even if present (2004: 50%) bed occupancy of existing establishments were to increase by +10%, the additional arrivals would reach about 22 000, meaning additional revenues that would still be insufficient

The new product will, furthermore, consolidate the trend recently set for a new approach to Tourism in Seychelles.

6.4.2 From the Employment Point of View

If the growth of Tourism in Seychelles takes place within sustainability limits, then, potentially, the employment sector should be able to accommodate the Project. The more so that the turnover of the *Seychelles Hotel & Tourism Training Centre* at La Misère, is guaranteed to find challenging activity in upper segment establishments. "Encadrement" by experienced expatriate senior staff may still be required in the catering and technical sectors, but this may only be a short term constraint that formal training of local staff can eventually remove.

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Chapter 7: Detailed and Quantitative Description

7.1 Project Site Location

The site locations of the main project components, namely the Resort itself, and the Staff and Islanders Village are shown in Figure 1.1.1 and Figure 2.1.1.

7.2 Building Site Layout

The Site Layout of all the Resort components is shown in Figure 2.1.1

This figure:
- reproduces the Architect's Ground Floor Plan, or the footprints, of all the buildings forming part of the Resort and object of the present EIA
- shows the set back of the said buildings from the HWM

7.3 Detailed Building Description

7.3.1 The Resort

The buildings forming part of the Resort are all Ground Level buildings according to the plans and elevations issued by the Architect, and attached in appendix hereto. The Architect's brief gives a detailed account of the Resort's components, namely:
- The Guest accommodation units, namely Garden Villas, Garden Pool Villas, Beach Villas, Beach Pool Villas, Beach Villas with Plunge Pool and Presidential Villas, as listed in the foregoing
- The Public Area, comprising *inter alia*:
  - The Main Reception Desk and Administration Unit
  - The Main Restaurant & the Speciality restaurant
  - The Main Bar and North and South Beach Bars
  - The Spa, Fitness Centre & Tennis Courts
  - The Pizza Garden, Grill & Tapanyaki Island
  - The Kids Club
  - The Pool
  - The Conference Room

7.3.2 Back of House Facilities

The buildings forming part of the Resort Back-of-House facilities are under the responsibility of **IDC**.

IDC's brief gives a detailed account of the Resort Back-of-House components, namely:
- The Power Generation Plant
- The Sewage Treatment Plant & Treated Effluent storage
- The R/O desalination plant & Potable Water Storage

7.3.3 The Resort Staff Quarters

The buildings hosting the Junior, Senior and Executive Resort Staff are according to the floor plans issued by IDC.

IDC's brief gives footprints of:
- The residential quarters for the junior staff
- The residential quarters for the senior staff
- The residences of the Executive Staff

7.4 Services and Utilities

7.4.1 Water Supply

7.4.4.1 Water Requirements

The water requirements for the operation of the Resort, its staff as well as the existing IDC settlement are established hereunder.

Table 7.4.4.1: Water Demand and Production Capacity

Consumer Category	Number	Consumption Rate ℓ/day	Daily Volume (m^3)
Guests	232		
Resort Staff	240		
Villagers	100	300	
Laundry		Not stated	
Pool Losses		Not stated	
DAILY DEMAND			**175-300**
10% Network Losses			
DAILY PRODUCTION			**192-330**

7.4.4.2 Water Production and Storage

7.4.4.2.1 Grande Rivière Diversions

The Proponent proposes to erect a new diversion weir across Grande-Rivière at the location of the existing one.

The diversion rules will be such that:
- a circular orifice in the weir shall allow systematic downstream flows for the sustainability of aquatic ecology in the Main Marsh
- an opening at the crest of the weir for the diversion of all flows in excess of the aforesaid downstream allowance

The raw water will be piped to a 34m^3 Braithwaite-type sedimentation tank with baffle to improve the settling rate of SS in the raw river water. After sedimentation, the raw water will flow to a 323m^3 Hydrex Raw water storage unit in waiting for filtration *via* a battery of 2Nos CulliganUF48 water pressure filters. The filtered water will be sterilised using UV or Cl gas obtained in situ by electrolysis of sea water before storage and utilisation.

7.4.4.2.1 Desalination Process

The desalination plant, of the Reverse Osmosis type, from IDROMAR International (Italy), will consist of two 100m^3/day capacity units.

The Reverse Osmosis desalination plant will operate as follows:

- Seawater (35 000mgTDS) will be drawn from four dug wells the location indicated in the layout plan, filtered and treated with an anti-scalant agent before being fed into the R/O unit located as shown in the said plan
- Permeate (236mgTDS/ℓ; 4m^3/h for 24h/day) from the R/O unit and stored for consumption in tanks housed at the service building.
- The Brine (48 905mgTDS/ℓ; 10m^3/h for 24h/day) will be returned to the sea *via* a return line running from the plant to discharge into the lagoon at the location shown.
- Backwash from filters will be returned to the Brine reject tank to be discharged at sea

7.4.4.2.3 Water Storage Facility

A freshwater storage tank of 1 000m^3 aggregate capacity will be installed to ensure a 4-day supply.

7.4.5 Sewerage System

7.4.5.1 Sources and Production Rates

The Promoter has stated his wish to implement a dual sewerage system, namely a gray water system and a black water system. The sources and production rates.

Table 7.4.5.1.1: Domestic Wastewater Sources and Production Rates

	GRAY WATER		**BLACK WATER**	
Waste Water Sources	**Daily Volume** (m^3)	**Flow Rates** (m^3/h)	**Daily Volume** (m^3)	**Flow Rates** (m^3/h)
Guests Complex				
Resort Staff				
IDC Residents				
PRODUCTION	**165**	**6.9**	**55**	**2.3**
Peak Coefficient	**3**		**3**	

7.4.5.2 Sewerage Treatment Process

The Treatment Process submitted by the selected supplier ISEA S.p.a (Italy) is reproduced in *toto in* Appendix hereto.

7.4.6 Electricity

7.4.6.1 Power requirements

The Total Connected Load for the entire island is estimated at 1 000kVA.

7.4.6.2 Electrical Power Supply

Electricity will be supplied to the Complex and the whole island from the diesel-powered Generator Plant that shall be installed and that will be equipped as follows:

- Manufacturer: Caterpillar
- Number of units: 4
- Power rating: 725kVA/580kW (power factor~0.8) each
- Duty: Sequential operation with one stand-by.
- Normal Voltage: 400/230V, 50Hz
- Engine Type: 4-cycle diesel powered
- Rated speed: 1 500RPM
- Fuel: oil as available at **SEYPEC**.
- Automatic synchronization, load balance controller, load sharing/load shedding controller
- Programmable automatic start/stop
- Noise Level: 70 dBA at 1m from Plant enclosure

7.4.6.3 Diesel Supply and Storage

7.4.6.3.1 Diesel Supply

Diesel will be supplied by **SEYPEC**.

The tanker ship shall deliver the diesel oil at a pipeline terminal at the landing station.

The pipeline, conceptually, as proposed by the Promoter, shall be a stainless steel pipeline manufactured and assembled to API Standards. The steel pipeline shall run into an outer sleeve between successive observation impermeable manholes where any leak should be immediately discovered and localised.

7.4.6.3.2 Diesel Storage

The diesel tanks will be made out of steel of quality and characteristics to API standards. The diesel tanks will:

- be fitted with an external vertical glass tube to facilitate the routine observation of levels
- be erected within impermeable reinforced concrete bunded containment cells of capacity at least 10% more than the tank capacity in order to avoid contamination of the sandy soils and of the water table should leaks occur

7.4.7 Telecommunications

The Project will require the following telecommunication facilities:
Telephone: 10 lines
- Fax 2 lines
- E-mail 10 lines

The internal system will require 30 extension lines.

A Satellite Master Antenna Television (SMATVS) system shall be installed, with adequate capacity to drive all TV/FM and future TV outlets, taking into account all losses through distribution, termination, etc. The SMATV system shall provide good reception of colour TV broadcast in bands I to V, and of other satellite stations.

7.4.8 Solid Wastes Production and Disposal

As a result of the demolition of existing structures, of the Construction Works and of operation of the Hotel and ancillary Residential Complex, solid wastes will be produced that will include degradable and non-degradable, toxic and non-toxic wastes. The origins of these wastes and their characteristics are identified hereunder in Table 7.4.8.1.

Table 7.4.8.1: Origins and Characteristics of Solid Wastes expected

Origin	Non-toxic		Toxic	
	Degradable	**Non-degradable**	**Degradable**	**Non-degradable**
Gardens	vegetal			
Workshop	scrap wood	scrap metal		- hydrocarbons - accumulators
Kitchen, catering Demolition Works Construction	organic wastes	- plastic - metal work - wopodwork - cardboard, paper - glassware - concrete	Septic tank sludge	- hydrocarbons
Treatment Plant			Dry sludge	Screenings

7.4.8.1 Solid Wastes at Demolition Stage

7.4.8.1.1 Existing Buildings to be demolished

They will include *inter alia*, all the buildings existing on the La Passe Site earmarked for the implementation of the Resort, whether derelict or still in operation:
- the school and school staff residences
- Silhouette Island lodge guest accommodation units and ancillary buildings
- derelict poultry and pig farm buildings
- other building, residential or otherwise within the said perimeter

7.4.8.1.2 Assessment of Building Demolition Wastes

An accurate assessment of the demolition wastes is not feasible, as constructional details of the actual buildings are not available. However, the following quantities have been identified:

- concrete (mainly bases of derelict farms and Silhouette Lodge buildings): ~ 8 000sq m
- corrugated iron sheets and metal work: ~ 1 000sq m reading from survey map
- wood and other fabric (from school, residential and hotel buildings): about 2 000sq.m
- pipe-work for potable water and sewerage in the Silhouette Lodge Complex: unknown
- septic tanks for usage of hotels: a few cum of eventually stabilised sludge

7.4.8.2 Disposal of Solid Wastes at Operation

The used accumulators and other non-combustible wastes like metal and glassware, will be stored on Site in bins until collected by an agreed waste collector, and shipped away to sanitary Landfill.

All combustible solid wastes, including treatment plant wastes, will be disposed of by means of an incinerator that the Promoter will install on Site.

The incinerator units proposed will be supplied by SAUBATECH (Pty) Ltd, who have tabled appropriate technical specification attached in appendix hereto. The Silhouette Incinerator plant will be characterised by:

- Number and capacity of units: 1No 100kg waste/h manual feed unit and 1 No stand-by 50kg waste/h manual feed unit, the latter to be installed first for the disposal of domestic waste generated during construction stage
- Fuel: light fuel oil (diesel) available locally
- Incineration process: two-stage combustion process
- The incorporation of a flame intensifier that will act as a 'dryer' for wet waste
- Combustion temperatures: 600 ºC at primary chamber and 1 200 ºC at secondary chamber
- Controlled rate of combustion
- Typical ash production rate: 3-5% of total input

7.5 Construction Works

7.5.1 Time Table

The tentative Construction Works Schedule put forward by the Proponent, and the Contractor sets out the following Timetable, aiming at the Hotel starting operations by 2006.

This Timetable is based upon the assumption that any Site Preparation Works and the Coastal Improvement Works have been given Environmental and Planning Clearance to proceed forthwith.

7.5.2 Construction Material

Material that will be required for Construction will involve:
- Reinforcement steel
- Aggregates, rock sand, cement, for *in-situ* concrete mixing
- CHB brick to walls, with plaster
- Pre-fabricated Wood / PVC Timber door and window frames
- Timber
- Floor and roof tiles

7.6 Construction Site Management

7.6.1 Site Staff and Manpower

The Site Staff will be lead by a Construction Manager, to be appointed by the Project Manager. He shall be familiar with all the Environmental constraints, and will be responsible for the implementation of the Environmental Management Plan as set out by the EIA or imposed in the EIA License issued by the Division of Environment.

Working time will be limited from 07h00 a.m. to 17h00, from Mondays to Fridays, and from 07h00 to 13h00 on Saturdays, unless otherwise provided by Working Regulations in force in Seychelles.

7.6.2 Temporary Site Worker's Accommodation

The labour force stated in the foregoing, are expected to reside on Site throughout the duration of the Works.

7.6.3 Services and Utilities

7.6.3.1 Potable Water Supply at Construction

Domestic water supply to the Workers' camp will be **IDC**'s responsibility:
- either from existing Grande Rivière tapping;
- or the R/O desalination unit installed in anticipation

7.6.3.2 Workers Camp Sewerage System

This will be **IDC**'s responsibility.

7.6.3.3 Domestic wastes

They will be collected in bins and will be disposed of by incineration in the 50kg/d **SAUBATECH** Incinerator that will be installed for that purpose.

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ENVIRONMENTAL IMPACT ASSESSMENT

Chapter 8: Environmental Management Plan

8.1 Introduction

In this chapter, the positive and negative impacts generated by the Project at its Conceptual, Construction and Operation phases are identified and assessed. Mitigation measures proposed to offset negative impacts are also examined, and whenever necessary, further mitigation is proposed for the efficient protection of the Environment.

8.2 Conceptual Stage

8.2.1 Visual Impact

Normally, the implantation of buildings in any given Site will modify, to an extent depending upon architectural details, setting out, etc., the initial landscape, viewed from the sea or from the Site neighbourhood.

The basic criterion is that, to an observer from the sea, or anywhere in the Site neighbourhood, no part of the Resort buildings should stand out against the skyline. The following parameters are therefore important:

- Height of buildings above ground
- Site slope
- Altitude of skyline

In the case of the Silhouette Resort:

- the palms and other tall canopy trees are 10 to 15m tall and closely spaced up to HWM and will not be removed, and viewed from the sea, Anse La Passe is backed by the steep slopes of Mt Dauban
- the height of the Guests Suites, and Central Public Area above ground level will not exceed 10m

Thus no visual impact may result in the sense of modifications by the Resort, to the landscape at skyline level.

8.2.2 Loss of Vegetation

It will be necessary to fell a few trees at the emplacements earmarked for the implantation of the buildings, and any coconut trees inclined towards the buildings. But these may not be endangered or rare species, as none exist on the Resort Site already deeply modified by man from its initial floral state

8.2.2.1 Mitigating Measures

8.2.2.1.1 Identification and Protection of existing land species

All the tall canopy trees excluding coconuts within the Site Zone have to be logged on the Site Layout Plan and the Architect and the Proponent have taken all precautions to spare all specimens that deserve to be spared.

8.2.2.1.2 Control of Exotic Species

Of the 270 floral species recorded from Silhouette, 103 are believed to be introduced species, some of which have proved to be invasive. A control of the species likely to cause problems, such as *Tabebuia pallida*, with excellent dispersal abilities, and *Hevea brasiliensis* should be programmed in intelligence with the NPTS.

8.2.2.1.3 Reforestation of Site with Silhouette Endemic Species

Rare endemic species should be reintroduced at the La Passe Site under the aegis of the NPTS and its agronomist experts. A zoning of the endemic species of Silhouette is necessary to determine which species will thrive on the sandy lowlands of Anse La Passe.

8.2.2.1.4 Protection of the Back-beach Species

No back-beach vegetation is to be removed and the setback agreed with the Authorities, if the 35m-setback obligation is released must be such as not to entrain the destruction of the beach vegetation. In fact, in certain spots, the beach vegetation has been already impacted by wave-induced erosive processes and is menaced in other locations. Measures will therefore be taken for its rehabilitation.

8.2.3 Beach/Resort Interaction

In Seychelles, it is recommended to maintain a minimum distance of 35m between the buildings and the HWM, across the sand dune. This is apparently not mandatory, legally, by regulation or otherwise.

Thus, for the Anse La Passe Resort, and per letter PA/LTR/05/625 dated 28 February 2005, the set back of the buildings with respect to HWM, the Ministry of Land Use and Habitat is willing to relax the setback limits to considerably less than 35m from the HWM.

This can be a major impact, considering the status of the beach as observed recently and given its vulnerability to wave attacks.

Hotel structures in that zone may be directly endangered, as was the case elsewhere, eventually necessitating the erection of a beach or sea wall, which can in turn induce beach instability. Seawalls are excellent reflectors of waves and energy being a scalar, incident and reflected wave energies will add up to accelerate the removal of sand from the beach, assuming that the velocity fields associated with waves are responsible for shearing beach sediments into suspended loads that are thereafter carried away.

8.2.3.1 Mitigating Measures

It is not recommended to relax the setback limits under the recommended value of 35m from HWM.

Given the present state of partial knowledge of the marine environment, the sediment transits as well as the beach stability at Anse La Passe deserve a more thorough survey through at least a complete cycle of monsoon regime.

Moreover, other actions such as the deepening of the lagoon for acceptable 'all-tide' bathing experience, can also accelerate beach erosion, unless they are thoroughly studied and the beaches are protected from erosive attacks.

It may be advisable to review the site layout of the beach villas in conformity with recommended setbacks.

8.2.4 Interaction with Marine Turtle Nesting

The implementation of the Project as per the layout presented in Figure 1.1.1 will impose the construction of beach villas, main pool, etc. along the La Passe sea front.

So far, it has not yet been possible to know whether these developments will be in the background of beach zones that have been identified as being ecologically sensitive as turtle nesting zones.

This may therefore necessitate the implementation of mitigating measures.

8.2.4.1 The Sea Turtles

Particular reference must be made to the Hawksbill turtle (*Eretmochelis imbricata*) that nests on the beaches of Silhouette Island[19].
It may therefore be essential:

- To put the residents wise as to the eventuality of encountering marine turtles on the beach, or of nests where eggs have been laid
- To keep watch of the arrival of Hawksbill turtles ashore and to identify nests, if need be, under the aegis of the turtle specialists of the Local Research Unit and Division of Environment
- Allow photographs of turtles to be taken, but strictly without flash, as this scares the turtles off to other places
- To organise beach monitoring for turtle protection, eventually coupled with beach zoning, and preservation of the natural state of the beach from the primary dunes seaward
- To set up protective barriers around the nests until hatching
- To restrict night activities – noise, floodlighting, etc - near nesting zones during eggs-laying, and incubation periods, particularly of the green turtle, which beaches at night.
- To carry out dredging works during the period when the turtles are known not to swim ashore to nest

[19] Nesting Marine Turtles of Silhouette Island requested from Jeanne A. MORTIMER – ...

8.3 Demolition & Construction Phase

8.3.1 Generation of Non-hazardous Wastes

8.3.1.1 Origins

8.3.1.1.1 Vegetal Waste

Considering the ground area of the various buildings and the accesses, the amount of solid vegetal waste expected from clearing, could reach some 1 000m^3 or more.

8.3.1.1.2 Excavates

Earthworks must be expected in connection with, *inter alia*:

- the base of all buildings as described in the foregoing, although may will occupy emplacements where earthworks have had to be executed
- the sewerage collector network and treatment plant
- services distribution duct

They will involve excavation in the sandy flats: excavated unsound materials (apart from top-soil with organic contents) is therefore unlikely.

8.3.1.1.3 Demolition Wastes

Demolition will concern any derelict buildings on Site, provided any of these buildings are still standing as it has been observed that their dismantling was proceeding rather fast lately. Demolition wastes will consist mostly of inert masonry and structural concrete with reinforcement steel after the removal of, *inter alia*:

- Woodwork associated with inside doors, doorframes, etc.
- Glass windows, or louvers with metal frames, metal openings (if any left)
- Corrugated metal roofs (if any left).

8.3.1.1.4 Construction Wastes

They will consist mostly of paper/plastic packages, paint containers, timber, cuttings, pipe-work, floor-tiles, plaster and concrete wastes etc.

8.3.1.1.5 Domestic Wastes from Site-resident Workers

They will typical domestic wastes, *i.e.* paper/plastic packages, metal tins, glass, and food leftovers.

8.3.1.2 The Impact and Impact receivers

The Impact receptors will be the Site itself and eventually, may also be the neighbouring Environment. Impacts from solid waste production at construction may be generated as follows:

- solid vegetal waste produced, if left unattended, will decay under the ambient moisture and may be host undesirable insects like mosquitoes, worms, etc.; this impact may be temporary
- construction wastes if left unattended, may produce leachate (containing solvents, paints, etc) that may reach the lagoon waters and prove toxic to their population; this impact may be a long-term impact, if it leads to the destruction of vegetal and animal life

The generation of solid waste during the demolition and construction phases must therefore be mitigated.

8.3.1.3 Mitigating Measures

8.3.1.3.1 Safe Disposal of Concrete/masonry Demolition Wastes

The disposal of derelict concrete and masonry by burying at La Passe does not pose any major problem. At least inasmuch as they are inert material. It will be just the finding of an appropriate burying place. These will be buried at places to be agreed with the Authorities after being crushed to dimensions not larger than 300mm. The debris will be compacted in lifts of not more than 500mm up to not less than 1 000mm from formation, final back fill being part of the sand excavated for the disposal of the said debris

8.3.1.3.2 Reuses or Land-filling of Sundry Demolition Material

Woodwork (doors, windows, shutters, roof & partitioning elements), glassware, metal work, corrugated iron sheets, etc., that can be carefully dismantled at demolition, may be eventually put to use elsewhere if still in a usable condition.

All demolition debris, metalwork, pipe-work, woodwork mainly that cannot be disposed of safely, or re-used on Silhouette, will be shipped to Mahé for safe disposal in landfill or as scrap metal.

8.3.1.3.3 Safe decommissioning of derelict septic tanks of Silhouette Lodge

Dismantling of any existing sewerage collector and septic tanks will be carried out:
- after disinfection of the network with hypochlorite
- and stabilisation of sludge with quick lime

The stabilised sludge may then be safe to be composted.

8.3.1.3.4 Care and diligence on Site

Without prejudice to the constant diligence expected of the Site Contractors, in particular, provision will be made, in the Project Construction Schedules, Specifications and Bills of Quantities, and generally to the Contract Documents, so that:
- No top soil with organic components are dumped on the coral sand formations
- No demolition/construction wastes are dumped in the sea.

All vegetal wastes from Site clearing will be burned on Site or buried at an agreed location.

8.3.2 Production of Effluents

8.3.2.1 Origins

The Contractor's employees working or residing on Site during the construction period, will produce domestic effluents, a daily rate not defined at this stage.

8.3.2.2 The Impact and Impact Receivers

The impact will basically result from an uncontrolled release of nutrients (P, N and K) and of faecal coliform. Impact receivers will be the lagoon and the local aquifer, if these pollutants reach the waters without undergoing leaching through the permeable soils.

The amount of pollution which can be expected from domestic sewerage, can be estimated from the following typical composition ascertained from past experience and observations:

Typical Pollutants and Concentration in Raw Domestic Sewerage
$10m^2$ around release point

POLLUTANT	CONCENTRATION	
	At Release	Within $10m^2$
COD	300 mg/ℓ	~75 mg/ℓ
TKN	12-34 mg/ℓ	~5 mg/ℓ
NH_3	6-18 mgN/ℓ	0 mgN/ℓ
NO_3	0 mgN/ℓ	~5 mgN/ℓ
P	4-7 mgP/ℓ	0 mgP/ℓ
Coliform (No)	10^8	10^3

The worst case would be direct discharge into the lagoon. The impact would be of a temporary nature, as the pollutants will finally degrade. The faecal coliforms, however, may have more serious pathological impacts. Mitigation is essential.

8.3.2.3 Mitigation Measures

Toilet and sanitary facilities will be erected temporarily on Site for the use of Site personnel and workers. Unless the sanitary appliances existing on the premises, can be upgraded and for that purpose.

Site wastewater may be treated as follows:
- either a classical septic tank cum leaching field arrangement
- or chemical toilets

8.3.2.3.1 Septic Tanks *cum* Leaching Fields

In this scenario the domestic sewerage produced by the Site workers, will be collected as it used to be and treated in a septic tank whose effluents will be disposed of *via* a temporary leaching field.

The quality of effluents released in nature from the leaching field can be described in Table 8.3.2.3.1.1 below[20].

Table 8.3.2.3.1.1: Quality of Treatment via Septic Tank/Leaching Field

	INFLUENT TO SEPTIC TANK	EFFLUENT TO LEACHING FIELD	5m- AROUND LEACHING FIELD
COD (mg/ℓ)	300	90-120	<20
TKN (mgN/ℓ)	12-24	5-10	<5
NH_3 (mgN/ℓ)	6-18	6-20	0
Nitrate (mgN/ℓ)	0	0	0
Phosphate (mgP/ℓ)	4-7	3-5.5	<0
Coliform (No)	10^8	10^6	$0\text{-}10^3$

Upon termination of Works, the temporary septic tank unit will be stabilised by means of quick lime as advocated in the foregoing.

8.4 Spillage of Hydrocarbons

8.4.1 Origins

Such spillage will be mostly accidental, from plant lorries and equipment on Site, in the event of maintenance operations, involving lubricant changes, re-fuelling etc., or breakdowns

8.4.2 The Impact and Impact Receivers

The impact will result from the discharging of inorganic compounds into the soil, sand, or lagoon and marshes.

In particular, films of hydrocarbon compounds will form at the surface of the water and may contribute to the soiling of the beach and the destruction of marine life and aquatic life in the main marsh.

8.4.3 Mitigating Measures

These measures will primarily aim at no hydrocarbon spillage on Site.

[20] Ref: measurements made in Mauritius.

8.4.3.1 Adequate Temporary Diesel Storage Facilities

If necessary, the temporary storage on Site of diesel for the operation of plant and machinery will be to American Petroleum Institute (API) Standards, by means of fibreglass, or plastic-jacketed steel tanks:

- constructed to withhold efficiently all pressures associated with "full conditions"
- fitted with a level monitor allowing continuous check of fuel tank status, cross-checked by records of daily drawings and periodic refills by **SEYPEC**

The tank will be erected on a leak proof reinforced concrete trough, API Standards, where any leaking diesel will collect and flow to a sump where it will be recuperated. These items will form part of the Works Contract documents.

8.4.3.2 Safe Plant Maintenance Operations on Site

All programmed maintenance to equipment shall be carried safely within a Service Platform and all greases and oils from the separator will be collected, stored in barrels to be shipped to disposal at Mahé.

8.4.3.3 SEYPEC Contingency Plan

SEYPEC has implemented a Contingency Plan for action against all hydrocarbon spillage at sea, in coastal and inland zones.

This plan should be available prior to the start of any activity concerning the new Resort at Silhouette.

8.4.3.4 Plants to be in Perfect State and Working Condition

Only those items of plant and equipment, that are in perfect mechanical and operational order, will be introduced so as to minimise risks of accidental breakdown and failure and consequently, of hydrocarbon spillage.

In the event of a breakdown, which leads to a hydrocarbon spill, immediate action shall be taken to minimise the spills and execute repairs after protecting the local sand formation by means of plastic sheets.

8.5 Operation Phase

In its Operation Phase, the Project will be associated to various degrees, with:

- discharge of effluents
- production of solid wastes
- air emissions
- noise
- flood lighting at night
- proliferation of pests
- accidental spill of hydrocarbons
- restriction of access to the beach

8.5.1 Discharge of Domestic Effluents

8.5.1.1 Origin

Effluents will be released primarily from the wastewater treatment plant to which wastewater collected from all the discharging ports of the Resort as well as the Resort Staff Quarters and the Silhouette Village will be pumped.

The Reuse of treated effluent for flushing of Toilets may also generate negative impacts.

8.5.1.2 The Impact and Impact Receivers

The quality of the treated effluent from the sewage treatment plant must satisfy the local standards for the discharge of effluents promulgated under the Environment Protection (Standards) Regulations, 1995 for discharge into the natural environment. However for the direct reuse of treated effluent for flushing of toilet, there are no standards or guidelines in Seychelles.

With regard to the above local standards, the maximum permissible limits for key parameters are reproduced in Table 8.5.1.2.1 below.

Table 8.5.1.2.1: Effluent Quality Standards[21] - Pertinent Parameters*[1]

Parameters	Unit	Concentration*[2]
Temperature	^{o}C	30 *[3]
pH		5.5-8.5
Suspended Solids	mg/l	30
BOD_5 @20^{o}C	mg/l	30
COD	mg/l	80
Free chlorine (as Cl_2)	mg/l	0.5
Phosphorus (as PO_4^{3-})	mg/l	5
Nitrate (as NO_3^-)	mg/l	15
Nitrite (as NO_2^-)	mg/l	1
Oil & Grease	mg/l	10
Total coliforms	Per 100ml	500
Faecal coliforms	Per 100ml	100
Faecal streptococcus	Per 100ml	100
Salmonella	Per 100ml	Must not be detectable

Note

1: Parameters referring to metals, phenol and pesticides have been omitted, as they are not pertinent to this type of wastewater.

2: Refers to maximum permissible concentration.

3:Measured at the point of discharge.

21 Standards for the discharge of effluents in Seychelles to a recipient system have been promulgated under the Environment Protection (Standards) Regulations, 1995. A recipient system is defined under these regulations as the part of the environment such as soil, water or rain or other medium that receives an effluent.

It must be noted that the above treated effluent standards pertain to the minimum water quality to be achieved for disposal into the natural environment. A conventional activated sludge system with tertiary treatment (*i.e*. disinfection and filtration) can produce a treated effluent that conforms to the quality standards with respect to carbonaceous removal (COD and BOD_5 parameters, namely) and bacteriological removal.

However, the presence of high nitrogen (mainly organic N and ammonia) in the influent indicates that a concomitant high level of nitrate will be produced (excluding the low amount of nitrogen required for cell synthesis). This will be far in excess to the maximum permissible (nitrate concentration of 15mg NO_3/l or 3.5mgN/l).

To achieve this low level of nitrate, a de-nitrification process (conversion of nitrate into nitrogen gas by biological reaction) MBBR's have been included in the proposed grey and black water treatment system.

Similarly phosphorus concentration in the influent is present in excess of that required for cell synthesis and the activated sludge system cannot removed the remaining

Inasmuch as the reuse of effluents for flushing of toilets is concerned, ss indicated above, no standards or guidelines for the direct reuse of treated effluent for flushing of toilets are available under the laws of Seychelles.

8.5.1.3 Mitigating Measures

8.5.1.3.1 De-nitrification and Phosphate Removal

With regard to nitrogen and phosphate permissible limits for discharge into the natural environments, the performance of the proposed system, as regards N levels, will have to be formally monitored at commissioning and operation stages.

Further mitigation will have to be considered for P Removal from Treated Effluents to satisfy the Seychelles effluent discharge requirements.

8.5.1.3.2 Adequate Sewer Collector Network

The sewer collector network should comprise:

- connection manhole at each wastewater production point
- buffering septic tanks at the exit of accommodation units to intercept all fabric or other elements likely to impair operation of lifting pumps
- lifting stations where sewer retention time will be adjusted to avoid fermentation processes
- grease traps wherever grease is likely to be present in effluents

Furthermore, a mobile septic tank de-sludging tanker must be at all times operational on Site.

8.5.1.3.3 Frequent quality monitoring of Influents and Treated Effluents

Samples of influent grey waters and black waters, treated grey and black water effluents will be collected at most fortnightly and analysed for conformity with the official Seychelles discharge standards.

The case arising, it will be the duty and responsibility of the designer/supplier to make good to the satisfaction of the Authorities.

8.5.2 Air Emissions: Atmospheric Pollution

8.5.2.1 Source of the Impact

The sources of the impact will be air emissions of:

- SO_2, NO_x, CO, CO_2 and Particulate Matter will result from the operation of diesel powered generator plants to be installed on Site.
- Refrigerant gas, whenever system leaks occur
- Incinerator Exhaust Gases

8.5.2.2 Nature of Impact and Impact Receptors

8.5.2.2.1 Power Station Exhaust Gases

The impact receptors will be the residents, tourists and local alike, as well as the natural and built environment.

In human beings, traffic pollution, *i.e.* NOx, CO and particulate emissions, depending upon the degree of exposure of course, have been correlated with nausea, pains in the back, arms and shoulders, weakness in extensor muscles, tremors, palpitations, indigestion, dizziness, feeling pale, nervous, anxious or restless, eye irritation, cold and flu[22].

The natural and built environment will also be directly impacted by the pollutants, an indirectly, in terms of "Acidification of the Atmosphere", associated with the release of SO_2, NO_X, etc., that are dissolved by rain.

It is not known however how endemic flora and fauna will react to the atmospheric emissions.

Ultimately, impacts of a more Global Nature will result, such as the *Green House Effect*, due to the release of CO_2 and N_2O mainly.

8.5.2.2.2 Refrigerant Gases

Refrigerant gases such as ... when escaping to atmosphere, are known to destroy the protective Ozone layers around the Earth

[22] **I. KRUGER Consultants AS - COWI Consult**: *Environmental Investment Programme* Project No 7A. **Final Report** June 1993. Government of Mauritius. Ministry of Health.

8.5.2.2.3 Incinerator Exhaust Gases

The combustion of plastic in the presence of ligneous matter, at temperatures of 800/900ºC can result in the formation of PCDD (Dioxins) and PCDF (Furanes) which are notoriously poisonous. This can therefore take place in the primary combustion chamber of the incinerator.

Normally, PCDD's and PCDF's would be decomposed in the second chamber where temperatures reach 1 200ºC albeit for a short time. But afterwards, when the exhaust gases cool down, it is known that conditions exist anew for the recombination of PCDD and PCDF and their emission to atmosphere.

Whereas PCDD and PCDF are known to be dangerous to animal life in general, their effects on exotic flora and fauna is not known

8.5.2.3 Intensity of Impact

8.5.2.3.1 Power Station Emissions

The intensity of the impact is normally governed by, *inter alia*:

- emission factors characteristic of the diesel plant and of its power rating, and which are normally given by the engine manufacturer
- the duration of the plant operation
- the S-content of the diesel (light oil), that which is presently imported in Seychelles, having a S-content of 0.5% by weight[23], consumed at a nominal rate of 197ℓ/h per unit

The plant capacity operational on Site at any time will be 3x 725 MVA.

The exhaust gas flux may be characterised as follows:

- Volume flow: 2 718Nm^3/s, to be doubled or trebled depending upon the number of units in operation
- Temperature: the exhaust temperature will depend upon the installation of exhaust heat exchangers to supply hot water to the Resort

Table 8.5.2.3.1.1: Maximum Emissions from Proposed diesel powered plant

Exhaust Component	Typical Maximum Emissions from a 725MVA diesel-powered plant		
	Emission factor	Activity factor	Annual Emissions
Particulates (total)	144g/h; 53 mg/Nm^3	24h/d; 8 760 h/year	pro-rata running time
PM_{10}	<144g/h; < 53mg/Nm^3	24h/d; 8 760 h/year	- ditto -
SO_2 [0.5%S by weight]	795g/h; 293mg/Nm^3	24h/d; 8 760 h/year	- ditto -
NO_X as No_X	6.55kg/h; 2 40g/Nm^3	24h/d; 8 760 h/year	- ditto -
CO	1.0kg/h; 371mg/Nm^3	24h/d; 8 760 h/year	- ditto -
CO_2	506g/h; 187mg/Nm^3	24h/d; 8 760 h/year	- ditto -
HF	317g/h; 117 mg/Nm^3	24h/d; 8 760 h/year	- ditto -

[23] Captain Guy **ADAM**: Telephone conversation, Monday 22nd February 1999.

In order to situate the proposed power plant with respect to criteria acceptable to Local and/or World Bank Group Standards, the emissions concentrations {g/Nm^3} have been entered for the diesel-powered plant in Table 8.5.2.3.1.1. They are compared, in Table 8.5.2.3.1.2, with maximum air emission levels stipulated by Local Authority. Except for SO_X which requires knowledge of the average S concentration in the SEYPEC diesel.

Table 8.5.2.3.1.2: Plant Emissions and World Bank Acceptability Criteria

POLLUTANT	Plant Emission	World Bank
Particulate	53mg/Nm^3	100mg/Nm^3
PM_{10}	< 53mg/Nm^3	140mg/Nm^3
SO_2	293 mg/Nm^3	2 000mg/Nm^3
NO_X (NO_2)	2 408mg/Nm^3	1 000mg/Nm^3
CO	371mg/Nm^3	1 000mg/Nm^3
CO_2	187gm/Nm^3	

The impact of the eventual emissions would have to be assessed with reference with the base-line quality of the air at Silhouette, as measured for example using a Mobile Air Quality Laboratory. But the air quality there must be very good although the presence of emissions from the existing diesel power unit will undoubtedly be detected. However, in the absence of any base-line data concerning the ambient air quality, it must be taken to be unpolluted in the sense prescribed by World Bank To all intents and purposes, air quality data as prescribed by WHO[24] and Mauritius are given in Table 8.5.2.3.1.3 below.

Table 8.5.2.3.1.3: Guidelines for Air Quality

POLLUTANT	MAURITIUS	WHO Guidelines	World Bank Guidelines	Averaging Time
PM_{10}	--	--	N.S	1-h
	150 µg/m^3	70 µg/m^3	500 µg/m^3	24-h
	50 µg/m^3		100 µg/m^3	Annual
SO_2	--	350 µg/m^3	N.S	1-h
	1 000 µg/m^3	--	N.S	3-h
	200 µg/m^3	125 µg/m^3	200 µg/m^3	24-h
	50 µg/m^3	50 µg/m^3	50 µg/m^3	Annual
NO_2	--	400 µg/m^3	N.S	1-h
	200 µg/m^3	150 µg/m^3	N.S	24-h
			100 µg/m^3	Annual
CO	40 000 µg/m^3	30 000 µg/m^3	N.S	1-h
	10 000 µg/m^3	10 000 µg/m^3	N.S	8-h

Atmospheric dispersions of SOx, NOx and Cox have been simulated numerically using the ISCST3 EPA model and continuous wind (magnitude and direction) and temperature data recorded at Mahé International Airport, as none is available for Silhouette.

[24] **WHO**: *Air Quality Guidelines for Europe*. Copenhagen 1987.

The spatial distribution of 1-h, 3-h, 24-h and annual concentrations of these pollutants have been plotted and the polar plots attached in Appendix D hereto. Stack heights of 5m, 10m and 15m have been used in an attempt to assess the influence of stack heights on the dispersion patterns.

Maximum concentrations computed at various receptor locations are detailed in Appendix D hereto.

These results, as it can be seen confirm the high level of NOx concentrations, which could have been predicted from high emission rates. It must be appreciated that the simulations concern only one 725kVA unit in operation.

8.5.2.4 Mitigating Measures

8.5.2.4.1 Reduction of NOx Emissions

The NOx concentrations are higher than would be tolerated by World Bank Standards.

The normal procedure for the elimination of NOx will be the fitting of a liquid NH_3 catalytic reactor to the diesel plant exhaust. NOx will be catalytically reduced to harmless N2 and H2O.

But this has a cost. The plant will be in continuous operation, and considering its location at the foot of steep rising slopes, the resulting impact on the environment must be assessed in function of potential dispersion by trade winds.

8.5.2.4.2 Fitting a PM filter to the Power Station Exhausts

To keep the particulate emissions as low as possible, it will be necessary to filter the stack gases by means of bag filters.

It is expected that about 10% of NOx and SOx will be retained with the PM retained in the bag filters.

8.5.2.4.3 Avoiding Formation and Emission of PCDD and PCDF

This will be achieved by avoiding incinerating plastic with the other solid wastes sent to the incinerator.

All plastic material must therefore be sorted out from solid waste sources, and must be disposed of safely in a sanitary landfill after compaction.

8.5.2.4.4 Use refrigerant gases in compliance with the Montréal Protocole

All ozone-depleting refrigerant gases must be strictly avoided. Only ozone-friendly refrigerant gases will be used and they shall be submitted to the approval of the Ministry of Environment.

8.5.3 Production of Hazardous Waste

8.5.3.1 Origin

Hazardous wastes will originate from, *inter alia*:
- Excess sludge and screenings from Hotel *cum* Village Treatment Plant
- Solvents/paints from workshop
- Batteries for powering DC electrical appliances such as golf carts

8.5.3.2 The Impact and Impact Receivers

The impact will result from the uncontrolled release to the natural environment, of chemical and biological contaminants that will reach the water table and eventually the lagoon and to the marsh or wetland.

Mitigating measures are essential, and will be proposed below.

8.5.3.3 Mitigating Measures

8.5.3.3.1 Sludge from Treatment Plant

Sludge wasted from the treatment plant must be disposed of safely and must be de-watered
- either on adequately dimensioned drying beds, sheltered against rainfall
- or using hydraulic presses

In both cases, the liquor expelled from the sludge will be collected and returned to the plant.

The de-watered sludge produced periodically from the dying beds may be:
- turned into compost for the internal landscaping requirements, or
- incinerated

Screenings from the WWTP will also be collected and destroyed in the incinerator.

8.5.3.3.2 Chemically hazardous wastes

Batteries, paint and solvent containers will be stored in special bins to be shipped to Mahé for safe disposal in hazardous waste cells of the sanitary landfill.

8.5.4 Non hazardous Wastes from Hotel

8.5.4.1 Origin

They will originate from the Resort and the Village, and will be made up of organic/inorganic, degradable /non-degradable matter as described in the foregoing.

8.5.4.2 The Impact

If left unattended, kitchen and restaurant waste in particular, will attract rats and vermin, in spite of proper collection, storage and disposal. The proliferation of such pests will be highly detrimental to existing wildlife, birds, etc.

Tins, glassware, cardboard, paper and plastic packages will rapidly amass up to an unsightly volume if not attended to. This is particularly unwanted at La Passe where eco-tourism may generate.

Since sanitary landfill does not exist at La Passe, mitigating measures are essential

8.5.4.3 Mitigation Measures

8.5.4.3.1 Waste sorting out at Source

Separate bins will be provided, at the Resort and the Village alike, for the separate collection of:

- metal ware, such as tins, or other food containers, which are non-combustible
- glassware, such as bottles, glass debris, etc., which are non-combustible
- paper and cardboard, which are good combustibles
- plastic, whose combustion is not recommended in view of the generation of PCDD
- vegetal wastes, with high water content, not very good combustible, but excellent for composting
- food and kitchen rests, which need to be destroyed

8.5.4.3.2 Safe collection and Storage of Domestic Wastes

Solid wastes from the hotel in general shall be stored in a closed and ventilated place so that they do not receive rainfall, enhancing leachate from them. The storage areas shall have an impermeable floor to receive any leachate from the solid waste. The leachate, as well as floor washings, will be taken to the treatment plant.

Food wastes from the restaurant, room service, kitchen and cold rooms shall be stored in cold rooms at 4ºC to prevent fermentation.

8.5.4.3.3 Disposal of Solid Wastes

8.5.4.3.3.1 No Shredding and disposal to Sewer

Shredding of wastes in a proprietary waste disposal units (garbage grinder) and discharging into the sewage treatment system is not recommended, as this will overload the Treatment Plant in terms of TSS.

8.5.4.3.3.2 Compaction of Metal Wastes

All metal wastes will be compacted mechanically in view of shipment to safe disposal at Mahé.

8.5.4.3.3.3 Incineration of Combustible wastes

The Promoter has proposed an incinerator for the safe disposal of kitchen and restaurant wastes, paper, wood and cardboard, and eventually excess WWTP dried sludge (if not used for compost) and screenings.

It is recommended to install a dryer for the pre-processing of kitchen and restaurant wastes that tend to produce leachate and therefore behave as poor combustible impairing the efficiency of the incinerator.

8.5.4.3.3.4 Composting

Composting may be envisaged with mainly vegetal wastes and stabilised WWTP excess sludge.

8.5.4.3.3.5 Glassware and plastics

Glassware will be packed apart and shipped to sanitary landfill or the glass may be recuperated in glass-blowing units on Mahé.

Plastics may be compacted and also sent to Mahé for eventual re-use or safe landfill disposal

8.5.5 Noise

8.5.5.1 Origin

Noise will be generated by:
- The power plant eventually, which therefore must be mounted in a noise-insulating enclosure
- Air compressors for the treatment plant, if an extended aeration unit is used
- Entertainment.

8.5.5.2 The Impact and Impact Receivers

The noise levels are usually assessed in terms of dBA. Each source of noise will contribute to the overall noise level and impacts will result if the overall noise level, at any given time exceeds levels that are estimated to produce no nuisance.

Thus, for example, the following typical noise levels have been observed:
- an air compressor for a treatment plant: 90dBA at 1.0m
- a *disco band*: 95dBA typically

Inasmuch as the Power Plant proposed is concerned, acoustic performances announced by the Proponent are as follows:

SPL at Source	**SPL at Various Distances from Enclosure**		
	1m	**7m**	**15m**
94.8dBA	<79.5dBA	<69.0dBA	<63.0dBA

At Silhouette Is, the dominating noise near the sea front would that generated by the waves breaking every 4 to 5 seconds. This is a natural noise that has been produced forever and forms part of the natural environment. Not intense and with a typical spectral content. It could even have a masking effect for noises emanating from other sources.

Moving further inland, the ambient noise level would probably not exceed 30/35dBA. Table 8.5.5.2.1 gives noise levels (in dBA) that are typically representative of conditions in various zones and at various times of the day.

Table 8.5.5.2.1: Typical Ambient Noise Levels.

ACTIVITY ZONES	ACTIVITY PERIOD		
	Day Time 07h00 – 20h00	**Intermediate 06h00 –07h00 20h00 – 22h00**	**Night Time 22h00 – 06h00**
Rural, hospital, recreational	45 dBA	40 dBA	35 dBA
Sub-urban residential, light road traffic	50 dBA	45 dBA	40 dBA
Urban Residential	55 dBA	50 dBA	45 dBA

It would be a very complex task to produce an acoustic model of the Project in its environment. But a good idea of the noise nuisance can be gained by referring typical noise levels at various sources to the above table.

It is also true that under strictly geometrical attenuation (ignoring atomic absorption), and under (theoretical) spherical propagation, a noise field will decrease by 6dB each time the distance of the observer from the source is doubled.

Human beings will not be the only receptors to be impacted. Artificial noise fields from the Project may disturb endemic, or rare species from their habitats. No knowledge of the reactions of such animal species to noise intensities and frequency bands is available, and it is therefore difficult to quantify the impact.

Normally, the natural ambient environment should be calm: it is essential to isolate and attenuate all sources of noise and to limit the production of noise strictly to the building zones.

8.5.5.3 Mitigating Measures

The first mitigating measure will be provided by nature itself: a noise field looses intensity at a rate in excess of 6dB each time the distance of the observer from the source is doubled.

The diesel-powered generator sets will be housed in a standard sound-attenuating enclosure and the Supplier shall provide all the necessary acoustic data.

If an activated sludge extended aeration WWTP is used, it will be:

- located such that it will benefit as much as possible from geometrical noise attenuation
- the air compressor units shall be acoustically shielded.

8.5.6 Spillage of Hydrocarbons

8.5.6.1 Origins

Such spillage can occur as follows:
- as a result of accidental breakdown of power plant
- during servicing an maintenance operations to same, or during repair works
- through leaks or overflows at the hydrocarbon storage tanks
- through leaks in the pumping mains from the harbour terminal to the storage tanks

8.5.6.2 The Impact and Impact Receivers

The impact will result from the discharging of inorganic compounds into the soil, sand, marsh, wetlands or lagoon. In particular, films of hydrocarbon compounds will form at the surface of the water and may contribute to the soiling of the beach, of the marsh and the destruction of marine and aquatic life.

8.5.6.3 Mitigating Measures

8.5.6.3.1 Diesel Handling & Storage Facilities

The diesel tanks and supply pipeline from the harbour shall be constructed to American Petroleum Institute (API) Standards, erected within the Technical Yard:
- constructed to withhold efficiently all pressures associated with "full conditions"
- sited well beyond reach of flood waters, as the location earmarked for their location is in the vicinity of the Grande Rivière estuarine marshes
- fitted with a level monitor allowing continuous check of fuel tank status, cross-checked by records of daily drawings and periodic refills by SEYPEC
- a diesel resistant external sleeve will be provided to the steel pipeline, between impermeable inspection manholes where any diesel leak can be detected, localised and made good withou spillage to the natural environment

The tank will be erected on a leak proof reinforced concrete trough, API Standards, where any leaking diesel will collect and flow to a sump where it will be recuperated. These items will form part of the Works Contract documents.

8.5.6.3.2 Collection and Disposal of Waste Hydrocarbons

8.5.6.3.2.1 From the Diesel Plant

Similarly, the diesel power plant shall be mounted on an appropriately designed concrete base with a properly sized peripheral trough where all diesel or/and lubricant that it may contain will collect in case of severe breakdown (oil/diesel pipe rupture) or during servicing and maintenance operations. The trough shall be fitted with a sump for the removal of all hydrocarbons collecting in it which shall be safely disposed of in agreement with the Authorities.

8.5.6.3.2.2 From the Diesel Storage Tanks

The removal of any sludge and condensation oily water at the bottom of the Diesel storage tank for the stand-by Plant will be carried out when the tank is empty, by the **SEYPEC** specialist.

The sludge and water will be collected in closed containers and carted away to safe disposal off Site. This shall be one of the duties to be performed contractually by **SEYPEC**.

8.3.7 Floodlighting of Site at Night

The Site is under natural darkness unlit at night, and that condition certainly suits the marine and terrestrial animal species that are found on the water front (marine turtles, in particular) and inland.

Floodlighting may scare wild life from their habitats, in particular marine turtles off their reproduction beaches.

8.6 Socio-economic Impacts

8.6.1 Impacts on National Economy

The best way to illustrate the economic impact is probably by studying the relative importance in the National Economy, of the Seychelles Tourism Industry.

Economic Indicators from the MISD[25] have been reproduced in Table 8.6.1.1 hereunder to highlight the part played by Tourism in the National Seychelles Economy.

Table 8.6.1.1: GDP, Balance of Payment, and Tourism Expenditure in Seychelles.

	ANNUAL VALUES in x 10^6 SR					
	1992	**1993**	**1994**	**1995**	**1996**	**1997**
GDP (*re* 1986)	1 845.3	1 936.6	1 950.0	1 937.9	1 974.3	2 121.7
GDP at Market Prices	2 221.1	2 419.2	2 440.4	2 419.8	2 482.1	2 754.3
TOURISM Contribution to GDP	387.0	325.3	355.7	386.1	426.5	426.0
BALANCE of PAYMENT (less Tourism)	-639.3	--824.4	-638.9	-679.3	-631.3	
TOURISM Receipts	599.5	607.4	510.0	466.2	531.4	
OVERALL BALANCE	-39.8	-217.0	-128.9	-213.1	-99.9	
TOURIST Arrivals (x 1 000)	98.5	116.2	109.9	120.7	131.0	130.1
***Per capita* TOURIST RECEIPT** (SR)	6 086	5 227	4 640	3 862	4 056	

From 1992 to 1997:

- GDP at Market Prices grew by +24%, whereas the contribution of the Tourism Sector to GDP grew by 10% only
- Balance of Payment (excluding Tourism) except in 1993 and 1995, was more or less stable at –630 to –640MSR
- Tourism Receipts at arrival levels observed, and other current services, have been contributing positively to the Balance of payments, but not at a rate sufficient to bridge the gap apparently created by increasing Merchandise and Investment costs[26].

[25] **Management and Information Systems Division**: *National Income and Expenditure*. **1998 Expenditure**.

[26] **Management and Information Systems Division** (MISD): *Statistical Bulletin*. **March 1998**. Table 1: *Selected Economic Indicators of Seychelles*.

Assuming that the *per capita* Tourist Receipt is of the order of 4 000SR, then any additional count of tourists would contribute to cancel the deficit in the Overall Balance.

8.6.2 Impact on Employment

The Beach Resort will provide stable direct employment to resort staff in the ratio 1.5:1 according to the Promoters. With 232 beds, this means some 248 staff numbers.

- Since the resident population of Silhouette is presently of the order of 130 and not all qualified or trained to form part of the new resort staff, the following apportionment can be expected
  Staff recruited from Silhouette residents: 30
- Staff "imported: to Silhouette: ~ 218

Indirect employment will be provided to maybe 100 people in Tour Operators, transit boat skippers and mariners, etc.

There is no doubt that, under successful operation, the new Silhouette Resort may contribute to increasing the employment potential of Tourism in Seychelles.

The creation of employment is certainly a positive impact.

8.7 Closure

The Impact Matrix below synthesises the Activity/Environment Interactions, gives an assessment of the impacts and appropriate remarks concerning issues still to be addressed and mitigating measures proposed.

PROJECT STAGE	ACTIVITIES	Natural Environment	Built Environment	Social Environment	Economic Environment	REMARKS
I Conceptual	Silhouette Resort Siting					Site heavily influenced by human activity. Mitigating measures proposed
	IDC Village relocation					An IDC issue not yet finalised. No assessment made: to be addressed by IDC.
	Resort Staff Accommodation					-Ditto-
	Resort Architecture					Adapted to local style Approved by Authorities. Conforms to Planning Guidelines
	Resort occupancy of Site					Dense. Likely to impact on beach stability
	Staff & IDC Architecture					An IDC issue not yet finalised. No assessment made: to be addressed by IDC.
	Set-back from High Water Mark					Agreed with Authorities to accommodate site density. Impact identified
II Construction	Building & Professional					
	Production of Effluents					Mitigating measures proposed for on-Site disposal
	Production of Solid Waste					Mitigated by safe disposal and on-Site incineration
	Hydrocarbon Spillage					Mitigation measures proposed, with a Contingency Plan from SEYPEC.
	Noise generation					Partly mitigated
	Power Consumption					Unavoidable, mitigated by power savings
	Atmospheric Emissions					Partly mitigated, NOx & CO_2 not controlled
	Water Consumption					Mitigated by production of potable water through implementation of R/O plant
III Operation	Effluents from Resort, Staff, R/O					Mitigating measures proposed
	Production of Solid Wastes					- Ditto -
	Hydrocarbon Spillage					- Ditto -
	Noise Generation					Partly mitigated by silenced generating sets
	Flood Lighting					To be mitigated
	Atmospheric pollution					Partly mitigated, NOx & CO_2 not controlled
	Employment					

LEGEND (Colour Code): **Low -ve Impact**: **Moderate -ve Impact**: **High -ve Impact**: **Positive Impact**:

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Chapter 9: Environmental Management Plan

9.1 The Environmental Management Plan

The Environmental Monitoring Plan (EMP) is in fact an integral part of the Impact Mitigating Plan that has been elaborated in detail in Chapter 10, to make sure that the required environmental objective are attained.

For the purpose of the Environmental Management Plan, the EMP will aim at ascertaining that:

- the mitigating measures proposed under the Environmental Plan are duly incorporation in the Project Engineering Specifications and actually implemented
- any impact that may still result from the way in which the Project is implemented and run is addressed and mitigated by appropriate measures

The EMP submitted in conformity with the provision of **Clause 5. Environmental Management** of the Terms of Reference

The Proponent, of his nominated Representative, will be responsible for the implementation of the Environmental Monitoring Process at both the Construction and Operation phases.

9.2 EMP at Construction Phase

With reference to the foregoing, the Environmental Monitoring Process can be planned as described hereunder in Table 9.2.1.

9.3 EMP at Operation Phase

With reference to the foregoing, the Environmental Monitoring Process recommended for the Project in its Operation Phase can be planned as described hereunder in Table 9.3.1.

9.4 Environmental Action Plan

In Table 9.4.1, an Environmental Action Plan is suggested.

Table 9.2.1: Environmental Monitoring Plan at Construction Stage

ACTIVITY	REQUIREMENTS	PROCEDURE	RESPONSIBILITY
A. Site Establishment & Clearance	A.1. Site Plan	Following handing over, the Site Plan detailing the layout of Site facilities such as access points, temporary ablution and sanitary facilities, stockpiling areas, storage of hazardous materials if any, earthmoving equipment, temporary technical yard	Contractor's Representative
	A.2. Site Fencing	Site shall be properly fenced and its access controlled	-Ditto-
	A.3. Heavy vehicle routing to avoid impacts to lagoon and wetlands	The heavy vehicle routes shall be identified. All bras-de-mer or river crossings shall be the object of detailed design guaranteeing no impact under all tide and or flood conditions.	-Ditto-
	A.4. Planning of Site Services requirements	An estimate of daily potable and construction water requirements shall be provided for the duration of the Construction Period Likewise for electricity consumption Temporary ablution and sanitary facilities, appropriate waste containers shall be provided	-Ditto-
	A.5. Control of Inland Vegetation clearance	Removal of tall canopy trees and other earmarked species shall be executed as per instructions of the Landscaping Engineer and after clearance of the Division of Environment. Disposal of dried vegetal by burning on Site shall be to the approval of the Responsible Party	-Ditto-
	A.6. No Dune Vegetation Clearance	The vegetal cove to the dune specially where the marine turtles are reputed to nest shall not be removed.	-Ditto-
B. Materials Management	B.1. Safe Stockpiling of Material	Areas for the stockpiling of imported materials such as coral sand, topsoil, basalt aggregates must be carefully chosen to avoid interfering with or contaminating Site under rain storms. Stockpiled topsoil, sand and dredged spoils shall not be taller than 6m, covered or regularly dampened to avoid nuisance from wind born dust	-Ditto-
	B.2. Safe Storage of Hydrocarbon & Hazardous Wastes	Hazardous material shall be stored in a demarcated area, fenced and of restricted access. All hydrocarbon containers shall be stored within a suitable reinforced-concrete area surrounded by a containment (bunded) wall to a capacity of at least 110% of that of the containers.	-Ditto-

Table 9.2.1 (continued): Environmental Monitoring Plan at Construction Stage

ACTIVITY	REQUIREMENTS	PROCEDURE	RESPONSIBILITY
C. Waste Management	C.1.Systematic Collection and Disposal of Domestic and Construction Solid Waste	The Site is to be kept free of litter at all time. Food leftovers shall be packed in bins to prevent leachate contamination of the aquifer and proliferation of pests, to be safely disposed of by incineration in a temporary furnace. Demolition/Construction wastes shall be stored in a demarcated area pending safe disposal by haulage to an agreed landfill site or incineration.	-Ditto-
	C.2. Provision of Sanitary facilities	Adequate toilet facilities shall be provided and sited with the Engineers approval. The facilities could be a septic tank with a temporary leaching field, or of the 'chemical type' to be emptied periodically by specialist effluent tankers and disposed in the Ocean	-Ditto-
D. General	D.1: EMP Reports	The nominated Representative of the Contractor shall submit monthly reports to the Engineer who will verify the information	-Ditto-
	D.2: Complaints Received	Complaints received regarding the construction activities on Site that relate to the Environment shall be recorded in a special designated register and the response noted with the date and the action taken. This record shall be submitted with the monthly EMP report and be available for inspection by the regulatory authorities.	-Ditto-
	D.3: Care & Diligence on Local Roads	When heavy vehicles from Site have to borrow the local unpaved tracks, they shall not be allowed to speed on the said Roads and the drivers shall endeavour to generate as little dust as possible	-Ditto-
	D.4: Baseline Data Acquisition	As soon as possible after the Contractor has taken possession of Site: • water samples shall be collected at a location to be agreed, from various pre-determined locations along the marsh and analyse for COD, NH3, NO3, PO4, pH, conductivity • Beach gradients shall be measured • Air Quality shall be assessed (PM, SOx, NOx) ar various locations to be predetermined with NPTS and DoE	-Ditto-

Table 9.3.1: Environmental Monitoring Plan at Operation Stage

ACTIVITY	REQUIREMENTS	PROCEDURE	RESPONSIBILITY
A. Materials Management	A.1. Safe Handling and Storage of Hazardous Material	Hazardous material such as lead accumulators for electrical appliances shall be stored and serviced in a demarcated area, fenced and of restricted access.	-Promoter's Representative-
	A.2. Check for Safe Storage & Monitoring of Hydrocarbon	It is necessary to ensure that all hydrocarbon containers are always stored within the bunded reinforced-concrete area specified in the Management Plan. A regular hydrocarbon material balance shall be kept to equate supply to usage and detect all losses from the storage tanks.	-Ditto-
B. Waste Management	B.1. Sorting, Safe Storage & Disposal of Domestic Waste	Domestic wastes from the Residences (Tourists & Staff) must be: • sorted out specially in as much as non-combustible wastes (glass, metal and plastic) are concerned • packed in separate bins, with combustibe wastes hauled to the Solid Waste Incinerator and the others conditioned for shipment to Mahé. Fermentable wastes from the Guests and Staff Restaurant and Kitchen must be stored at not more than 4°C and hauled straight in appropriate quantities compatible with waste mixes, to the incinerator	-Ditto-
	B.2. Safe Disposal of Hazardous Wastes	(i) From the WWTP: • Screenings from the WWTP will be packed in adequate containers to be hauled to incinerator • Sludge from the WWTP can either be dried and stabilised with lime as compost or eventually incinerated when dry (ii) From the Technical Yard: • the totality of used batteries are hauled to safe disposal • All hydrocarbon wastes - l from Generator Set, diesel tank sludge, 'oily waters', shall be removed by the nominated Diesel Supplier team in appropriate sealed containers for safe disposal at Mahé	-Ditto-

Table 9.3.1: Environmental Monitoring Plan at Operation Stage (Continued)

ACTIVITY	REQUIREMENTS	PROCEDURE	RESPONSIBILITY
C. Protection of Wildlife	C.1. Protection of Marine Turtle nesting habitats	The beach sectors (WHICH) Silhouette Island shall be proclaimed sensitive nesting habitats and continuously monitored in respect of its natural vegetal cover	-Promoter's Representative-
	C.2. Protection of marine turtles in the lagoon	The Boat-house manager shall be instructed to remain vigilant particularly during the marine turtle nesting season so as to: • keep watch of turtles approaching the island • avoid physical impacts by sailing crafts operated by the boat house • avoid illuminating the lagoon in the aforesaid period	-Ditto-
	C.3. Behaviour of Guests in conformity with respect of Environment	Guests shall be • put wise to the eventuality of encountering turtles on the beach • instructed to keep away from these sectors • warned not to use flash photographic equipment in case they wish to take pictures of the turtles nesting	-Ditto-
	C.4. Restricted Night Activities	Noise shall not be generated in the vicinity of the proclaimed nesting sectors. Floodlighting of same sectors shall not be allowed	-Ditto-

Table 9.3.1: Environmental Monitoring Plan at Operation Stage (Continued)

ACTIVITY	REQUIREMENTS	PROCEDURE	RESPONSIBILITY
D. General	D.1: EMP Reports	The Representative of the Promoter shall submit reports periodically, whenever necessary, to the Relevant Authorities who will verify the information	-Ditto-
	D.2: Complaints Received	Complaints received regarding the activities on the Resort that relate to the Environment shall be recorded in a special designated register and the response noted with the date and the action taken. This record shall be submitted with the monthly EMP report and be available for inspection by the regulatory authorities.	-Ditto-
	D.3: Care & Diligence on Local Roads	When vehicles from Site have to borrow the local unpaved tracks, they shall not be allowed to speed on the said Roads and the drivers shall endeavour to generate as little dust as possible	-Ditto-
	D.4: Physical and chemical assessment of air, water and beach on Site	At a rate to be agreed or whenever deemed necessary: • water samples shall be collected at a location to be agreed, from the local marshes and wetlands (in terms of COD, NH3, NO3, PO4, TSS, conductivity and pH) • Beach gradients shall be measured at each monsoon change • Air quality shall be assessed at various locations in terms of (PM, SOx, NOx)	-Ditto-
	D.5: Wildlife Monitoring	Health and behaviour on endemic floral and faunal species on or in vicinity of Site shall be regularly monitored in intelligence with approved local specialists Observations shall be made specifically in the EMP Reports of the behaviour, habits or fate of the wildlife and of any predatory or menacing risks these protected species are subjected to	

Table 9.4.1: Environmental Action Plan

Issues	Tasks	Target Completion Date
A. Emissions to water	Install wastewater treatment plant consisting of primary, secondary and tertiary treatment to ensure that project effluent conforms to effluent quality as per irrigation standards.	Before start of production
B. Emissions to water	Install sewage reception facility capable of storing 12hours' hotel effluent to provide safeguard in the event of failure of WWTP. Connect to the regional sewer network operated by Wastewater Management Authority.	
C. Diesel Storage	Construct diesel storage tanks with high quality welds, high tensile bolts, impervious fire screens and bunded area equivalent to 110% capacity of storage tanks. Provide sprinklers, fire hose, emergency isolating valve and automatic shut-off valves. Provide automatic pressure monitoring, alarms and control, leakage detection and alarm.	Before First diesel Loading
D. Chemicals Management	Develop a chemical management programme incorporating a hazardous risk management plan in conformity with mauritian regulations and international guidelines.	Before first delivery of chemicals.
E. Safety	Develop emergency response plan, incorporating guidance for communication with local authorities	Before Hotel operation
F. Environmental Management	Establish environmental management unit	
G. Environmental Monitoring	Commission on site laboratory unit equipped with all testing equipment for chemical, physical and bacteriological quality for the water and wastewater treatment units.	Before Hotel operation
H. Environmental Monitoring	Undertake daily monitoring of key parameters for treated effluent quality entering and leaving the WWTP.	At Start of Hotel operation
I. Environmental Monitoring	Undertake twice annual monitoring of particulate, smoke, Nox, CO_2 and SO_2 discharged from the generators.	At Start of Hotel operation
J. Environmental Monitoring	Undertake twice annual monitoring of noise produced by the hotel.	At Start of Hotel operation
K. Environmental Monitoring	Provide annual monitoring report on environmental, safety and social matters to the Department of Environment.	Every year after Hotel operation

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CONCLUSIONS

1 The Silhouette Island Spa Resort Project conceived by **IDC** in a Joint Venture with **Universal Enterprises** (Pvt) Ltd., will be implemented on a 11-hectare site which has been profoundly modified from its original state by human activity and as such presents no direct threat to the land Environment. It will however imply:

- phasing out the existing Silhouette Lodges (about 30 keys)
- relocating a number of the Silhouette villagers and a school presently on the aforesaid Site
- a substantial increase in the residential density at Anse La Passe, due to the 116-keys Resort and the junior, senior and executive staff to be mobilised to Silhouette for the proper operation of the Resort

2 Pursuant to the administrative procedure currently in vigour in Seychelles the Project has been officially presented to the National Inter-ministerial Committee (NIC) chaired by the President of the Republic, in 2004. The Environmental Impacts have been assessed by **SIGMA Ove ARUP & Partners** Associated Consulting Engineers:

- as per the Terms of Reference issued by the Division of Environment of the Republic of Seychelles in January 2005 upon the submission of a Scoping Report in November 2004
- within the legal, regulatory and administrative framework in vigour in Seychelles

3 In particular, potential negative impacts have been identified, on the basis of the information provided by the Proponent as well as in-situ base-line data acquisition (land and marine), at Conceptual, Construction and Operation phases in connection with:

- the setting out on Site of the proposed Resort Buildings with respect to set-back from HWM
- additional burden on the limited water resources of Silhouette
- the generation of sewerage and waste water from builders staff, the Guests and Hotel Staff residential units and the Silhouette Village
- the generation of hazardous, organic and non-organic solid wastes from the builders staff, the Guest and Staff residential units and the Silhouette Village
- the generation of stack gases from the generator sets
- the spillage of hydrocarbons from equipment, as well as storage facilities
- the nocturnal flood lighting and noise on the natural behaviour of protected terrestrial and marine fauna (turtles, birds, ...)
- the relocation of the existing Silhouette Settlement moved to make room for the undertaking

Certain issues like the detailed pipe reticulations, architecture of Resort Staff Quarters, technical and architectural details of Back-of-House, social aspects of IDC villagers relocation, not available for the purpose of the present EIA, will be addressed by IDC-

No lagoonar works issues have been addressed although marine base-line data has been collected for the purpose of assessing any Resort/Beach interactions.

4 Measures have been proposed to mitigate impacts resulting form generation of solid wastes, domestic effluents, gaseous emissions to atmosphere, hydrocarbon spillage. They imply the provision of all the following service and utility infrastructure:

- A Sewerage System, a dual Grey Water/Black Water system, which will comprise a collector network complete with manholes and lift stations, serving the entire complex, including the Staff Quarters and the village
- A potable water system will be supplied from Modular Reverse Osmosis desalination plants, and also from tapping from existing water courses, storage and filtration system, with adequate water storage capacity
- An electricity supply system comprising 4 No 725kVA diesel-powered units in sequential link and sound attenuating enclosures, complete with control switch gear, individual day diesel tanks and bulk diesel tank to supplied from the IDC supply ship and protected against fire and spillage
- A two-chamber solid waste incinerator for the safe disposal of combustible waste, eventually dried sludge from the WWTP and hazardous wastes from the Health Unit; non-combustible wastes resulting from sorting-out at source (metal, glass) will be conditioned in a refuse compactor and hauled to Mahé for disposal. A stand-by incinerator unit will also be provided
- Bunded hydrocarbon storage, sleeved diesel pipelines (with leak observation manholes) and the immediate implementation of the SEYPEC Contingency Plan in case of hydrocarbon spillage

5 The mitigating measures proposed have been scrutinised. They must form part of all contractual documentation pertaining to the construction of the Complex. Further recommendations are made in the following issues:

- respect of the normally recommended 35m set-back of Resort buildings with respect to the HWM, in view of the vulnerability of the beach to erosion
- the implementation of an Environmental Monitoring Plan and of an Environmental Action Plan during the Constructional and Operational phases

The implementation of the EMP and EAP are recommended, in particular formal effluent quality monitoring at commissioning and operation, to determine the necessity for further N and P removal.

6 The Silhouette Island Resort Project has certainly been the object of a feasibility study in the context of the Seychelles Tourism Industry, and in particular of its up-market segment. According to the Project Brief, it will aim at the release on the Seychelles Tourism Market of 116 keys on a Site that is not exploited to its full touristic potential.

Furthermore it will create additional employment, permanent in relation with the operation of the resort, and temporary inasmuch as engineers, architect and builders are concerned.

Such are potentially the positive impacts of the project, which will only be substantiated if and only if the project is environmentally sustainable. No efforts must therefore be spared to ensure that sustainability condition. This is the sense of the present conclusions.

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ENVIRONMENTAL IMPACT ASSESSMENT

Appendix A: Flood Simulation Model

Catchment Characteristics

A

Drainage area:	2.038	km^2	
Main channel length:	903	m	
Main channel slope:	0.200		
Manning's coefficient:	0.028		(corresponding to "Channels - Coarse Gravel")
SCS Curve Number:	83		(corresponding to "Woods -Poor"+ Soil Group D)

Overland flow plane #1:

Mean length:	689.61	m	
Mean slope:	0.285		
Estimated % of total area:	40%		
Roughness coefficient:	0.4		(corresponding to "Woods - Lt Underbrush")

Overland flow plane #2:

Mean length:	850.74	m	
Mean slope:	0.433		
Estimated % of total area:	60%		
Roughness coefficient:	0.4		(corresponding to "Woods - Lt Underbrush")

Rainfall Data (Seychelles)

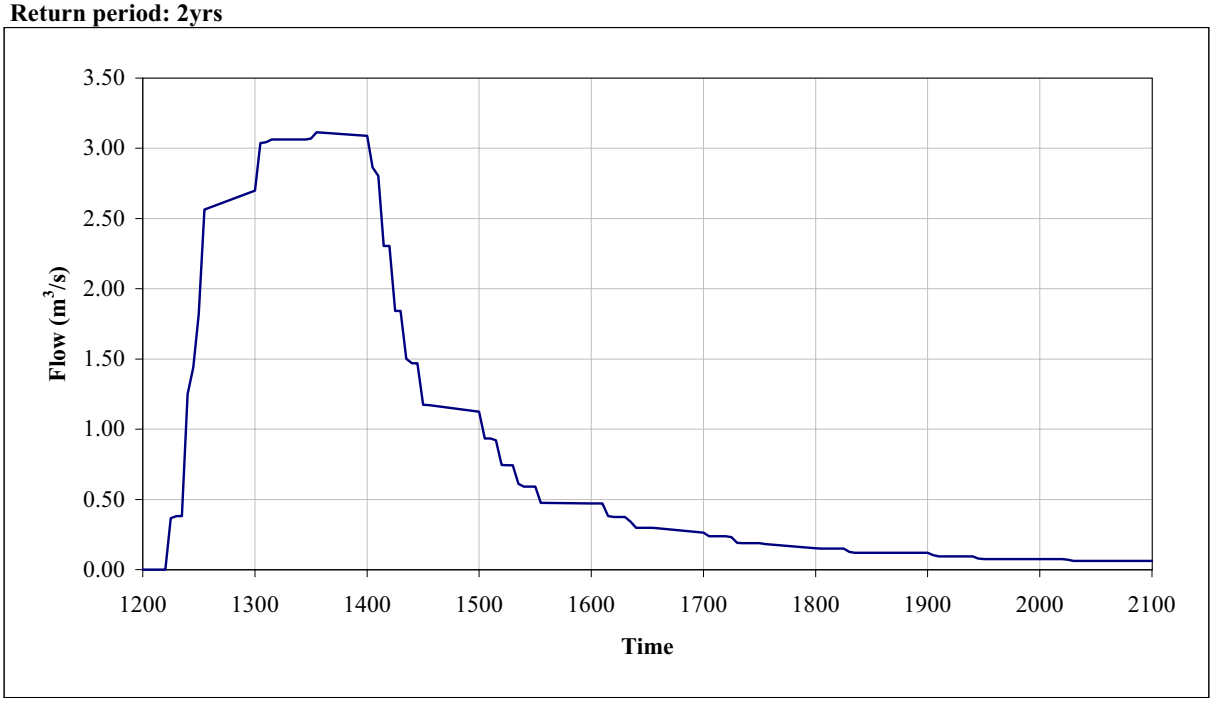
Duration	Return Period (yrs)					
	2	5	10	25	50	100
15 minute intensity (mm/hr)	91	107	117	129	137	144
30 minute intensity (mm/hr)	73	91	102	115	124	133
60 minute intensity (mm/hr)	51	67	77	91	101	111
3 hour intensity (mm/hr)	27	37	43	61	57	62
6 hour intensity (mm/hr)	17	24	28	33	37	41
9 hour intensity (mm/hr)	13	18	21	25	28	31
12 hour intensity (mm/hr)	11	15	17	21	23	26
18 hour intensity (mm/hr)	8	10	12	14	16	17
24 hour intensity (mm/hr)	6	8	9	11	12	13

Flood Flows

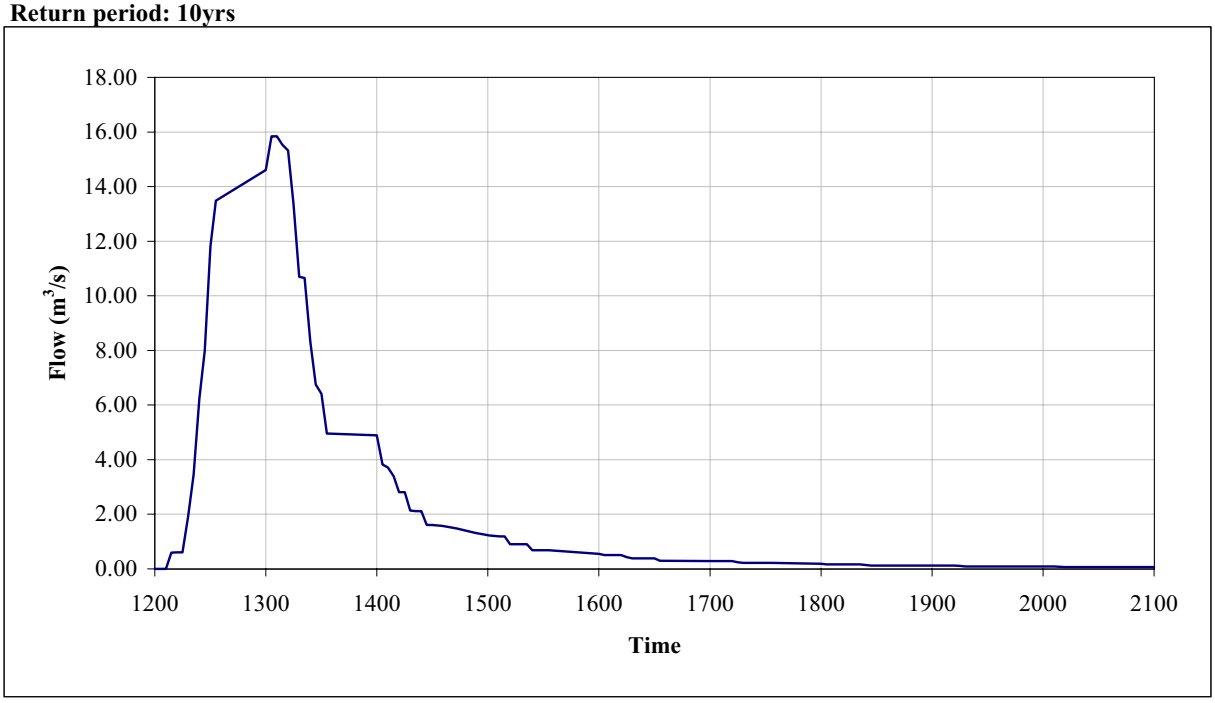
Return Period	2yr	10yr	25yr	50yr
Flow (m^3/s)	3.1	15.8	25.5	32.7

Hydrographs

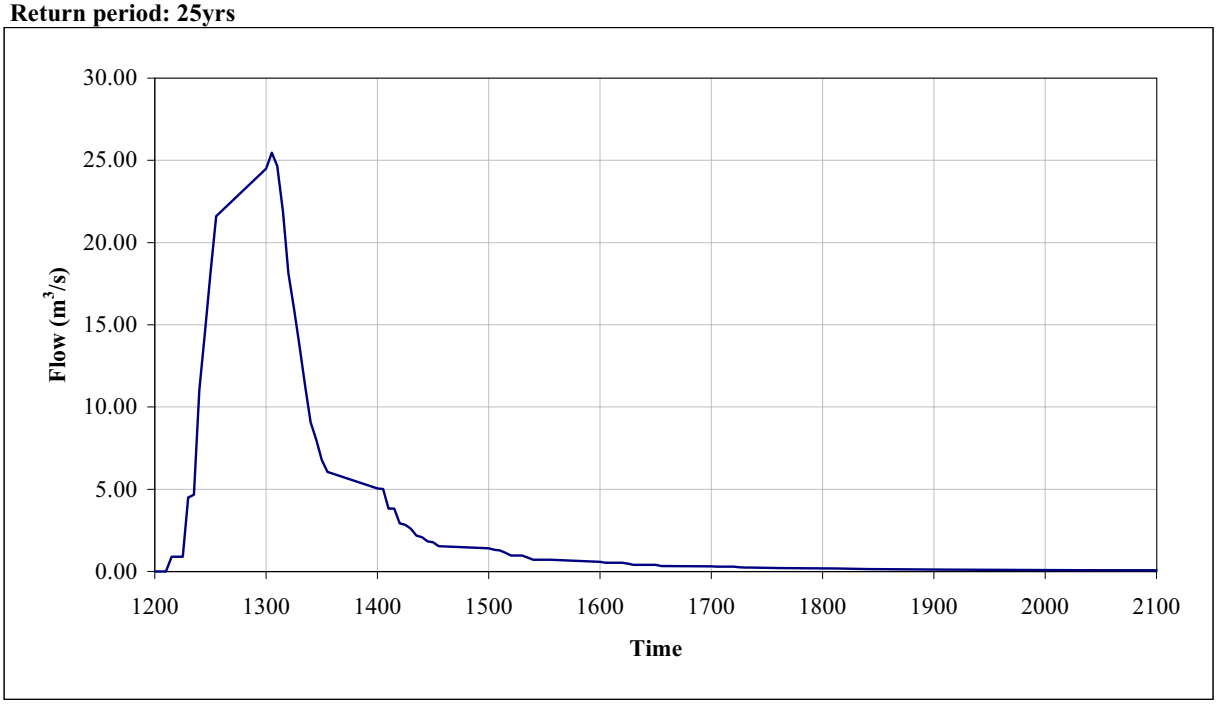
Return period: 2yrs



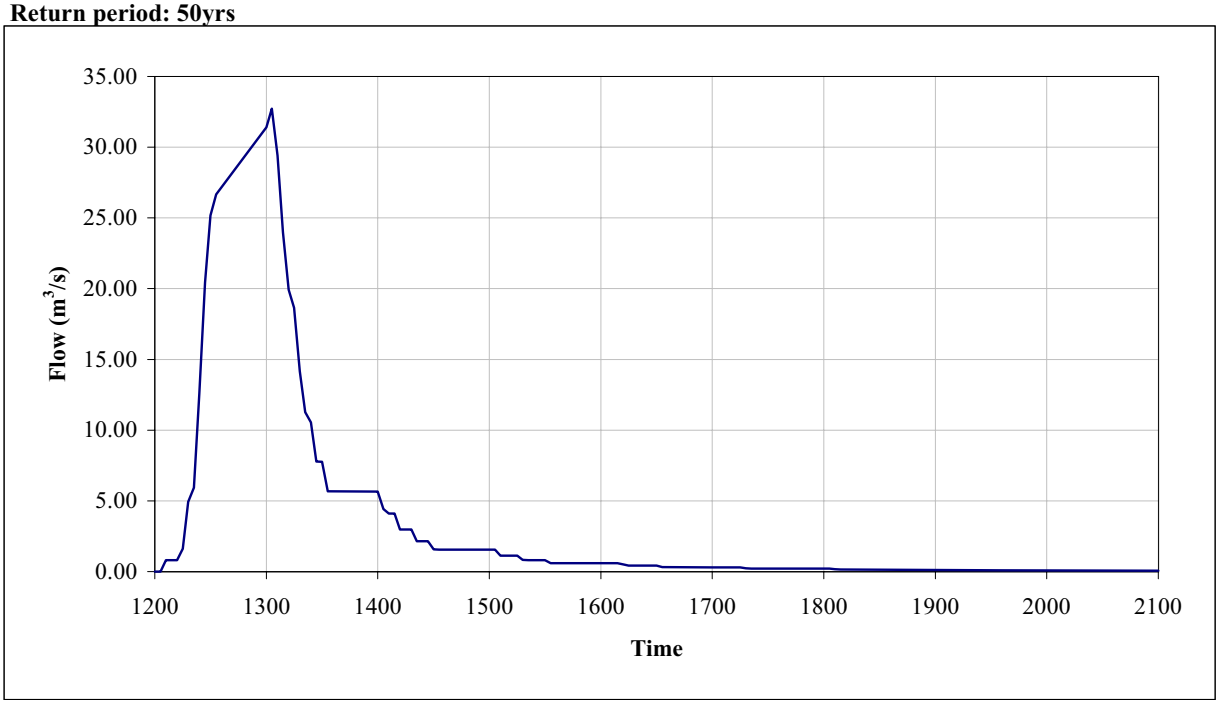
Return period: 10yrs



Return period: 25yrs



Return period: 50yrs



HMS * Summary of Results for J-Out

Project : Silhouette **Run Name : Run 4**

Start of Run	**: 24Feb05 1200**	**Basin Model**	**: Silhouette**
End of Run	**: 24Feb05 2100**	**Met. Model**	**: 2yr Flood**
Execution Time	**: 24Feb05 1028**	**Control Specs**	**: Silhouette**

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1200	0.0000	0.0000
24 Feb 05	1205	0.0000	0.0000
24 Feb 05	1210	0.0000	0.0000
24 Feb 05	1215	0.0000	0.0000
24 Feb 05	1220	0.0000	0.0000
24 Feb 05	1225	0.3671	0.3671
24 Feb 05	1230	0.3822	0.3822
24 Feb 05	1235	0.3823	0.3823
24 Feb 05	1240	1.2494	1.2494
24 Feb 05	1245	1.4410	1.4410
24 Feb 05	1250	1.8178	1.8178
24 Feb 05	1255	2.5641	2.5641
24 Feb 05	1300	2.6981	2.6981
24 Feb 05	1305	3.0370	3.0370
24 Feb 05	1310	3.0429	3.0429
24 Feb 05	1315	3.0633	3.0633
24 Feb 05	1320	3.0633	3.0633
24 Feb 05	1325	3.0633	3.0633
24 Feb 05	1330	3.0633	3.0633
24 Feb 05	1335	3.0633	3.0633
24 Feb 05	1340	3.0634	3.0634
24 Feb 05	1345	3.0641	3.0641
24 Feb 05	1350	3.0703	3.0703
24 Feb 05	1355	3.1148	3.1148
24 Feb 05	1400	3.0896	3.0896
24 Feb 05	1405	2.8634	2.8634
24 Feb 05	1410	2.8033	2.8033
24 Feb 05	1415	2.3053	2.3053
24 Feb 05	1420	2.3052	2.3052
24 Feb 05	1425	1.8428	1.8428
24 Feb 05	1430	1.8420	1.8420
24 Feb 05	1435	1.5010	1.5010
24 Feb 05	1440	1.4699	1.4699
24 Feb 05	1445	1.4699	1.4699
24 Feb 05	1450	1.1735	1.1735
24 Feb 05	1455	1.1716	1.1716
24 Feb 05	1500	1.1254	1.1254
24 Feb 05	1505	0.9339	0.9339
24 Feb 05	1510	0.9332	0.9332
24 Feb 05	1515	0.9210	0.9210
24 Feb 05	1520	0.7448	0.7448
24 Feb 05	1525	0.7429	0.7429
24 Feb 05	1530	0.7429	0.7429
24 Feb 05	1535	0.6112	0.6112
24 Feb 05	1540	0.5912	0.5912

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1545	0.5912	0.5912
24 Feb 05	1550	0.5907	0.5907
24 Feb 05	1555	0.4750	0.4750
24 Feb 05	1600	0.4704	0.4704
24 Feb 05	1605	0.4703	0.4703
24 Feb 05	1610	0.4703	0.4703
24 Feb 05	1615	0.3821	0.3821
24 Feb 05	1620	0.3742	0.3742
24 Feb 05	1625	0.3741	0.3741
24 Feb 05	1630	0.3741	0.3741
24 Feb 05	1635	0.3396	0.3396
24 Feb 05	1640	0.2981	0.2981
24 Feb 05	1645	0.2976	0.2976
24 Feb 05	1650	0.2976	0.2976
24 Feb 05	1655	0.2976	0.2976
24 Feb 05	1700	0.2644	0.2644
24 Feb 05	1705	0.2370	0.2370
24 Feb 05	1710	0.2367	0.2367
24 Feb 05	1715	0.2367	0.2367
24 Feb 05	1720	0.2367	0.2367
24 Feb 05	1725	0.2318	0.2318
24 Feb 05	1730	0.1910	0.1910
24 Feb 05	1735	0.1882	0.1882
24 Feb 05	1740	0.1882	0.1882
24 Feb 05	1745	0.1882	0.1882
24 Feb 05	1750	0.1882	0.1882
24 Feb 05	1755	0.1810	0.1810
24 Feb 05	1800	0.1513	0.1513
24 Feb 05	1805	0.1497	0.1497
24 Feb 05	1810	0.1496	0.1496
24 Feb 05	1815	0.1496	0.1496
24 Feb 05	1820	0.1496	0.1496
24 Feb 05	1825	0.1496	0.1496
24 Feb 05	1830	0.1272	0.1272
24 Feb 05	1835	0.1192	0.1192
24 Feb 05	1840	0.1190	0.1190
24 Feb 05	1845	0.1190	0.1190
24 Feb 05	1850	0.1190	0.1190
24 Feb 05	1855	0.1190	0.1190
24 Feb 05	1900	0.1190	0.1190
24 Feb 05	1905	0.1036	0.1036
24 Feb 05	1910	0.0950	0.0950
24 Feb 05	1915	0.0946	0.0946
24 Feb 05	1920	0.0946	0.0946
24 Feb 05	1925	0.0946	0.0946
24 Feb 05	1930	0.0946	0.0946
24 Feb 05	1935	0.0946	0.0946
24 Feb 05	1940	0.0946	0.0946
24 Feb 05	1945	0.0795	0.0795
24 Feb 05	1950	0.0754	0.0754
24 Feb 05	1955	0.0752	0.0752
24 Feb 05	2000	0.0752	0.0752
24 Feb 05	2005	0.0752	0.0752
24 Feb 05	2010	0.0752	0.0752
24 Feb 05	2015	0.0752	0.0752

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	2020	0.0752	0.0752
24 Feb 05	2025	0.0702	0.0702
24 Feb 05	2030	0.0621	0.0621
24 Feb 05	2035	0.0612	0.0612
24 Feb 05	2040	0.0612	0.0612
24 Feb 05	2045	0.0612	0.0612
24 Feb 05	2050	0.0612	0.0612
24 Feb 05	2055	0.0612	0.0612
24 Feb 05	2100	0.0612	0.0612

HMS * Summary of Results for J-Out

Project : Silhouette Run Name : Run 1

Start of Run : 24Feb05 1200 Basin Model : Silhouette
End of Run : 24Feb05 2100 Met. Model : 10yr Flood
Execution Time : 24Feb05 1024 Control Specs : Silhouette

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1200	0.000	0.000
24 Feb 05	1205	0.000	0.000
24 Feb 05	1210	0.000	0.000
24 Feb 05	1215	0.593	0.593
24 Feb 05	1220	0.601	0.601
24 Feb 05	1225	0.601	0.601
24 Feb 05	1230	1.941	1.941
24 Feb 05	1235	3.452	3.452
24 Feb 05	1240	6.224	6.224
24 Feb 05	1245	7.991	7.991
24 Feb 05	1250	11.823	11.823
24 Feb 05	1255	13.488	13.488
24 Feb 05	1300	14.604	14.604
24 Feb 05	1305	15.844	15.844
24 Feb 05	1310	15.844	15.844
24 Feb 05	1315	15.530	15.530
24 Feb 05	1320	15.321	15.321
24 Feb 05	1325	13.369	13.369
24 Feb 05	1330	10.700	10.700
24 Feb 05	1335	10.656	10.656
24 Feb 05	1340	8.315	8.315
24 Feb 05	1345	6.753	6.753
24 Feb 05	1350	6.406	6.406
24 Feb 05	1355	4.955	4.955
24 Feb 05	1400	4.890	4.890
24 Feb 05	1405	3.820	3.820
24 Feb 05	1410	3.711	3.711
24 Feb 05	1415	3.398	3.398
24 Feb 05	1420	2.806	2.806
24 Feb 05	1425	2.806	2.806
24 Feb 05	1430	2.140	2.140
24 Feb 05	1435	2.117	2.117
24 Feb 05	1440	2.117	2.117
24 Feb 05	1445	1.604	1.604
24 Feb 05	1450	1.595	1.595
24 Feb 05	1455	1.595	1.595
24 Feb 05	1500	1.236	1.236
24 Feb 05	1505	1.201	1.201
24 Feb 05	1510	1.201	1.201
24 Feb 05	1515	1.187	1.187
24 Feb 05	1520	0.905	0.905
24 Feb 05	1525	0.903	0.903
24 Feb 05	1530	0.903	0.903
24 Feb 05	1535	0.901	0.901
24 Feb 05	1540	0.682	0.682

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1545	0.679	0.679
24 Feb 05	1550	0.679	0.679
24 Feb 05	1555	0.679	0.679
24 Feb 05	1600	0.553	0.553
24 Feb 05	1605	0.511	0.511
24 Feb 05	1610	0.511	0.511
24 Feb 05	1615	0.511	0.511
24 Feb 05	1620	0.511	0.511
24 Feb 05	1625	0.425	0.425
24 Feb 05	1630	0.384	0.384
24 Feb 05	1635	0.384	0.384
24 Feb 05	1640	0.384	0.384
24 Feb 05	1645	0.384	0.384
24 Feb 05	1650	0.384	0.384
24 Feb 05	1655	0.297	0.297
24 Feb 05	1700	0.288	0.288
24 Feb 05	1705	0.288	0.288
24 Feb 05	1710	0.288	0.288
24 Feb 05	1715	0.288	0.288
24 Feb 05	1720	0.288	0.288
24 Feb 05	1725	0.243	0.243
24 Feb 05	1730	0.217	0.217
24 Feb 05	1735	0.217	0.217
24 Feb 05	1740	0.217	0.217
24 Feb 05	1745	0.217	0.217
24 Feb 05	1750	0.217	0.217
24 Feb 05	1755	0.217	0.217
24 Feb 05	1800	0.190	0.190
24 Feb 05	1805	0.164	0.164
24 Feb 05	1810	0.163	0.163
24 Feb 05	1815	0.163	0.163
24 Feb 05	1820	0.163	0.163
24 Feb 05	1825	0.163	0.163
24 Feb 05	1830	0.163	0.163
24 Feb 05	1835	0.163	0.163
24 Feb 05	1840	0.141	0.141
24 Feb 05	1845	0.123	0.123
24 Feb 05	1850	0.122	0.122
24 Feb 05	1855	0.122	0.122
24 Feb 05	1900	0.122	0.122
24 Feb 05	1905	0.122	0.122
24 Feb 05	1910	0.122	0.122
24 Feb 05	1915	0.122	0.122
24 Feb 05	1920	0.122	0.122
24 Feb 05	1925	0.105	0.105
24 Feb 05	1930	0.093	0.093
24 Feb 05	1935	0.092	0.092
24 Feb 05	1940	0.092	0.092
24 Feb 05	1945	0.092	0.092
24 Feb 05	1950	0.092	0.092
24 Feb 05	1955	0.092	0.092
24 Feb 05	2000	0.092	0.092
24 Feb 05	2005	0.092	0.092
24 Feb 05	2010	0.092	0.092
24 Feb 05	2015	0.080	0.080

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	2020	0.071	0.071
24 Feb 05	2025	0.070	0.070
24 Feb 05	2030	0.070	0.070
24 Feb 05	2035	0.070	0.070
24 Feb 05	2040	0.070	0.070
24 Feb 05	2045	0.070	0.070
24 Feb 05	2050	0.070	0.070
24 Feb 05	2055	0.070	0.070
24 Feb 05	2100	0.070	0.070

HMS * Summary of Results for J-Out

Project : Silhouette **Run Name : Run 2**

Start of Run : 24Feb05 1200 **Basin Model : Silhouette**

End of Run : 24Feb05 2100 **Met. Model : 25yr Flood**

Execution Time : 24Feb05 1024 **Control Specs : Silhouette**

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1200	0.000	0.000
24 Feb 05	1205	0.000	0.000
24 Feb 05	1210	0.000	0.000
24 Feb 05	1215	0.901	0.901
24 Feb 05	1220	0.905	0.905
24 Feb 05	1225	0.905	0.905
24 Feb 05	1230	4.506	4.506
24 Feb 05	1235	4.671	4.671
24 Feb 05	1240	11.034	11.034
24 Feb 05	1245	14.605	14.605
24 Feb 05	1250	18.132	18.132
24 Feb 05	1255	21.596	21.596
24 Feb 05	1300	24.490	24.490
24 Feb 05	1305	25.470	25.470
24 Feb 05	1310	24.663	24.663
24 Feb 05	1315	21.890	21.890
24 Feb 05	1320	18.143	18.143
24 Feb 05	1325	15.953	15.953
24 Feb 05	1330	13.715	13.715
24 Feb 05	1335	11.247	11.247
24 Feb 05	1340	9.065	9.065
24 Feb 05	1345	7.995	7.995
24 Feb 05	1350	6.778	6.778
24 Feb 05	1355	6.048	6.048
24 Feb 05	1400	5.052	5.052
24 Feb 05	1405	5.020	5.020
24 Feb 05	1410	3.829	3.829
24 Feb 05	1415	3.828	3.828
24 Feb 05	1420	2.928	2.928
24 Feb 05	1425	2.833	2.833
24 Feb 05	1430	2.597	2.597
24 Feb 05	1435	2.173	2.173
24 Feb 05	1440	2.091	2.091
24 Feb 05	1445	1.825	1.825
24 Feb 05	1450	1.774	1.774
24 Feb 05	1455	1.541	1.541
24 Feb 05	1500	1.416	1.416
24 Feb 05	1505	1.311	1.311
24 Feb 05	1510	1.288	1.288
24 Feb 05	1515	1.134	1.134
24 Feb 05	1520	0.972	0.972
24 Feb 05	1525	0.967	0.967
24 Feb 05	1530	0.967	0.967
24 Feb 05	1535	0.844	0.844
24 Feb 05	1540	0.717	0.717

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1545	0.712	0.712
24 Feb 05	1550	0.712	0.712
24 Feb 05	1555	0.712	0.712
24 Feb 05	1600	0.579	0.579
24 Feb 05	1605	0.532	0.532
24 Feb 05	1610	0.532	0.532
24 Feb 05	1615	0.532	0.532
24 Feb 05	1620	0.532	0.532
24 Feb 05	1625	0.482	0.482
24 Feb 05	1630	0.398	0.398
24 Feb 05	1635	0.395	0.395
24 Feb 05	1640	0.395	0.395
24 Feb 05	1645	0.395	0.395
24 Feb 05	1650	0.395	0.395
24 Feb 05	1655	0.338	0.338
24 Feb 05	1700	0.314	0.314
24 Feb 05	1705	0.291	0.291
24 Feb 05	1710	0.291	0.291
24 Feb 05	1715	0.291	0.291
24 Feb 05	1720	0.291	0.291
24 Feb 05	1725	0.258	0.258
24 Feb 05	1730	0.246	0.246
24 Feb 05	1735	0.246	0.246
24 Feb 05	1740	0.217	0.217
24 Feb 05	1745	0.214	0.214
24 Feb 05	1750	0.214	0.214
24 Feb 05	1755	0.214	0.214
24 Feb 05	1800	0.191	0.191
24 Feb 05	1805	0.182	0.182
24 Feb 05	1810	0.181	0.181
24 Feb 05	1815	0.181	0.181
24 Feb 05	1820	0.171	0.171
24 Feb 05	1825	0.157	0.157
24 Feb 05	1830	0.157	0.157
24 Feb 05	1835	0.157	0.157
24 Feb 05	1840	0.138	0.138
24 Feb 05	1845	0.134	0.134
24 Feb 05	1850	0.134	0.134
24 Feb 05	1855	0.134	0.134
24 Feb 05	1900	0.134	0.134
24 Feb 05	1905	0.134	0.134
24 Feb 05	1910	0.121	0.121
24 Feb 05	1915	0.115	0.115
24 Feb 05	1920	0.114	0.114
24 Feb 05	1925	0.101	0.101
24 Feb 05	1930	0.099	0.099
24 Feb 05	1935	0.098	0.098
24 Feb 05	1940	0.098	0.098
24 Feb 05	1945	0.098	0.098
24 Feb 05	1950	0.098	0.098
24 Feb 05	1955	0.098	0.098
24 Feb 05	2000	0.098	0.098
24 Feb 05	2005	0.090	0.090
24 Feb 05	2010	0.083	0.083
24 Feb 05	2015	0.075	0.075

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	2020	0.073	0.073
24 Feb 05	2025	0.073	0.073
24 Feb 05	2030	0.073	0.073
24 Feb 05	2035	0.073	0.073
24 Feb 05	2040	0.073	0.073
24 Feb 05	2045	0.073	0.073
24 Feb 05	2050	0.073	0.073
24 Feb 05	2055	0.073	0.073
24 Feb 05	2100	0.073	0.073

HMS * Summary of Results for J-Out

Project : Silhouette Run Name : Run 3

Start of Run : 24Feb05 1200 Basin Model : Silhouette

End of Run : 24Feb05 2100 Met. Model : 50yr Flood

Execution Time : 24Feb05 1024 Control Specs : Silhouette

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1200	0.000	0.000
24 Feb 05	1205	0.000	0.000
24 Feb 05	1210	0.811	0.811
24 Feb 05	1215	0.816	0.816
24 Feb 05	1220	0.816	0.816
24 Feb 05	1225	1.606	1.606
24 Feb 05	1230	4.940	4.940
24 Feb 05	1235	5.923	5.923
24 Feb 05	1240	12.580	12.580
24 Feb 05	1245	20.438	20.438
24 Feb 05	1250	25.181	25.181
24 Feb 05	1255	26.657	26.657
24 Feb 05	1300	31.405	31.405
24 Feb 05	1305	32.719	32.719
24 Feb 05	1310	29.406	29.406
24 Feb 05	1315	23.985	23.985
24 Feb 05	1320	19.917	19.917
24 Feb 05	1325	18.645	18.645
24 Feb 05	1330	14.151	14.151
24 Feb 05	1335	11.272	11.272
24 Feb 05	1340	10.546	10.546
24 Feb 05	1345	7.789	7.789
24 Feb 05	1350	7.755	7.755
24 Feb 05	1355	5.688	5.688
24 Feb 05	1400	5.659	5.659
24 Feb 05	1405	4.433	4.433
24 Feb 05	1410	4.110	4.110
24 Feb 05	1415	4.110	4.110
24 Feb 05	1420	2.981	2.981
24 Feb 05	1425	2.977	2.977
24 Feb 05	1430	2.977	2.977
24 Feb 05	1435	2.155	2.155
24 Feb 05	1440	2.153	2.153
24 Feb 05	1445	2.153	2.153
24 Feb 05	1450	1.580	1.580
24 Feb 05	1455	1.555	1.555
24 Feb 05	1500	1.555	1.555
24 Feb 05	1505	1.555	1.555
24 Feb 05	1510	1.126	1.126
24 Feb 05	1515	1.123	1.123
24 Feb 05	1520	1.123	1.123
24 Feb 05	1525	1.123	1.123
24 Feb 05	1530	0.836	0.836
24 Feb 05	1535	0.810	0.810
24 Feb 05	1540	0.810	0.810

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	1545	0.810	0.810
24 Feb 05	1550	0.810	0.810
24 Feb 05	1555	0.595	0.595
24 Feb 05	1600	0.585	0.585
24 Feb 05	1605	0.585	0.585
24 Feb 05	1610	0.585	0.585
24 Feb 05	1615	0.585	0.585
24 Feb 05	1620	0.514	0.514
24 Feb 05	1625	0.423	0.423
24 Feb 05	1630	0.422	0.422
24 Feb 05	1635	0.422	0.422
24 Feb 05	1640	0.422	0.422
24 Feb 05	1645	0.422	0.422
24 Feb 05	1650	0.419	0.419
24 Feb 05	1655	0.309	0.309
24 Feb 05	1700	0.304	0.304
24 Feb 05	1705	0.304	0.304
24 Feb 05	1710	0.304	0.304
24 Feb 05	1715	0.304	0.304
24 Feb 05	1720	0.304	0.304
24 Feb 05	1725	0.304	0.304
24 Feb 05	1730	0.229	0.229
24 Feb 05	1735	0.220	0.220
24 Feb 05	1740	0.219	0.219
24 Feb 05	1745	0.219	0.219
24 Feb 05	1750	0.219	0.219
24 Feb 05	1755	0.219	0.219
24 Feb 05	1800	0.219	0.219
24 Feb 05	1805	0.219	0.219
24 Feb 05	1810	0.175	0.175
24 Feb 05	1815	0.159	0.159
24 Feb 05	1820	0.158	0.158
24 Feb 05	1825	0.158	0.158
24 Feb 05	1830	0.158	0.158
24 Feb 05	1835	0.158	0.158
24 Feb 05	1840	0.158	0.158
24 Feb 05	1845	0.158	0.158
24 Feb 05	1850	0.158	0.158
24 Feb 05	1855	0.141	0.141
24 Feb 05	1900	0.115	0.115
24 Feb 05	1905	0.114	0.114
24 Feb 05	1910	0.114	0.114
24 Feb 05	1915	0.114	0.114
24 Feb 05	1920	0.114	0.114
24 Feb 05	1925	0.114	0.114
24 Feb 05	1930	0.114	0.114
24 Feb 05	1935	0.114	0.114
24 Feb 05	1940	0.114	0.114
24 Feb 05	1945	0.114	0.114
24 Feb 05	1950	0.092	0.092
24 Feb 05	1955	0.083	0.083
24 Feb 05	2000	0.082	0.082
24 Feb 05	2005	0.082	0.082
24 Feb 05	2010	0.082	0.082
24 Feb 05	2015	0.082	0.082

Date	Time	Inflow (cms) from A	Outflow (cms)
24 Feb 05	2020	0.082	0.082
24 Feb 05	2025	0.082	0.082
24 Feb 05	2030	0.082	0.082
24 Feb 05	2035	0.082	0.082
24 Feb 05	2040	0.082	0.082
24 Feb 05	2045	0.082	0.082
24 Feb 05	2050	0.073	0.073
24 Feb 05	2055	0.067	0.067
24 Feb 05	2100	0.067	0.067

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Appendix B: Term of References Issued by MoE

MINISTRY OF ENVIRONMENT & NATURAL RESOURCES
POLLUTION CONTROL & ENVIRONMENTAL IMPACTS DIVISION
Botanical Gardens, Mont Fleuri, P.O. Box 445, Republic of Seychelles
Telephone: (248) 224644, Telefax: (248) 224500 E-mail Address: eapc@seychelles.net

Please address all correspondence to the Principal Secretary

Your Ref:
Our Ref: MENR/PCEI /EIA/Silhouette Island Resort
Enquiries To: J. Rath
Telephone: 670 500
Telephone Ext: 568
Date: 18th January 2005

Patrick Harel
SIGMA – Ove Arup and Partners Consulting Engineers
19 Church Street
Port Louis
Mauritius

Dear Sir,

RE: SCOPING REPORT FOR THE PROPOSED SILHOUETTE ISLAND RESORT

Reference is made to your submission of the above document for comments by our ministry.

Please note that after perusal of the document, the Ministry of Environment and Natural Resources has no objection to its content.

However, we noticed that the scoping verification forms for each individual consulted in the process had not been submitted as an Annex to the report. We attach herewith a copy of the form. It will need to be filled in accordingly and submitted as an annex to the detailed environmental impact assessment report for the project.

The Terms of Reference (TOR) for the environment impact study will be submitted soon.

Full adherence to the TOR is expected if the process of environmental authorization is to be treated expediously

We count on your continued support and cooperation.

Yours faithfully,

Joseph Rath
Ag. Director (EIA)
For: DIRECTOR GENERAL (PCEI)

Seychelles

MINISTRY OF ENVIRONMENT & NATURAL RESOURCES
POLLUTION CONTROL AND ENVIRONMENT IMPACTS DIVISION
Botanical Gardens, Mont Fleuri, P.O. Box 445, Republic of Seychelles
Telephone: (248) 670 500, Telefax: (248) 610 648 E-mail Address: eapc@seychelles.net

Please address all correspondence to the Principal Secretary

Your Ref:	
Our Ref:	**MENR/PCEI/EIA/Silhouette Island Resort**
Enquiries To:	**Joseph Rath**
Telephone:	**670 500**
Telephone Ext:	**568**
Date:	**27th January 2005**

TERMS OF REFERENCE FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STATEMENT UNDER THE ENVIRONMENT PROTECTION (IMPACT ASSESSMENT) REGULATIONS, 1996

PROPOSED HOTEL RESORT DEVELOPMENT ON SILHOUETTE ISLAND

POLLUTION CONTROL AND ENVIRONMENTAL IMPACTS DIVISION
ENVIRONMENTAL IMPACT ASSESSMENT SECTION
BOTANICAL GARDENS
P. O. BOX 445
VICTORIRA

Millennium Seychelles
One Nation One Future

Terms of Reference for the preparation of an Environmental Impact Assessment (EIA) Statement for a Hotel Development

APPLICANT: SIGMA – Ove Arup and Partners Consulting Engineers

PROPOSED DEVELOPMENT: HOTEL RESORT DEVELOPMENT

LOCATION: SILHOUETTE ISLAND

PREAMBLE

Pursuant to Schedule 1, Regulation 3(1) (b) of the Environment Protection (Impact Assessment) Regulations, 1996, Schedule 1, a hotel resort development is a prescribed project. Under Section 15(1) of the Environment Protection Act, 1994 the preparation of an Environmental Impact Assessment (EIA) statement is required when an application is made to the Authority for Environmental Authorization.

The impacts of a tourist development vary widely according to its type, size and location. Tourist developments tend to be proposed in areas of high environmental value (such as coasts, rivers and islands) and care needs to be taken to ensure that this environmental value is able to be maintained given the proposed increased usage of the site. Additionally, tourist developments have been regarded as contributing to a loss of community character, particularly when located close to small population centres.

DEGREE OF DETAIL

In preparing the EIA, it is the applicants responsibility to address the impacts of the proposal to the degree necessary to enable the Authority to be informed of all relevant impacts of the proposal. The level and nature of investigations should be relative to the likely extent and scale of impacts. It is suggested that the applicant/consultant contact the relevant referral agencies as outlined during the Scoping Exercise of the EA procedures to clarify the nature and level of investigations.
It should be noted that the preparation of Terms of Reference for an EIA does not indicate approval or support in any way, nor does it indicate approval in principle.

CONTENTS

The EIA produced to accompany the application is to address the issues set out below and should generally follow the format as suggested in this document.

1. Summary

A summary which generally follows the format of the EIA is to be included.

2. Alternatives to the project

Describe any prudent and feasible alternatives to the proposed development investigated during the planning process, including alternative locations for such a development, with an overview of the consequences in each case. Discussion should include the reason for choice of the preferred option, and the likely situation and use of the site if the project does not proceed.

Alternatives need to include alternative technologies as in sewage or wastewater disposal systems.

3. Terms of Reference

The Terms of Reference and accompanying letter of transmission provided by the Ministry of Environment and Natural Resources must be included in the EIA documentation.

4. Description of the Proposal

State the objectives of the proposal and why it is needed. Describe the type of development proposed including information on:

- location of the site (including map) and a site plan (including the nominated positions or areas for chalet developments, waterways and wildlife corridors, access roads and the location and identification of all facilities on the site);
- detailed concept and staging proposed;
- prospects or proposals for future expansion (including the proposal to increase the number of rooms for the undertaking);
- location criteria, including constraints (such as areas of high conservation value, steep areas, coastal zone);
- area of land required for the various types of development;
- number of residential units, allotment size, and resultant population size and structure likely to be generated by the development;
- the nature of any residential community to be created and/displaced;
- distances to boundaries;
- slopes and elevations;
- site drainage and erosion controls particularly during the clearing and construction phases that will ensure that all material is contained and cause no impact on nearby watercourses and sea;
- proposals for rehabilitation, including plant species and proposed final use of the site;
- details of the site, location and type of Public Open Space system proposed.
- extent of vegetation communities to be removed or impacted by the development, including what proportion of the existing natural vegetation will remain undeveloped;

Provide details of the development including:

- construction timetable;
- quantities, nature and sources of materials required for fill, construction and operation, and methods of moving materials to and from the site;
- extent and methods of blasting/excavation, extent of earthmoving and methods, and sites of spoil disposal
- the machinery and equipment to be used for excavation and construction;
- building design limitations and standards (e.g.. height, materials, aesthetic value).
- life of operations and employment projections; and
- hours of work

State and discuss pollution management strategies and control measures to be used, including:

- control measures to be taken during construction to minimize dust, noise, air and water pollution and sediment loss in rainfall runoff;
- the collection, treatment and disposal of contaminated storm water runoff and other liquid and solid wastes,

In particular, detail;

- any artificial wetlands including their effects on the natural hydrology; and
- proposed sewage treatment method and proposed staging of the works.

The following details relevant to the proposed site and surrounding area should also be described:

- government planning controls, regulations and policies applying to the development;
- past and current usage of the site and surrounding area, including any history of site contamination including the assessment and levels of existing contamination;
- approvals required for the project and expected program for approval applications
- existing infrastructure facilities available on and adjacent to the site.
- present and proposed future tenures of each parcel of land associated with and adjacent to the development, including areas for public purposes, environmental buffers, habitat corridor, commercial and any other uses;
- current applications or approvals; and
- existing infrastructure facilities available on and adjacent to the site

5. Description of Environment and Assessment of Potential Impacts

Describe the area surrounding the proposed site including information on: buffer distances from the site to alternative land uses; aesthetic and landscape values; structures or archaeological areas of cultural, historical, religious, heritage or social importance.

As well, detail overall environmental protection measures incorporated in the design, siting, layout, landscaping, rehabilitation and associated works to minimize impacts on the environment. Taking into account the adequacy of controls and safeguards, assess the impact of the development during the construction and operating phases.

Information required includes:

Topography

A description of the proposed site in relation to the catchment system and any waterways on or near the site. Discuss any likely influences of the geological features on water quality in the area, particularly if disturbed during construction.

Soils and Geology

A description and map (at suitable scale) covering areas to be disturbed with particular reference to those physical and chemical properties of the materials which may influence erosion potential, a rehabilitation programme, or the quality of water leaving the site.

Hydrology

Describe the water quality in the region of the project and give the average and maximum heights of the water table in relation to the floor of the site. Details provided should include a description and map of existing surface drainage patterns, flows in each stream and the nature and extent of flooding. Predict the quality of waste water to be produced and indicate any effects on water quality of nearby watercourses. Assess the effect of the development on nearby watercourse, on flood levels, on the frequency of flooding events of nearby streams and the effects on stream bank stability.

Waste and Wastewater Management

Discuss the following:

- local service requirements for drainage and water supply, including volume of water needed for the whole development;
- identification of any areas that cannot be adequately serviced by existing public utilities systems;
- details on the sizing and location of the proposed storm water drainage system, possible retention ponds and a risk analysis of susceptibility to flooding;
- method and conceptual design of "environmentally friendly" options for the disposal of storm water into the natural water systems;
- proposed sewage treatment method and proposed staging of the works;

- waste disposal requirements including solid waste treatment and disposal (emphasis should be placed on the positive considerations for the recycling of materials and composting of green wastes as much as possible).

Flora

A vegetation map at site specific scale with particular attention paid to populations of regional significance. The description should contain an assessment of the regional significance of native vegetation and a statement of the potential impacts of the proposal on the terrestrial and aquatic flora. The degree of disturbance to the landscape, stage of regeneration of the vegetation, and the level of exotic plant infestation should be outlined along with the following:

- major species and communities present;
- the conservation status of the area as part of regional conservation planning, indicating how well the affected communities are represented and protected elsewhere within the region;
- note the presence and habitat requirements of any rare or endangered species; and
- extent of the disturbance of natural vegetation.

Fauna

A determination of the fauna occurring in the area, on site and at a regional scale, and a statement of the potential impacts of the proposal on the terrestrial and aquatic fauna. A description of the fauna present or likely to be present in the area should include:

- species diversity and abundance for terrestrial animals,
- any rare or endangered species, their habitat requirements and sensitivity to changes; and
- occurrence, distribution and requirements of migratory species.

Air/Noise

Define the areas of impact and measure and discuss ambient noise levels in all areas likely to be affected by the development. Indicate nearby land uses, dwellings or proposed subdivisions which could be affected by the proposal. Where nearby residents are potentially affected by the proposal, list all noise sources and describe areas where noisy activity could be expected to occur as a result of the proposal. Information on existing air quality should be provided for those air pollutants expected to be emitted by the proposed development. In particular, the impacts of dust nuisance, including that associated with haulage roads, should be detailed.
Discuss potential impacts on existing air quality resulting from existing or approved uses in the vicinity of the subject area.

Transportation

A comprehensive traffic impact assessment should recognize existing and likely proposed transport corridors within the study area and highlight the effects of the development proposal on the existing and proposed transport system external to the area. This study should take account of the ultimate development of the site.

Economic

The economic impact including costs and benefits to local economies; effects on employment; and implications for future development in the locality.

Social

Discuss the following:

- population growth and distribution, existing and estimated for future;
- any impacts on access to public beaches and arrangements to ensure access of public on neighboring beaches
- the effects of the proposal on various individuals and social groups in the area, including measures to mitigate and accommodate any adverse effects of the proposal;

- visual intrusion to the impact of the proposal upon the existing appearance and views of surrounding areas. Consideration should be given to incorporating features within the design of the proposal to mitigate visual intrusion.

6. Environmental Management

In respect of impacts identified which need to be controlled, an environmental management program incorporating an Environmental Management Plan, Monitoring and Reporting should be considered. Where practicable the costs of monitoring programs should be estimated and responsibility for monitoring programs specified. References should be made to relevant legislation and standards.

An Environmental management plan should detail any: habitat enhancement projects or rehabilitation measures; maintenance schedules; erosion and sediment management strategies; pollution control and waste management methods; and a management and administration plan outlining strategies and procedures in the event of an emergency.

Monitoring programs should; ensure safeguards are being effectively applied; identify any unpredicted impacts requiring remedial measures; and measure any differences between predicted and actual impacts.

The reporting program should detail; steps to be taken to correct detrimental effects identified by monitoring; and procedures for reporting on monitoring programs and proposed recipients of reports.

7. Environmental Management

As a result of the findings of the EIA, present a balanced overview of the proposal's net impact and provide recommendations on the proposal. This should include the identification of any alterations to the proposal considered to further mitigate environmental impacts.

8. Conclusions and Recommendations

As a result of the findings of the EIA, present a balanced overview of the proposal's net impact and provide recommendations on the proposal. This should include the identification of any alterations to the proposal considered to further mitigate environmental impacts.

9. Consultation

In preparing the E1A, the applicant/consultant should consult affected and interest groups. The EIA should detail any public comment sought from and any consultation conducted with any affected groups (e.g. community, environmental, industry) in developing the proposal and preparing the EIA. Issues as raised by the Scoping Report submitted for the EIA should be addressed in the report and satisfactorily dealt with.

Early consultation is beneficial in helping to ensure that a development will cause a minimum of undesirable effects and in reducing delays in the latter stages of planning and design. In relation to this EIA, the following bodies and referral agencies should be contacted during the preparation of the EIA:

- list should be the same as that provided during the scoping exercise

10. Copies of Report

Upon completion of the environmental impact assessment statement, a total of **five (5) hard copies** and a digital copy on CD ROM (preferably in Acrobat PDF format) of the report are to be submitted to the Authority – Pollution Control and Environmental Impacts Division, as part of any application.

MINISTRY OF LAND USE AND HABITAT
Development Planning Division
P.O. Box 199, Independence House
Republic of Seychelles

Telex: 225526, Telegram: MINDEV SEYCHELLES, Tel: 284444, Email: tbiscornet@mluh.gov.sc

Please address all correspondence to the Director General

PA/ LTR/ 05/ 625

28th February 2005

Tirant Associates
P.O Box 31
Victoria

Dear Sir

RE: 116 ROOM HOTEL & SPA AT LA PASSE, SILHOUETTE ISLAND RESORT LTD – DC/1195/04

The application regarding the above matter was considered by the Planning Authority and was **approval in principle** subject to the following:

1. The set back distances of the villas to be maintained as proposed.
2. Buildings 3, 4, 5 & 6 to be setback 15m minimum with soft structures being 13m minimum.
3. Presidential villa on the foreshore is not acceptable and it should be relocated.

Also note that EIA to be approved prior to release of planning permission and amendments to be effected as required by the recommendations of the EIA.

4. Dune vegetation is not to be removed. Boardwalks to be provided for access across the dunes.
5. Buildings to be 1m above ground level.

It should be noted that revision submitted in connection with the above may be subject of further queries.

Please attend to the above mentioned at your earliest, but not later than 5 weeks from the date of our letter. Should you fail to respond within the prescribed period it will be assumed that you no longer wish to proceed with the application and we will treat it as "withdrawn". No further reminders will be sent.

Seychelles

Should you need to discuss the matter further, please do not hesitate to contact the Secretariat on telephone no. 284459 in order to book an appointment with Secretary Planning Authority.

Yours faithfully

Brohnsonn Winslow
SECRETARY PLANNING AUTHORITY

c.c: Silhouette Island Resort Ltd
P.O Box 69

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Appendix C: Architectural Details:

1 - RECEPTION
2 - CONFERENCE HALL
3 - MAIN RESTAURANT
4 - MAIN BAR
5 - GRILL
6 - POOL
7 - SPECIALITY RESTAURANT
8 - KIDDIES CLUB
9 - FITNESS CENTRE & TENNIS COURTS
10 - SPA
11 - PRESIDENTIAL VILLAS
12 - BEACH BAR
13 - HOUSEKEEPING STATIONS
14 - BACK OF HOUSE
15 - EXISTING BEACH BAR
16 - PIZZA GARDEN
17 - TAPANYAKI ISLAND

18 - JUNIOR STAFF BLOCK (120 STAFFS)
19 - SUPERVISORS BLOCK
20 - WORKSHOP
21 - SEWAGE & GRAY WATER TREATMENT PLANTS
22 - ELECTRICITY GENERATORS
23 - DESALINATION PLANT & RIVER WATER TREATMENT
24 - FRESH WATER STORAGE TANKS

SCHEDULE OF ROOMS

26 Nos	-	GARDEN VILLAS
4 Nos	-	INTERCONNECTING GARDEN VILLAS (2 pairs)
52 Nos	-	BEACH VILLAS
4 Nos	-	INTERCONNECTING BEACH VILLAS (2 pairs)
6 Nos	-	BEACH VILLAS WITH PLUNGE POOL
10 Nos	-	GARDEN POOL VILLAS
10 Nos	-	BEACH POOL VILLAS
2 Nos	-	PRESIDENTIAL VILLAS (4 rooms)
116 Nos		

Silhouette Island Resort limited

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

OVERALL SITE PLAN

SHEET 1 of 3

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P . O . Box 31
Victoria, Mahe, Seychelles Tel: 224835

Scale: 1:1500 Date: FEB. 2005

Dr: TC Ck:

Dwg No. 04-07/PA/00/101A Rev:

1 - RECEPTION
2 - CONFERENCE HALL
3 - MAIN RESTAURANT
4 - MAIN BAR
5 - GRILL
6 - POOL
7 - SPECIALITY RESTAURANT
8 - KIDDIES CLUB
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24 - FRESH WATER STORAGE TANKS

SCHEDULE OF ROOMS

26 Nos	-	GARDEN VILLAS
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52 Nos	-	BEACH VILLAS
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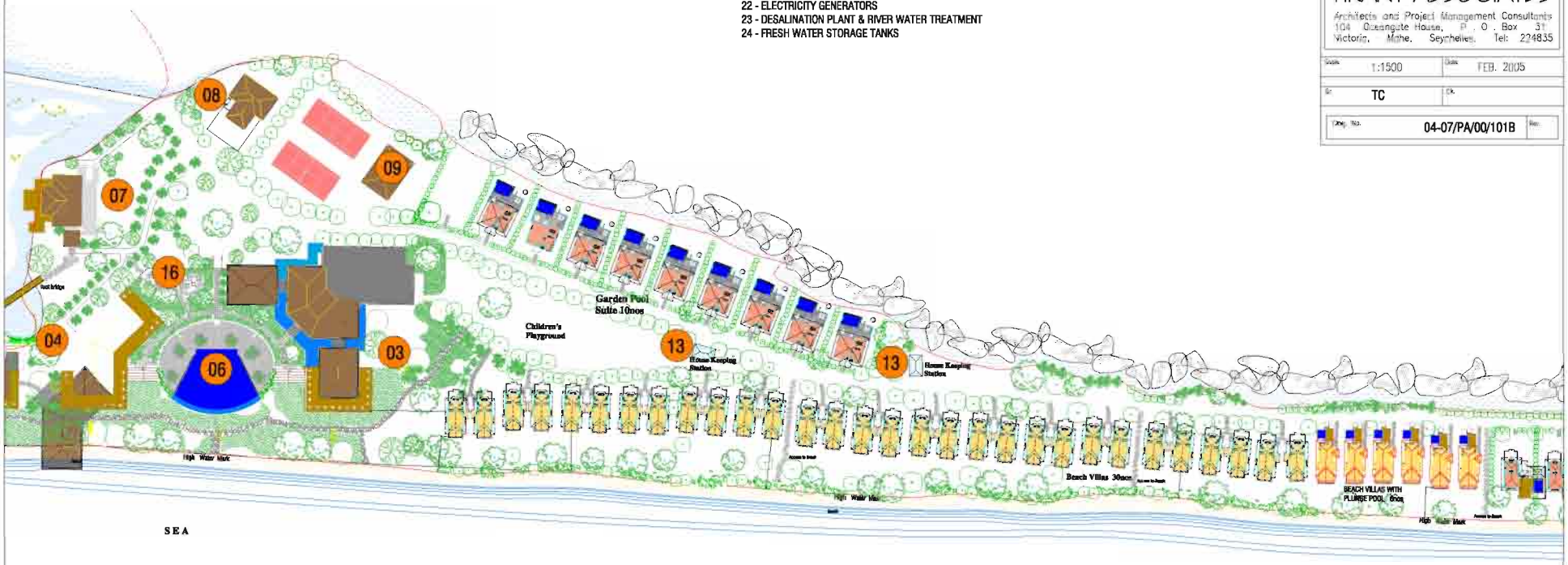
10 Nos	-	GARDEN POOL VILLAS
10 Nos	-	BEACH POOL VILLAS
2 Nos	-	PRESIDENTIAL VILLAS (4 rooms)
116 Nos		



Rev. | Amendments | By | Date

Client
Silhouette Island Resort limited

Project
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title
OVERALL SITE PLAN

SHEET 2 of 3

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles, Tel: 224835

Scale 1:1500 | Date FEB. 2005

Dr TC | Ck.

Dwg No. 04-07/PA/00/101B | Rev.

1 - RECEPTION
2 - CONFERENCE HALL
3 - MAIN RESTAURANT
4 - MAIN BAR
5 - GRILL
6 - POOL
7 - SPECIALITY RESTAURANT
8 - KIDDIES CLUB
9 - FITNESS CENTRE & TENNIS COURTS
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18 - JUNIOR STAFF BLOCK (120 STAFFS)
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24 - FRESH WATER STORAGE TANKS

SCHEDULE OF ROOMS

26 Nos	-	GARDEN VILLAS
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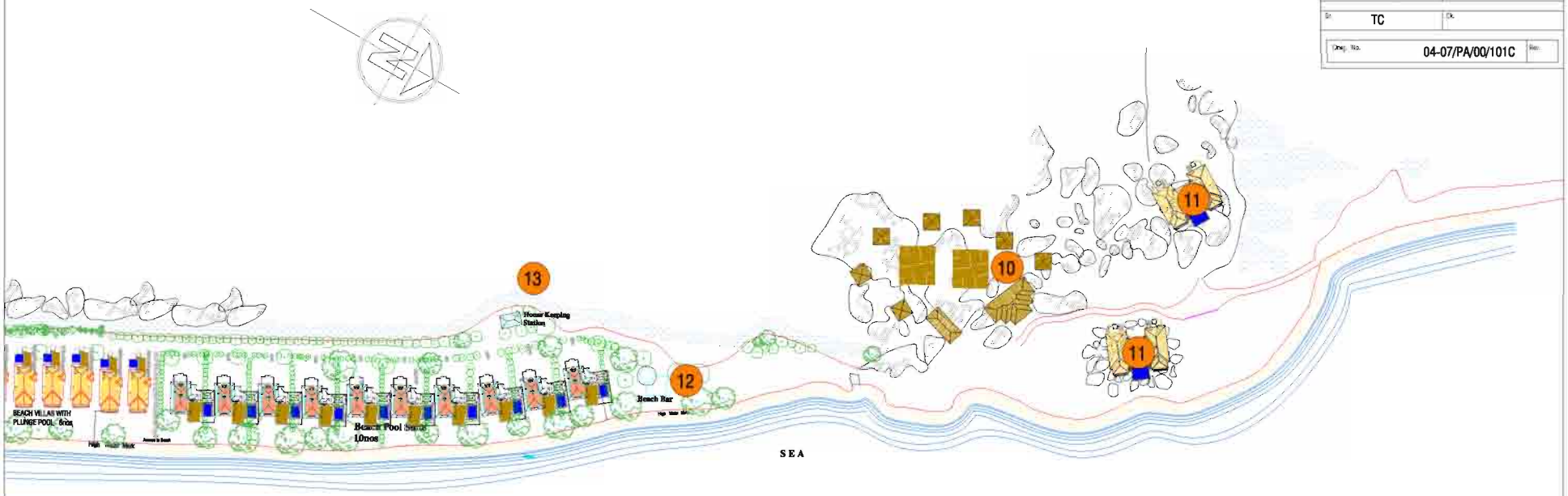


Silhouette Island Resort limited

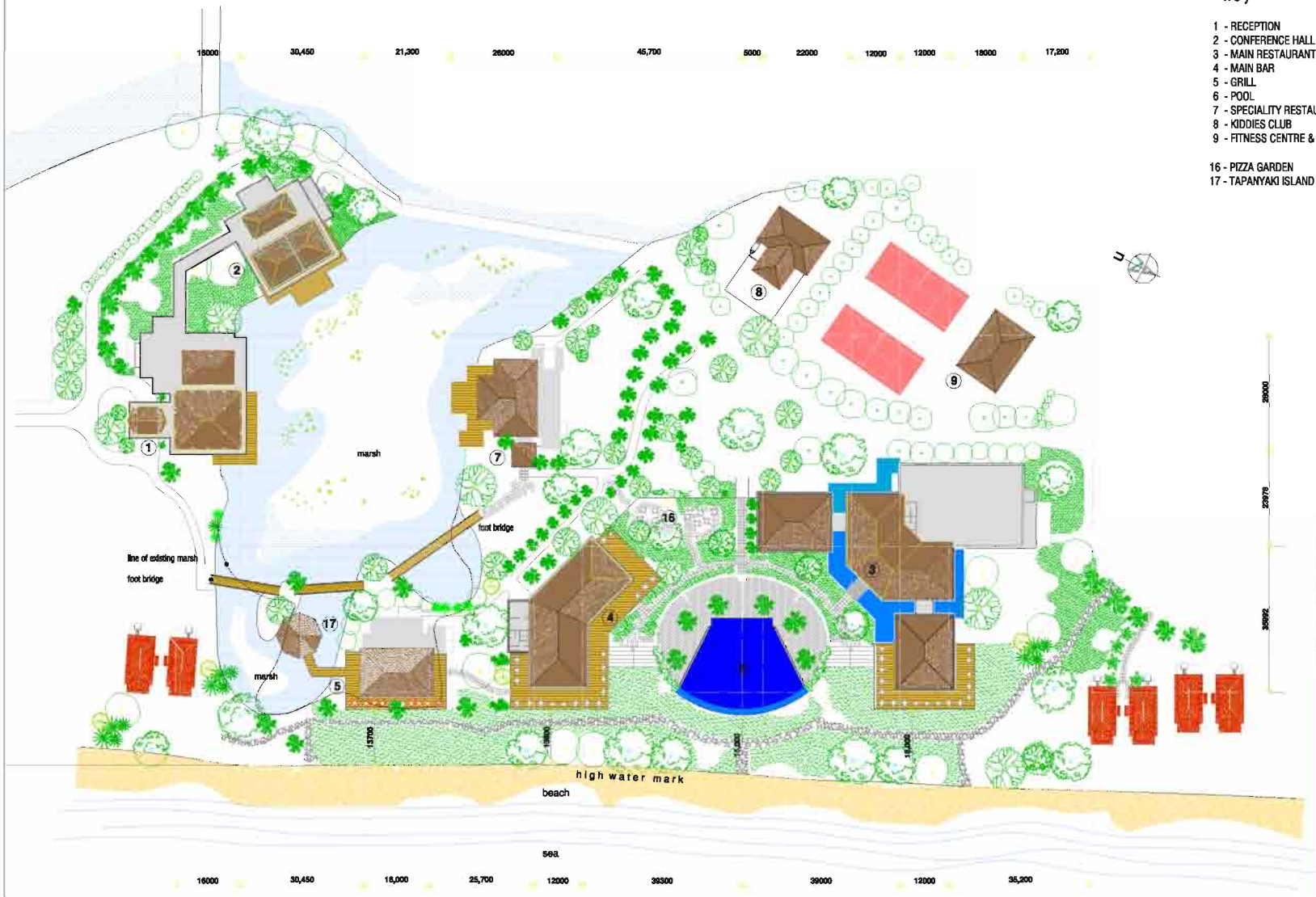
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

OVERALL SITE PLAN

SHEET 3 of 3

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles, Tel: 224835

Scale 1:1500	Date FEB. 2005
Dr TC	Ck
Dwg No. 04-07/PA/00/101C	Rev



key

1 - RECEPTION
2 - CONFERENCE HALL
3 - MAIN RESTAURANT
4 - MAIN BAR
5 - GRILL
6 - POOL
7 - SPECIALITY RESTAURANT
8 - KIDDIES CLUB
9 - FITNESS CENTRE & TENNIS COURTS

16 - PIZZA GARDEN
17 - TAPANYAKI ISLAND

Part SITE PLAN - Public Areas scale 1/500

0 5 10 15 20 scale

Rev. Amendments By Date

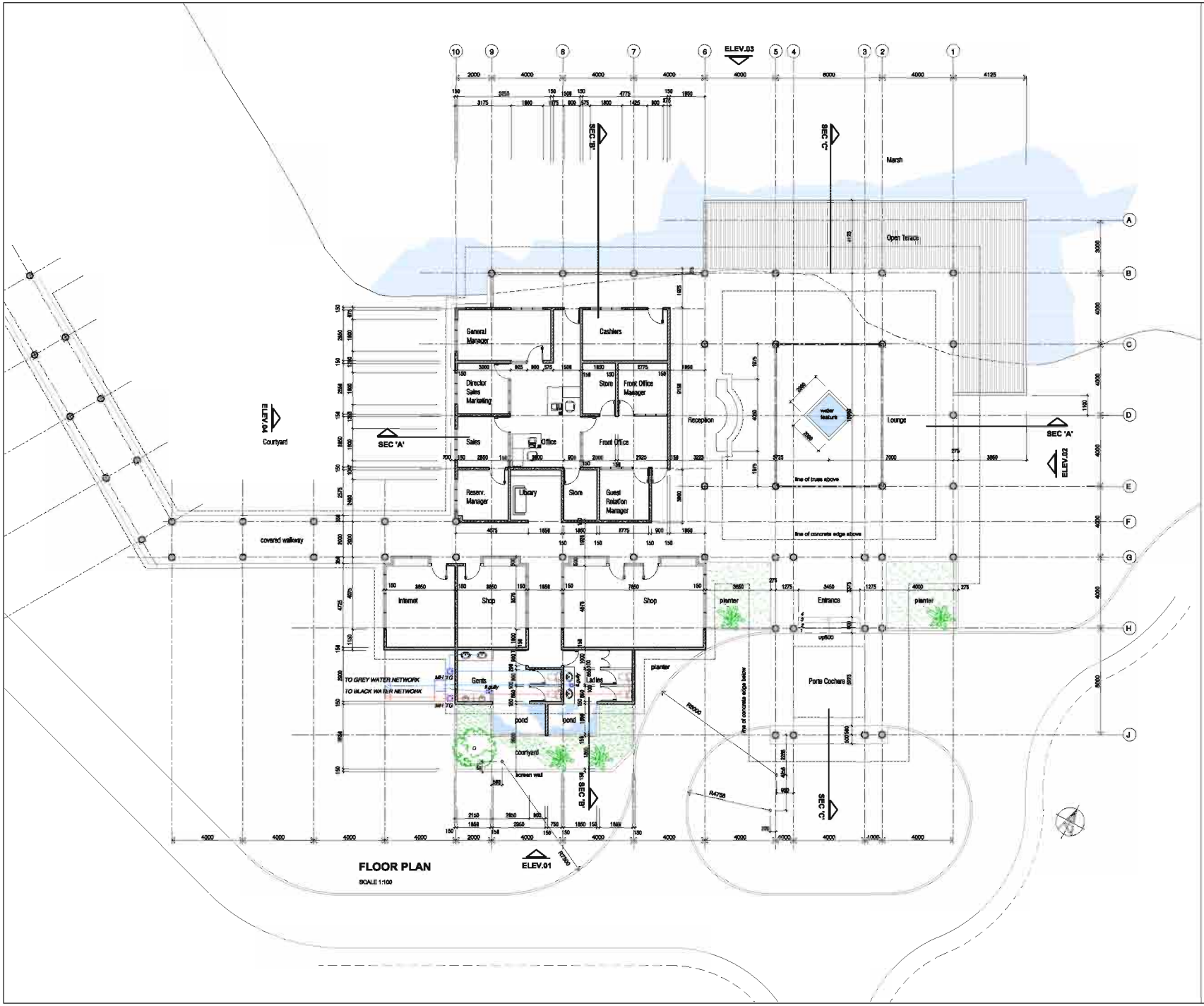
Client
Silhouette Island Resort limited

Project
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title
PART SITE PLAN
PUBLIC AREAS

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale 1:500 Date FEB. 2005
Dr. TC Ck
Drwg. No. 04-07/PA/00/100 Rev.



Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

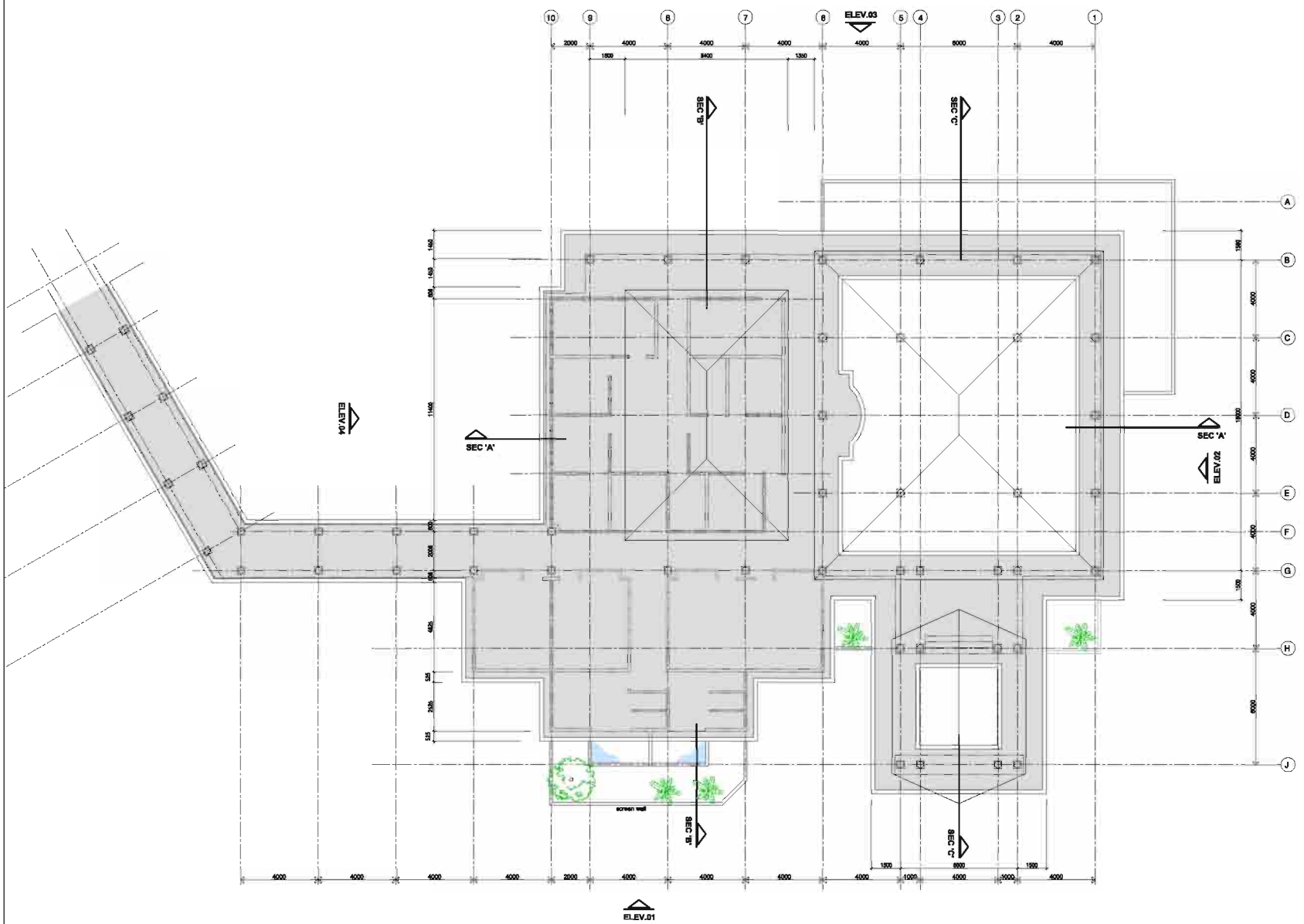
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title

RECEPTION
FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	
Drwg. No.	04-07/PA/01/100	Rev.	



ROOF PLAN

SCALE 1:100

Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title

RECEPTION
ROOF PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate Mahe, P . O . Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
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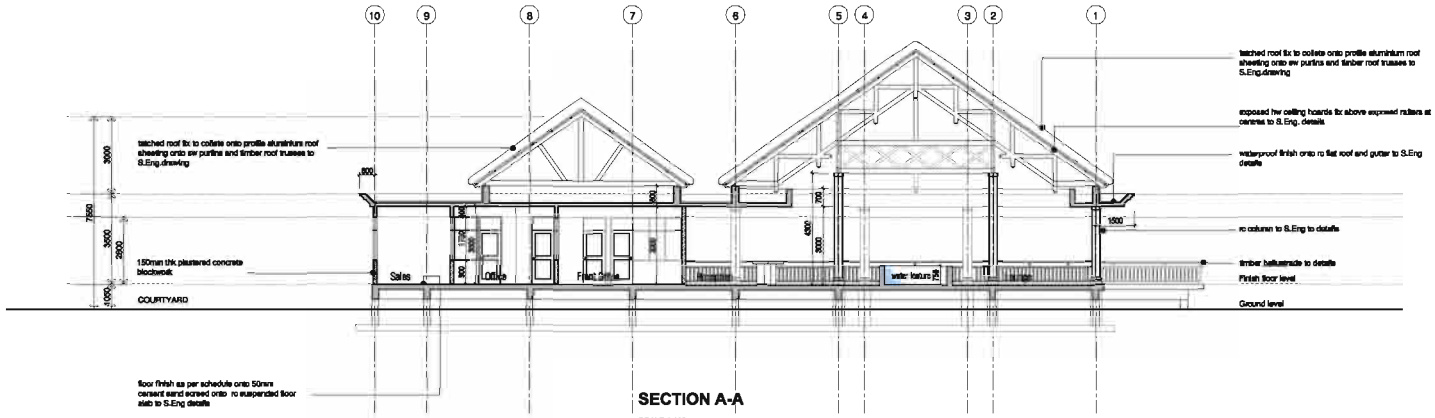
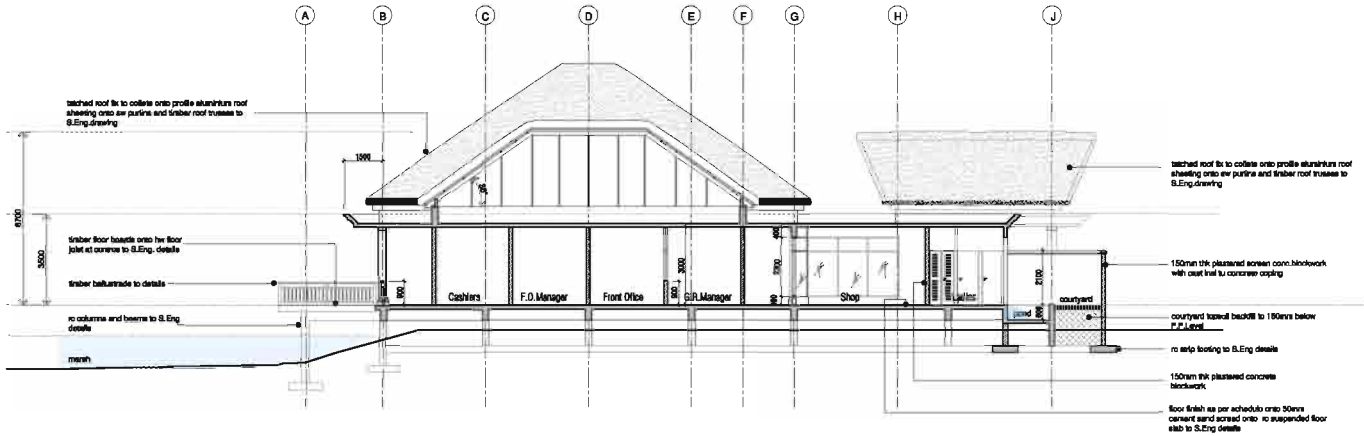
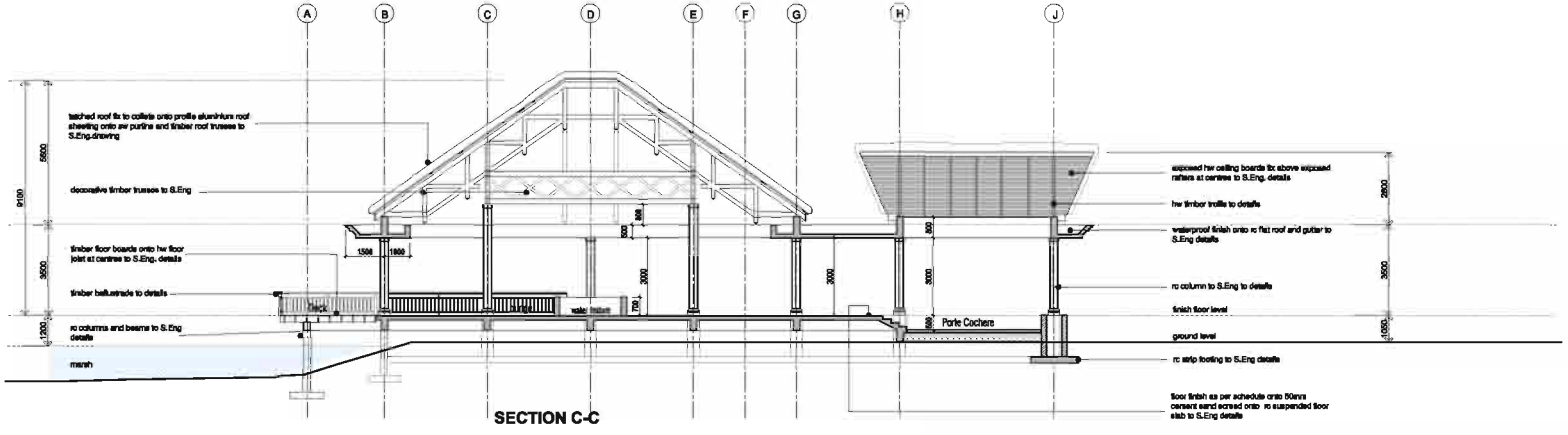
Drwg. No.	04-07/PA/01/101	Rev.	







Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title

RECEPTION
SECTION A-A,B-B.C-C

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P . O . Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
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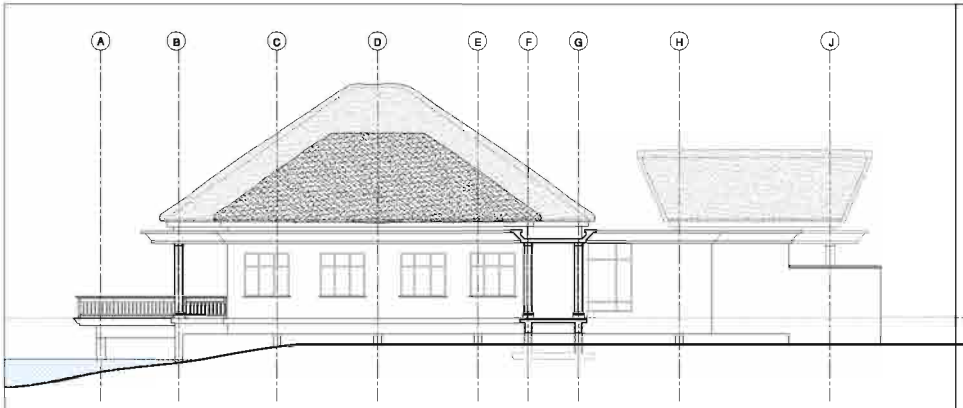
Drwg. No.	04-07/PA/01/102	Rev.	



ELEVATION '04' (from conference)

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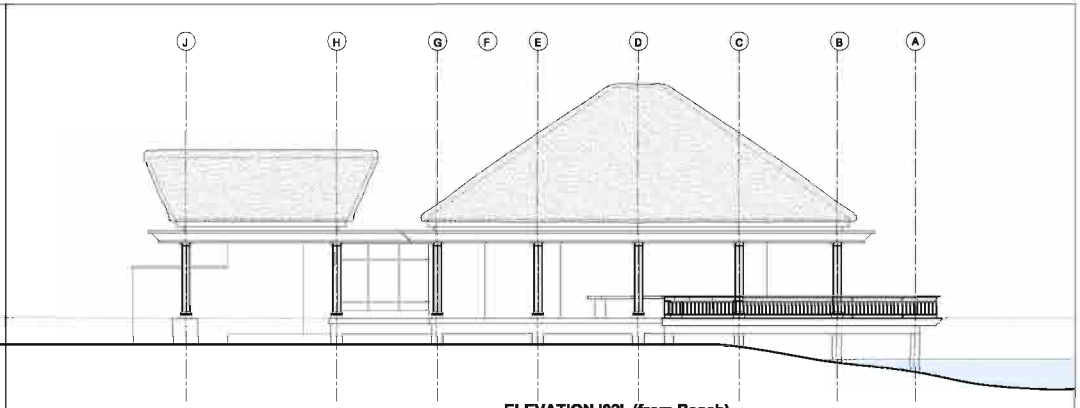

ELEVATION '02' (from Beach)

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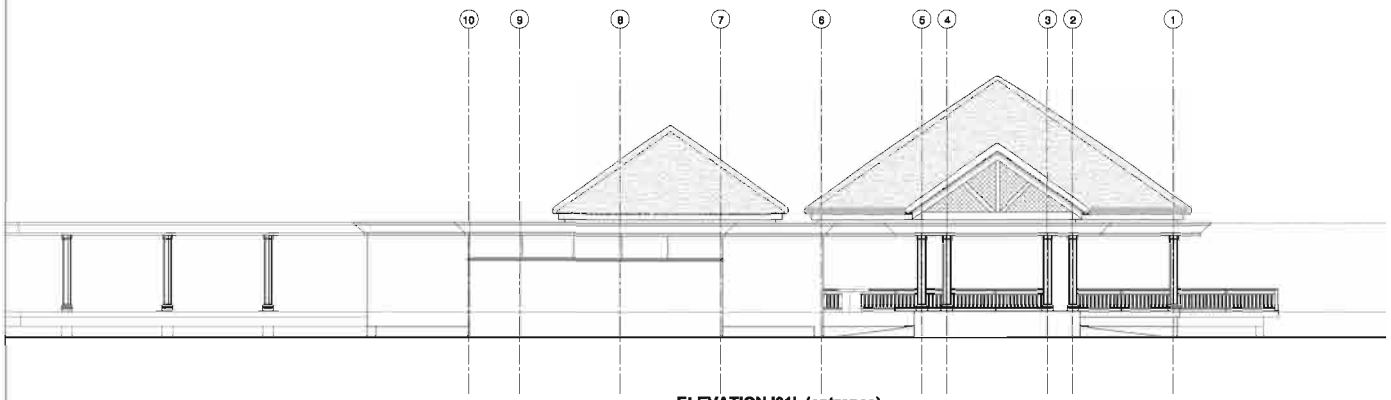
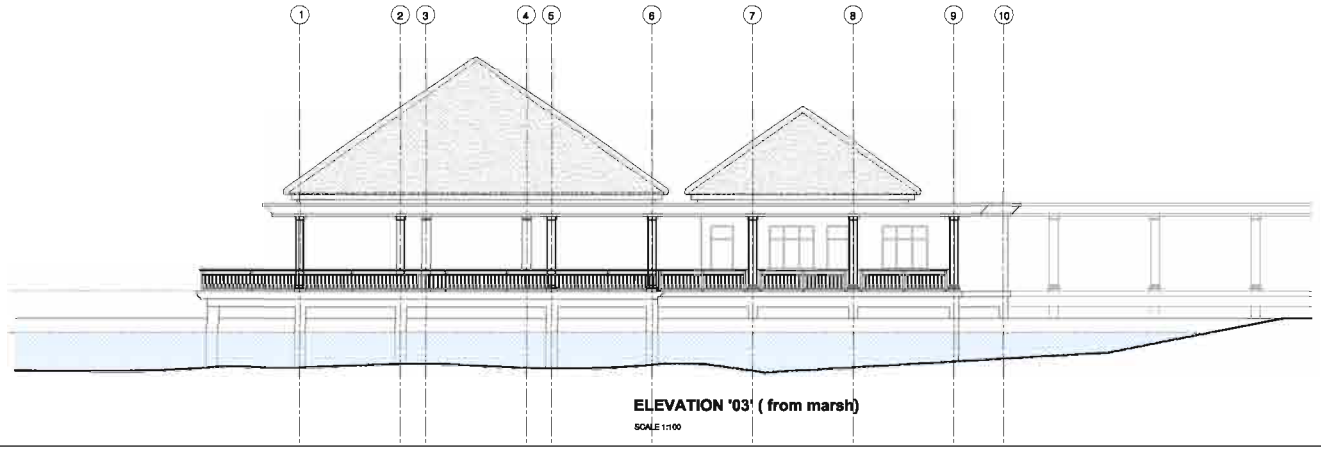


ELEVATION '01' (entrance)

SCALE 1:100



ELEVATION '03' (from marsh)

SCALE 1:100

Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

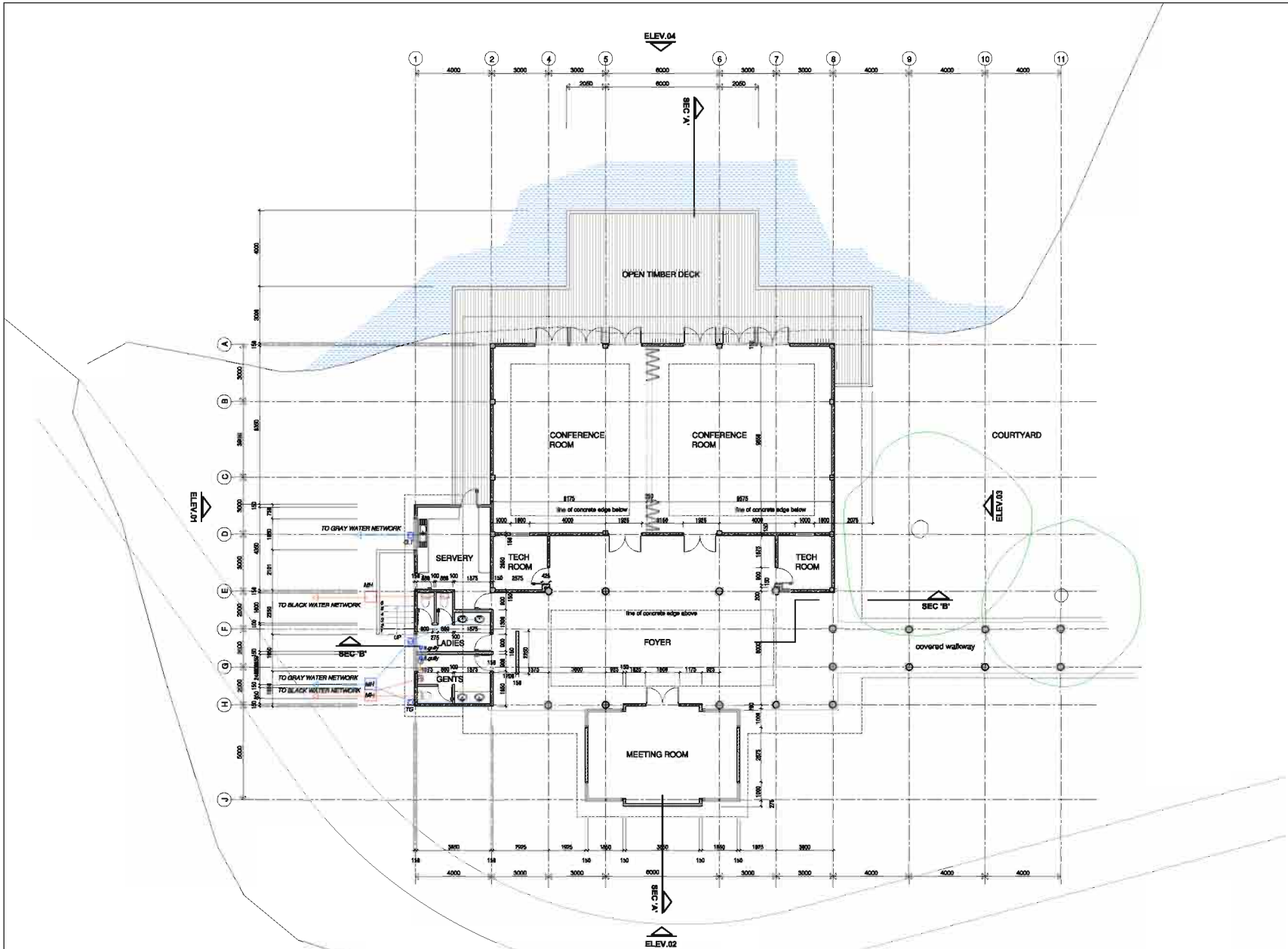
Drawing Title

RECEPTION
ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate Mahe, P . O . Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	

Drwg. No. **04-07/PA/01/103** Rev.



FLOOR PLAN

1/100

Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

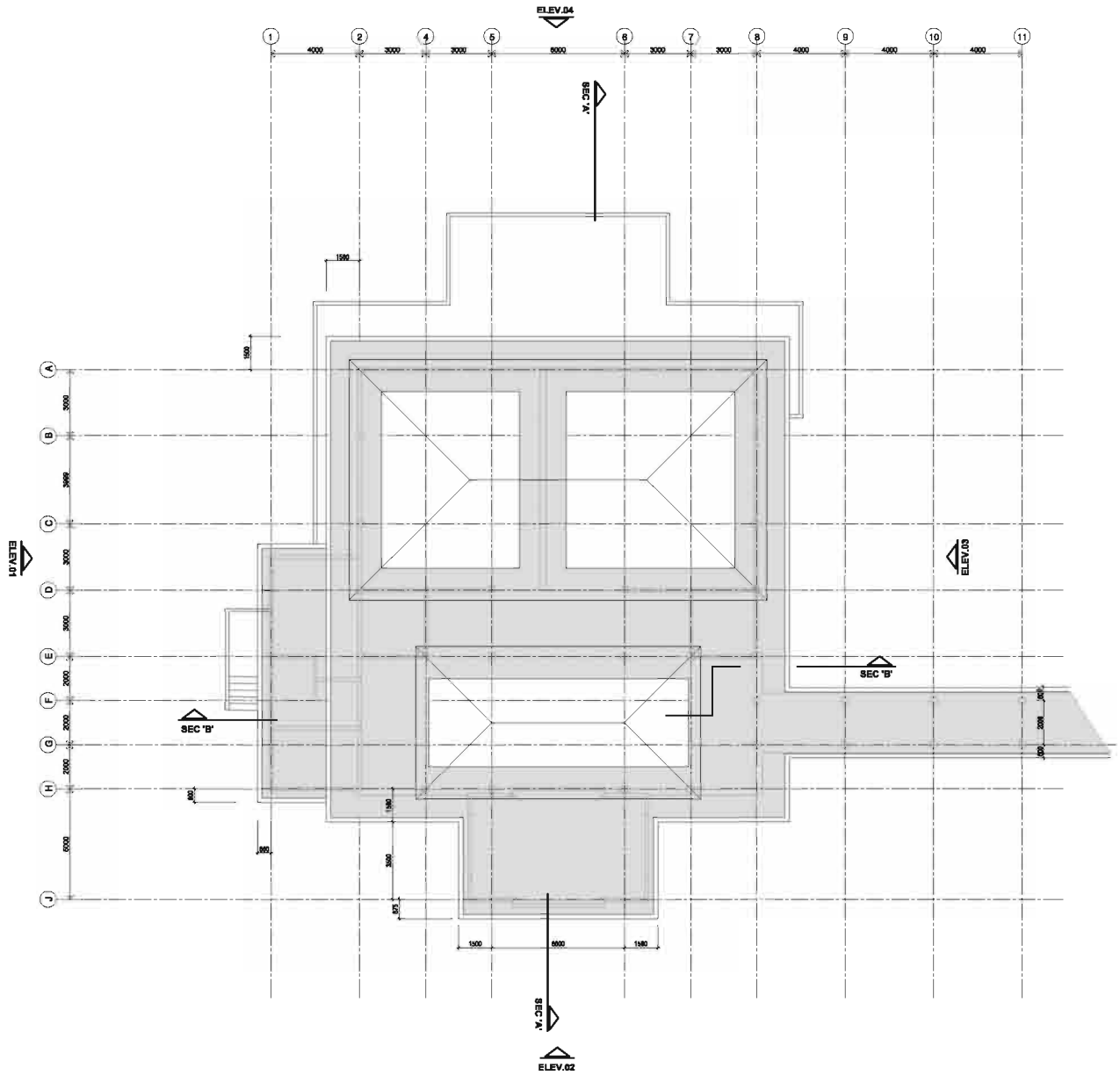
Drawing Title

CONFERENCE HALL
FLOOR PLAN

TIRANT ASSOCIATES

Architects and Project Management Consultants
104 Oceangate Mahe, P . O . Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	
Drwg. No.	04-07/PA/02/100	Rev.	



ROOF PLAN

1/100

Rev. | Amendments | By | Date

Client

Silhouette Island Resort limited

Project

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

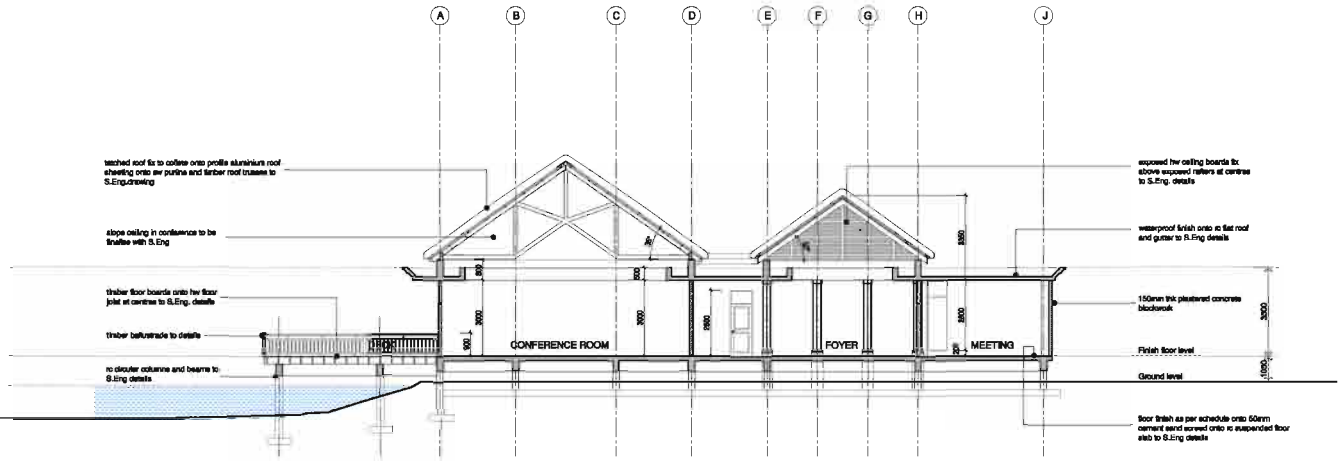
Drawing Title

CONFERENCE HALL
ROOF PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate Haute, P . O . Box 31
Victoria, Mahe, Seychelles. Tel: 224835

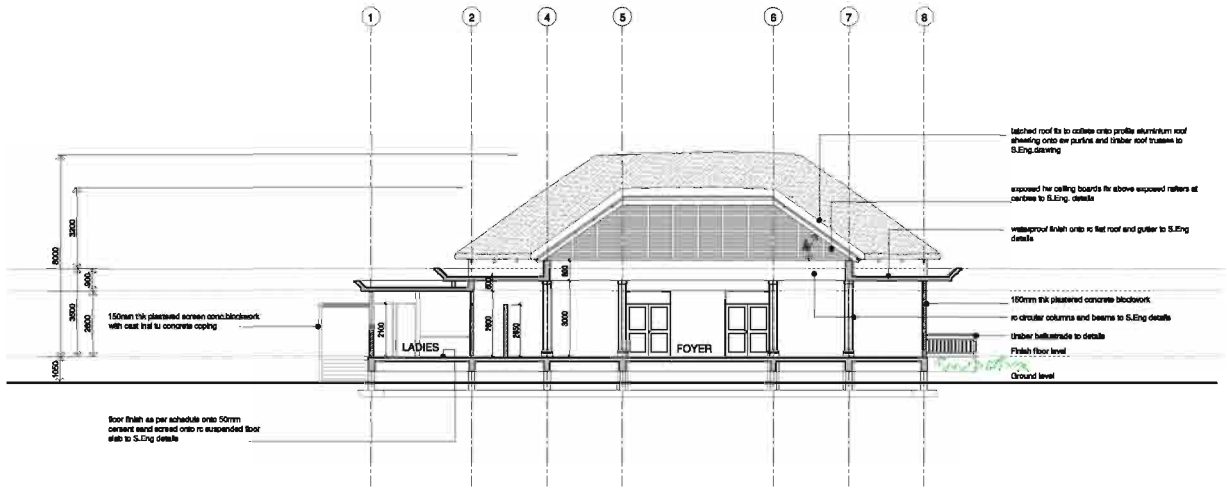
Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	

Drwg. No. 04-07/PA/02/101 | Rev.



SECTION A-A

SCALE 1:100



SECTION B-B

SCALE 1:100

No.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title

CONFERENCE HALL
SECTION A-A,B-B

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe. Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	
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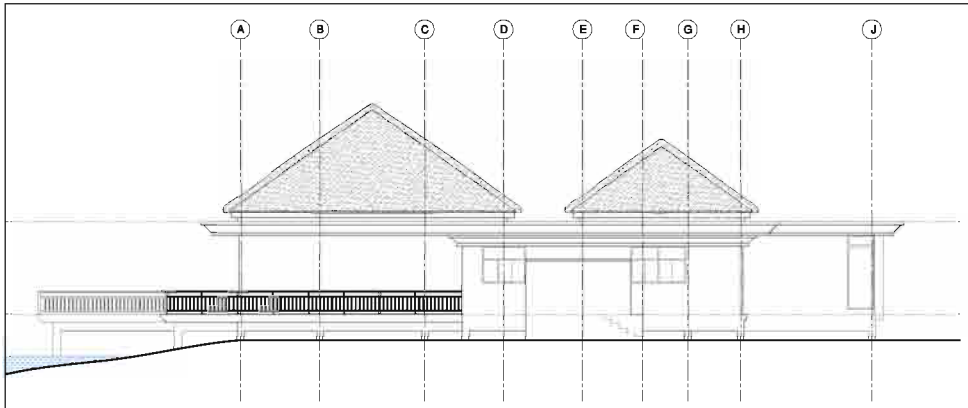
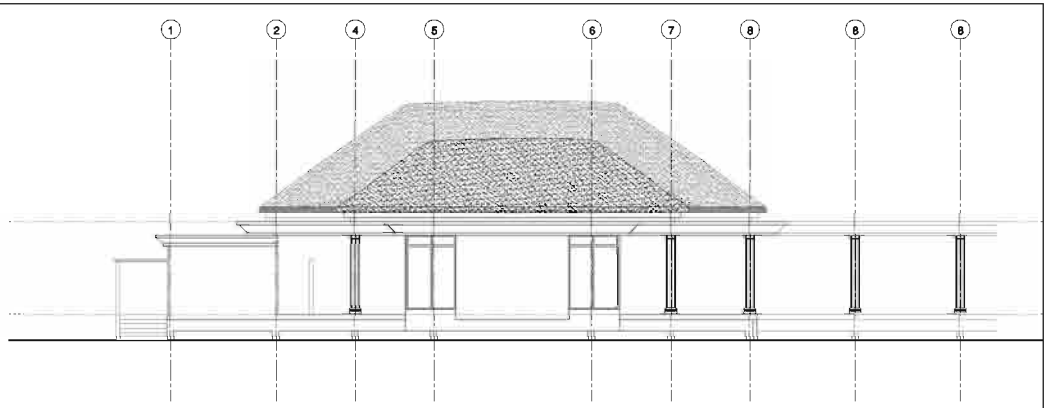


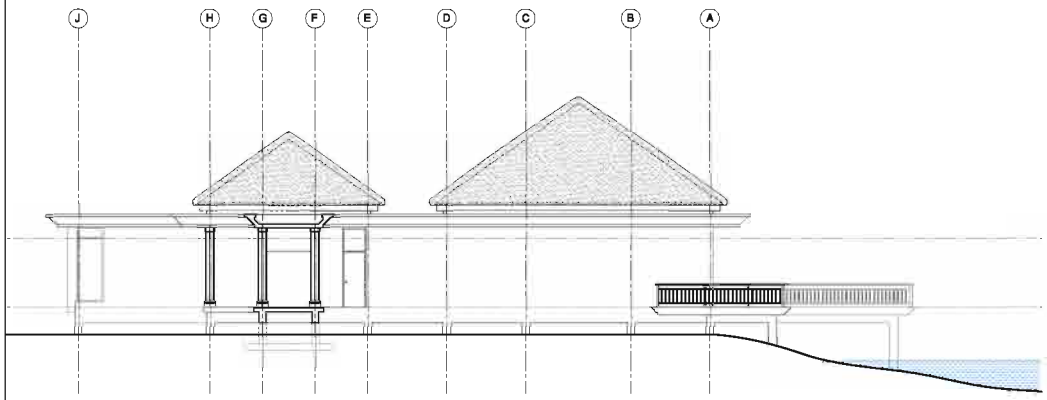
ELEVATION '01' (from road side)

SCALE 1:100



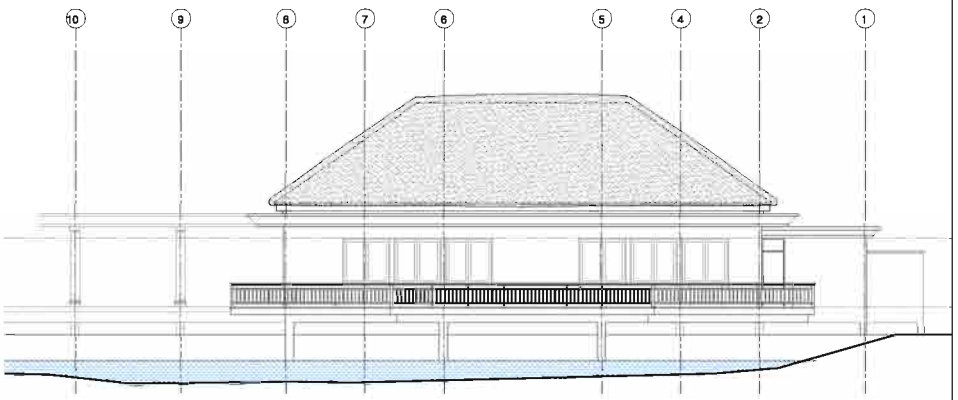
ELEVATION '02' (from road)

SCALE 1:100



ELEVATION '03' (from reception)

SCALE 1:100



ELEVATION '04' (from marsh)

SCALE 1:100

Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

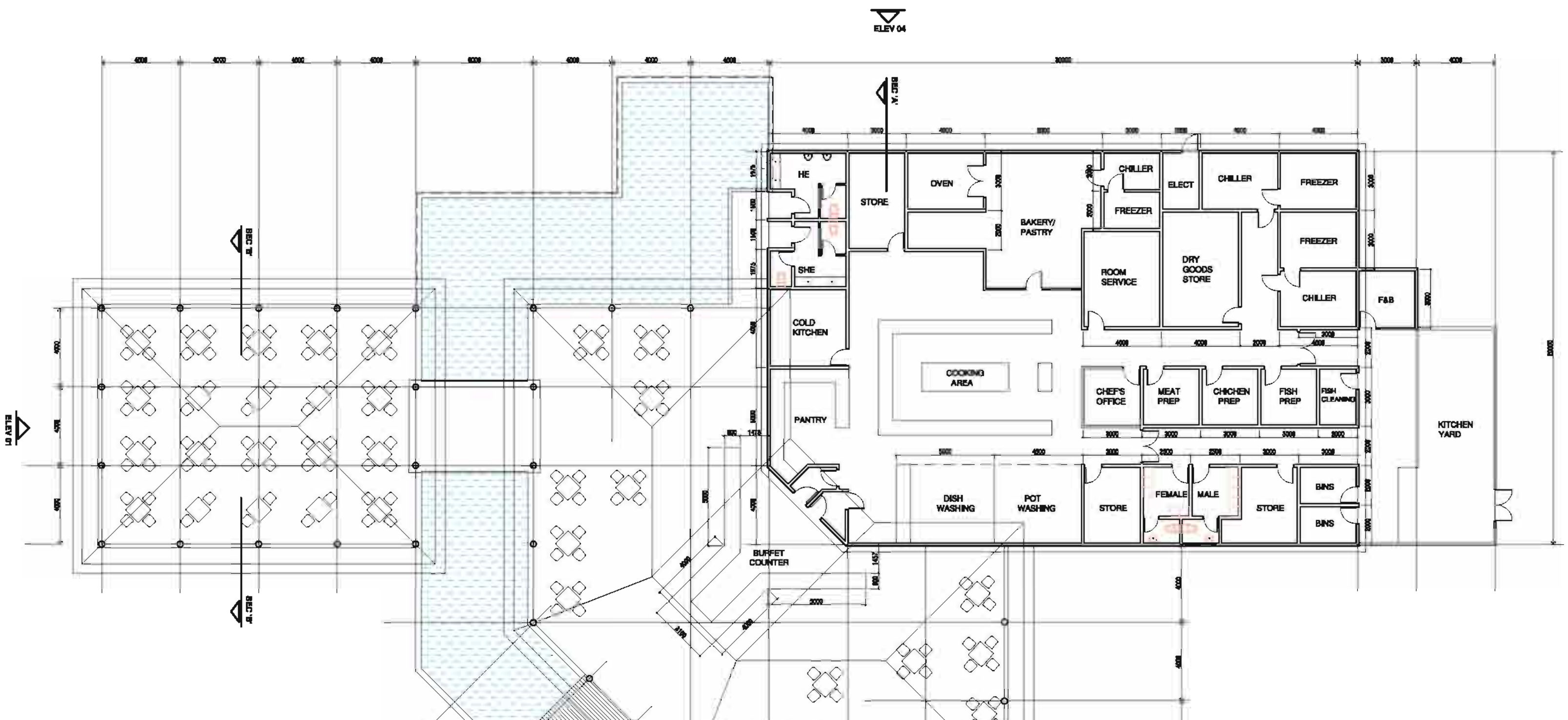
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

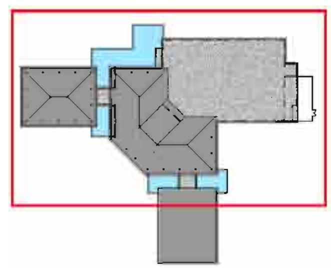
Drawing Title

CONFERENCE HALL
ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	
Dwg. No.	04-07/PA/02/103	Rev.	





KEY PLAN

NOTES

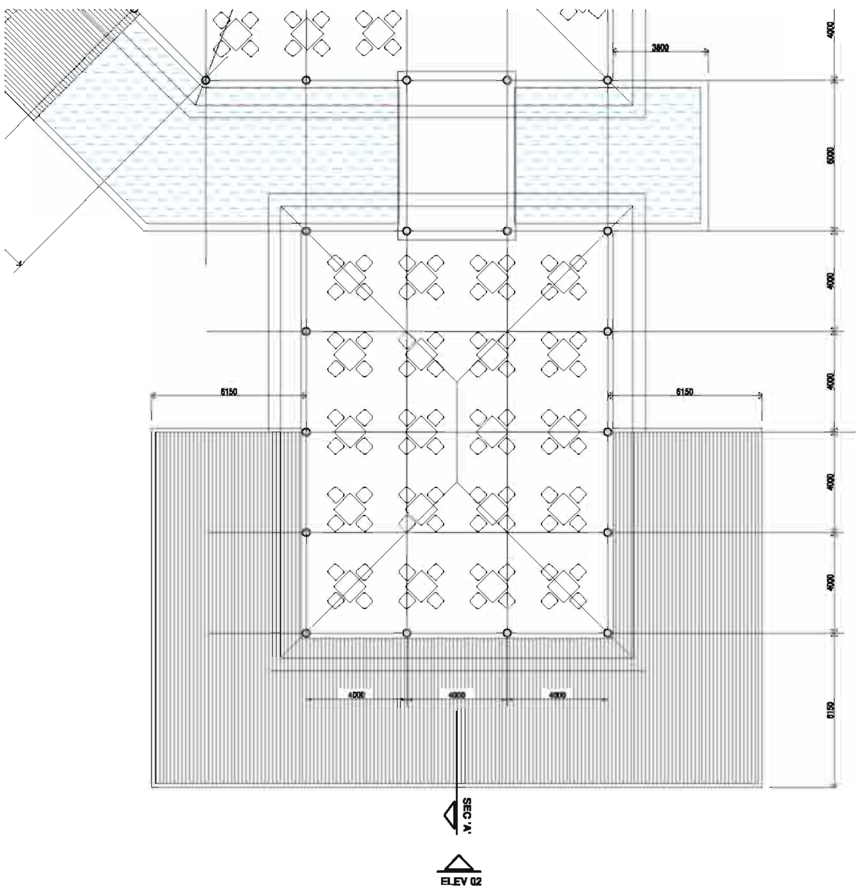
Client: SILHOUETTE ISLAND RESORT LTD.

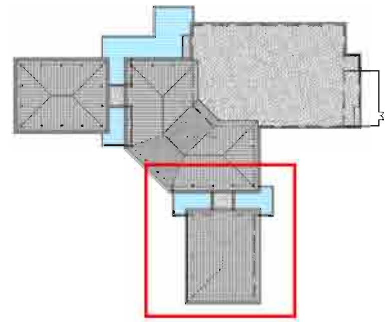
Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing title: MAIN RESTAURANT PART FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	KJ	Ck.	
Drg. No.	04-07/PA/03/100	Rev.	





KEY PLAN

NOTES

Rev.	Amendments	By	Date

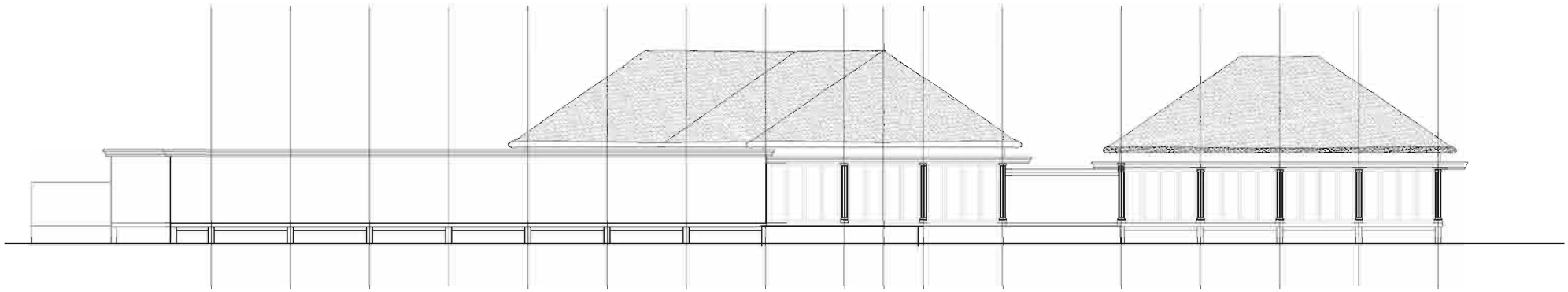
Client: SILHOUETTE ISLAND RESORT LTD.

Project: **PROPOSED SILHOUETTE ISLAND RESORT & SPA**

Drawing Title: **MAIN RESTAURANT PART FLOOR PLAN**

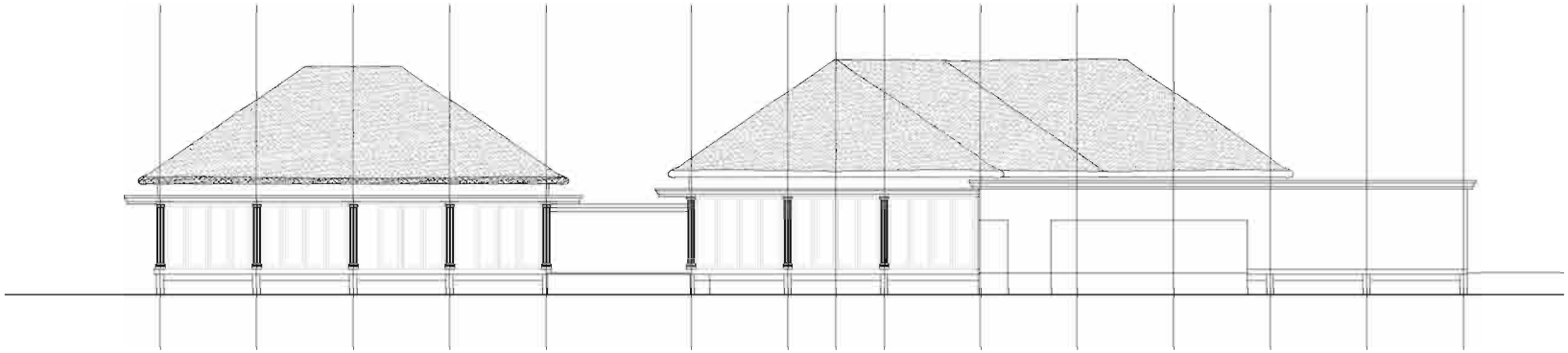
TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50	Date: FEB. 2005
Dr. K.G	Ck.
Drwg. No. 04–07/PA/03/101	Rev.



ELEVATION 04

SCALE 1:100



ELEVATION 03

SCALE 1:100

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

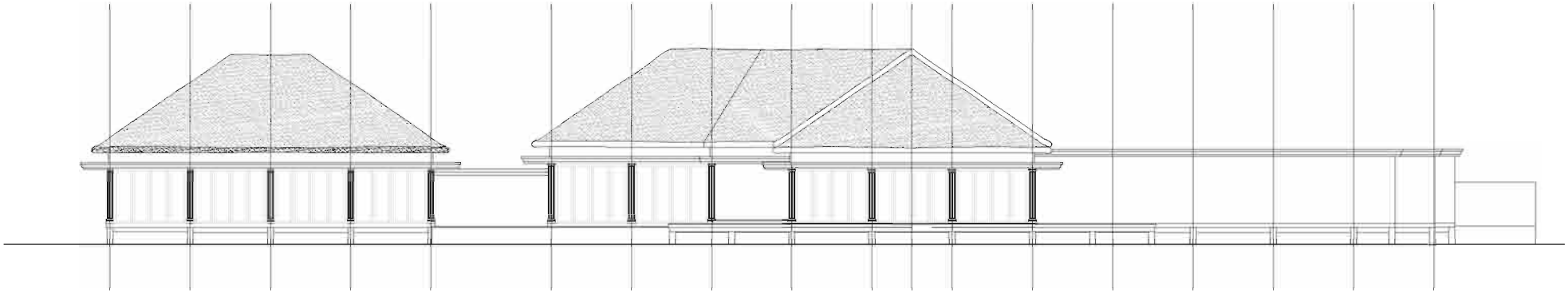
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

MAIN RESTAURANT
ELEVATIONS 03 & 04

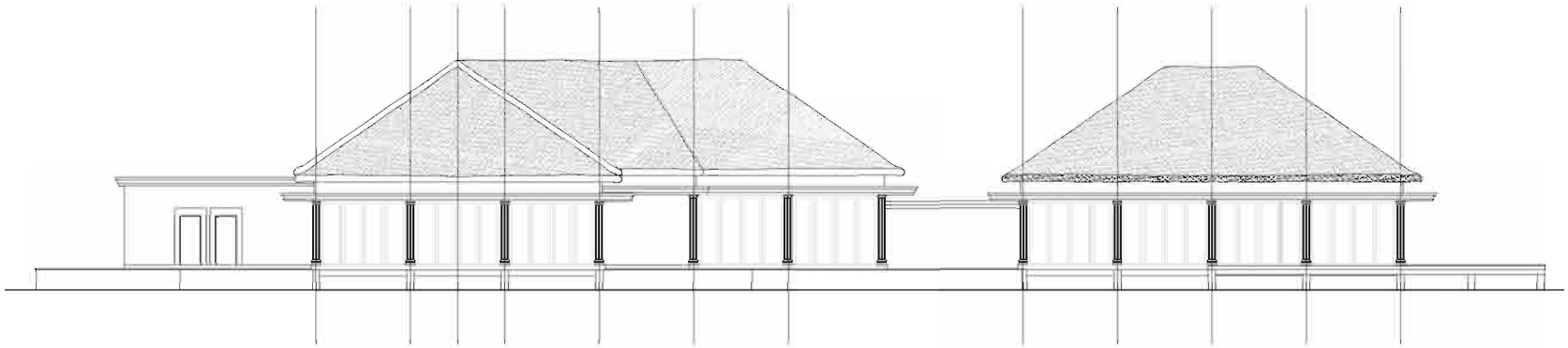
TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.C.	Ck.	
Drwg. No.	04–07/PA/03/104	Rev.	



ELEVATION 02

SCALE 1:100



ELEVATION 01

SCALE 1:100

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

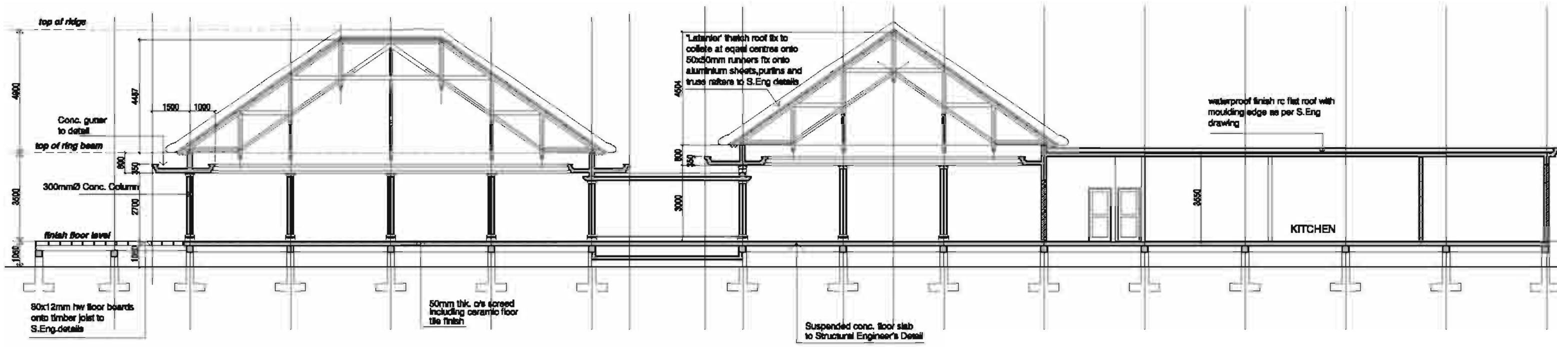
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

MAIN RESTAURANT
ELEVATIONS 01 & 02

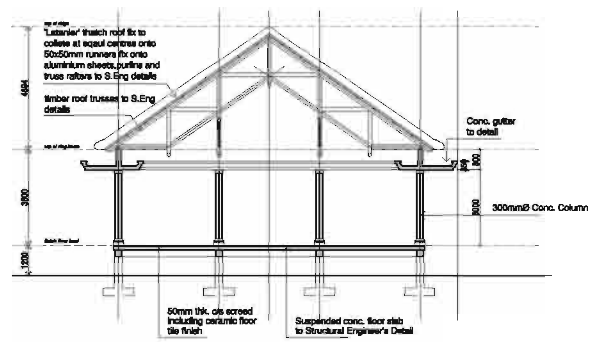
TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/03/103	Rev.	



SECTION A-A

SCALE 1:100



SECTION B-B

SCALE 1:100

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE

All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB

100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC

All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

Details as indicated, finished with 3 coats of [illegible] paint.

6. ROOF

"TAMKO ARCH SHINGLES" laid on [illegible] felt on 18mm thk. Ext. Grade OSB boards on 150 x 50mm s/w rafters at 600mm centres.

7. WINDOWS AND EXTERNAL DOORS

Solid timber panel door in timber frame.
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING

38mm Dia. UPVC waste to shower, bath and sink, 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

8. FOUL DRAINAGE

Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle and to fall 1 : 40 connected to manholes at locations shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER

150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.5m stone/rubble soakaway minimum 4.5m from any building or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by pea shingle.

10. MANHOLES

Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 750mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

11. SEPTIC TANK

To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water source or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION

All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT

Final position of house to be decided on site within the building limits. Final level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

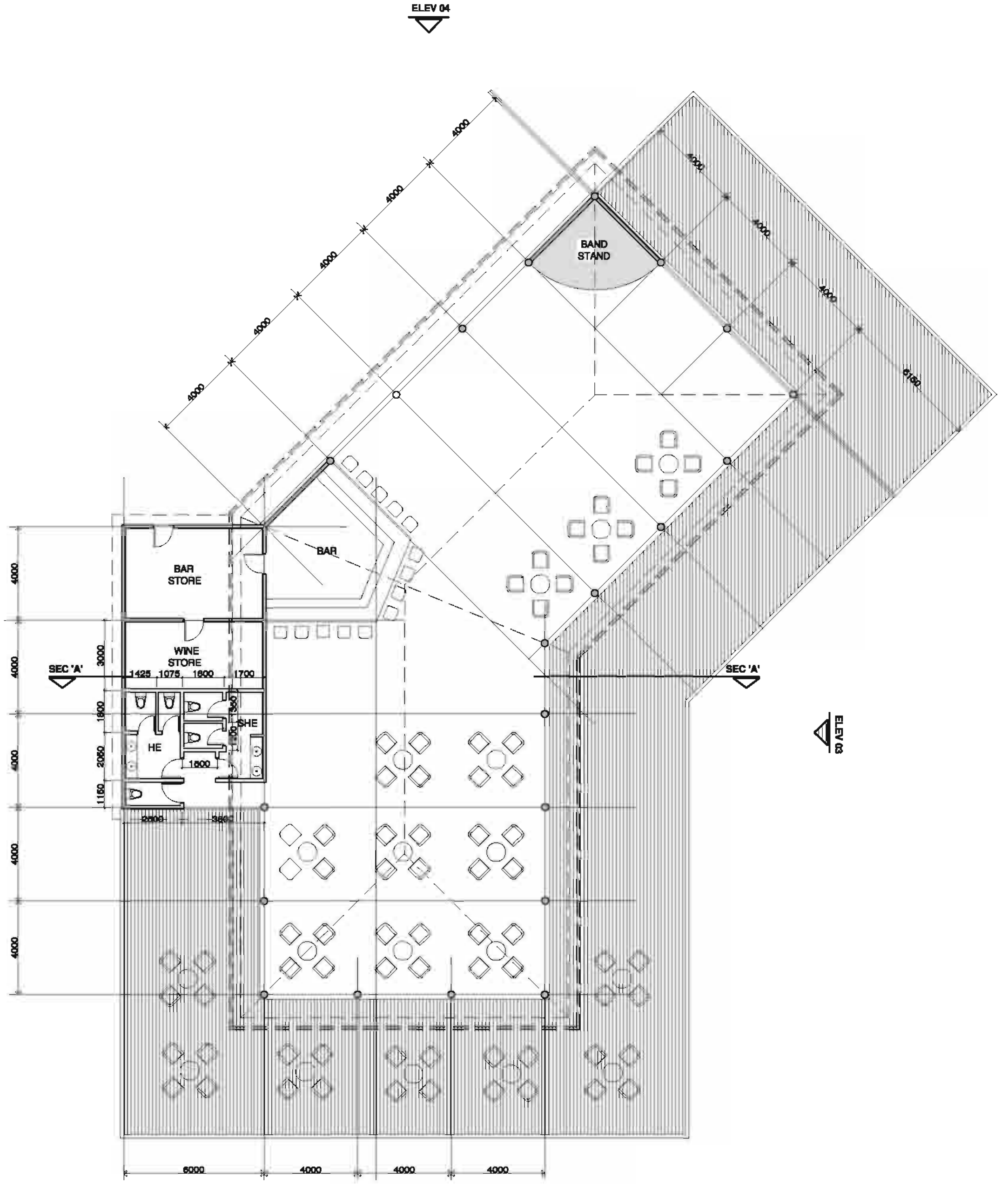
Client: SILHOUETTE ISLAND RESORT LTD.

Project: **PROPOSED SILHOUETTE ISLAND RESORT & SPA**

Drawing Title: **MAIN RESTAURANT**
SECTION A-A & B-B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/03/102	Rev.	



FLOOR PLAN

SCALE 1:100

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE

All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB

100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC

All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar [illegible] on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

[illegible] finished with 3 coats of [illegible] paint.

6. ROOF

[illegible] roof fixed to [illegible] at equal centre

7. WINDOWS AND EXTERNAL DOORS

Solid timber panel door in timber frame
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING

38mm Dia UPVC waste to shower, bath and sink. 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with rodding access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

8. FOUL DRAINAGE

Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle laid to fall 1 : 40 connected to manholes at location shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER

150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.2m stone/rubble soakaway minimum 4.0m from anybuilding or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by peashingle.

10. MANHOLES

Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 700mm with step irons 300mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

11. SEPTIC TANK

To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION

All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT

Final position of house to be decided on site within the building limits. Floor level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

PROPOSED SILHOUETTE ISLAND RESORT & SPA

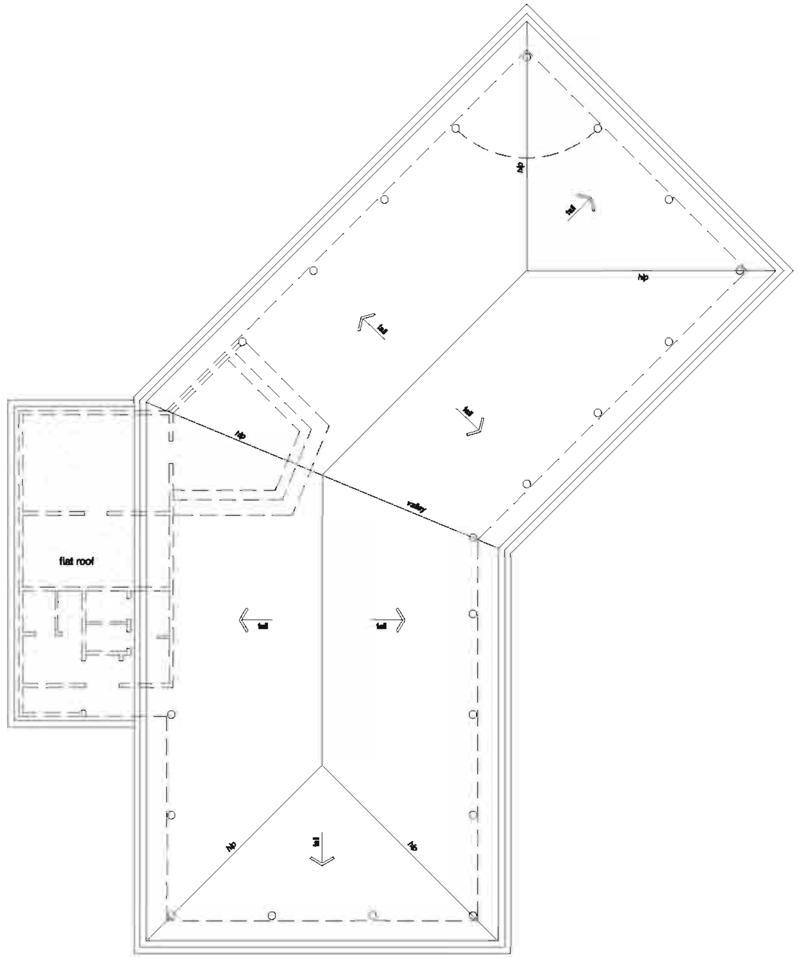
Drawing Title

BAR
FLOOR PLAN

TIRANT ASSOCIATES

Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/04/100	Rev.	



ROOF PLAN

SCALE 1:100

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE

All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB

100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC

All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

[illegible] as [illegible], finished with 3 coats of [illegible] paint.

6. ROOF

[illegible] thatch roof fixed to [illegible] at equal centre

7. WINDOWS AND EXTERNAL DOORS

Solid timber panel door in timber frame
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING

38mm Dia UPVC waste to shower, bath and sink. 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes.
All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

8. FOUL DRAINAGE

Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle laid to fall 1 : 40 connected to manholes at locations shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER

150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.2m stone/rubble soakaway minimum 4.0m from anybuilding or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by peashingle.

10. MANHOLES

Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 700mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

11. SEPTIC TANK

To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION

All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT

Final position of house to be decided on site within the building limits. Floor level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

PROPOSED SILHOUETTE ISLAND RESORT & SPA

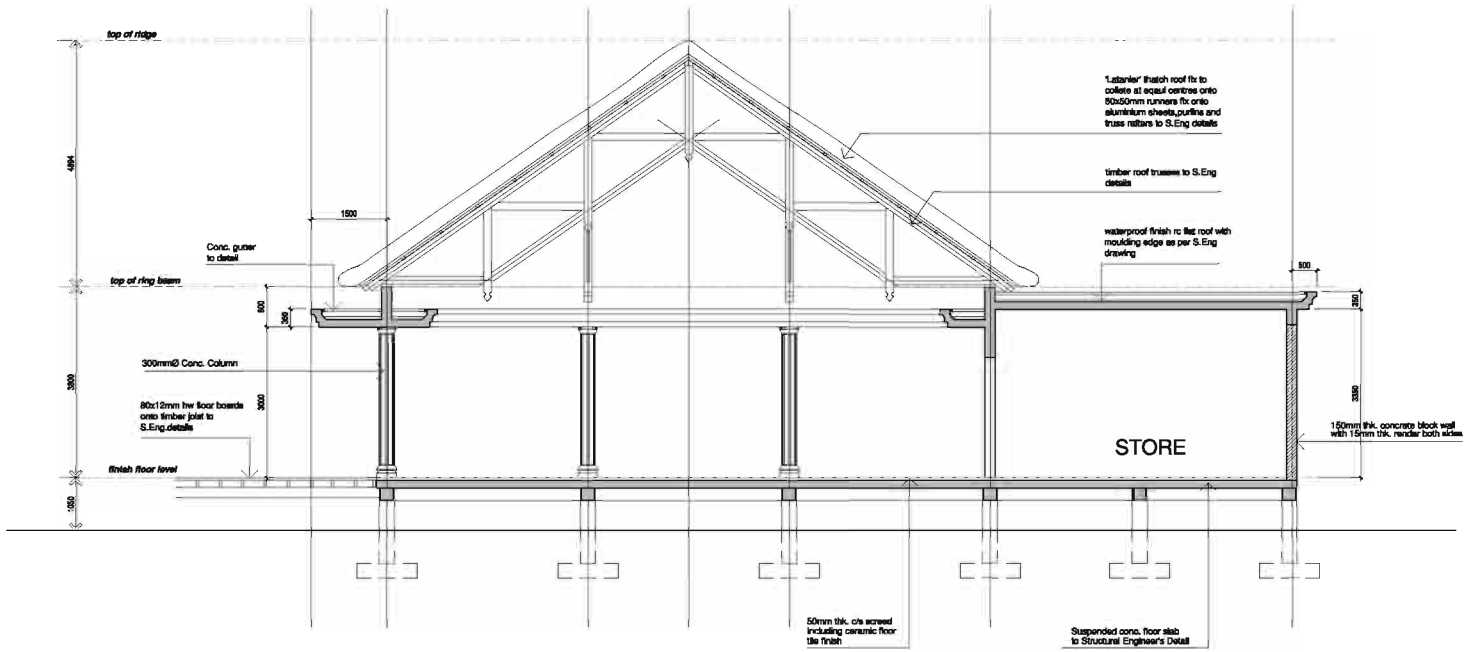
Drawing Title

BAR
FLOOR PLAN

TIRANT ASSOCIATES

Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/04/103	Rev.	



SECTION A-A

SCALE 1:50

NOTES

—DO NOT SCALE DRAWING IF IN DOUBTS ASK.
—DIMENSIONS ARE IN MILLIMETERS.
—ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER SPEC. DRAWINGS.

1. STRUCTURE
All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB
150mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of extension wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC
All external and internal walls to be Concrete Blocks (as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hylastic" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS
To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 20mm.

5. CEILING
Gable to insulated, finished with 3 coats of mumasent paint.

6. ROOF
Lakanal thatch roof fixed to purlins at equal centre

7. WINDOWS AND EXTERNAL DOORS
Solid timber panel door in timber frame
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING
38mm Dia UPVC waste to shower, bath and sink. 100mm Dia. UPVC waste to W.C.s. 32mm dia UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected on 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of work with accessible access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

9. FOUL DRAINAGE
Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. packings laid to fall 1 : 40 connected to manholes at location shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls

10. SURFACE WATER
150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.5m above/rubble soakaway, minimum 4.0m from any building or boundary via 100mm dia UPVC drainage pipes with flexible joints laid to to fall 1:40 with inlet on and surrounded by packings.

11. MANHOLES
Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1000 X 750mm with step irons 225mm centre. Provide all channels, branches and cusbress benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered internally.

12. SEPTIC TANK
To be as per design and location shown. The tank to be watertight and if necessary rendered internally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

13. ELECTRICAL INSTALLATION
All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of essential points should be discussed with the client prior to siting and clearly stated on the builders quotation.

13. SETTING OUT
Final position of house to be decided on site within the building limits. Final level to be established by owner and contractor on site in conjunction with street levels.

Rev.	Amendments	By	Date

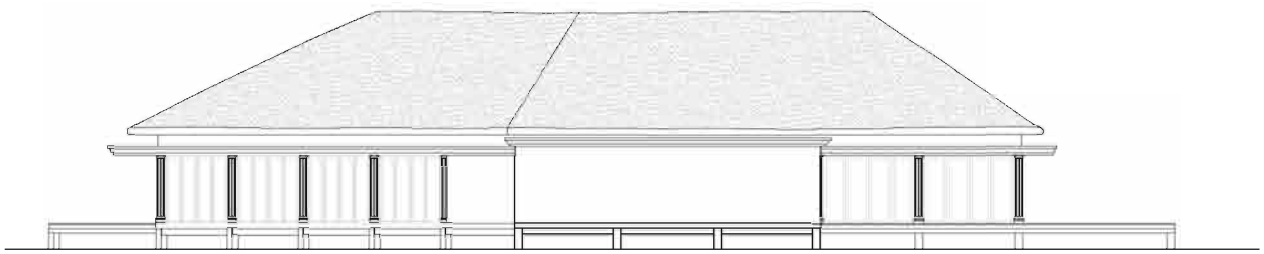
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
BAR
SECTION A-A

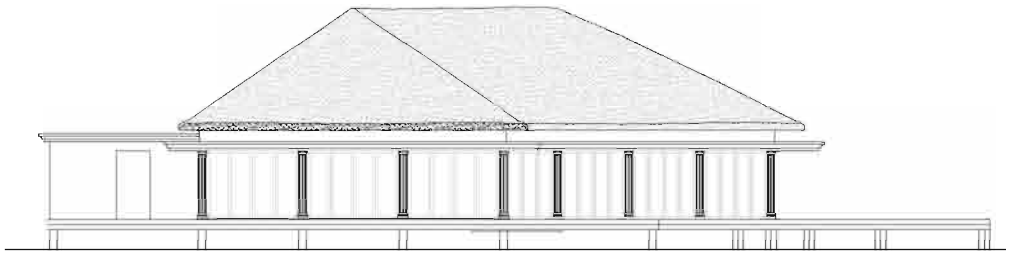
TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.C	Ck.	
Dwg. No.	04-07/PA/04/101	Rev.	



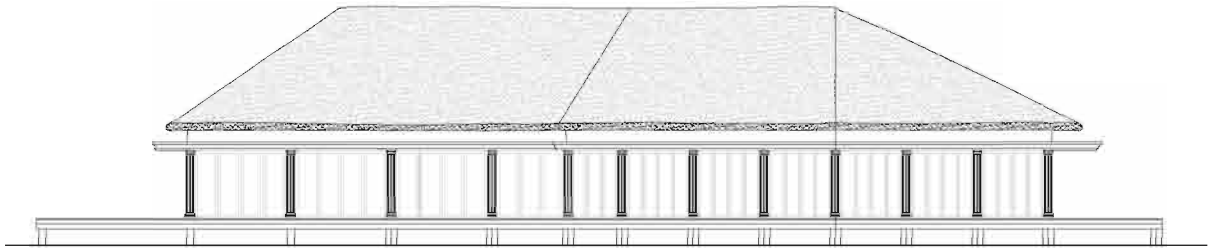
ELEVATION 01

SCALE 1:100



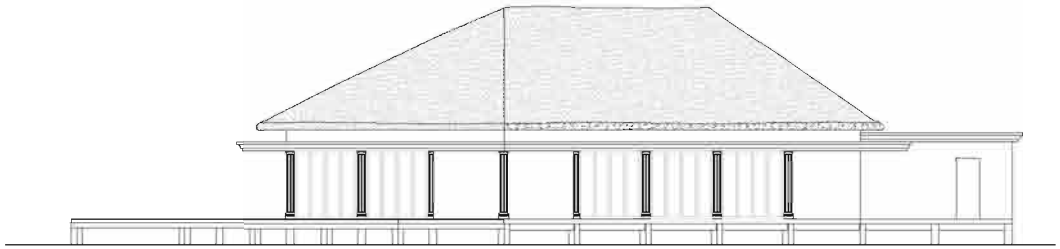
ELEVATION 02

SCALE 1:100



ELEVATION 03

SCALE 1:100



ELEVATION 04

SCALE 1:100

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

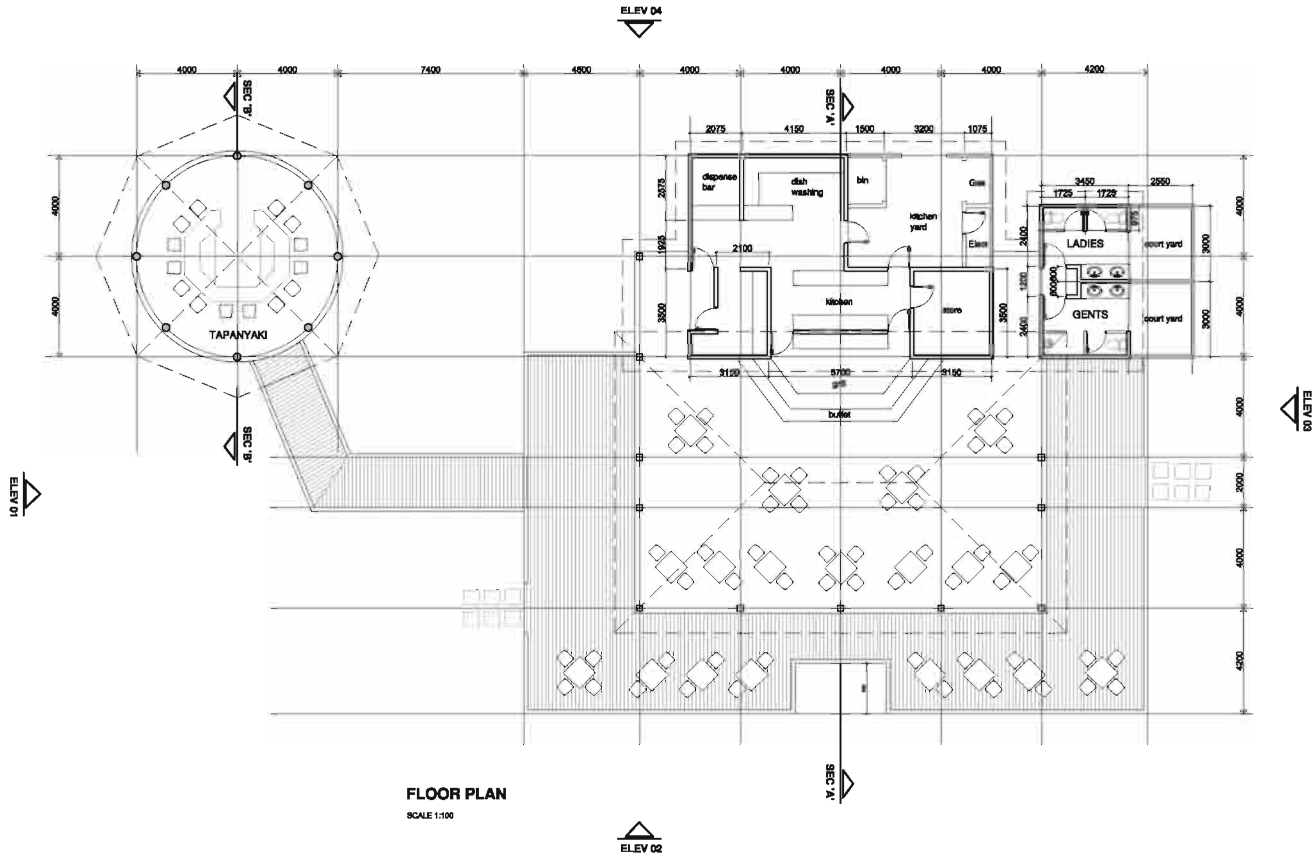
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

BAR
ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	KC..CS	Ck.	
Drwg. No.	04–07/PA/04/102	Rev.	



FLOOR PLAN

SCALE 1:100

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE

All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. [illegible]

2. GROUND FLOOR SLAB

[illegible]

3. WALLS AND DPC

[illegible]

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

[illegible]

6. ROOF

[illegible]

7. WINDOWS AND EXTERNAL DOORS

[illegible]

8. PLUMBING

[illegible]

9. FOUL DRAINAGE

[illegible]

9. SURFACE WATER

[illegible]

10. MANHOLES

[illegible]

11. SEPTIC TANK

[illegible]

12. ELECTRICAL INSTALLATION

[illegible]

13. SETTING OUT

[illegible]

Rev.	Amendments	By	Date

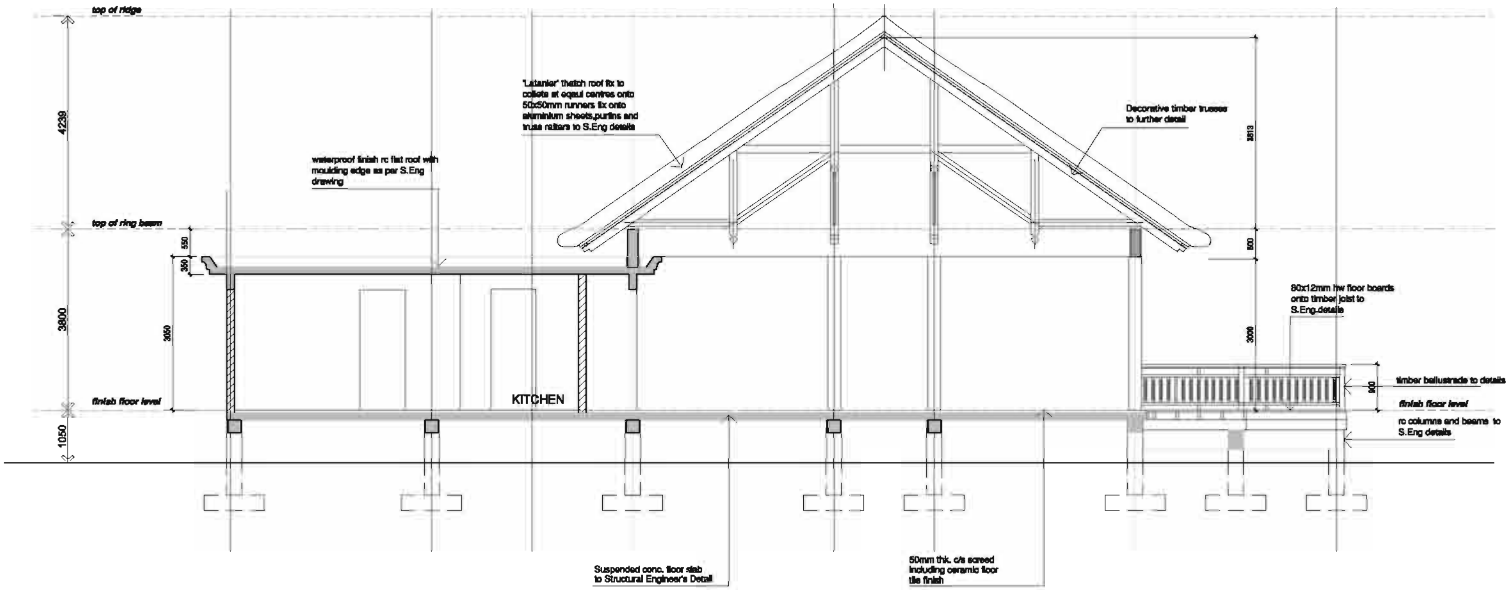
Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

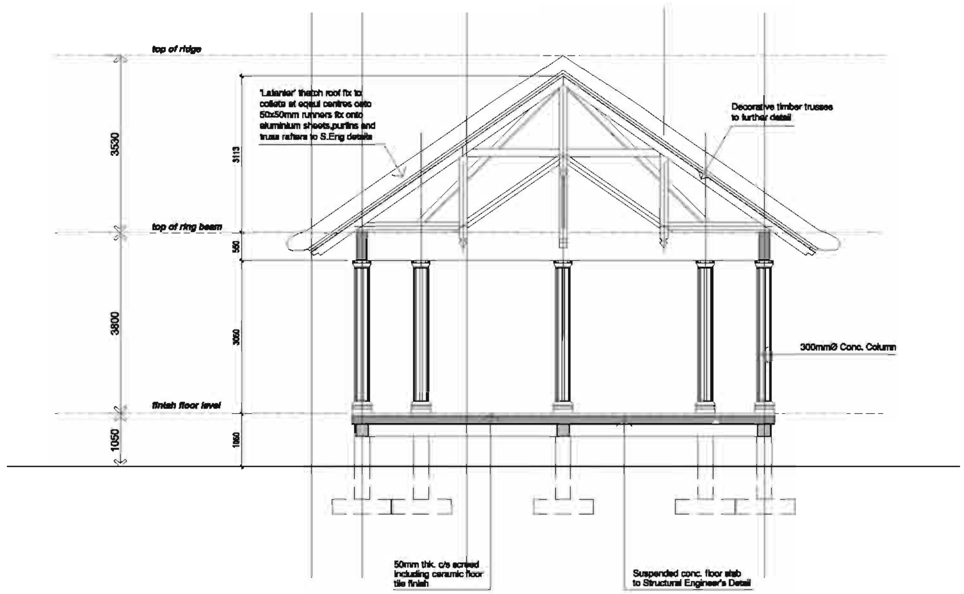
Drawing Title: OCEAN GRILL FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 100	Date: FEB. 2005
Dr. K.G	Ck.
Drwg. No. 04-07/PA/05/100	Rev.



SECTION A-A
SCALE 1:50



SECTION B-B
SCALE 1:50

NOTES

–DO NOT SCALE DRAWING IF IN DOUBTS ASK.
–DIMENSIONS ARE IN MILLIMETERS.
–ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE
All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB
100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC
All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS
To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING
[illegible] finished with 3 coats of [illegible] paint.

6. ROOF
"[illegible] SHINGLES" laid on [illegible] felt on 18mm thk. [illegible] Grade [illegible] boards on 150 x 50mm s/w rafters at 600mm centres

7. WINDOWS AND EXTERNAL DOORS
Solid timber panel door in timber frame
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING
38mm dia UPVC waste to shower, bath and sinks. 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

8. FOUL DRAINAGE
Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle laid to fall 1 : 40 connected to manholes at location shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER
150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.2m stone/rubble soakaway minimum 4.0m from anybuilding or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by peashingle.

10. MANHOLES
Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 700mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

11. SEPTIC TANK
To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION
All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT
Final position of house to be decided on site within the building limits. Final level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

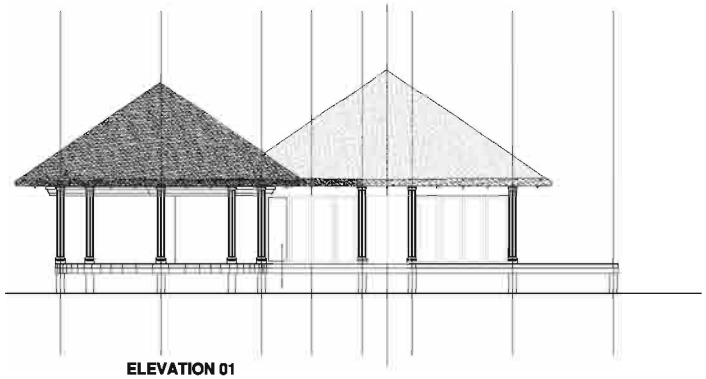
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

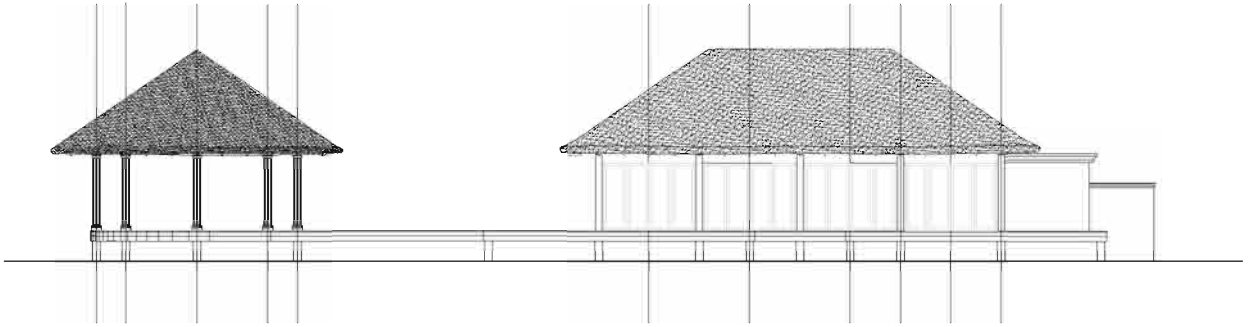
Drawing Title
OCEAN GRILL
SECTION A-A & B-B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 100	Date: FEB. 2005
Dr.: K.G	Ck.:
Drwg. No.: 04-07/PA/05/101	Rev:

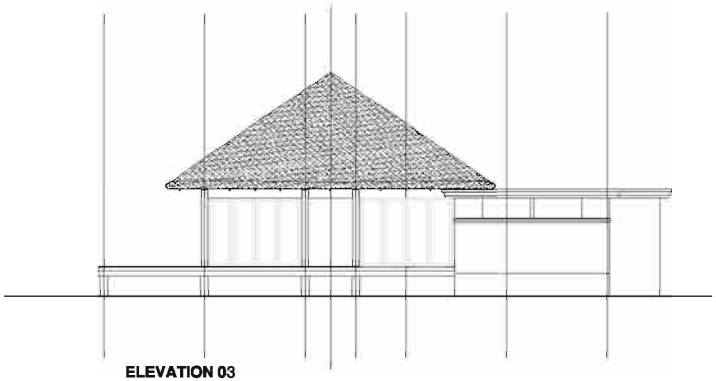


ELEVATION 01



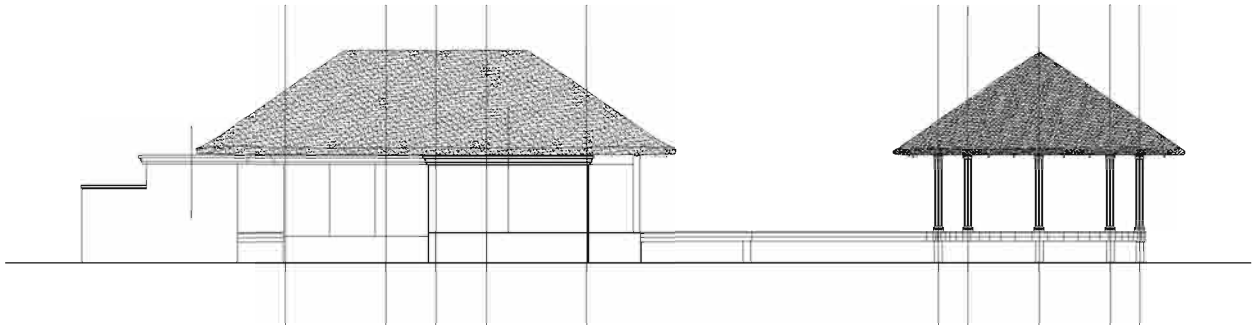
ELEVATION 02

SCALE 1:100



ELEVATION 03

SCALE 1:100



ELEVATION 04

SCALE 1:100

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

PROPOSED SILHOUETTE ISLAND RESORT & SPA

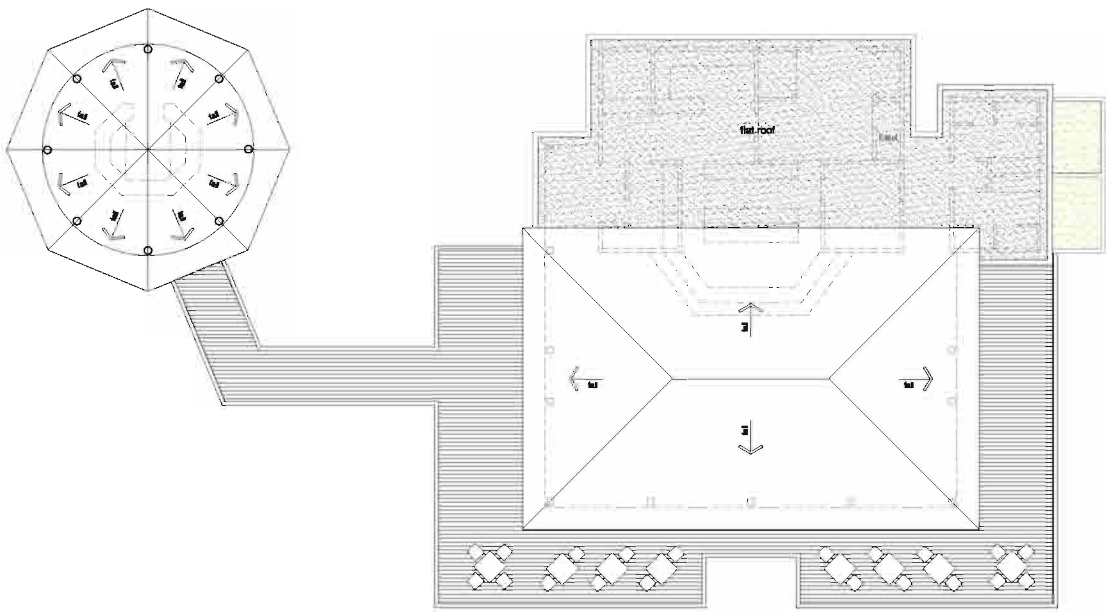
Drawing Title

OCEAN GRILL ELEVATIONS

TIRANT ASSOCIATES

Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.J.C	Ck.	
Dwg. No.	04-07/PA/05/102	Rev.	



ROOF PLAN

SCALE 1:100

NOTES

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- ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE

All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB

100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC

All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

[illegible] as indicated, finished with 3 coats of [illegible] paint.

6. ROOF

"TAMKO [illegible] SHINGLES" laid on [illegible] foil on [illegible] Grade [illegible] boards on 150 x 50mm [illegible] rafters at 600mm centres.

7. WINDOWS AND EXTERNAL DOORS

Solid timber panel door in timber frame.
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING

38mm Dia UPVC waste to shower, bath and sinks. 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

9. FOUL DRAINAGE

Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle laid to fall 1 : 40 connected to manholes at location shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER

150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.5m stone/rubble soakaway minimum 4.5m from any building or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by pea shingle.

10. MANHOLES

Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 750mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

11. SEPTIC TANK

To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION

All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT

Final position of house to be decided on site within the building limits. Floor level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

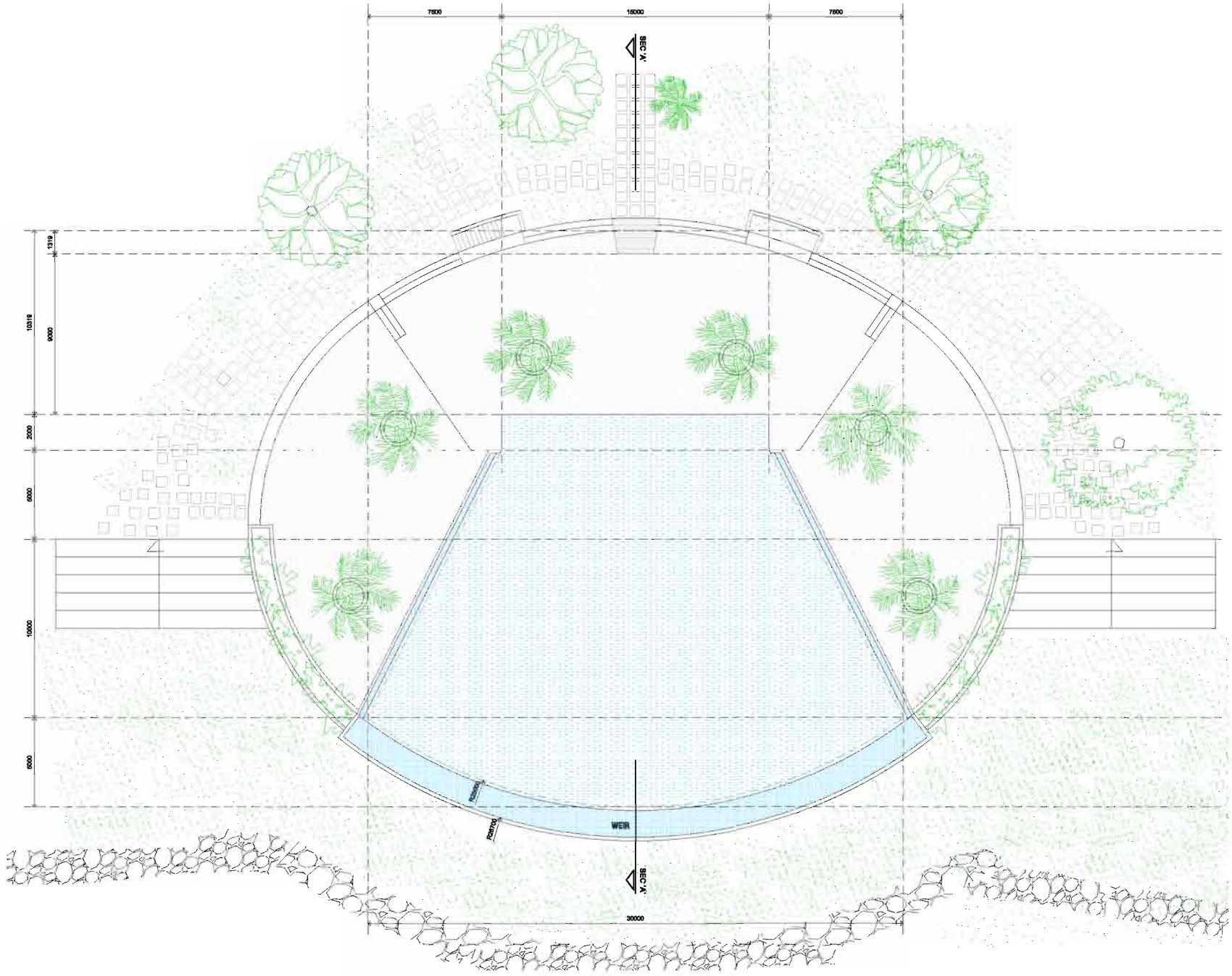
Client: SILHOUETTE ISLAND RESORT LTD.

Project: **PROPOSED SILHOUETTE ISLAND RESORT & SPA**

Drawing Title: **OCEAN GRILL ROOF PLAN**

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/05/103	Rev.	



NOTES

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Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

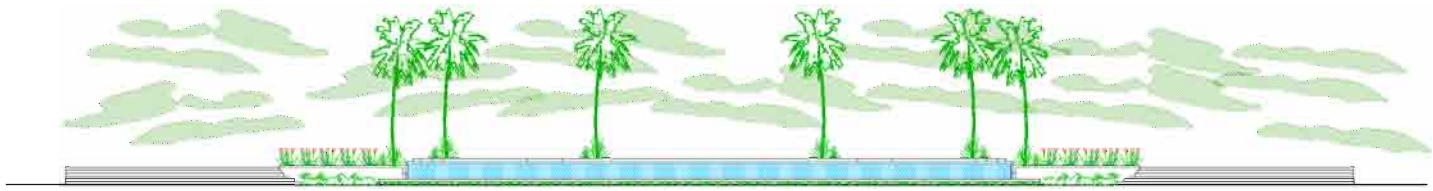
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

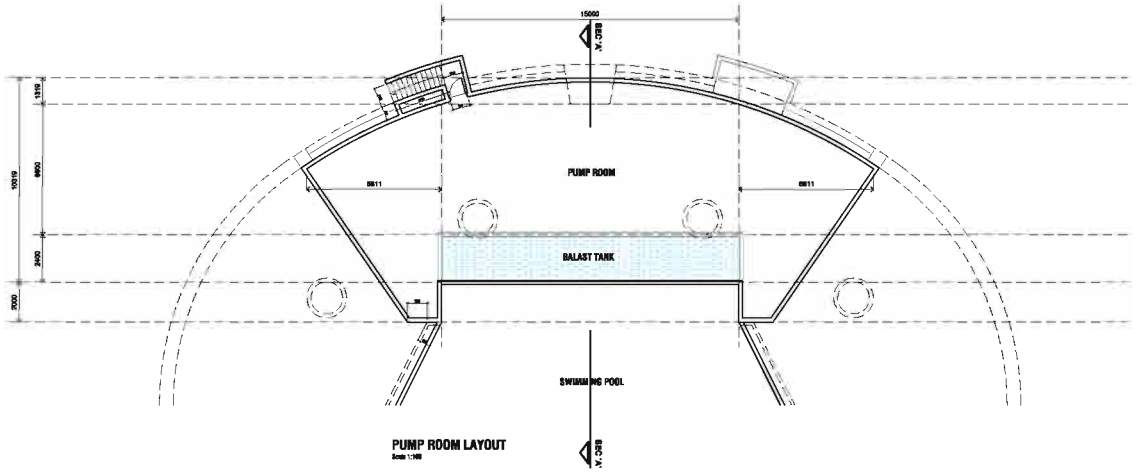
SWIMMING POOL LAYOUT PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

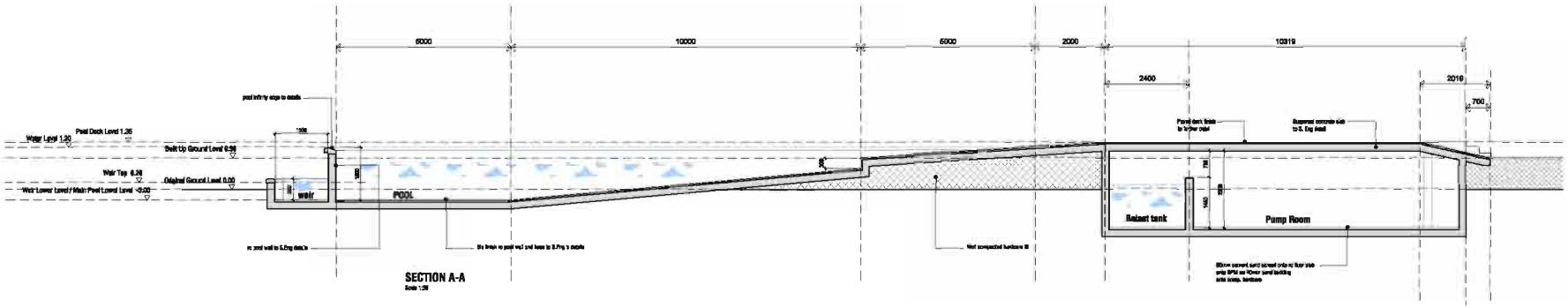
Scale	1 : 100	Date	FEB. 2005
Dr.	K.C	Ch.	
Drwg. No.	04-07/PA/06/100	Rev.	



BEACH ELEVATION
Scale 1:100



PUMP ROOM LAYOUT
Scale 1:100



SECTION A-A
Scale 1:50

NOTES

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Rev.	Amendments	By	Date

Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
SWIMMING POOL
PUMP ROOM LAYOUT
SECTION A-A & B-B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st Floor, Diksmgate House, P. O. Box 31
Victoria, Mahé, Seychelles. Tel: 224835

Scale	AS SHOWN	Date	FEB. 2005
Dr.	H.J.	Ck.	
Drwg. No.	04-07/PA/06/101	Rev.	

FLOOR PLAN

SCALE 1:100

No.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

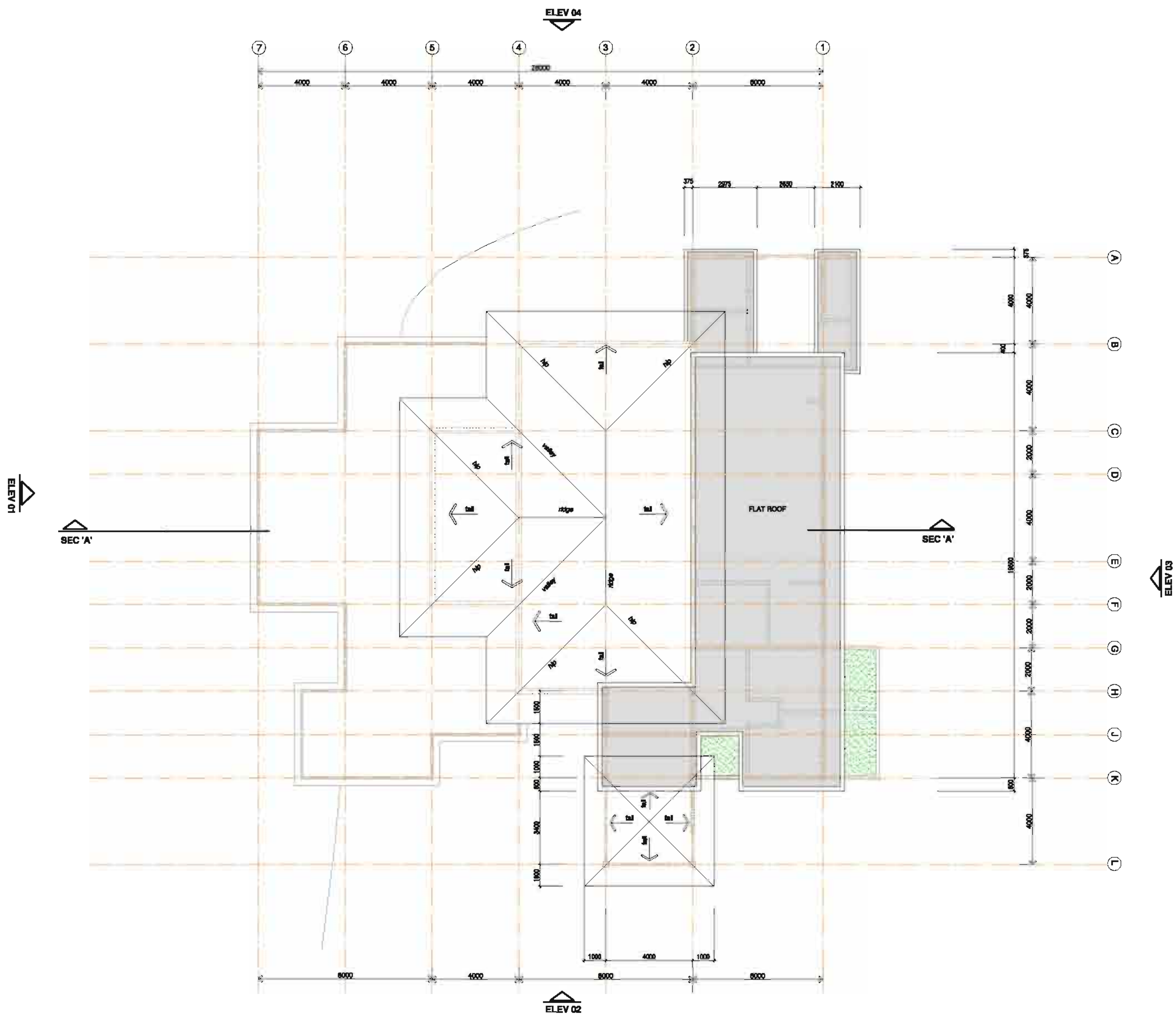
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title

SPECIALITY RESTAURANT
FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100	Date	FEB. 2005
Dr.	TC	Ck.	
Drwg. No.	04-07/PA/07/100	Rev.	



FLOOR PLAN

SCALE 1:100

Rev.	Amendments	By	Date

Client: Silhouette Island Resort limited

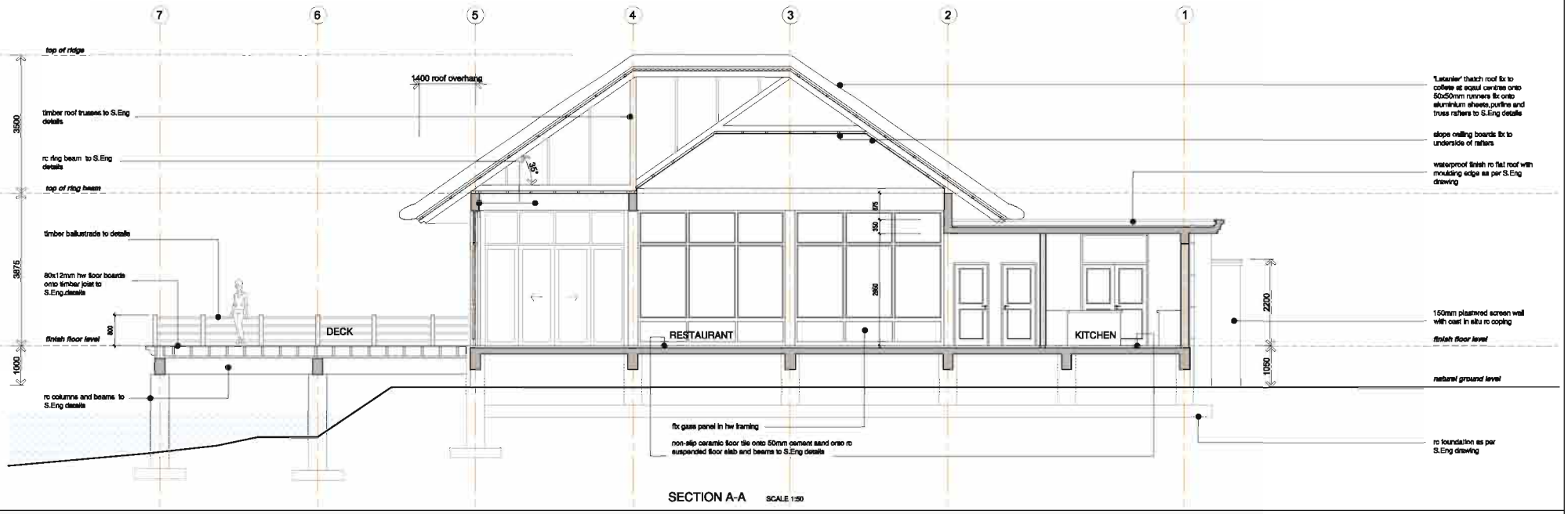
Project: **PROPOSED SILHOUETTE ISLAND RESORT AND SPA**

Drawing Title: **SPECIALITY RESTAURANT ROOF PLAN**

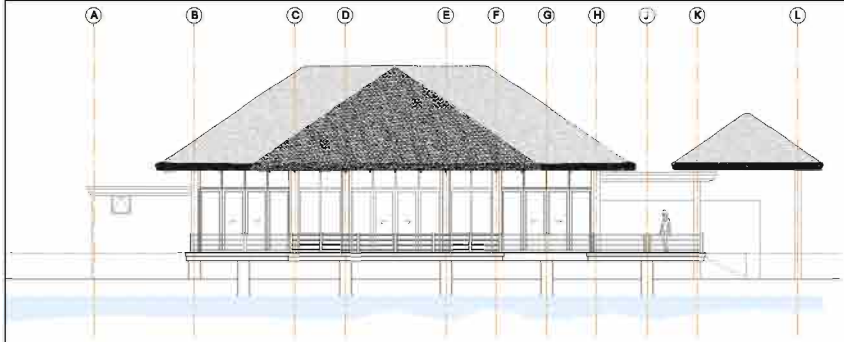
TIRANT ASSOCIATES

Architects and Project Management Consultants
104 Oceangate House, P.O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1:100	Date: FEB. 2005
Dr.: TC	Ck.:
Dwg. No.: 04-07/PA/07/101	Rev.:

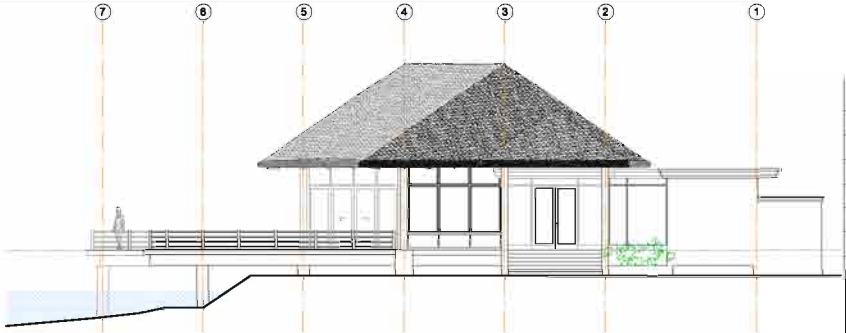


SECTION A-A SCALE 1:50



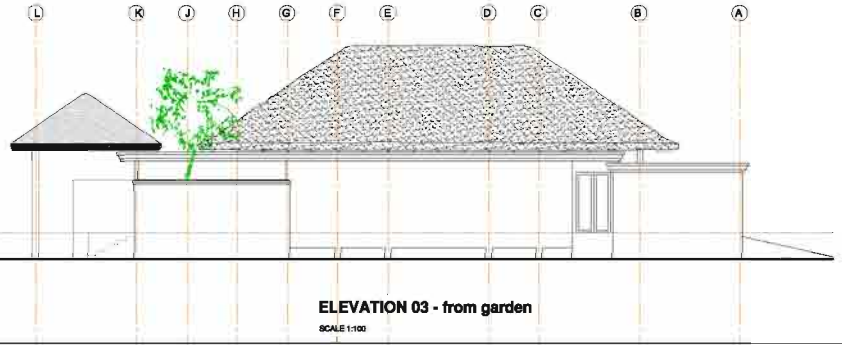
ELEVATION 01 - from marsh

SCALE 1:100



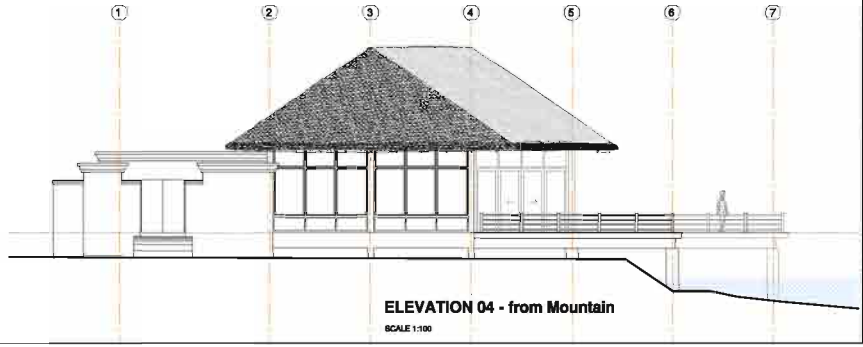
ELEVATION 02 - from Beach

SCALE 1:100



ELEVATION 03 - from garden

SCALE 1:100



ELEVATION 04 - from Mountain

SCALE 1:100

Rev.	Amendments	By	Date

Client

Silhouette Island Resort limited

Project

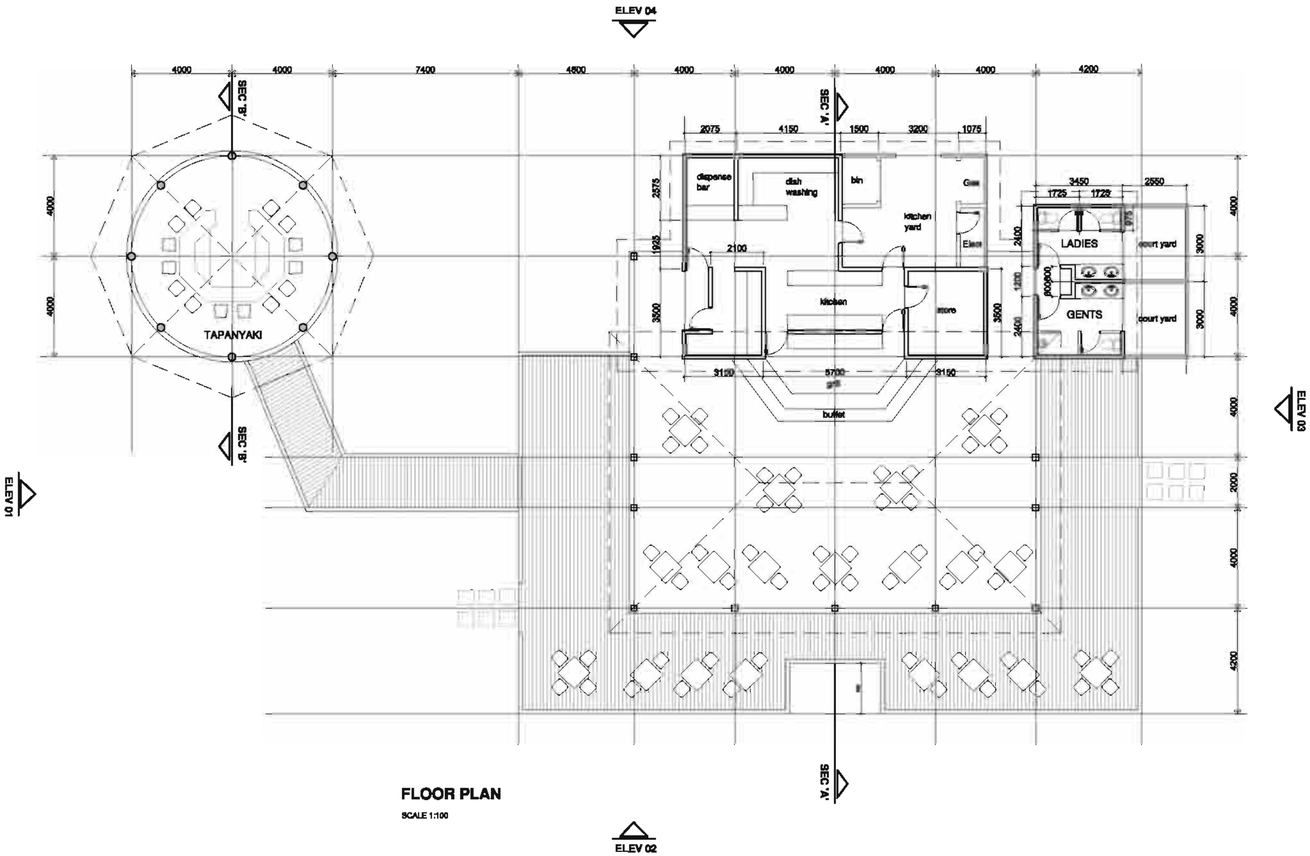
PROPOSED SILHOUETTE ISLAND RESORT AND SPA

Drawing Title

SPECIALITY RESTAURANT
SECTION A-A & ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
104 Oceangate House, P . O . Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1:100/1:50	Date	FEB. 2005
Dr.	TC	Ck.	
Drwg. No.	04-07/PA/07/103	Rev.	



FLOOR PLAN
SCALE 1:100

NOTES

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-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE
All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB
100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC
All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS
To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING
[illegible] finished with 3 coats of [illegible] paint.

6. ROOF
[illegible] laid on [illegible] felt on 19mm thk. [illegible] Grade [illegible] on 150 x 50mm s/w rafters at 600mm centres

7. WINDOWS AND EXTERNAL DOORS
Solid timber panel door in timber frame
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING
38mm dia UPVC waste to shower, bath and sink. 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes.
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8. FOUL DRAINAGE
Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle laid to fall 1 : 40 connected to manholes at locations shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER
150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.2m stone/rubble soakaway minimum 4.0m from anybuilding or boundary via 100mm dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by peashingle.

10. MANHOLES
Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 700mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

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Rev.	Amendments	By	Date

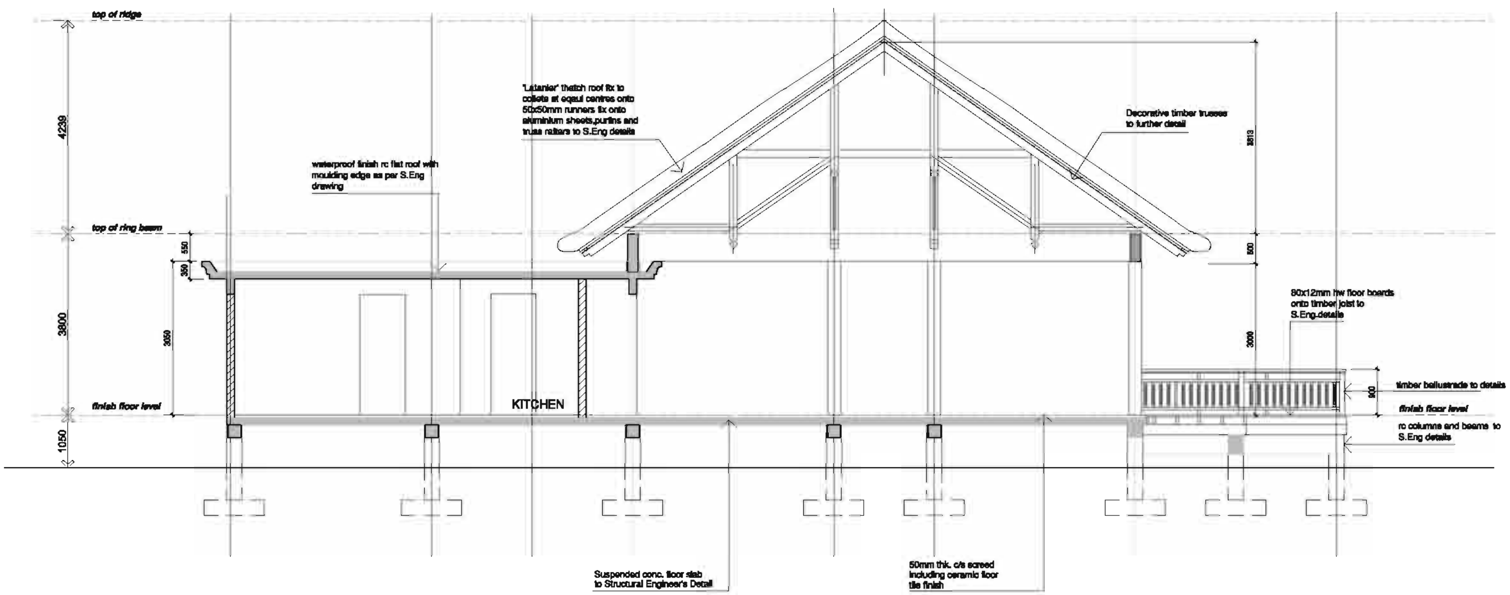
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

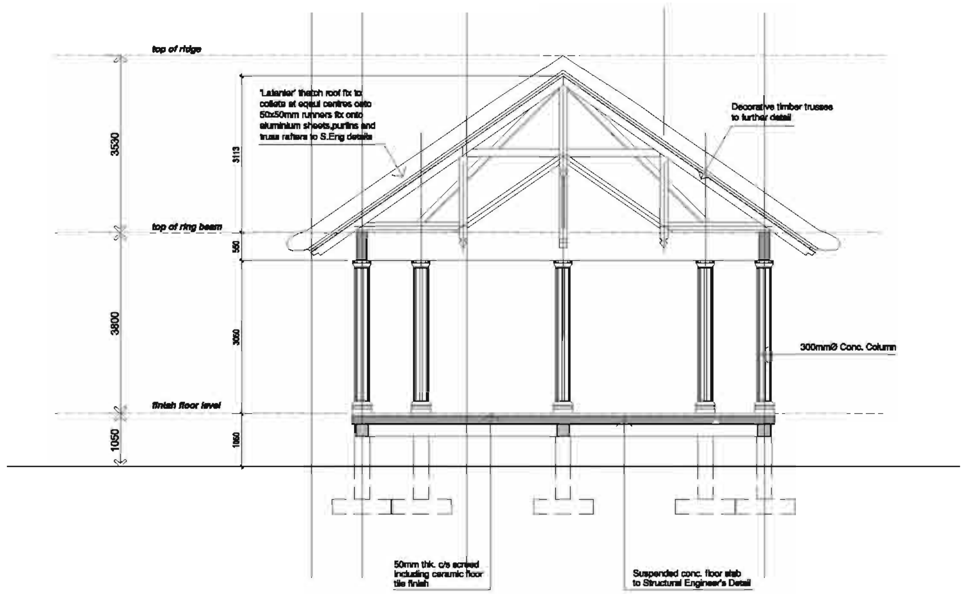
Drawing Title
OCEAN GRILL
FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/05/100	Rev.	



SECTION A-A
SCALE 1:50



SECTION B-B
SCALE 1:50

NOTES

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1. STRUCTURE

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2. GROUND FLOOR SLAB

100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC

All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar [illegible] on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

[illegible] finished with 3 coats of [illegible] paint.

6. ROOF

"[illegible] SHINGLES" laid on [illegible] on 19mm thk. [illegible] Grade [illegible] boards on 150 x 50mm s/w rafters at 600mm centres

7. WINDOWS AND EXTERNAL DOORS

Solid timber panel door in timber frame
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING

38mm Dia UPVC waste to shower, bath and sink. 100mm Dia. UPVC waste to W.C.s. 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

8. FOUL DRAINAGE

Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. pea shingle laid to fall 1 : 40 connected to manholes at location shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER

150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.2m stone/rubble soakaway minimum 4.0m from any building or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by pea shingle.

10. MANHOLES

Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 700mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered internally.

11. SEPTIC TANK

To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION

All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT

Final position of house to be decided on site within the building limits. Final level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

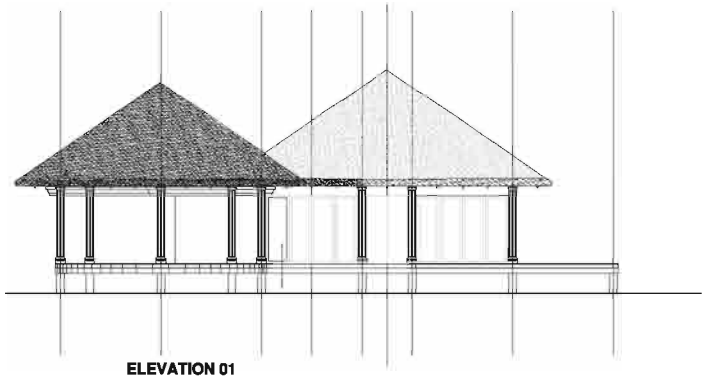
Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

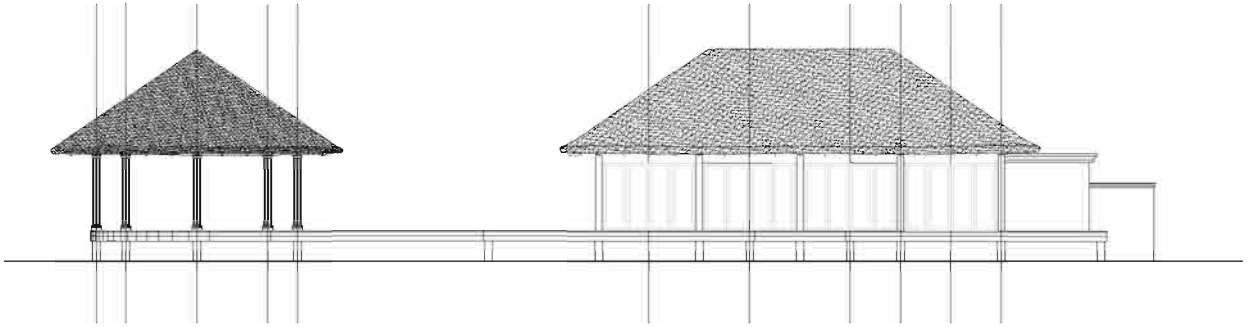
Drawing Title: OCEAN GRILL SECTION A-A & B-B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Dwg. No.	04-07/PA/05/101	Rev.	

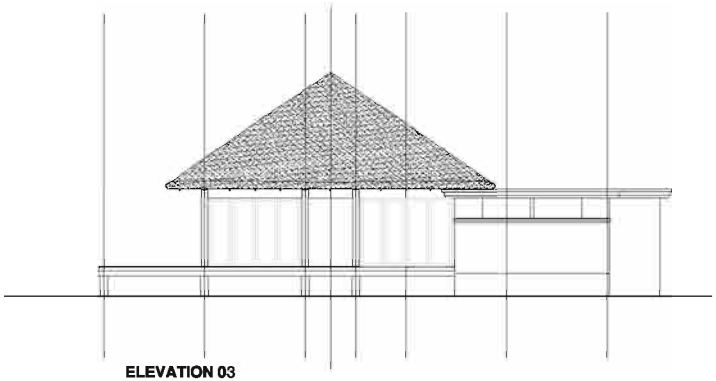


ELEVATION 01



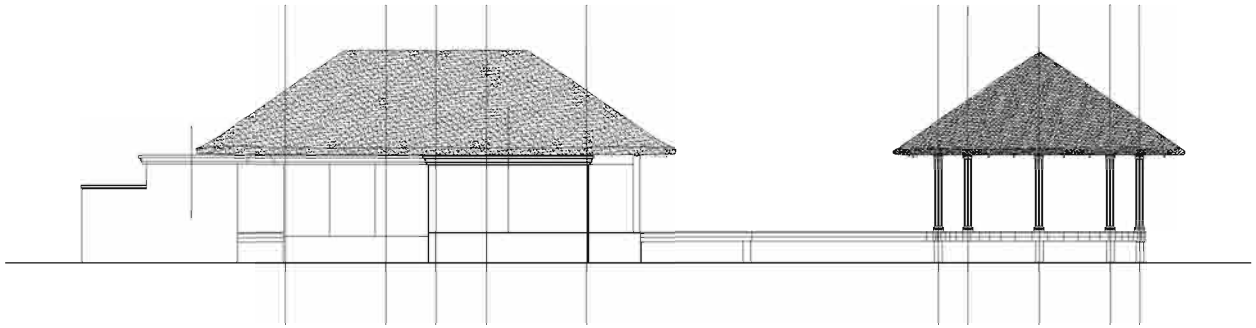
ELEVATION 02

SCALE 1:100



ELEVATION 03

SCALE 1:100



ELEVATION 04

SCALE 1:100

Rev.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

PROPOSED SILHOUETTE ISLAND RESORT & SPA

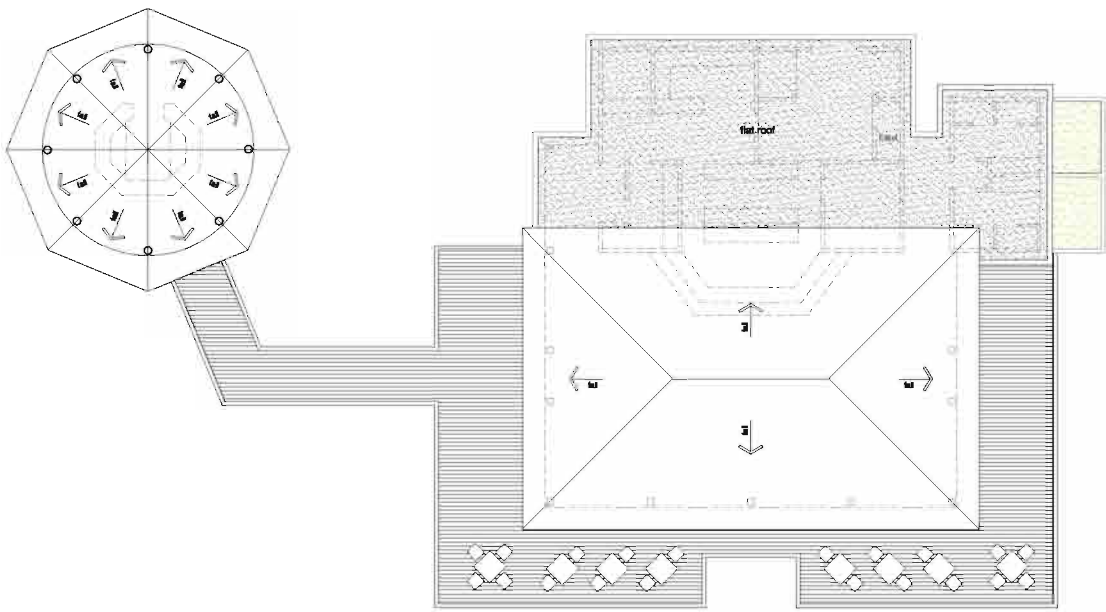
Drawing Title

OCEAN GRILL ELEVATIONS

TIRANT ASSOCIATES

Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.J.C	Ck.	
Dwg. No.	04-07/PA/05/102	Rev.	



ROOF PLAN

SCALE 1:100

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

1. STRUCTURE

All reinforced concrete slabs, beams, column, staircases and foundations to structural engineers drawing. (Where applicable)

2. GROUND FLOOR SLAB

100mm thick concrete slab with A142 steel mesh at the top with 25mm min. concrete cover, laid on min. 500 gauge "Visqueen" or similar D.P.M. on 50mm sand blinding on 150mm consolidated hardcore. D.P.M. to be taken up the side of external wall and lapped with the wall D.P.C.

3. WALLS ABOVE DPC

All external and internal walls to be Concrete Blocks as indicated with 15mm external render and 12.5mm internal plaster. D.P.C. to be "Hyload" pitch polymer or similar provided on all external walls placed min. 150mm above finish ground floor level. Blocks to be of min. strength 3.5 N/mm2 and 7.0 N/mm2 for load bearing wall.

4. LINTELS

To be of Concrete min. grade C25. Reinforcement and size of lintel as indicated. Minimum concrete cover to be 25mm.

5. CEILING

[illegible] finished with 3 coats of [illegible] paint.

6. ROOF

"TAMKO [illegible] SHINGLES" laid on insulation foil on 18mm thk. [illegible] Grade OSB boards on 150 x 50mm s/w rafters at 600mm centres.

7. WINDOWS AND EXTERNAL DOORS

Solid timber panel door in timber frame.
Aluminium frames with glazed panel or to client's spec.

8. PLUMBING

38mm Dia UPVC waste to shower, bath and sink. 100mm Dia. UPVC waste to W.C.s, 32mm dia. UPVC waste to wash hand basins.
All fitting to have anti syphonic traps.
Provide cleaning eyes at all changes of direction. All exposed waste connected to 100mm PVC soil and vent pipe terminating 900mm above the head of any window and fitted with durable plastic balloon unless otherwise shown. Soil pipe to connect to large radius bend at bottom of stack with suitable access above ground level for rodding purposes. All soil and vent connections in accordance with BS5572. All suspended waste to be supported at 900mm ctrs. Internal soil and vent pipes to be boxed and sound insulated with preformed flashing provided where soil and vent pipe passes through roof.

9. FOUL DRAINAGE

Kitchen sinks to be connected to a back inlet gully. All drain to be 100mm dia. UPVC drainage pipes with flexible joints laid on and surrounded by 150mm min. peashingle laid to fall 1 : 40 connected to manholes at locations shown. Drainage pipes passing under building to be encased in min. 150mm of concrete. Provide R.C. lintels over drains passing through walls.

9. SURFACE WATER

150mm Dia. half round UPVC guttering to 75mm Dia. UPVC down pipe to minimum 1.5m stone/rubble soakaway minimum 4.5m from anybuilding or boundary via 100mm Dia UPVC drainage pipes with flexible joints laid to to fall 1:40 min. laid on and surrounded by peashingle.

10. MANHOLES

Manholes not to exceed 900mm deep to be 600 X 450mm min. in 100mm dense concrete blocks on 150mm concrete base with suitable manhole cover to BS 497. Manholes exceeding 900mm deep to be in 225mm dense concrete blocks min. 1050 X 750mm with step irons 225mm centre. Provide all channels, branches and concrete benching. All manholes to be watertight and if necessary to be rendered with waterproof cement and sand rendered externally.

11. SEPTIC TANK

To be as per design and location shown. The tank to be watertight and if necessary rendered externally with waterproof cement. No septic tank to be located any nearer than 15m from a stream or water course or at an elevation which may result in contamination of water by seepage.

12. ELECTRICAL INSTALLATION

All electrical installation works are to comply with the requirements of the appropriate statutory body and should be carried out by a qualified electrician, providing requisite test certificates upon completion of the installation. Work should also be carried out in accordance with the approved Code of Practice. Number and position of electrical points should be discussed with the client prior to pricing and clearly stated on the builders quotation.

13. SETTING OUT

Final position of house to be decided on site within the building limits. Final level to be established by owner and contractor on site in conjunction with drain levels.

Rev.	Amendments	By	Date

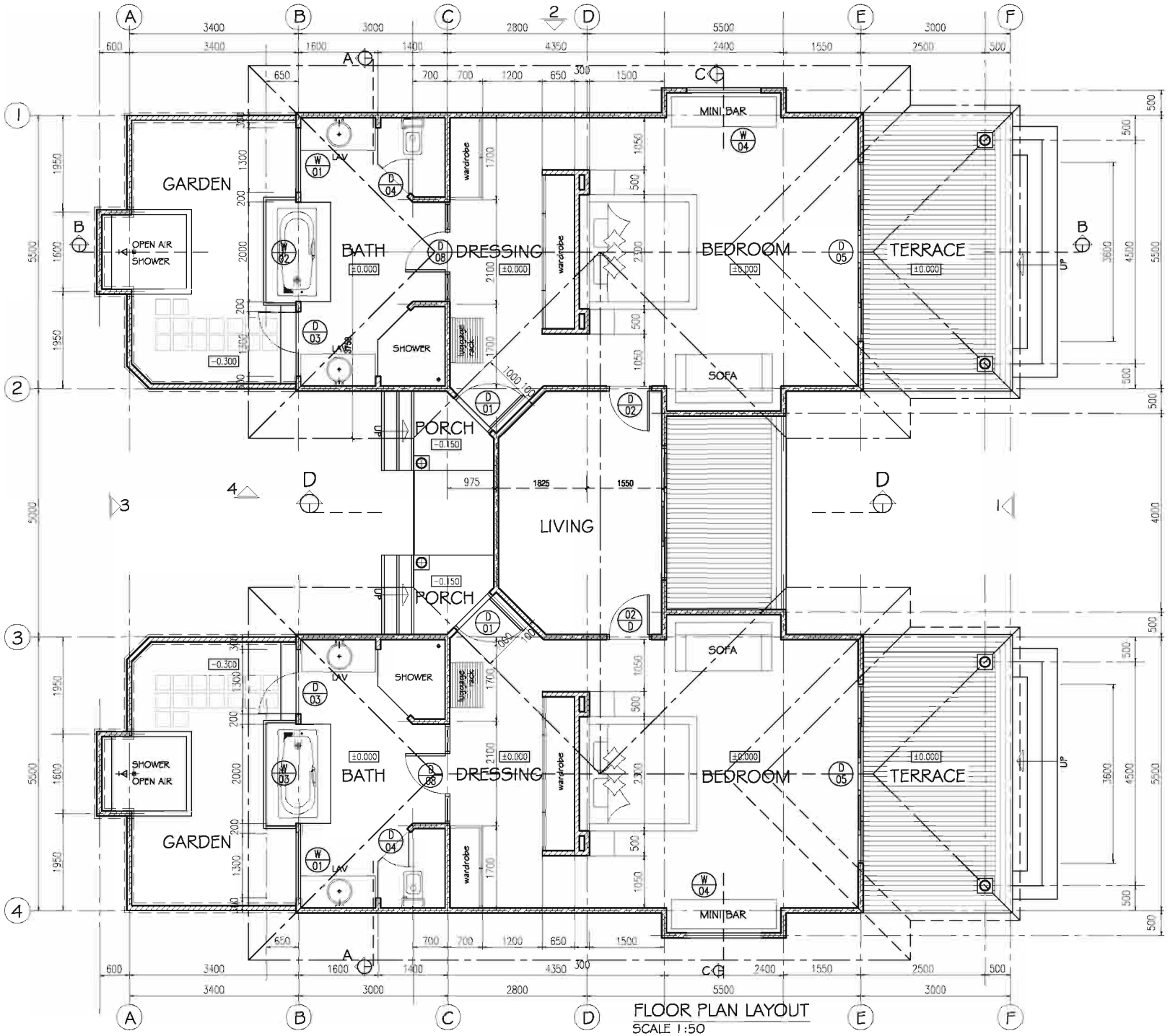
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
OCEAN GRILL
ROOF PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 31
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	FEB. 2005
Dr.	K.G	Ck.	
Drwg. No.	04-07/PA/05/103	Rev.	



FLOOR PLAN LAYOUT
SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS.
AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

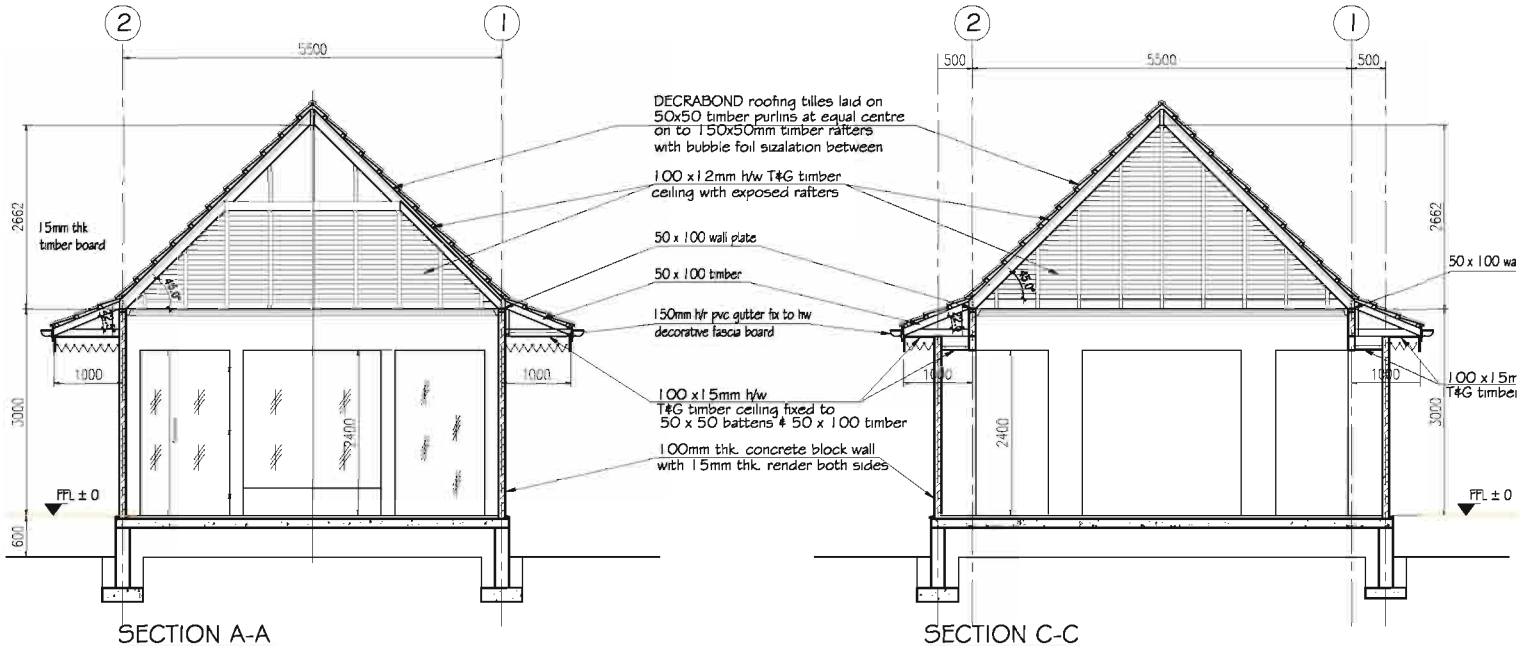
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
BEACH INTER-CONNECT VILLA FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4th Flat Floor, Greengate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 50	Date	DEC 2004
Dr.	K. D. Gendron	Ck.	
Drawing No.	04-07/02/WD/200	Rev.	

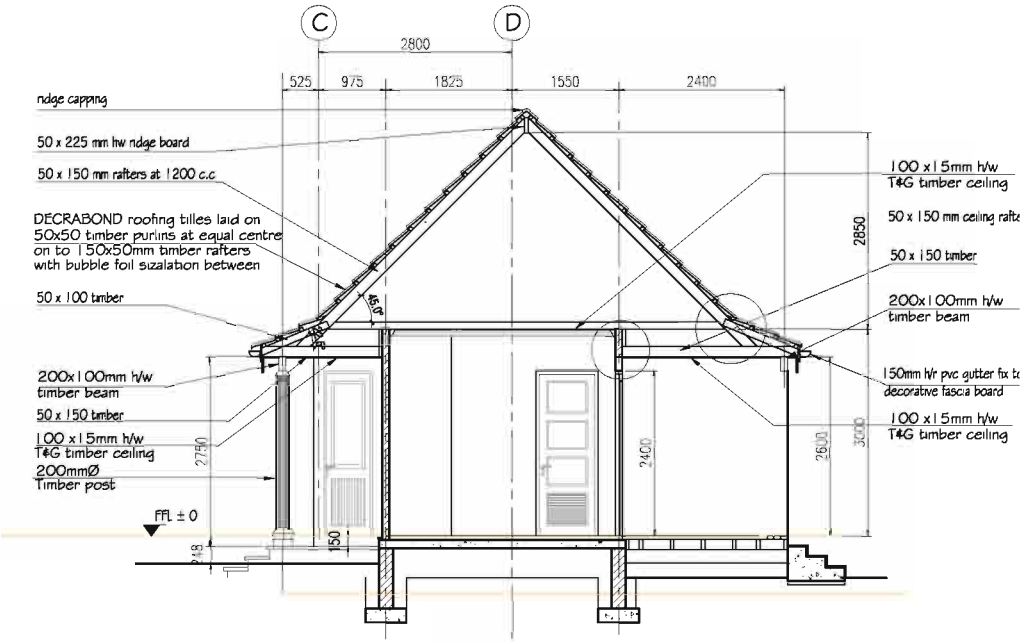


SECTION A-A

SCALE 1:50

SECTION C-C

SCALE 1:50



SECTION D-D

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CHASSEURS DRAWINGS.
AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

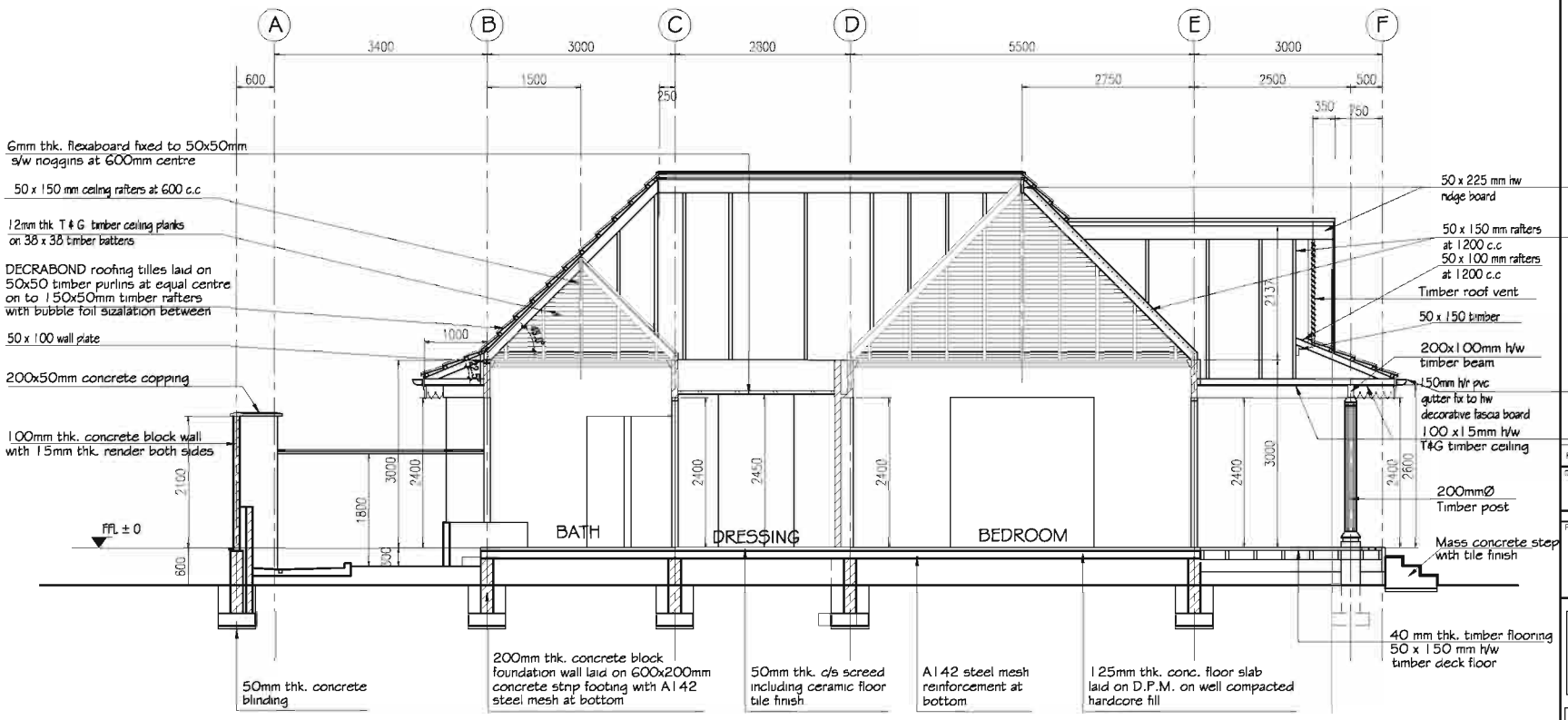
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

BEACH INTER-CONNECT VILLA SECTION A - A ,SECTION C -C & SECTION D - D

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 50	Date	DEC 2004
Dr.	K. D. Gendron	Ck.	
Drawing No.	04-07/02/WD/201	Rev.	



SECTION B-B

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

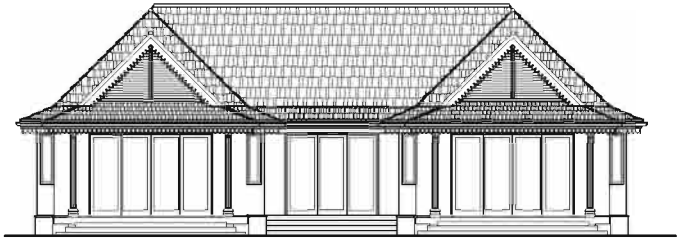
Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title: BEACH INTER-CONNECT VILLA SECTION B - B

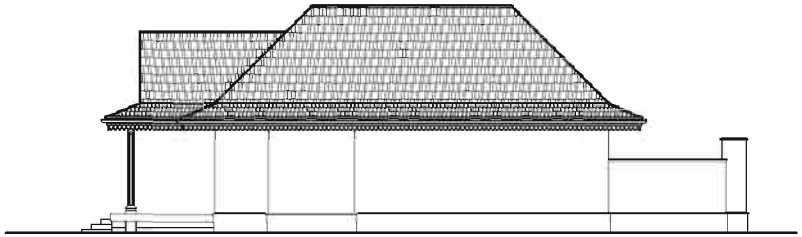
TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 50	Date	DEC 2004
Dr.	K. P. Gendron	Ck	
Drwg No.	04-07/02/WD/202	Rev	



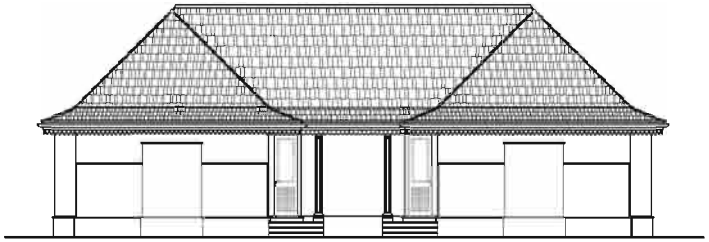
ELEVATION 1

SCALE 1:100



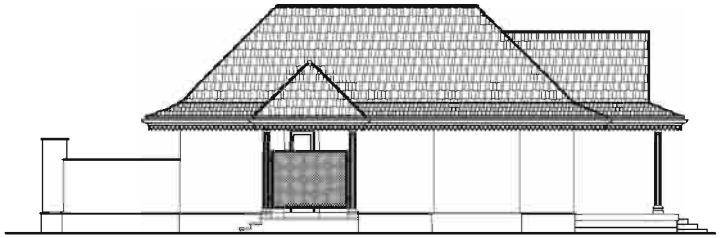
ELEVATION 2

SCALE 1:100



ELEVATION 3

SCALE 1:100



ELEVATION 4

SCALE 1:100

NOTES

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-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

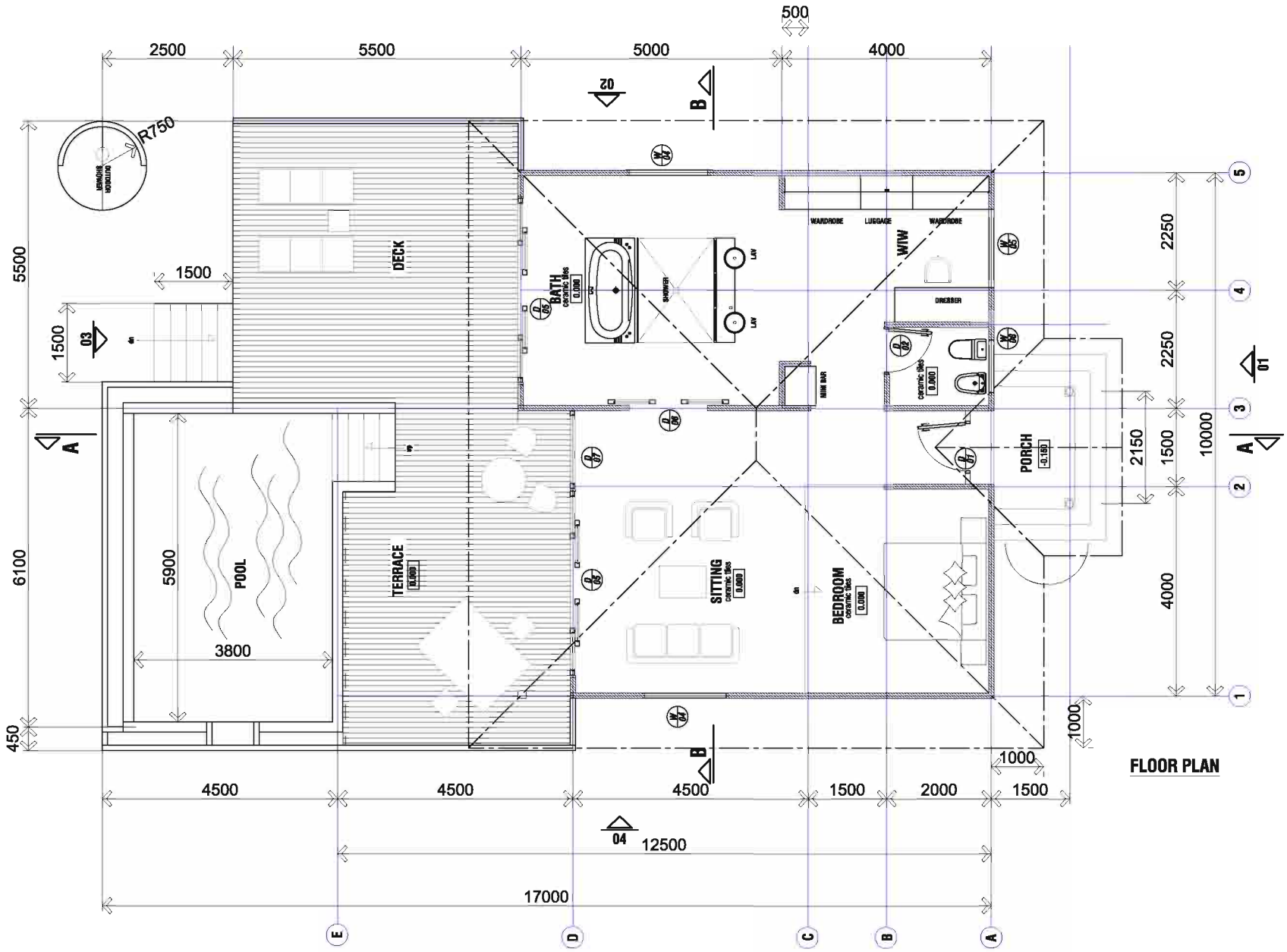
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

BEACH INTER-CONNECT VILLA ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	DEC 2004
Dr.	K. D. Gendron	Ck	
Drwg No.	04-07/02/WD/203	Rev	



FLOOR PLAN

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER RELEVANT DRAWINGS.

CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

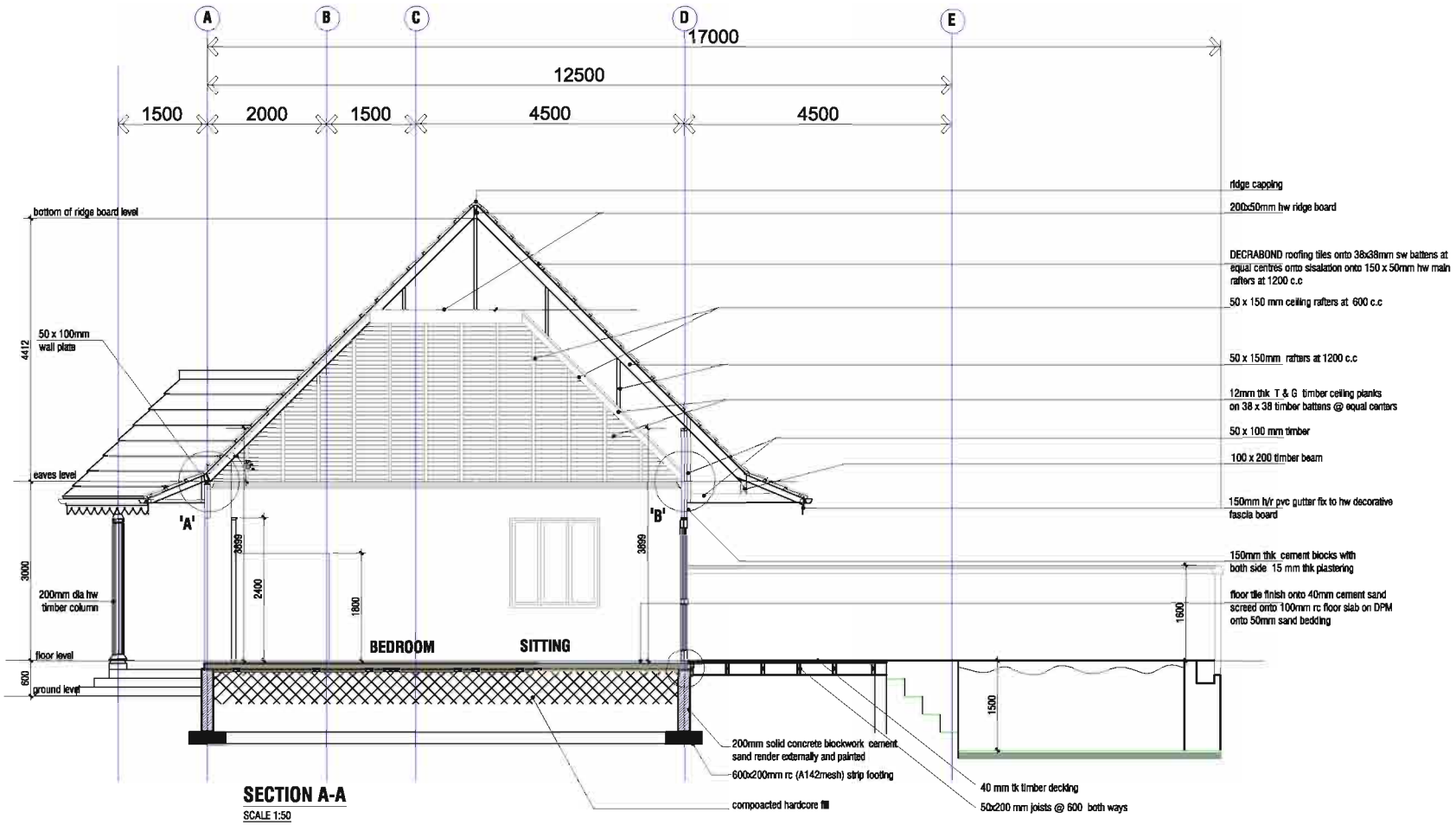
Drawing Title: BEACH POOL VILLA FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st Floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50 | Date: DEC 2004

Dr: K. D. Gendron | Ck:

Drawing No: 04-07/03/WD/200 | Rev:



SECTION A-A

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CHASSEURS DRAWINGS AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

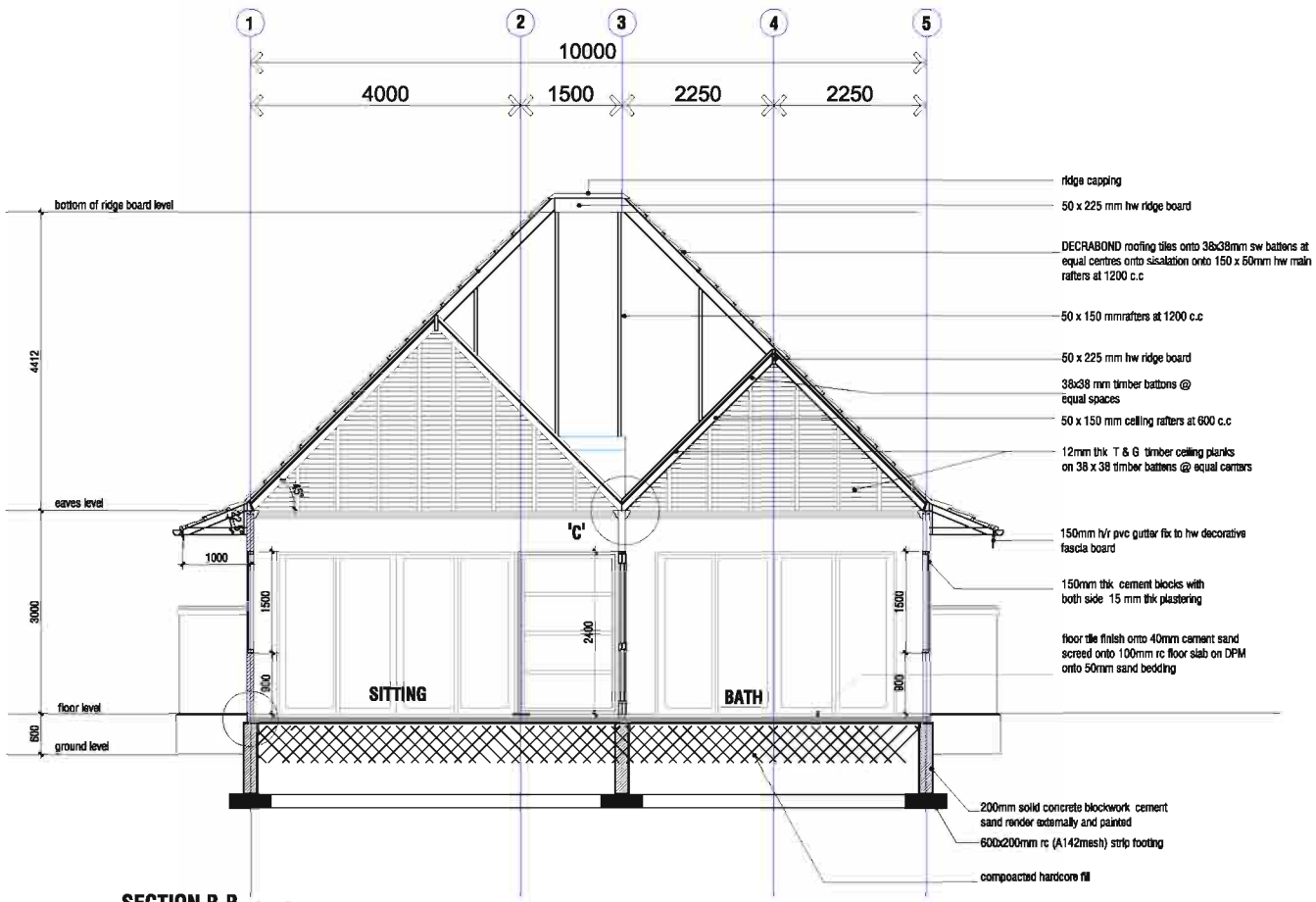
Drawing Title: BEACH POOL VILLA SECTION A - A

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50 | Date: DEC 2004

Dr: K. D. Gendron | Ck:

Dwg No: 04-07/03/WD/201 | Rev



SECTION B-B
SCALE 1:50

SECTION B-B
SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CHASSEURS DRAWINGS AND ANY OTHER RETAIL DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

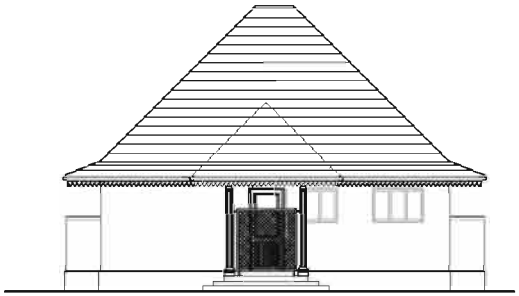
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

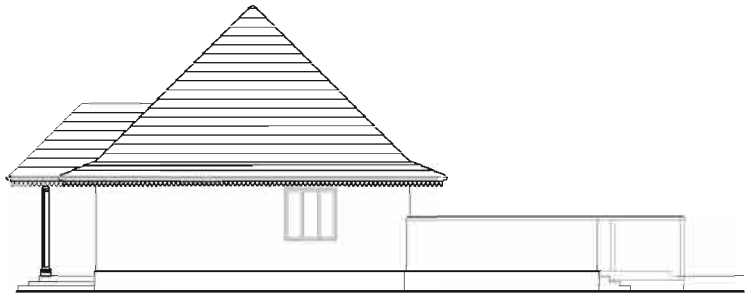
Drawing Title
BEACH POOL VILLA
SECTION B - B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

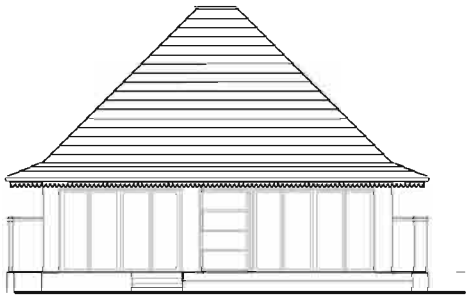
Scale	1 : 50	Date	DEC 2004
Dr.	K. D. Gendron	Ck	
Drwg No.	04-07/03/WD/202	Rev	



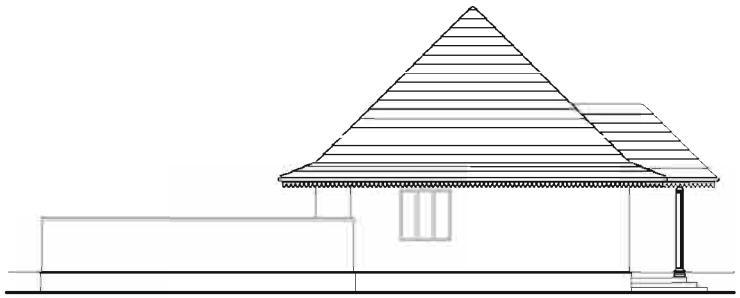
ELEVATION -01



ELEVATION -02



ELEVATION -03



ELEVATION -04

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETERS.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER RELEVANT DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

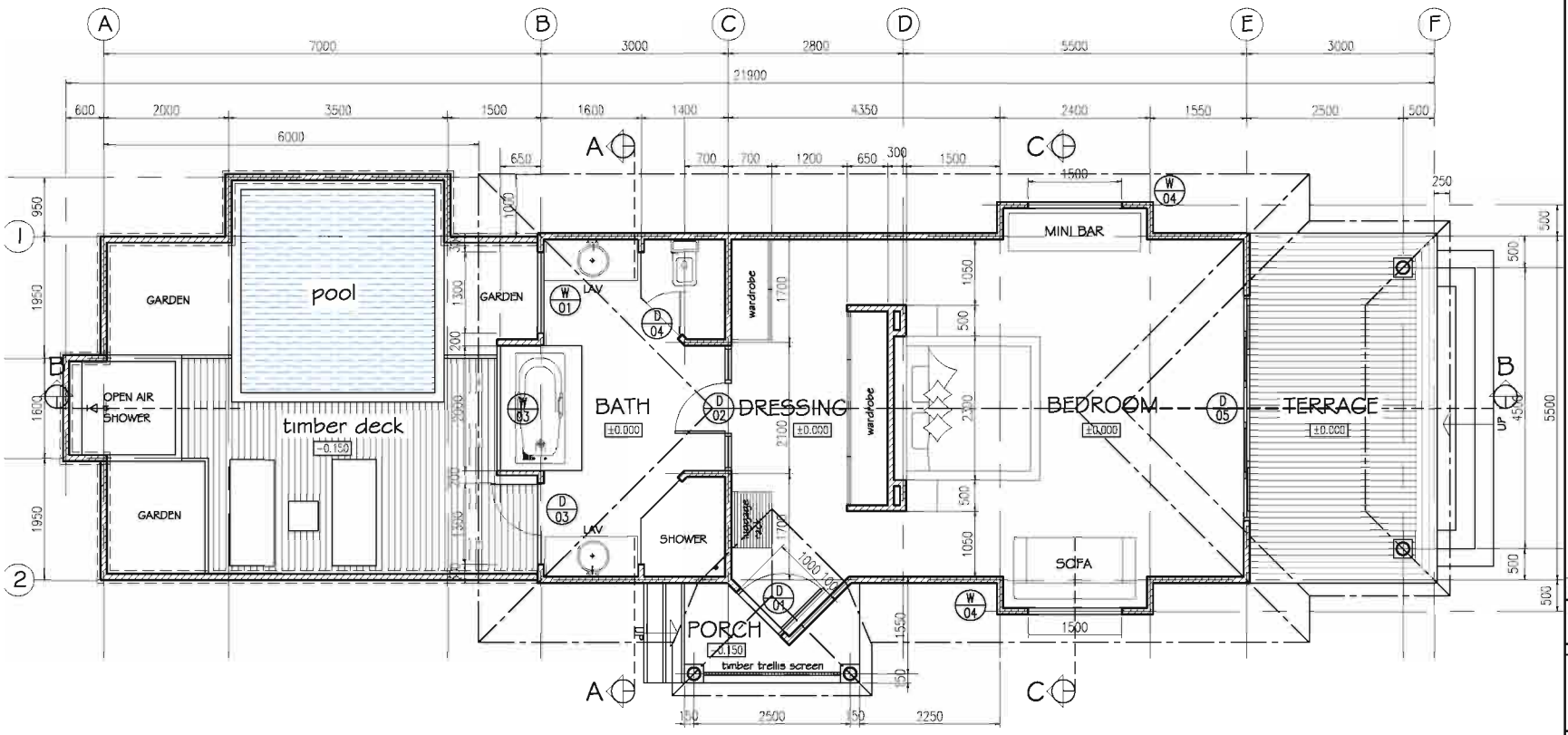
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
BEACH POOL VILLA ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	DEC 2004
Dr.	K. D. Gendron	Ck.	
Dwg No.	04-07/03/WD/203	Rev.	



FLOOR PLAN LAYOUT

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

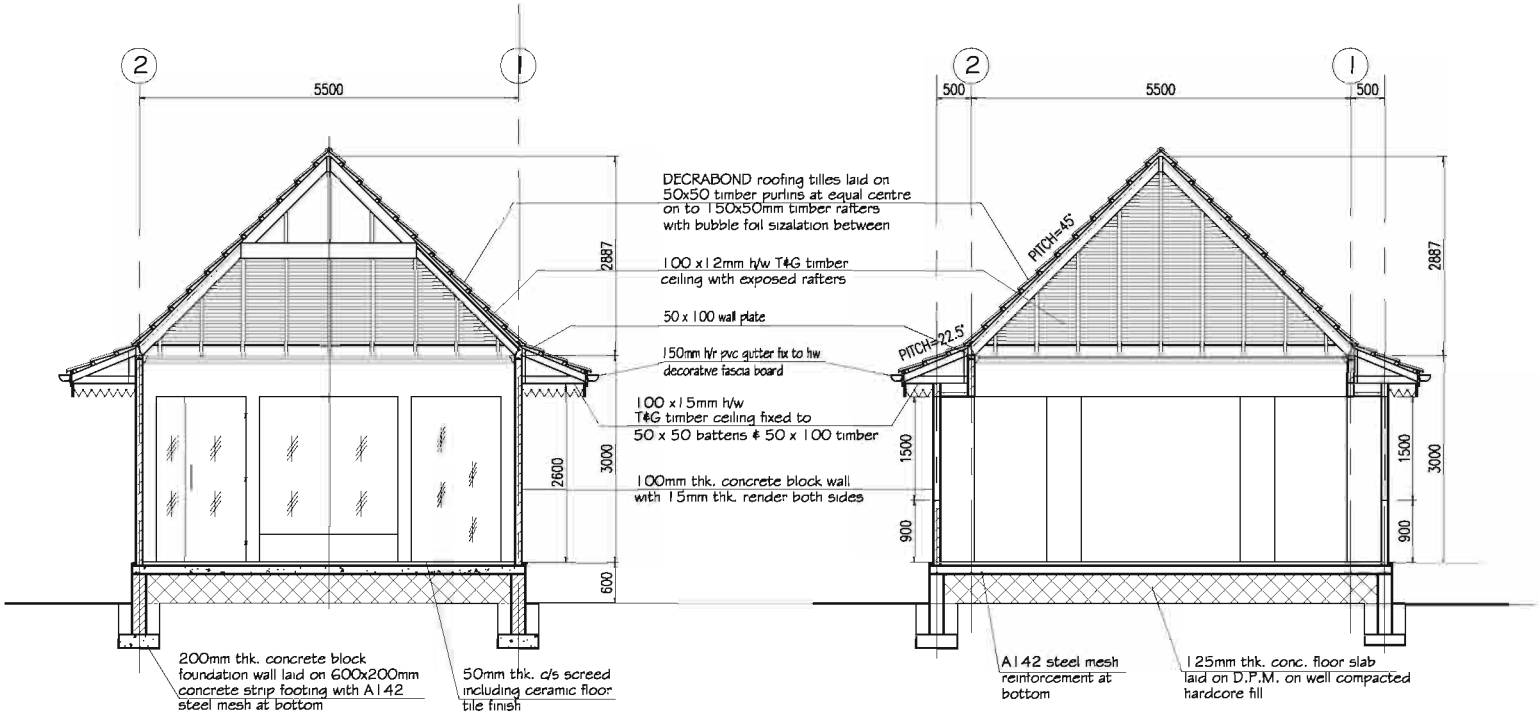
Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title: BEACH POOL VILLA FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50	Date: DEC 2004
Dr: K. D. Gendron	Ck:
Drwg No: 04-07/02/WD/300	Rev:



SECTION A-A

SCALE 1:50

SECTION C-C

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER RELEVANT DRAWINGS.

CONSTRUCTION DRAWING

No.	Amendments	By	Date

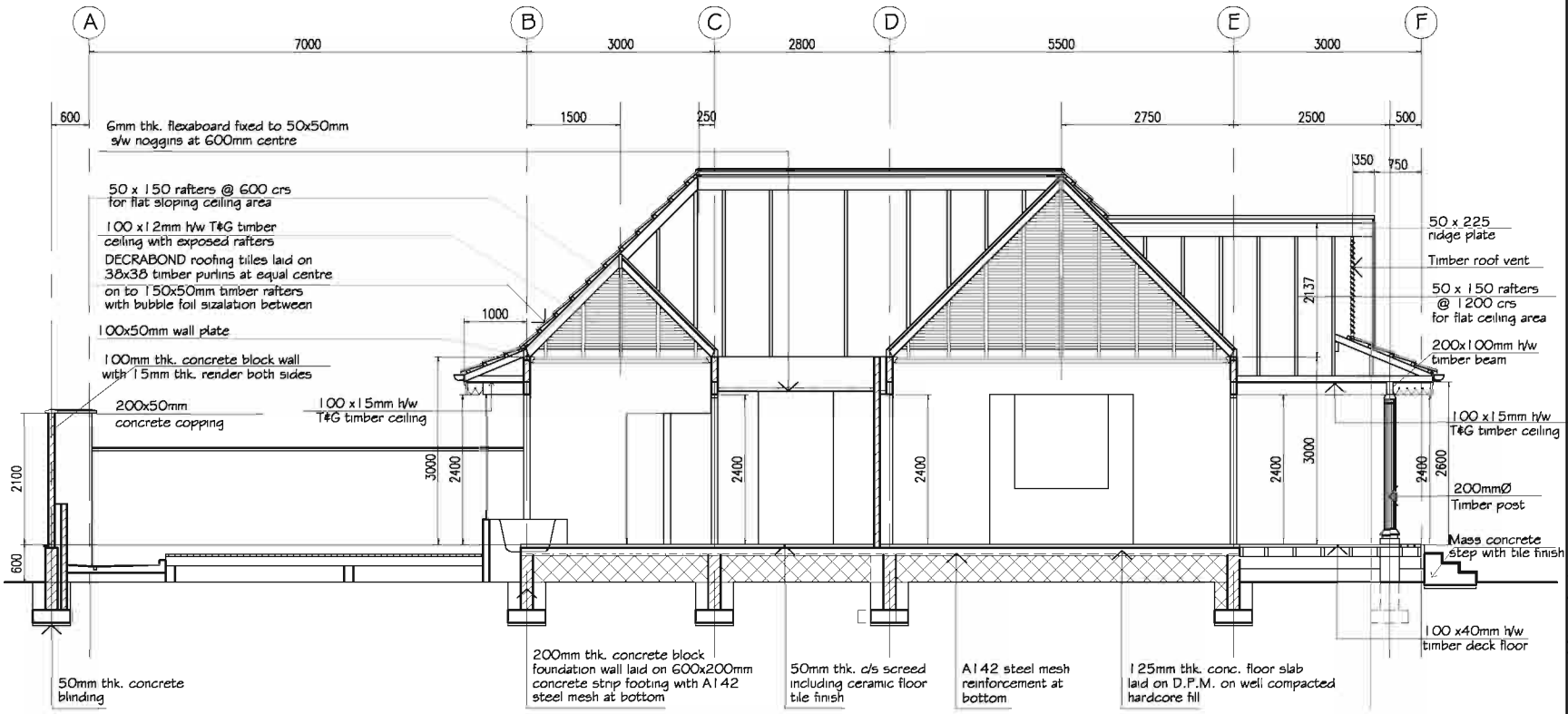
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
BEACH POOL VILLA
SECTION A-A , SECTION C -C

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Greengate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 50	Date	DEC 2004
Dr.	K. D. Gendron	Ck.	
Drwg No.	04-07/02/WD/301	Rev.	



SECTION B-B

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS AND ANY OTHER RELEVANT DRAWINGS.

CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

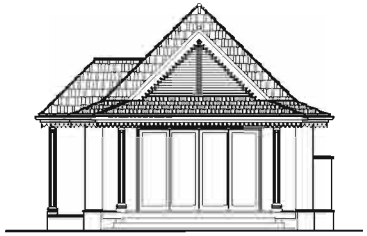
Drawing Title: BEACH POOL VILLA SECTION B-B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

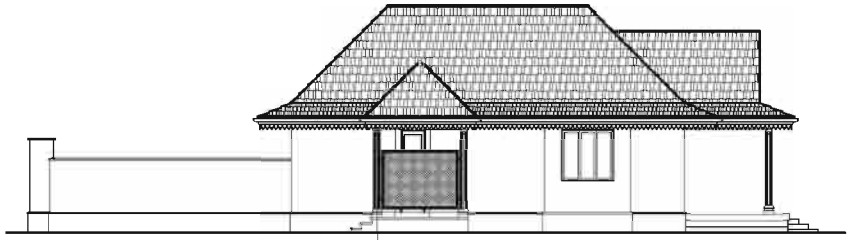
Scale: 1 : 50 | Date: DEC 2004

Dr: K. D. Gendron | Ck:

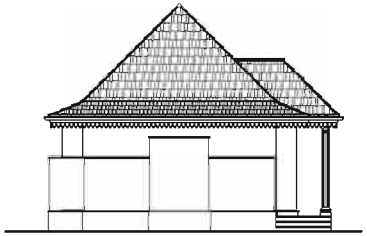
Dwg No: 04-07/02/WD/302 | Rev



FRONT ELEVATION
SCALE 1:100



SIDE ELEVATION
SCALE 1:100



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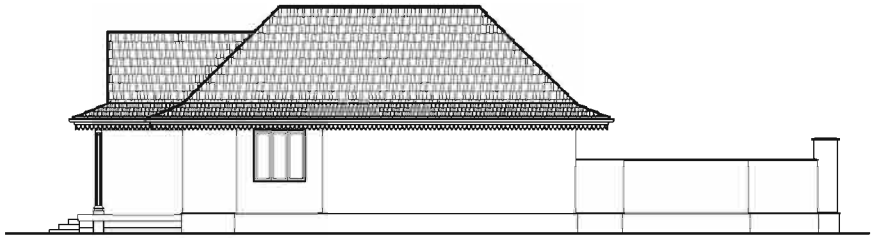
SCALE 1:100



SIDE ELEVATION
SCALE 1:100

NOTES

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CONSTRUCTION DRAWING

No.	Amendments	By	Date

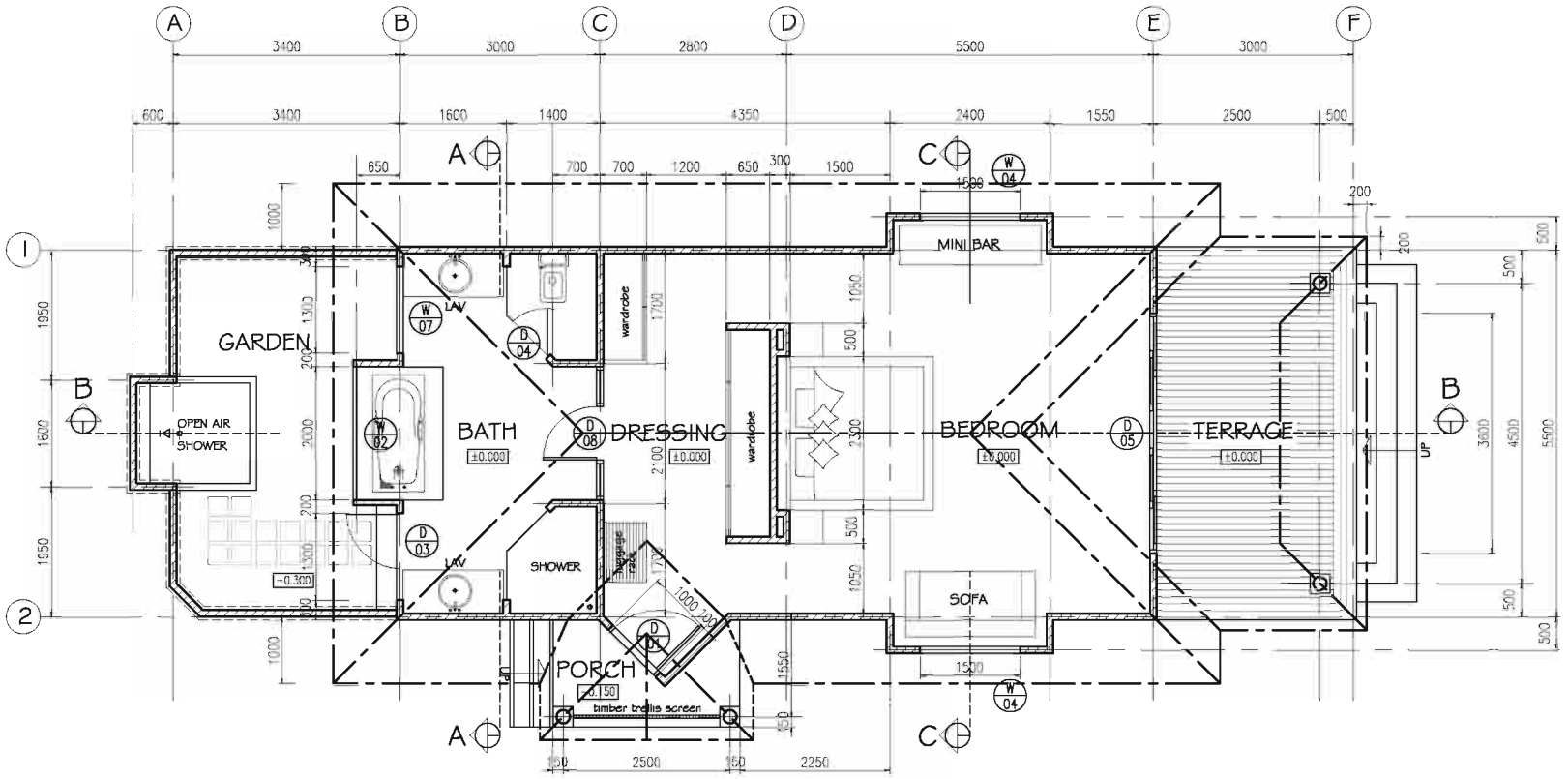
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
BEACH POOL VILLA ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
4th Flat Floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	DEC 2004
Dr.	K. D. Gendron	Ck	
Drwg No.	04-07/02/WD/303	Rev	



FLOOR PLAN LAYOUT

SCALE 1:50

BEACH VILLA

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
-DIMENSIONS ARE IN MILLIMETRES.
-ALL DIMENSIONS TO BE READ IN CONJUNCTION WITH CHARGEURS DRAWINGS AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

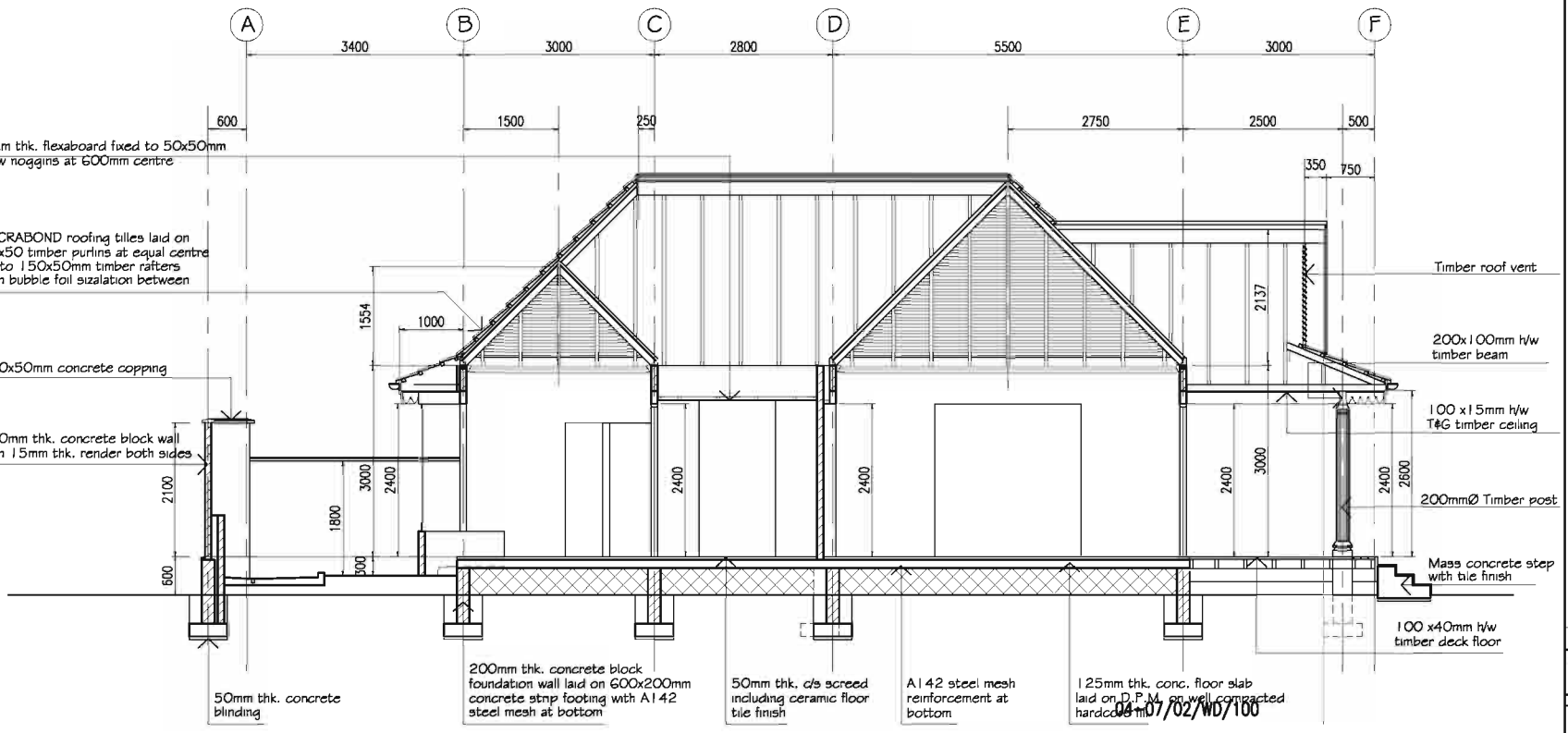
Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title: BEACH VILLA FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50	Date: DEC 2004
Dr: K. D. Gendron	Ck:
Drwg No: 04-07/02/WD/100	Rev



SECTION B-B

SCALE 1:50

BEACH VILLA

NOTES

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CONSTRUCTION DRAWING

No.	Amendments	By	Date

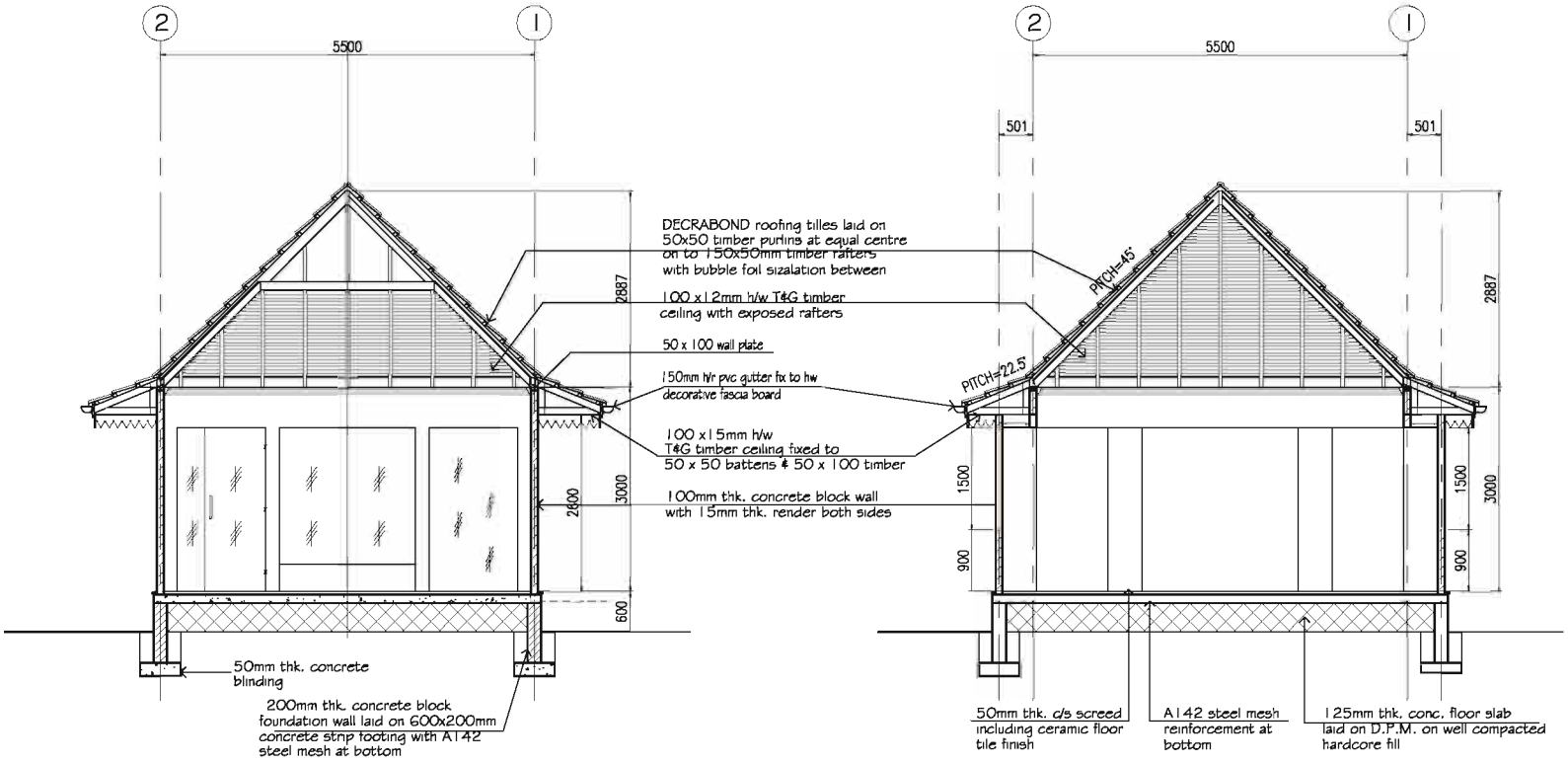
Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title: BEACH VILLA SECTION B - B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Greengate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 50	Date	DEC 2004
Dr.	K. P. Gendron	Ck.	
Drawing No.	04-07/02/WD/101	Rev.	



SECTION A-A
SCALE 1:50

SECTION C-C
SCALE 1:50

BEACH VILLA

NOTES

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CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

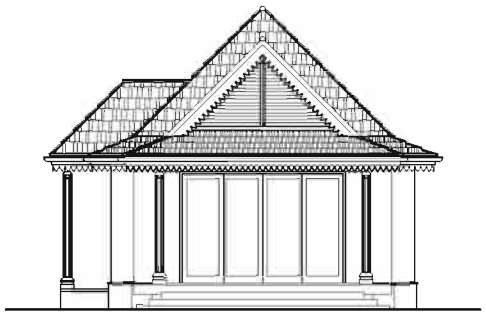
Drawing Title
BEACH VILLA
SECTION A - A , SECTION C -C

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st Floor, Greengate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50 | Date: DEC 2004

Dr: K. D. Gendron | Ck:

Drawing No: 04-07/02/WD/102 | Rev



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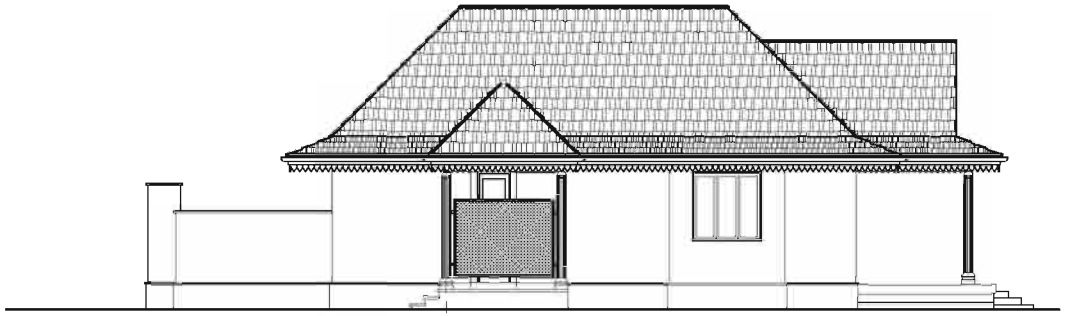

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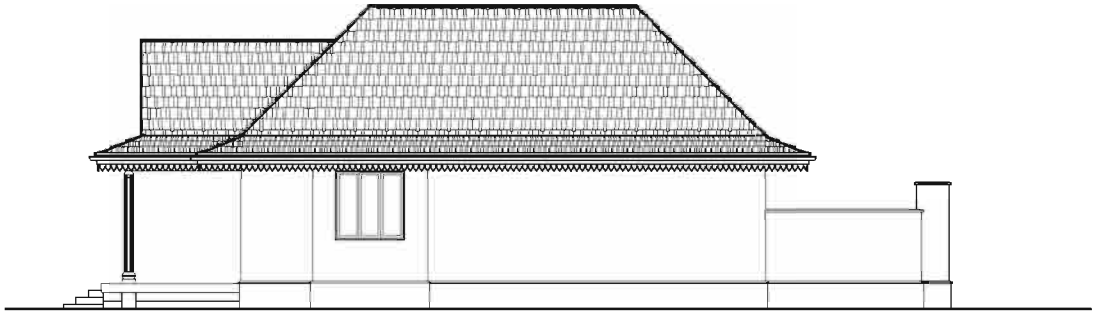
SCALE 1:100



SIDE ELEVATION
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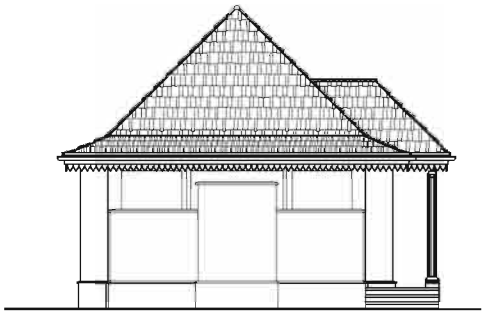

REAR ELEVATION
SCALE 1:100

BEACH VILLA

NOTES

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CONSTRUCTION DRAWING

No.	Amendments	By	Date

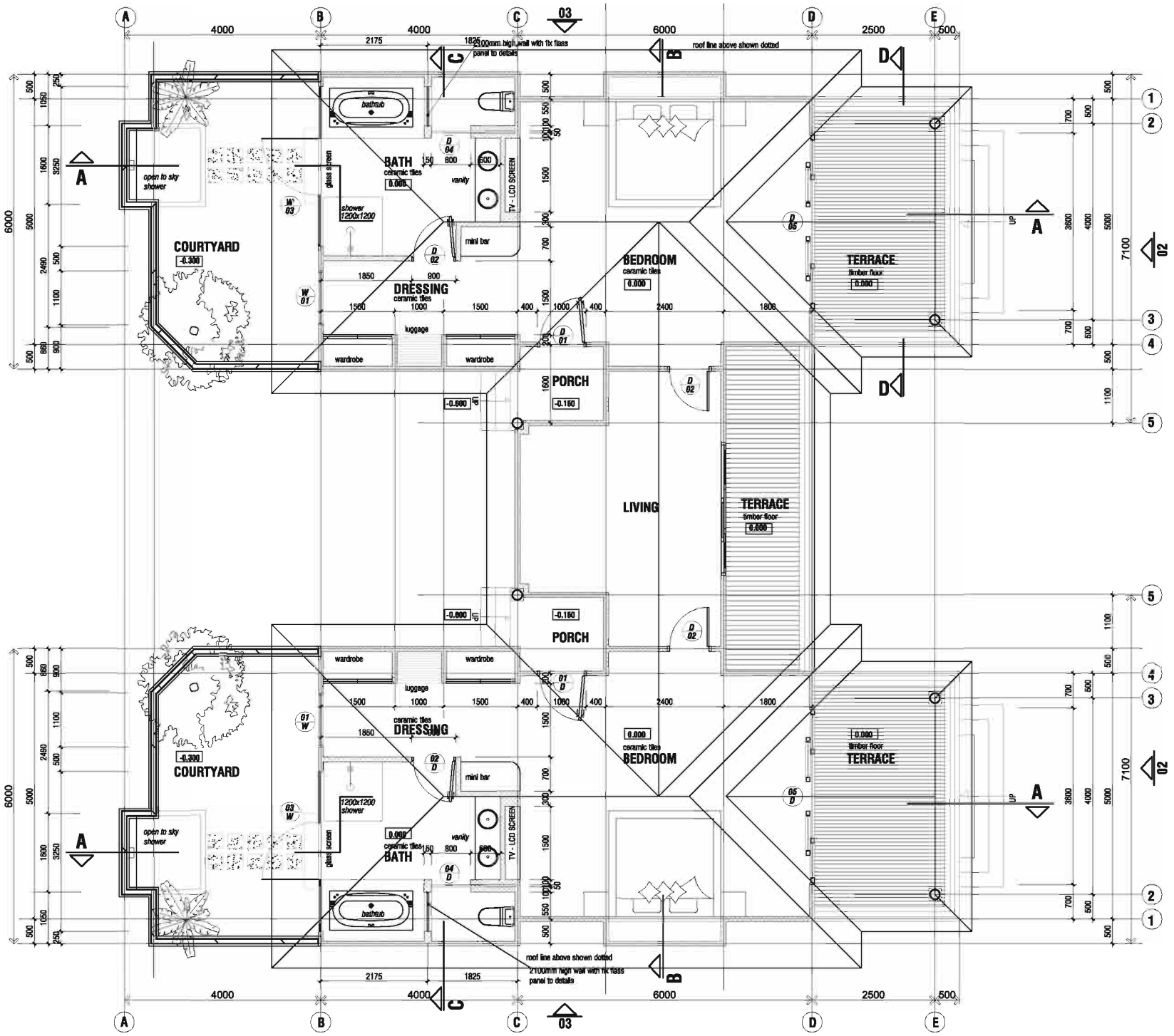
Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title
BEACH VILLA ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
4th Flat Floor, Greengate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 50	Date	DEC 2004
Dr.	K. D. Gendron	Ck	
Drwg No.	04-07/02/WD/103	Rev	



NOTES

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CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

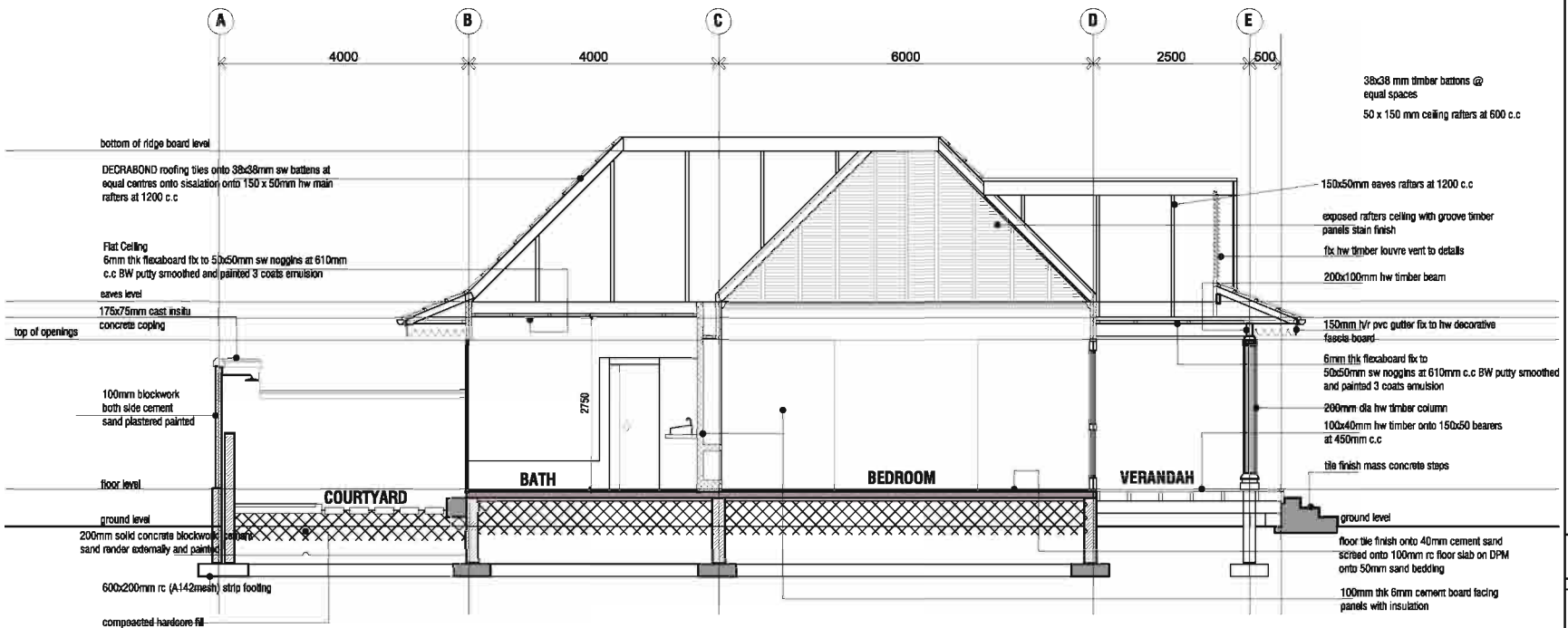
GARDEN INTERCONNECT VILLA
FLOOR PLAN

TIRANT ASSOCIATES

1 : 50	DEC 2004

K. D. Gamdron

04-07/01/WD/200



GARDEN VILLA - SECTION A-A

SCALE 1:50

NOTES

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CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

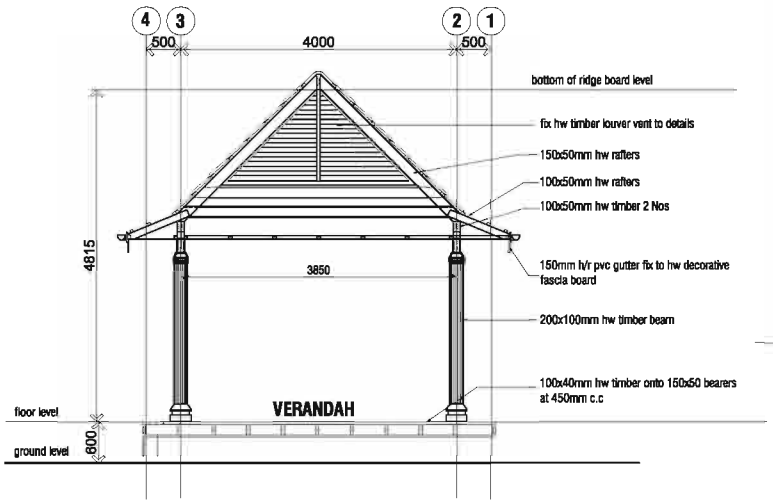
GARDEN INTERCONNECT VILLA
SECTIONS A-A

TIRANT ASSOCIATES

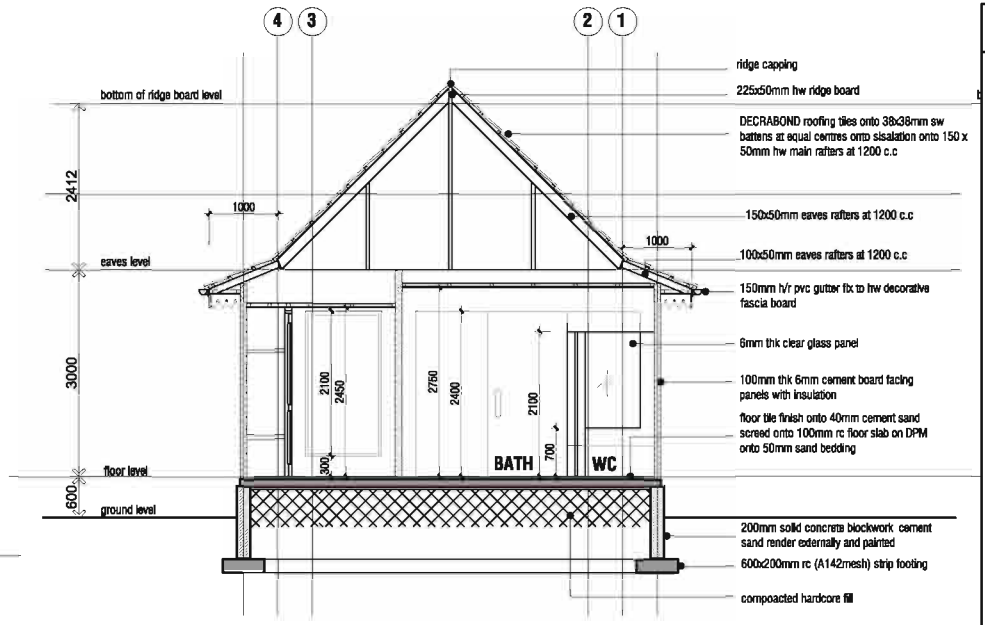
1 : 50	DEC 2004

K. D . Gamdron

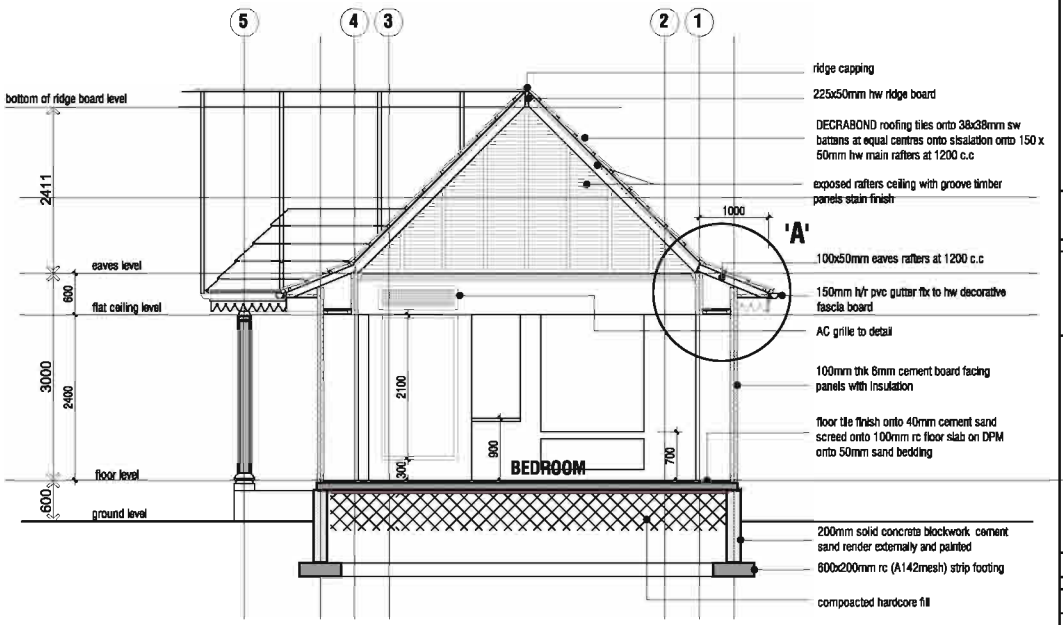
04-07/01/WD/201



GARDEN VILLA - SECTION D-D
SCALE 1:50



GARDEN VILLA - SECTION C-C
SCALE 1:50



GARDEN VILLA - SECTION B-B
SCALE 1:50

NOTES

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CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

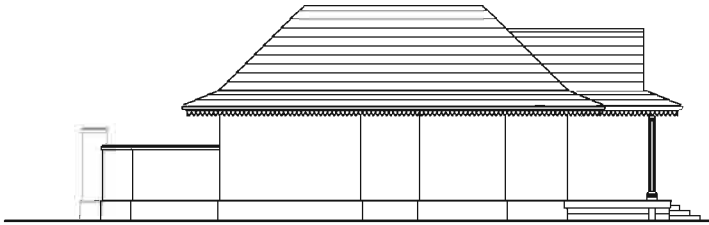
GARDEN INTERCONNECT VILLA
SECTION B-B ,SECTION C -C
SECTION D-D

TIRANT ASSOCIATES

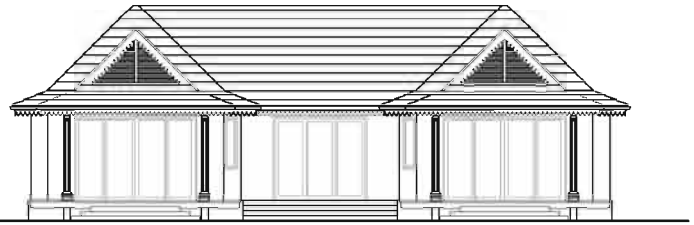
1 : 50	DEC 2004

K. D . Gamdron

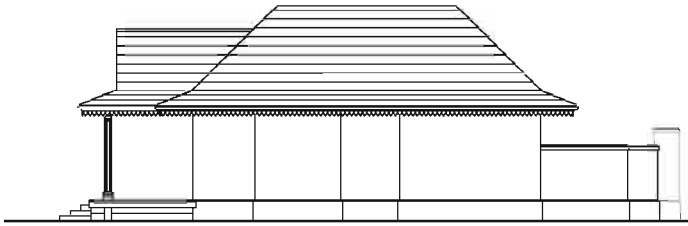
04-07/01/WD/202



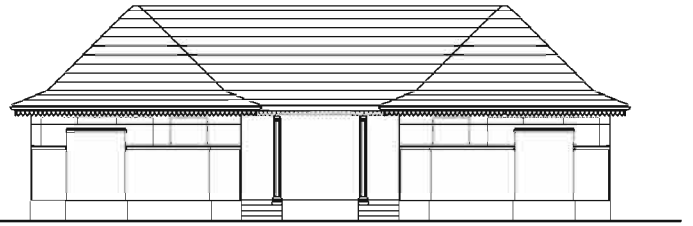
GARDEN VILLA - ELEVATION 01



GARDEN VILLA - ELEVATION 02



GARDEN VILLA - ELEVATION 03



GARDEN VILLA - ELEVATION 04

NOTES

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CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

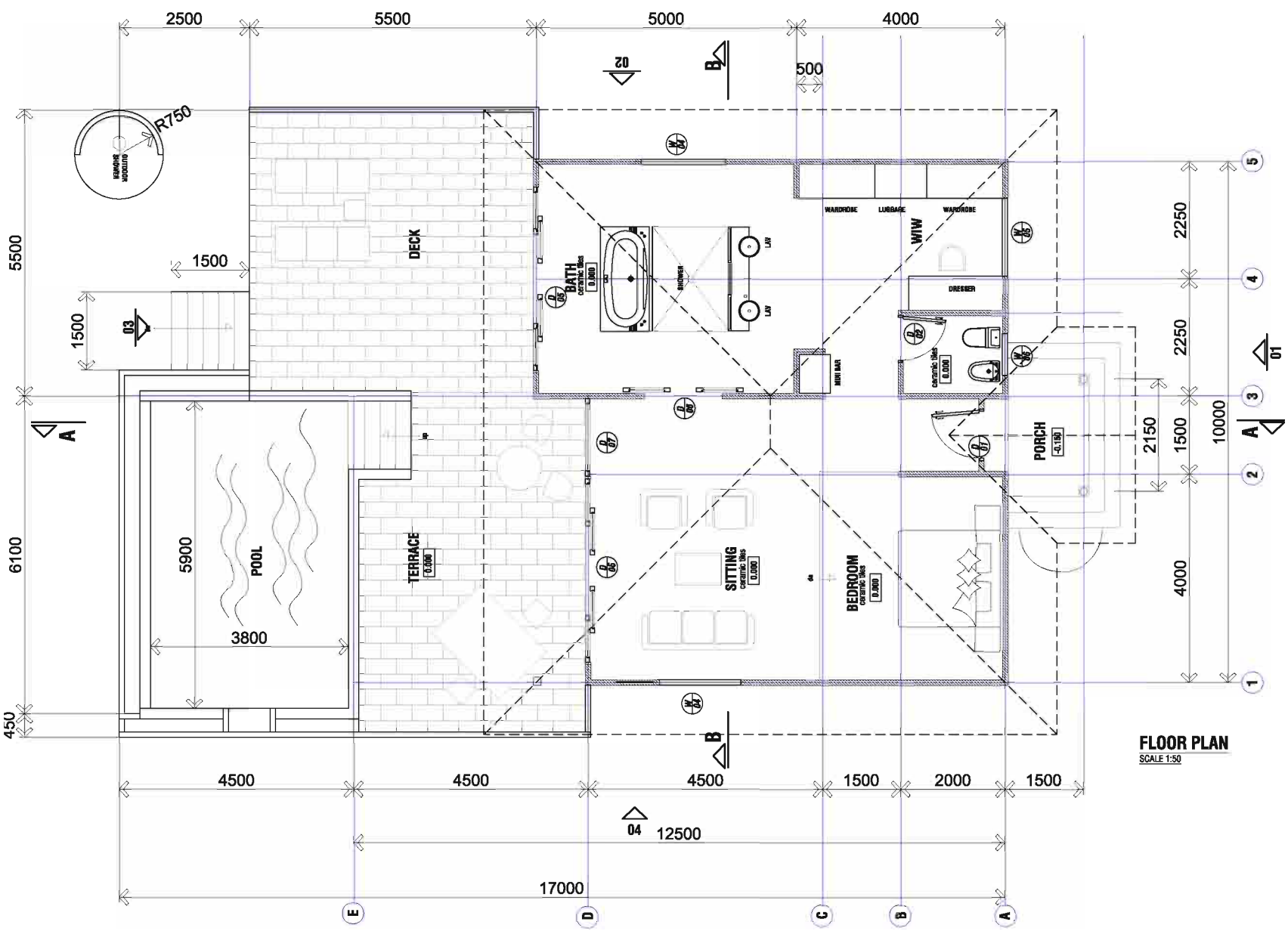
GARDEN INTERCONNECT VILLA ELEVATIONS

TIRANT ASSOCIATES

1 : 50	DEC 2004

K. D. Gamdron

04-07/01/WD/203



FLOOR PLAN
SCALE 1:50

NOTES

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CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

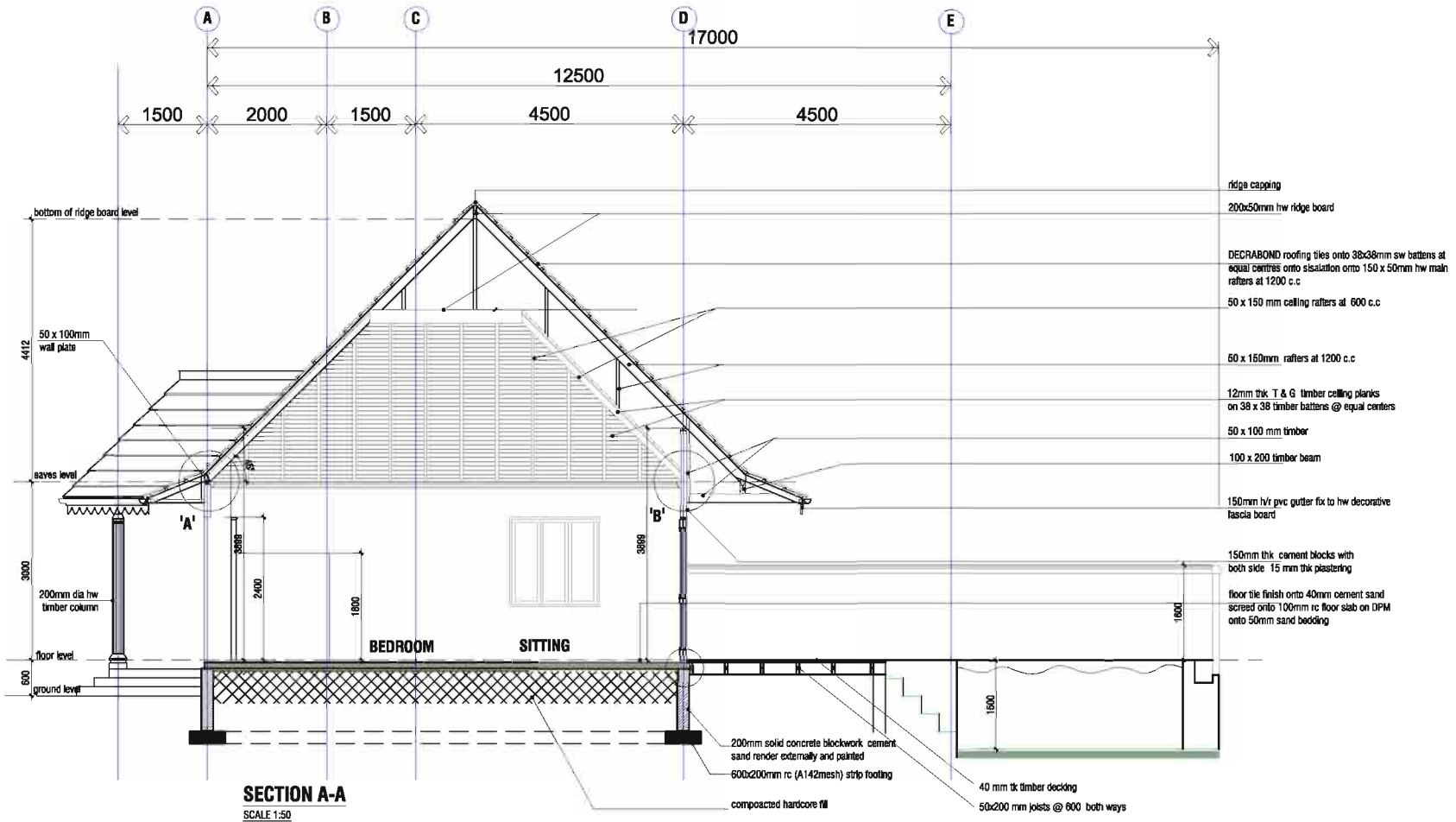
Drawing Title
BEACH POOL VILLA
FLOOR PLAN

TIRANT ASSOCIATES
Architects and Project Management Consultants
4th Flr. Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale 1 : 50 | Date DEC 2004

Dr. K. P. Gendron | Ck.

Dwg No. | Rev



SECTION A-A

SCALE 1:50

NOTES

-DO NOT SCALE DRAWING IF IN DOUBTS ASK.
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CONSTRUCTION DRAWING

Client: SILHOUETTE ISLAND RESORT LTD.

Project: PROPOSED SILHOUETTE ISLAND RESORT & SPA

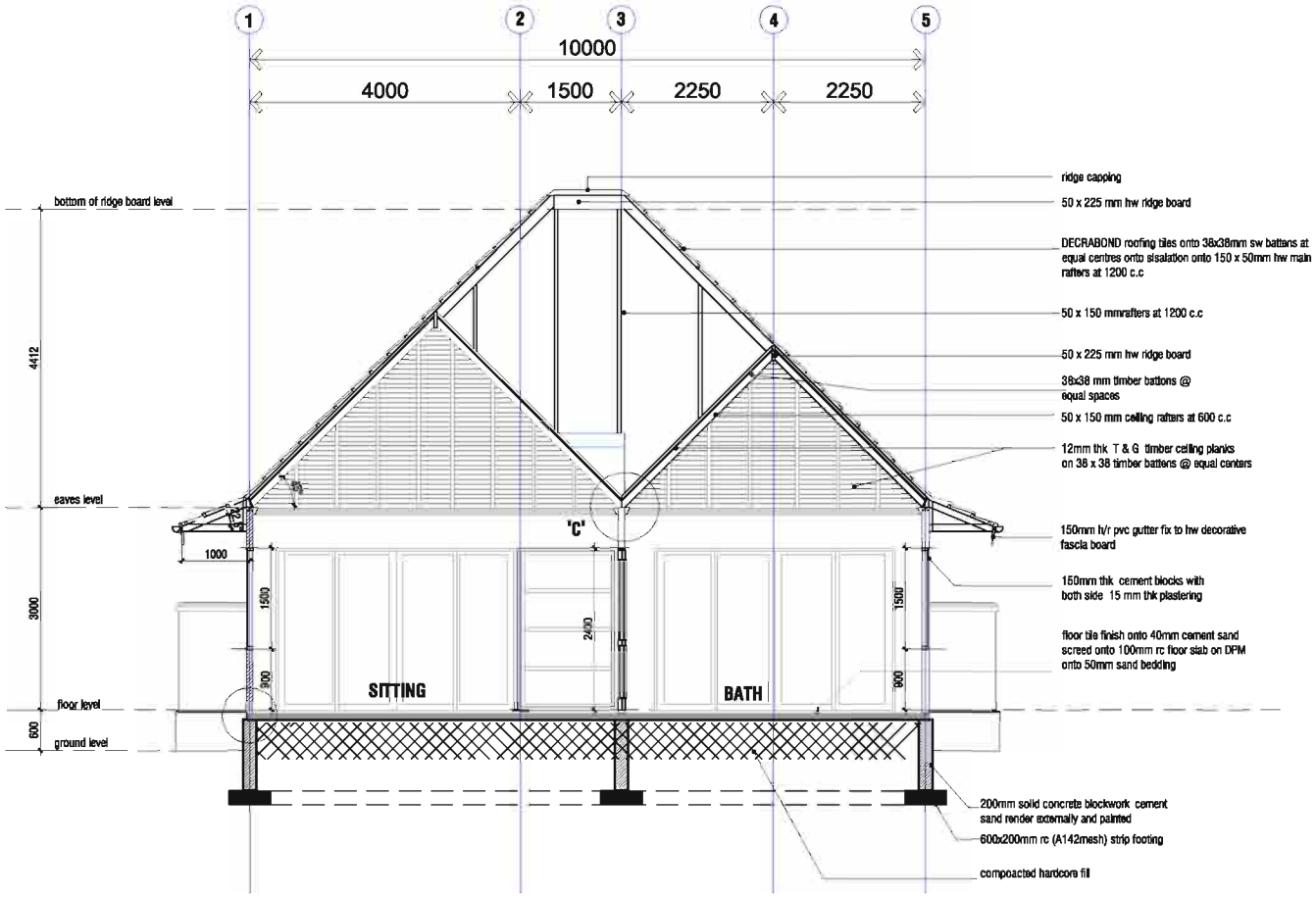
Drawing Title: BEACH POOL VILLA SECTION A - A

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50 | Date: DEC 2004

Dr: K. D. Gendron | Ck:

Dwg No: | Rev:



SECTION B-B
SCALE 1:50

NOTES

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CONSTRUCTION DRAWING

Rev. | Amendments | By | Date

Client
SILHOUETTE ISLAND RESORT LTD.

Project
PROPOSED SILHOUETTE ISLAND RESORT & SPA

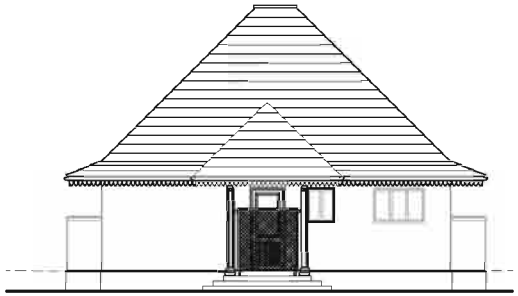
Drawing Title
BEACH POOL VILLA
SECTION B - B

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale: 1 : 50 | Date: DEC 2004

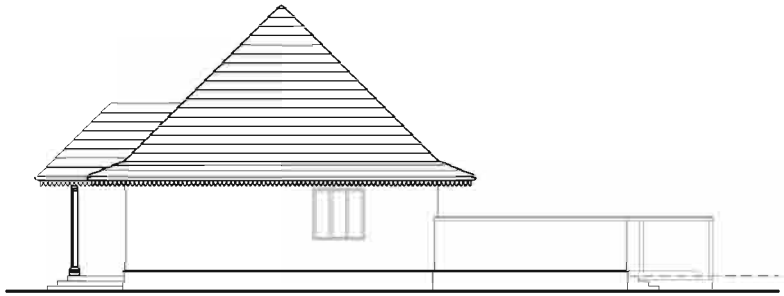
Dr: K. D. Gendron | Ck:

Dwg No. | Rev



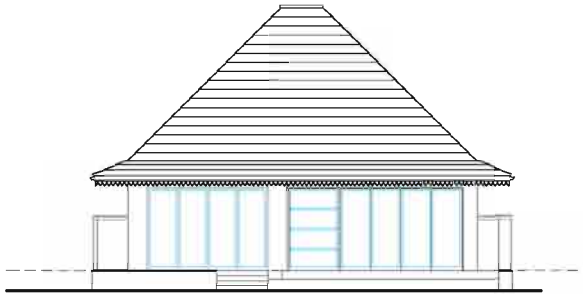
ELEVATION -01

SCALE 1:100



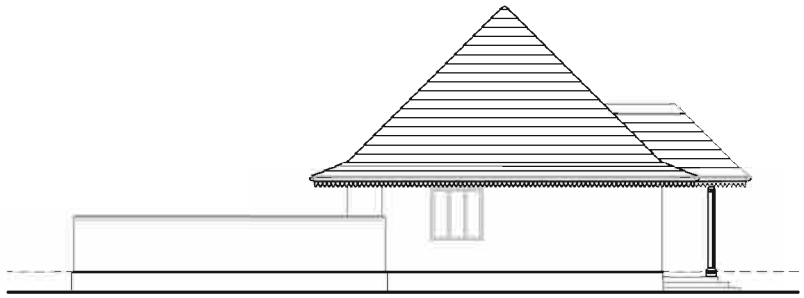
ELEVATION -02

SCALE 1:100



ELEVATION -03

SCALE 1:100



ELEVATION -04

SCALE 1:100

NOTES

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CONSTRUCTION DRAWING

No.	Amendments	By	Date

Client

SILHOUETTE ISLAND RESORT LTD.

Project

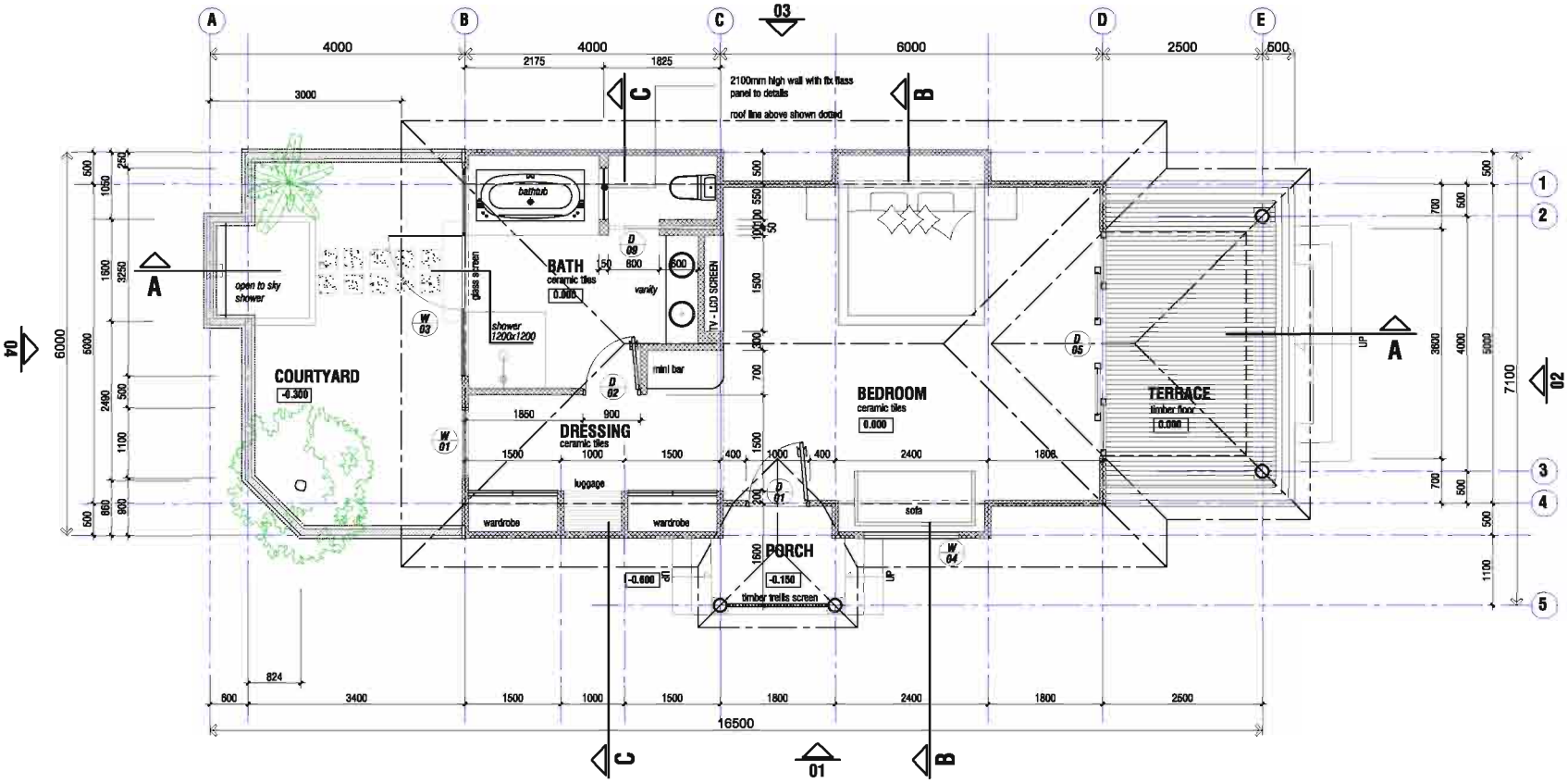
PROPOSED SILHOUETTE ISLAND RESORT & SPA

Drawing Title

BEACH POOL VILLA ELEVATIONS

TIRANT ASSOCIATES
Architects and Project Management Consultants
4, 1st floor, Oceangate House, P. O. Box 37
Victoria, Mahe, Seychelles. Tel: 224835

Scale	1 : 100	Date	DEC 2004
Dr.	K. D. Gendron	Ck	
Dwg No.		Rev	



GARDEN VILLA - FLOOR PLAN
SCALE 1:50

NOTES

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CONSTRUCTION DRAWING

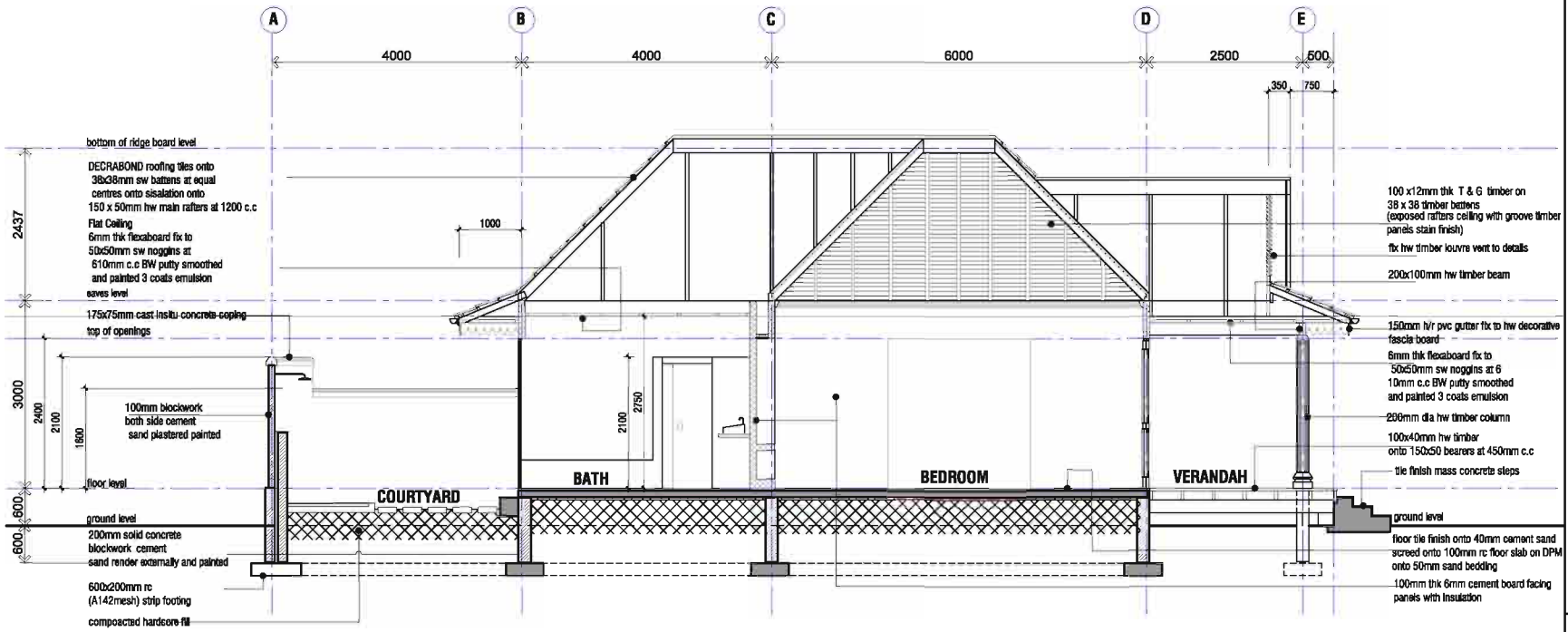
SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

GARDEN VILLA
FLOOR PLAN

TIRANT ASSOCIATES

1 : 50	DEC 2004
K. D. Gendron	
04-07/01/WD/100	



GARDEN VILLA - SECTION A-A

SCALE 1:50

NOTES

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-DIMENSIONS ARE IN MILLIMETRES.
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AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

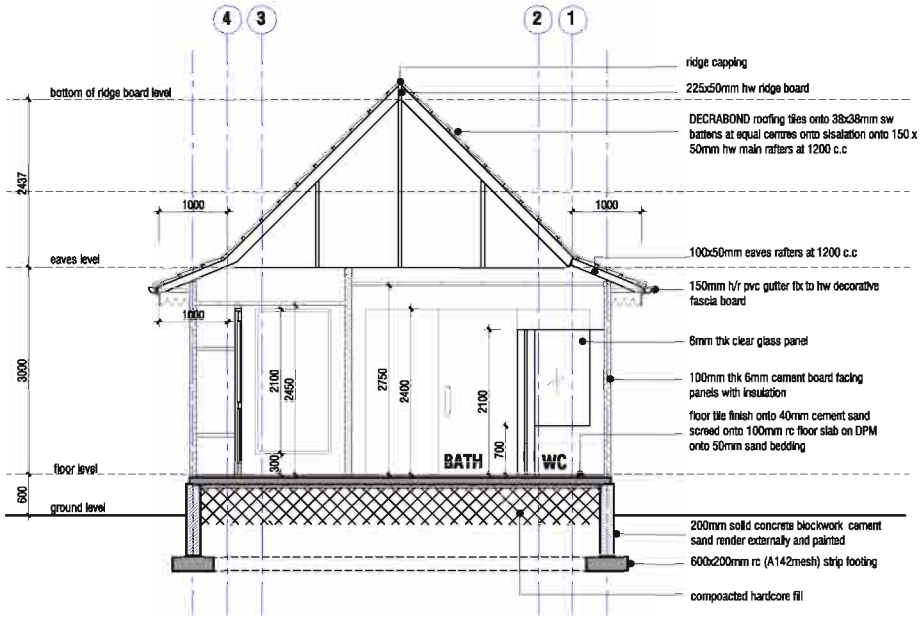
GARDEN VILLA
SECTION A - A

TIRANT ASSOCIATES

1 : 50	DEC 2004

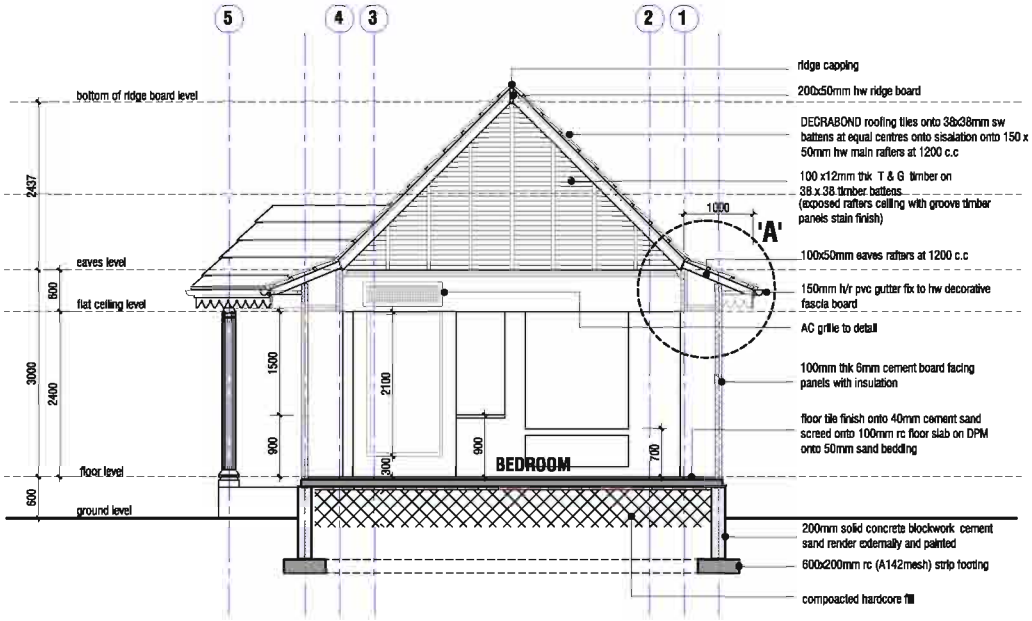
K. D. Gendron

04-07/01/WD/101



GARDEN VILLA - SECTION C-C

SCALE 1:50



GARDEN VILLA - SECTION B-B

SCALE 1:50

NOTES

- DO NOT SCALE DRAWING IF IN DOUBT ASK.
- DIMENSIONS ARE IN MILLIMETERS.
- ALL DRAWINGS TO BE READ IN CONJUNCTION WITH CONSENTS DRAWINGS, AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

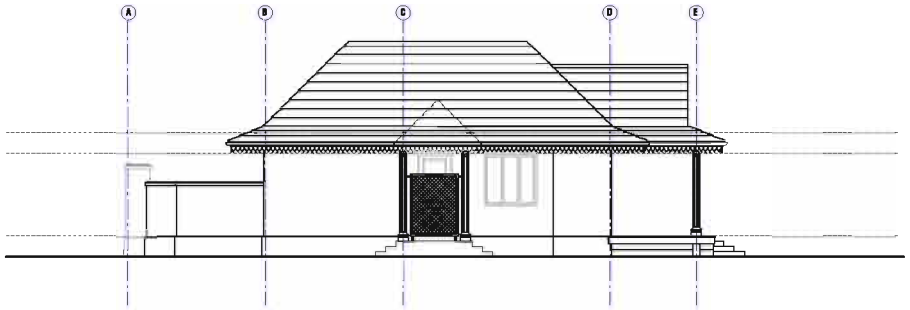
GARDEN VILLA
SECTION B - B
SECTION C - C

TIRANT ASSOCIATES

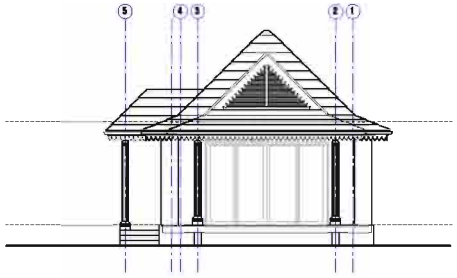
1 : 50	DEC 2004

K. B. Gendron

04-07/01/WD/102



GARDEN VILLA - ELEVATION 01



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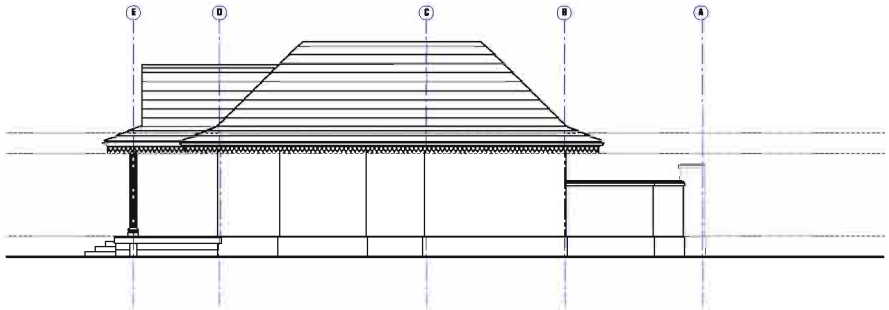

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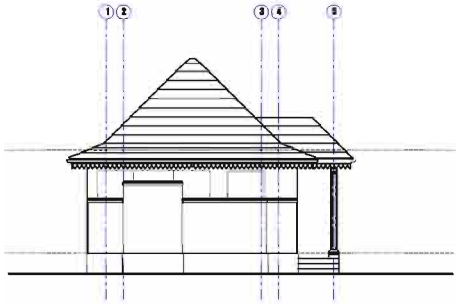


GARDEN VILLA - ELEVATION 04

NOTES

- DO NOT SCALE DRAWING IF IN DOUBTS ASK.
- DIMENSIONS ARE IN MILLIMETERS.
- ALL DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERS DRAWINGS AND ANY OTHER DETAIL DRAWINGS.

CONSTRUCTION DRAWING

SILHOUETTE ISLAND RESORT LTD.

PROPOSED SILHOUETTE ISLAND RESORT & SPA

GARDEN VILLA ELEVATIONS

TIRANT ASSOCIATES

1 : 100	DEC 2004

K. D. Gendron

04-07/01/WD/103

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Appendix D: Atmospheric Dispersion Model

Pollutant Concentration (µg/m^3) - Stack Height: 5m

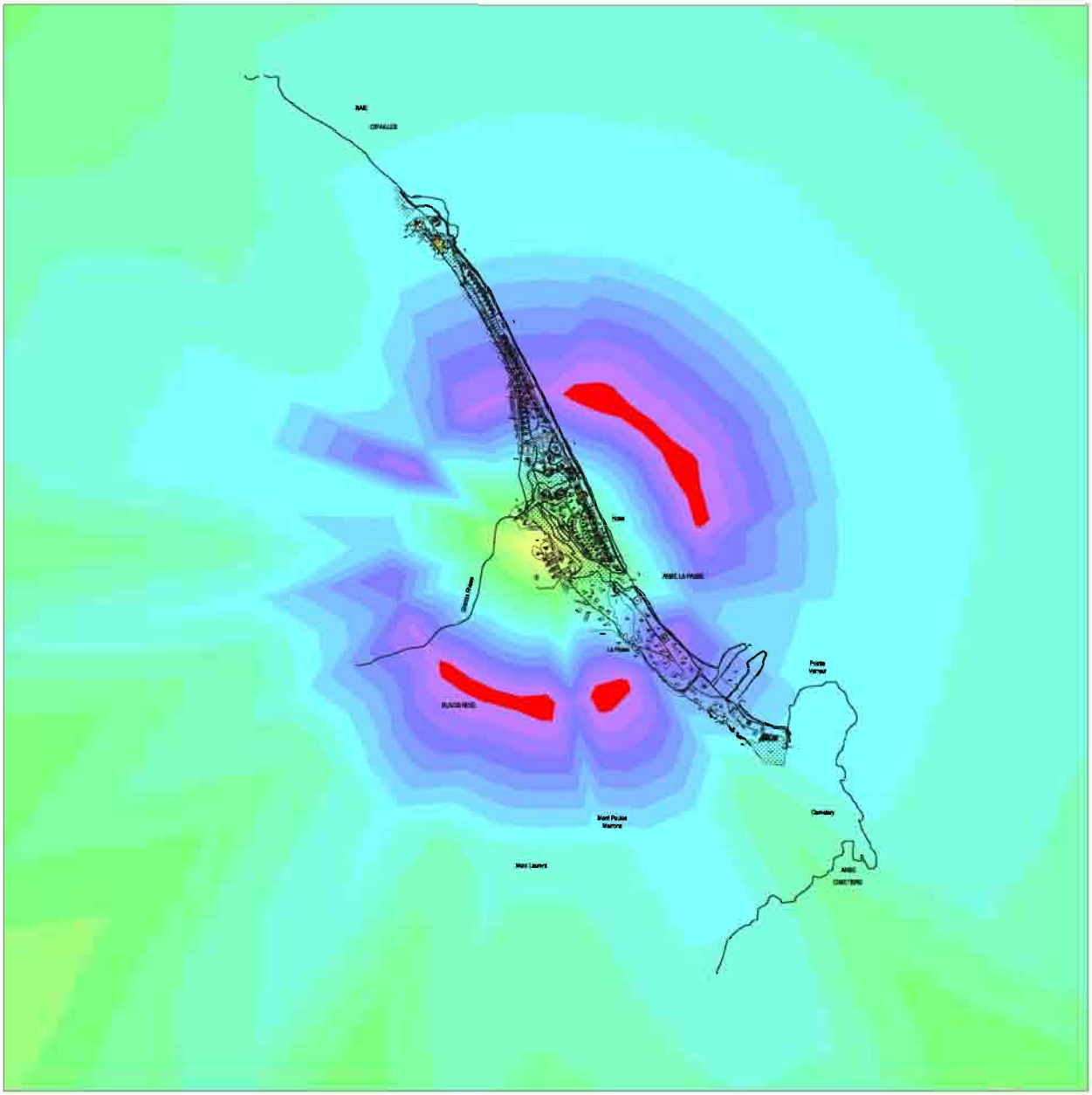
	Relative Location				SO2				NOX				CO			
	x (m)	y (m)	Dist (m)	Direct (deg)	1hr	3hr	24hr	Annual	1hr	3hr	24hr	Annual	1hr	3hr	24hr	Annual
Tortoise Pen - A	708.96	-608.13	934	130.6	29.2	10.5	2.8	0.15	240.3	86.1	23.1	1.22	39.4	14.1	3.8	0.20
Plantation House - B	556.12	-513.24	757	132.7	25.1	14.6	3.4	0.21	206.6	120.4	28.1	1.76	33.9	19.7	4.6	0.29
Clinic - C	421.76	-329.76	535	128.0	55.6	18.5	7.5	0.31	457.1	152.4	57.6	2.58	74.9	25.0	9.4	0.42
Beach Villa - D	205.74	-35.79	209	99.9	79.8	50.6	8.3	0.83	656.6	416.3	68.2	6.86	107.6	68.2	11.1	1.13
Staff Housing - E	26.71	-64.71	70	157.6	100.3	89.7	23.7	2.38	824.8	738.3	194.7	19.54	135.2	121.0	31.9	3.20
Public Area - F	8.03	308.74	309	1.5	74.0	33.9	6.4	0.40	608.5	279.2	52.3	3.28	99.7	45.8	8.6	0.54
Beach Villa - G	-119.07	643.32	654	349.5	42.1	18.1	4.3	0.24	346.0	149.0	35.4	1.94	56.7	24.4	5.8	0.32
President Villa - H	-385.2	1043.3	1112	339.7	31.0	14.4	3.4	0.16	254.7	118.7	27.7	1.29	41.7	19.5	4.5	0.21

Pollutant Concentration (µg/m^3) - Stack Height: 10m

	Relative Location				SO2				NOX				CO			
	x (m)	y (m)	Dist (m)	Direct (deg)	1hr	3hr	24hr	Annual	1hr	3hr	24hr	Annual	1hr	3hr	24hr	Annual
Tortoise Pen - A	708.96	-608.13	934	130.6	20.4	6.8	2.7	0.13	168.2	56.1	21.8	1.04	27.6	9.2	3.6	0.17
Plantation House - B	556.12	-513.24	757	132.7	19.8	10.1	3.1	0.18	163.2	83.4	25.6	1.48	26.8	13.7	4.2	0.24
Clinic - C	421.76	-329.76	535	128.0	42.0	14.0	6.2	0.26	345.7	115.2	50.9	2.16	56.7	18.9	8.3	0.35
Beach Villa - D	205.74	-35.79	209	99.9	49.5	34.0	6.1	0.57	407.2	279.5	50.2	4.74	66.7	45.8	8.2	0.78
Staff Housing - E	26.71	-64.71	70	157.6	41.4	34.7	7.4	0.67	340.4	285.1	60.7	5.50	55.8	46.7	10.0	0.90
Public Area - F	8.03	308.74	309	1.5	47.1	27.6	4.6	0.26	387.4	226.7	38.2	2.13	63.5	37.2	6.3	0.35
Beach Villa - G	-119.07	643.32	654	349.5	34.3	12.6	2.5	0.15	282.1	103.5	20.3	1.20	46.2	17.0	3.3	0.20
President Villa - H	-385.2	1043.3	1112	339.7	17.9	9.0	2.2	0.11	147.4	74.1	18.4	0.92	24.2	12.2	3.0	0.15

Pollutant Concentration (µg/m^3) - Stack Height: 15m

	Relative Location				SO2				NOX				CO			
	x (m)	y (m)	Dist (m)	Direct (deg)	1hr	3hr	24hr	Annual	1hr	3hr	24hr	Annual	1hr	3hr	24hr	Annual
Tortoise Pen - A	708.96	-608.13	934	130.6	17.1	5.7	2.3	0.10	140.8	46.9	19.0	0.85	23.1	7.7	3.1	0.14
Plantation House - B	556.12	-513.24	757	132.7	16.3	7.1	2.6	0.15	134.2	59.0	21.3	1.21	22.0	9.2	3.5	0.20
Clinic - C	421.76	-329.76	535	128.0	29.8	9.9	4.9	0.21	245.2	81.7	40.1	1.75	40.2	13.4	6.6	0.29
Beach Villa - D	205.74	-35.79	209	99.9	33.0	19.7	4.3	0.38	271.4	161.8	35.2	3.14	44.5	26.5	5.8	0.51
Staff Housing - E	26.71	-64.71	70	157.6	16.8	12.2	2.2	0.15	138.3	100.2	18.2	1.26	22.7	16.4	3.0	0.21
Public Area - F	8.03	308.74	309	1.5	34.9	21.9	3.3	0.18	286.8	180.3	27.1	1.45	47.0	29.5	4.4	0.24
Beach Villa - G	-119.07	643.32	654	349.5	26.3	8.8	1.5	0.10	216.1	72.1	12.7	0.79	35.4	11.8	2.1	0.13
President Villa - H	-385.2	1043.3	1112	339.7	14.8	4.9	1.4	0.08	121.8	40.6	11.2	0.62	20.0	6.7	1.8	0.10



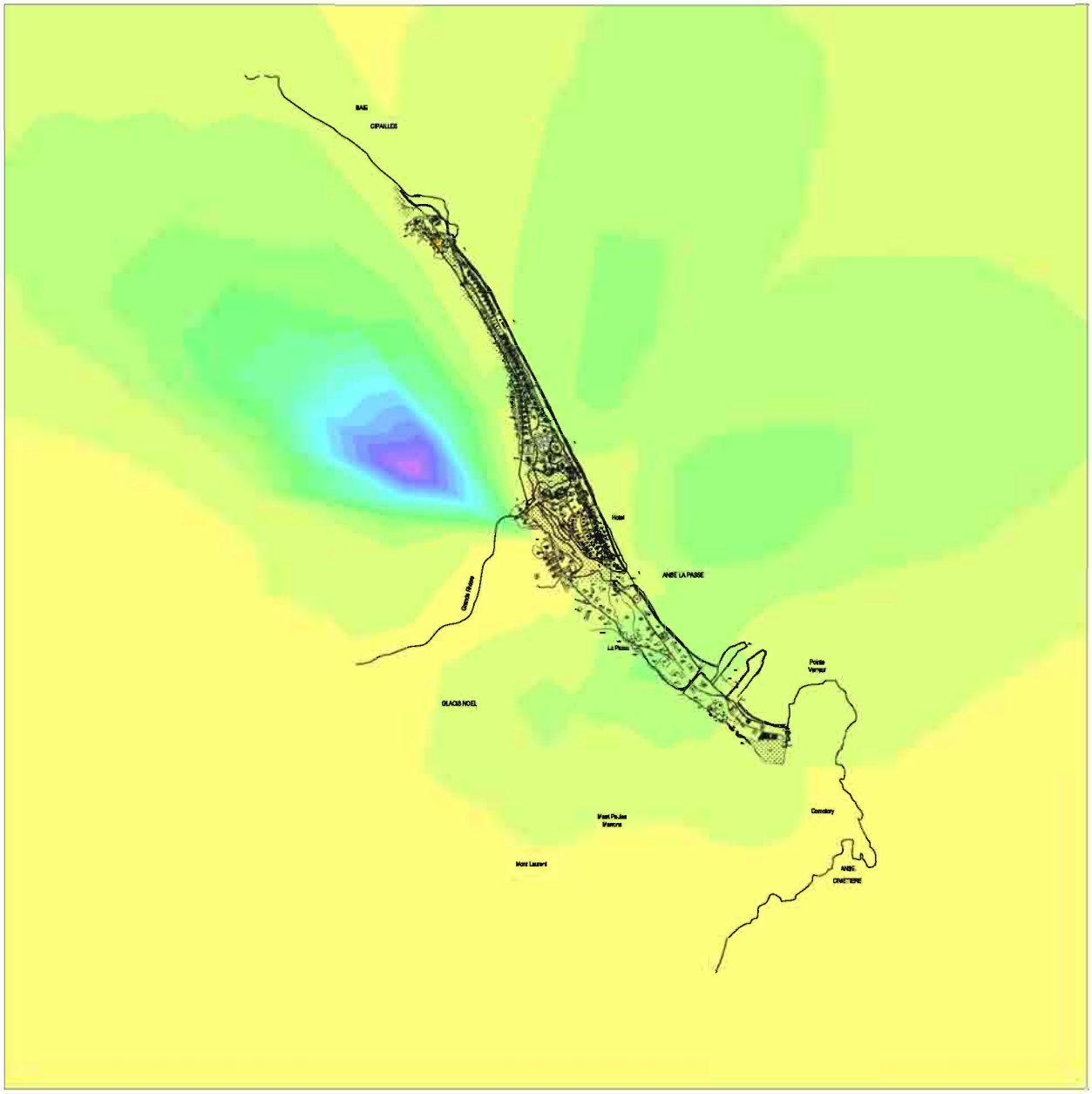
Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	5
	5	10
	10	15
	15	20
	20	25
	25	30
	30	35
	35	40
	40	45
	45	50
	50	55
	55	60
	60	65
	65	70
	70	75
	>75	

GENERATORS
Ambient Pollutant : CO
Stack Dimensions - HEIGHT : 5m
Averaging Time : 1 HOUR

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles

AMBIENT AIR QUALITY ON SITE - Polar Distribution of Carbon Monoxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

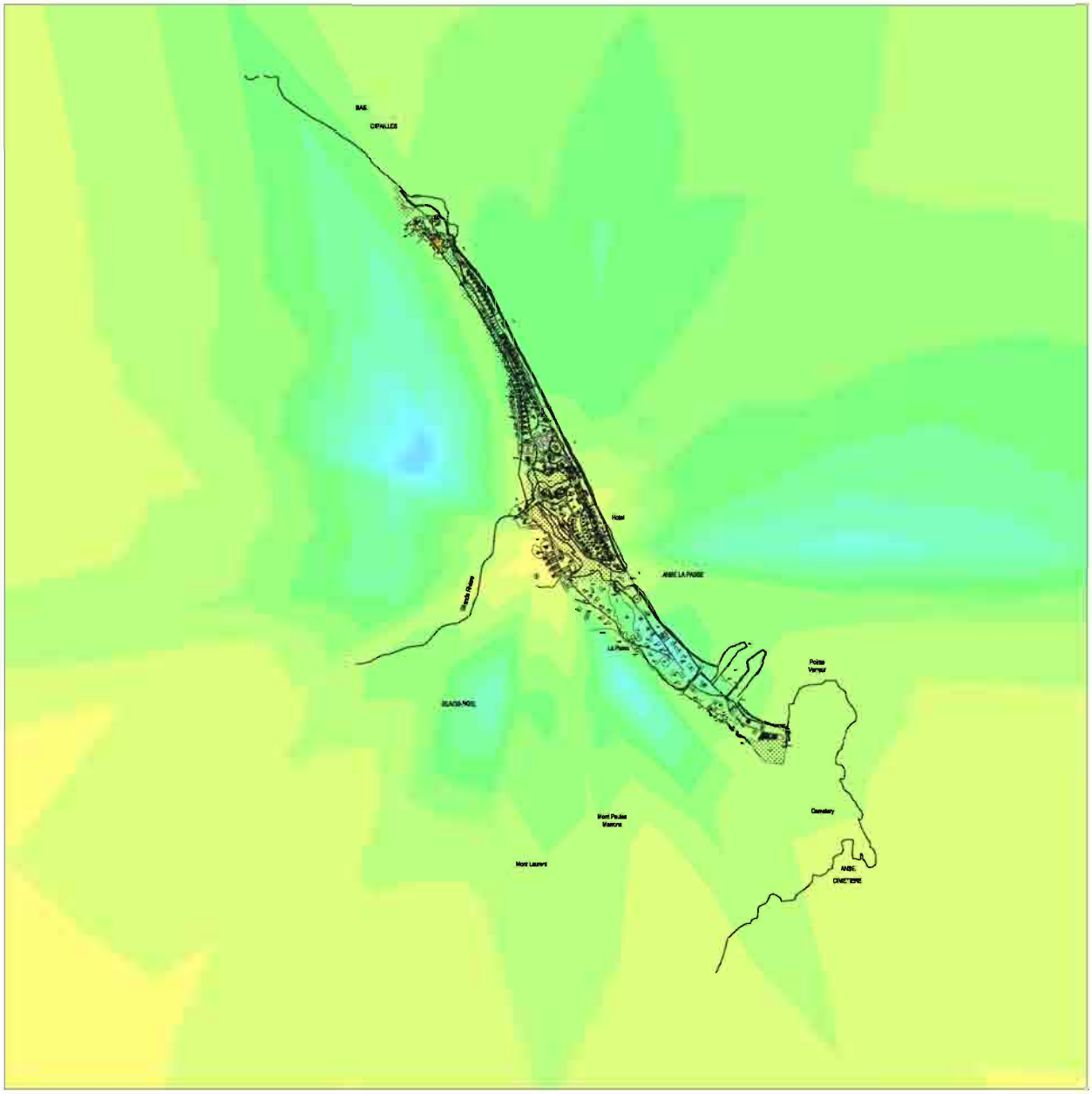


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	1
	1	2
	2	3
	3	4
	4	5
	5	6
	6	7
	7	8
	8	9
	9	10
	10	11
	11	12
	12	13
	13	14
	14	15
	>15	

GENERATORS
Ambient Pollutant : NOx
Stack Dimensions - HEIGHT : 5m
Averaging Time : ANNUAL

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Oxides of Nitrogen Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

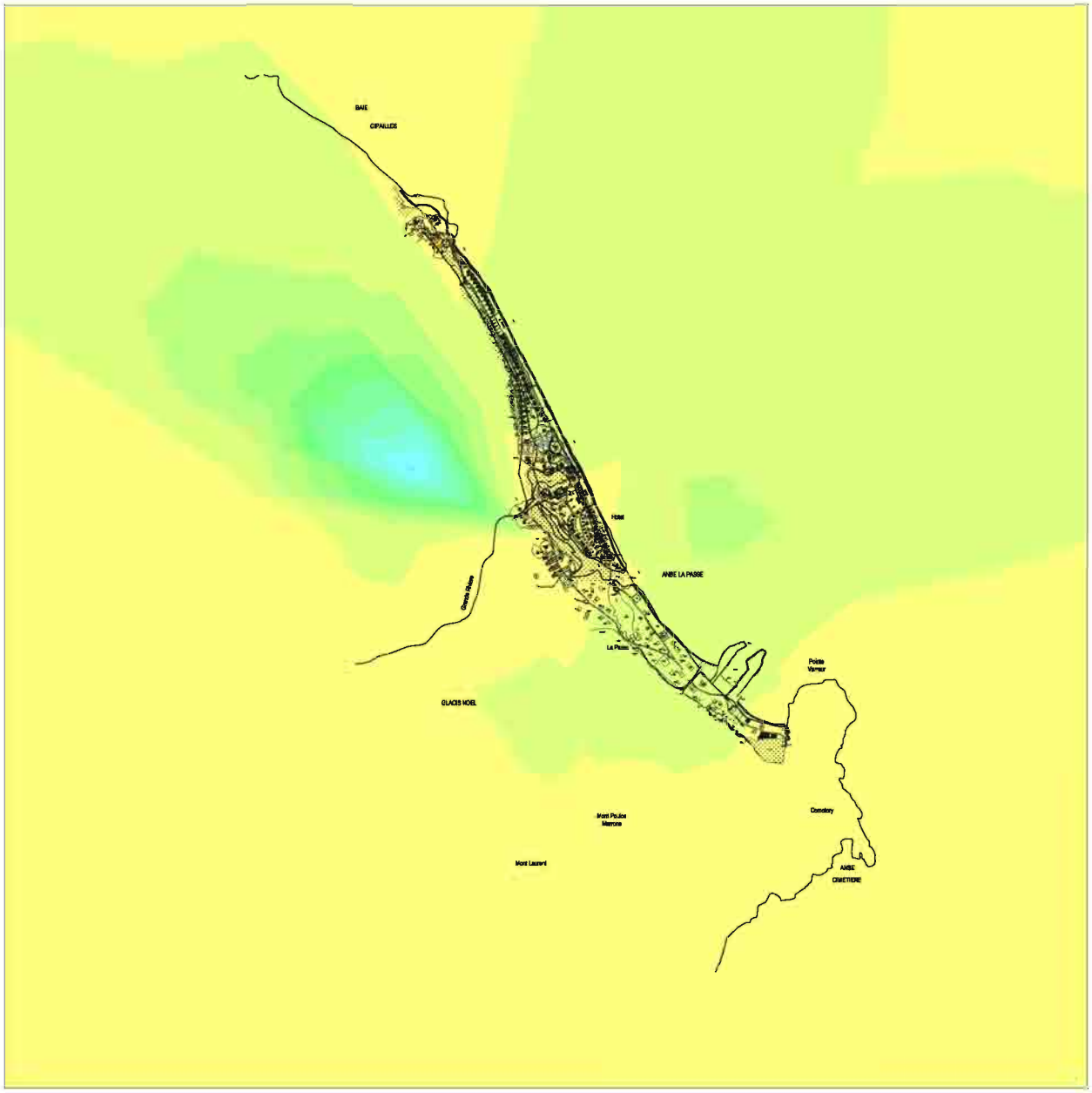


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	1
	1	2
	2	3
	3	4
	4	5
	5	6
	6	7
	7	8
	8	9
	9	10
	10	11
	11	12
	12	13
	13	14
	14	15
	>15	

GENERATORS
Ambient Pollutant : SO_2
Stack Dimensions - HEIGHT : 5m
Averaging Time : 24 HOURS

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Sulphur Dioxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

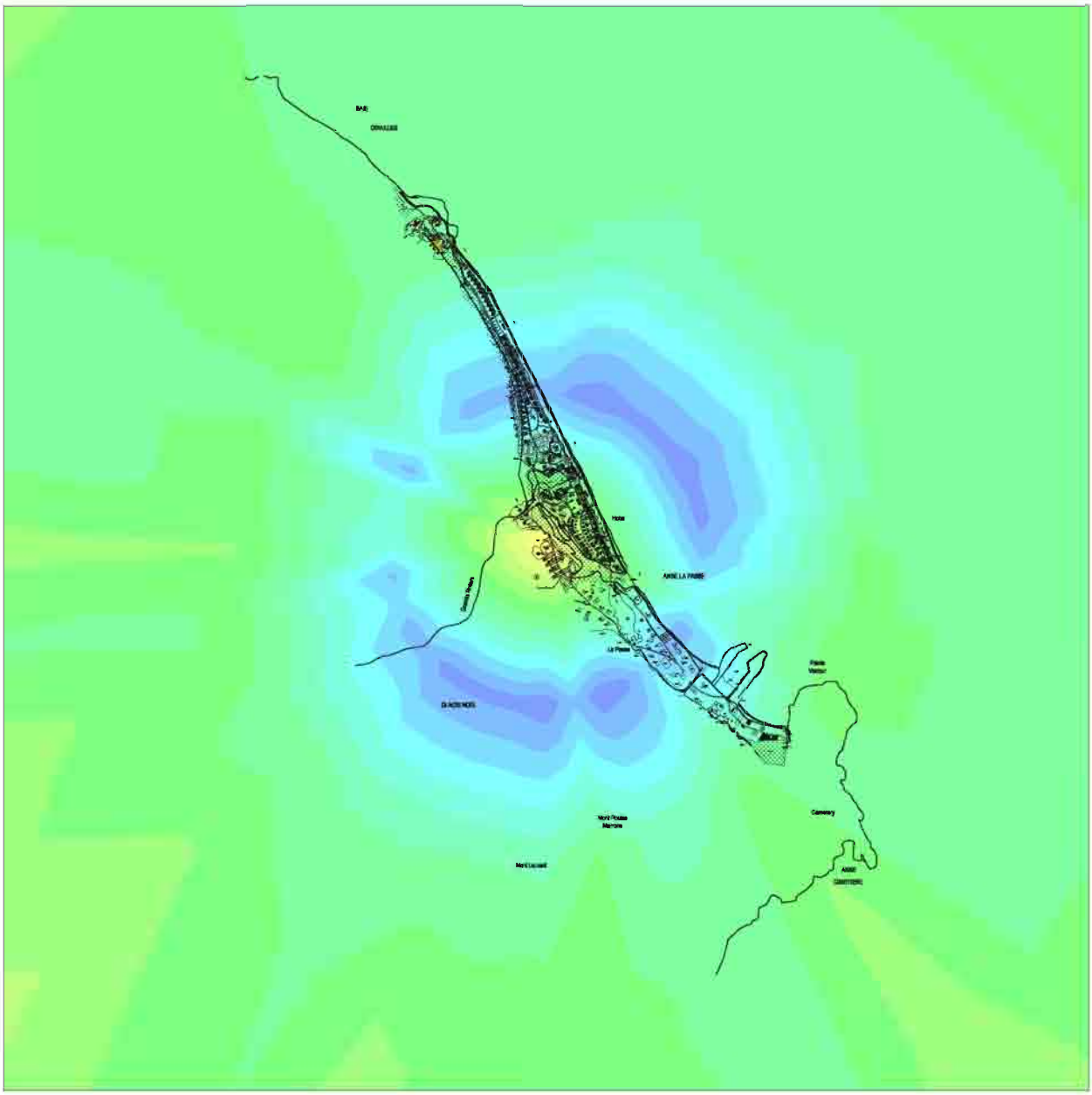


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0.0	0.2
	0.2	0.4
	0.4	0.6
	0.6	0.8
	0.8	1.0
	1.0	1.2
	1.2	1.4
	1.4	1.6
	1.6	1.8
	1.8	2.0
	2.0	2.2
	2.2	2.4
	2.4	2.6
	2.6	2.8
	2.8	3.0
	>3.0	

GENERATORS
Ambient Pollutant : SO2
Stack Dimensions - HEIGHT : 5m
Averaging Time : ANNUAL

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Sulphur Dioxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

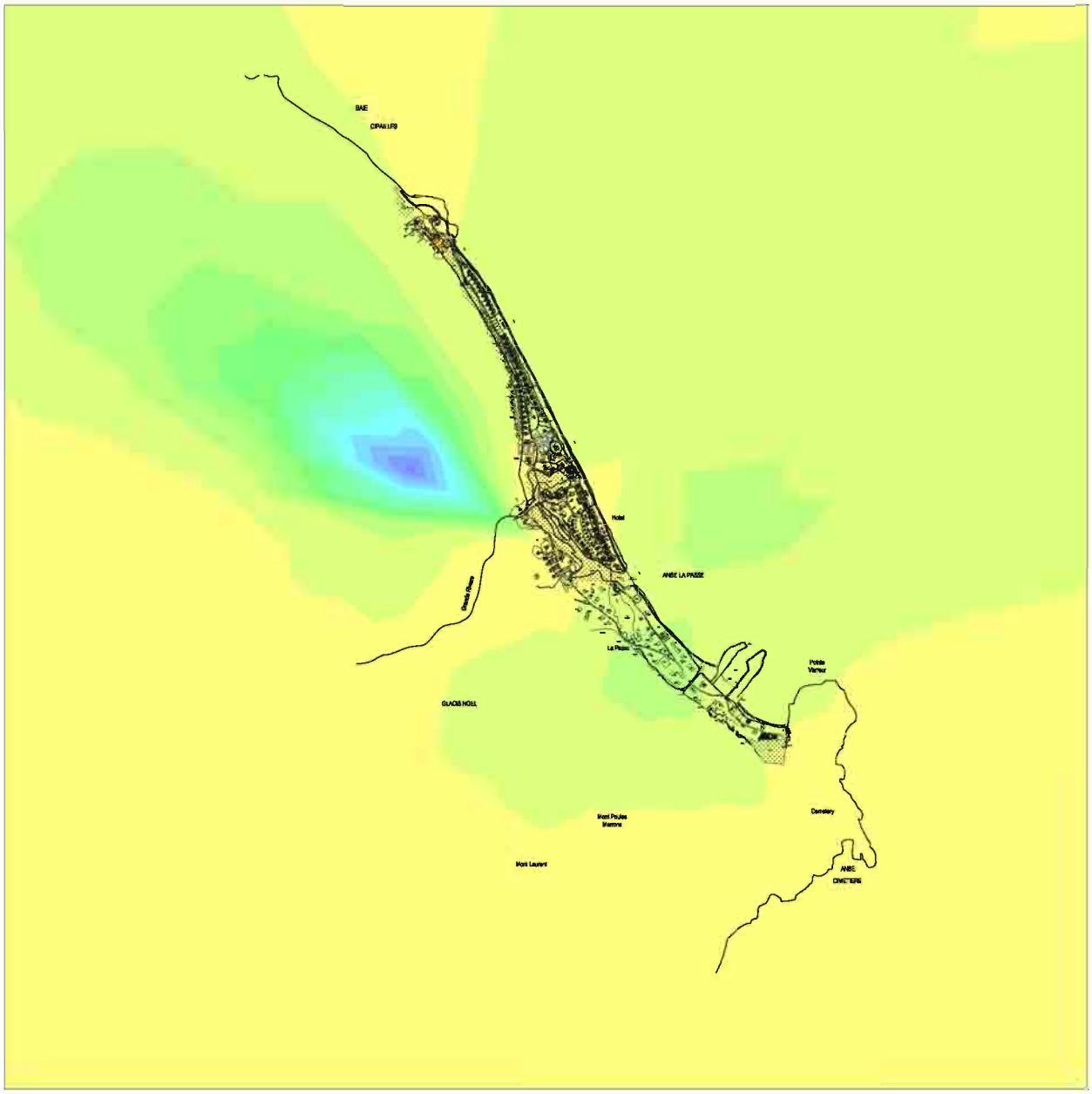


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	5
	5	10
	10	15
	15	20
	20	25
	25	30
	30	35
	35	40
	40	45
	45	50
	50	55
	55	60
	60	65
	65	70
	70	75
	>75	

GENERATORS
Ambient Pollutant : CO
Stack Dimensions - HEIGHT : 10m
Averaging Time : 1 HOUR

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Carbon Monoxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

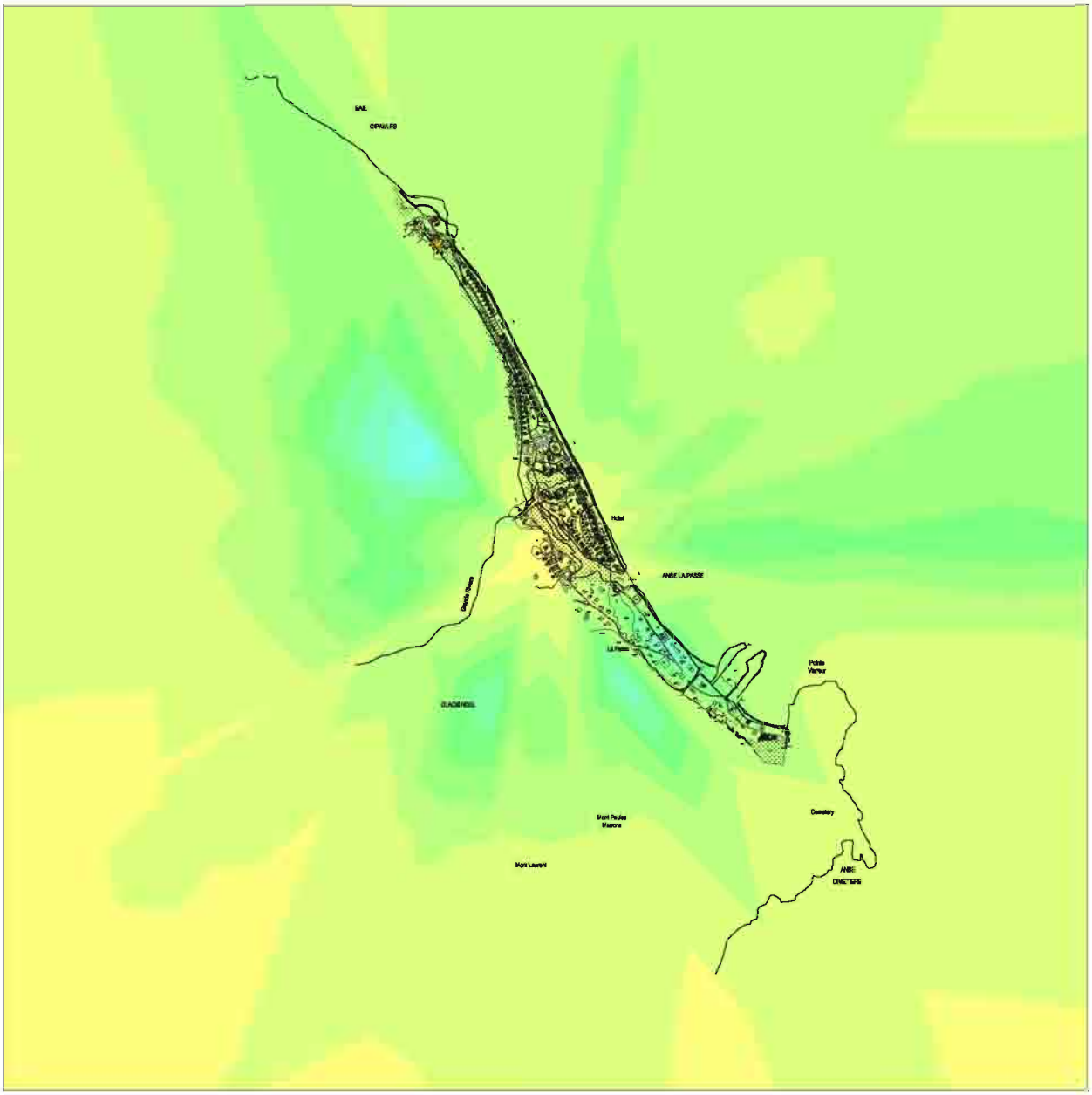


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	1
	1	2
	2	3
	3	4
	4	5
	5	6
	6	7
	7	8
	8	9
	9	10
	10	11
	11	12
	12	13
	13	14
	14	15
	>15	

GENERATORS
Ambient Pollutant : NOx
Stack Dimensions - HEIGHT : 10m
Averaging Time : 1ANNUAL

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Oxides of Nitrogen Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

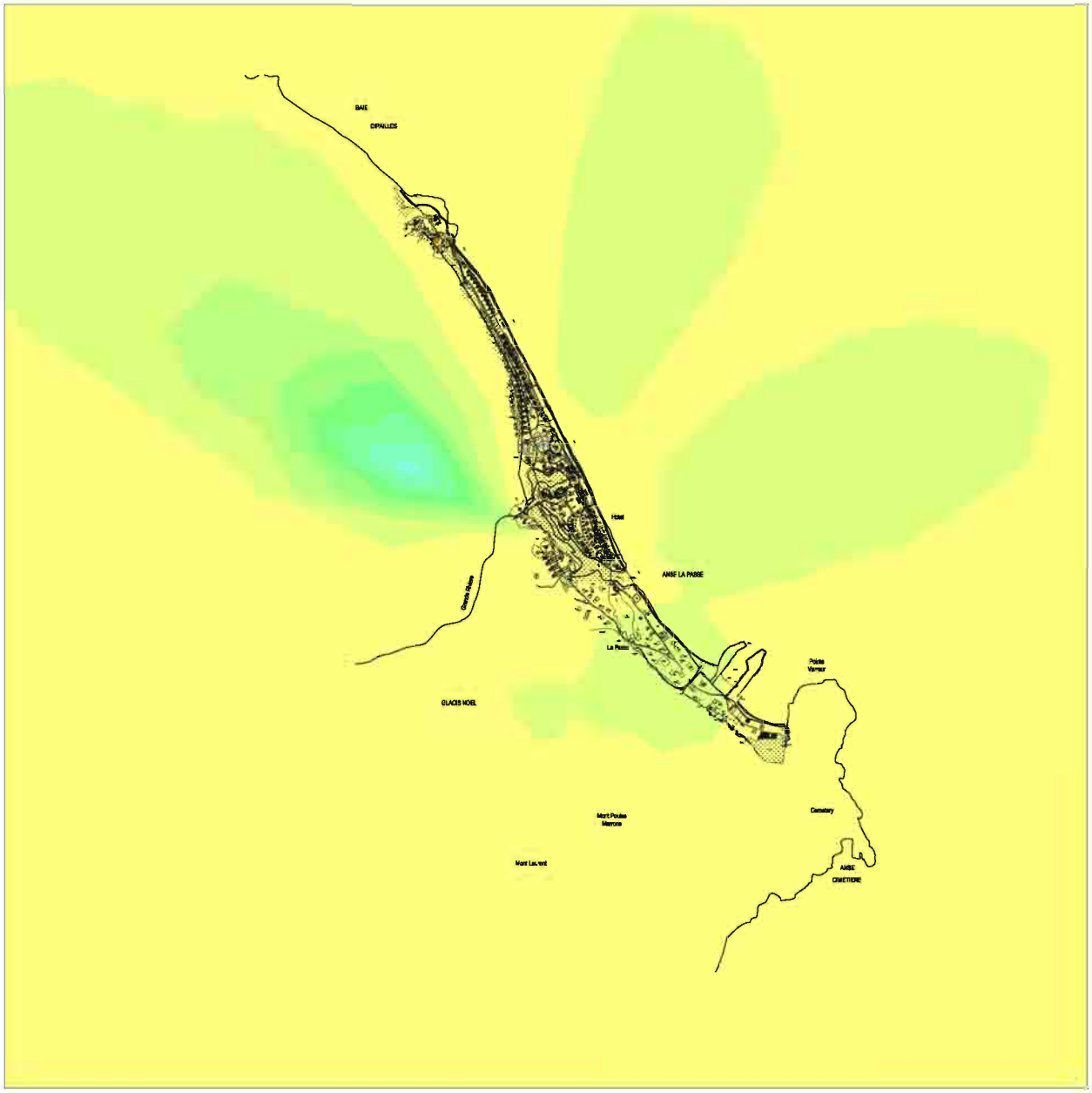


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	1
	1	2
	2	3
	3	4
	4	5
	5	6
	6	7
	7	8
	8	9
	9	10
	10	11
	11	12
	12	13
	13	14
	14	15
	>15	

GENERATORS
Ambient Pollutant : SO_2
Stack Dimensions - HEIGHT : 10m
Averaging Time : 24 HOURS

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Sulphur Dioxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

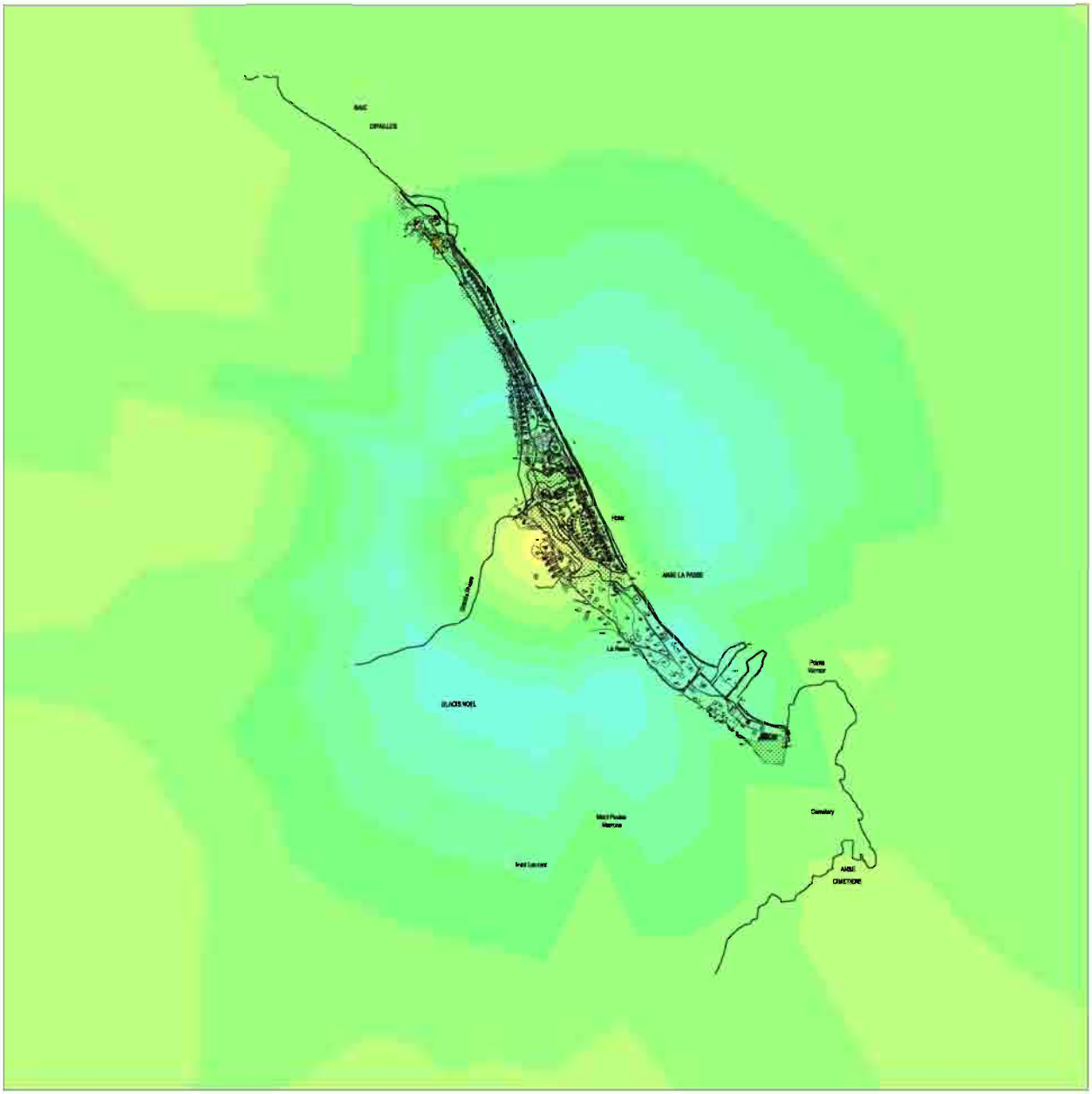


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0.0	0.2
	0.2	0.4
	0.4	0.6
	0.6	0.8
	0.8	1.0
	1.0	1.2
	1.2	1.4
	1.4	1.6
	1.6	1.8
	1.8	2.0
	2.0	2.2
	2.2	2.4
	2.4	2.6
	2.6	2.8
	2.8	3.0
	>3.0	

GENERATORS
Ambient Pollutant : SO_2
Stack Dimensions - HEIGHT : 10m
Averaging Time : ANNUAL

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Sulphur Dioxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

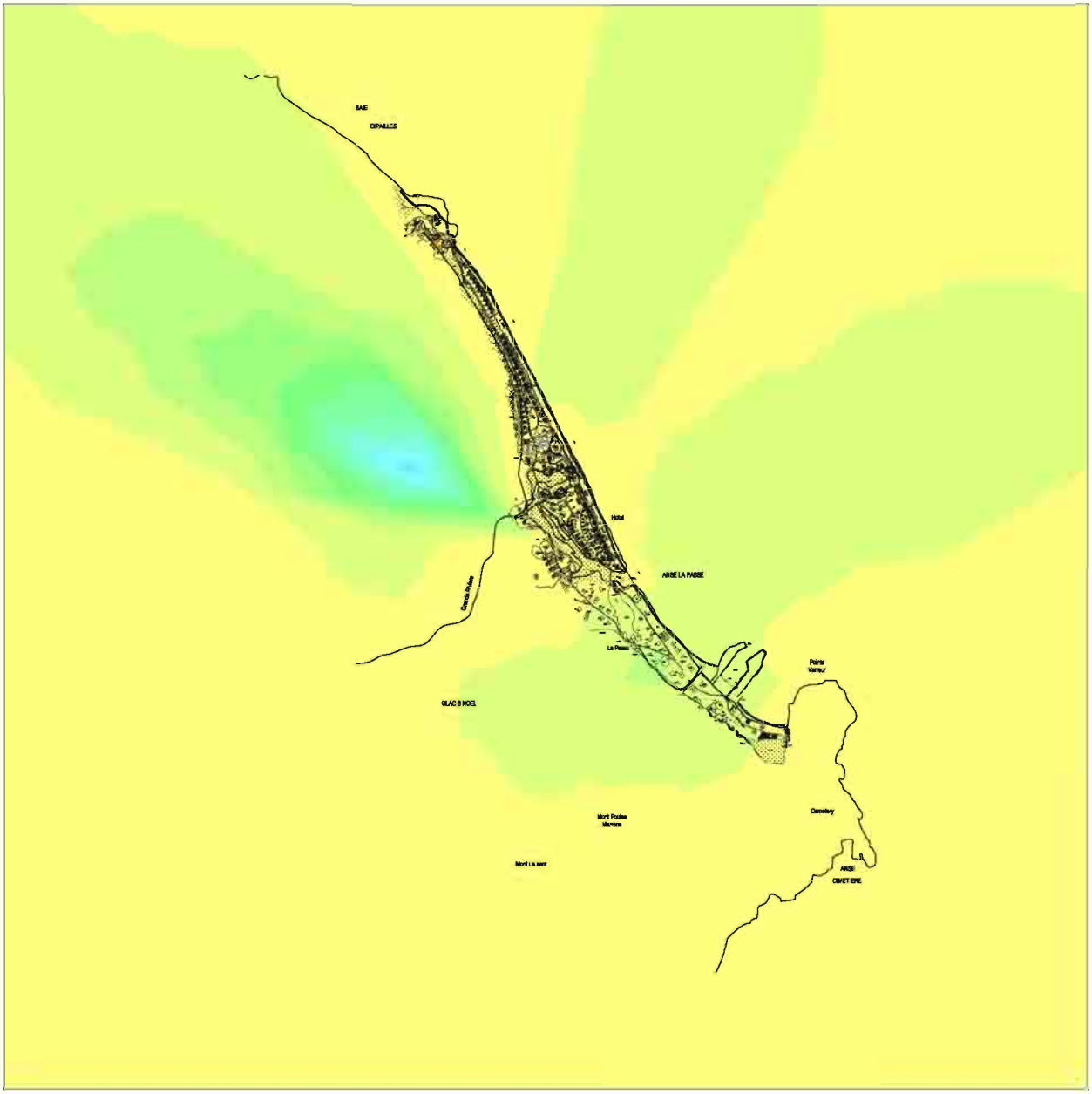


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	5
	5	10
	10	15
	15	20
	20	25
	25	30
	30	35
	35	40
	40	45
	45	50
	50	55
	55	60
	60	65
	65	70
	70	75
	>75	

GENERATORS
Ambient Pollutant : CO
Stack Dimensions - HEIGHT : 15m
Averaging Time : 1 HOUR

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Carbon Monoxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

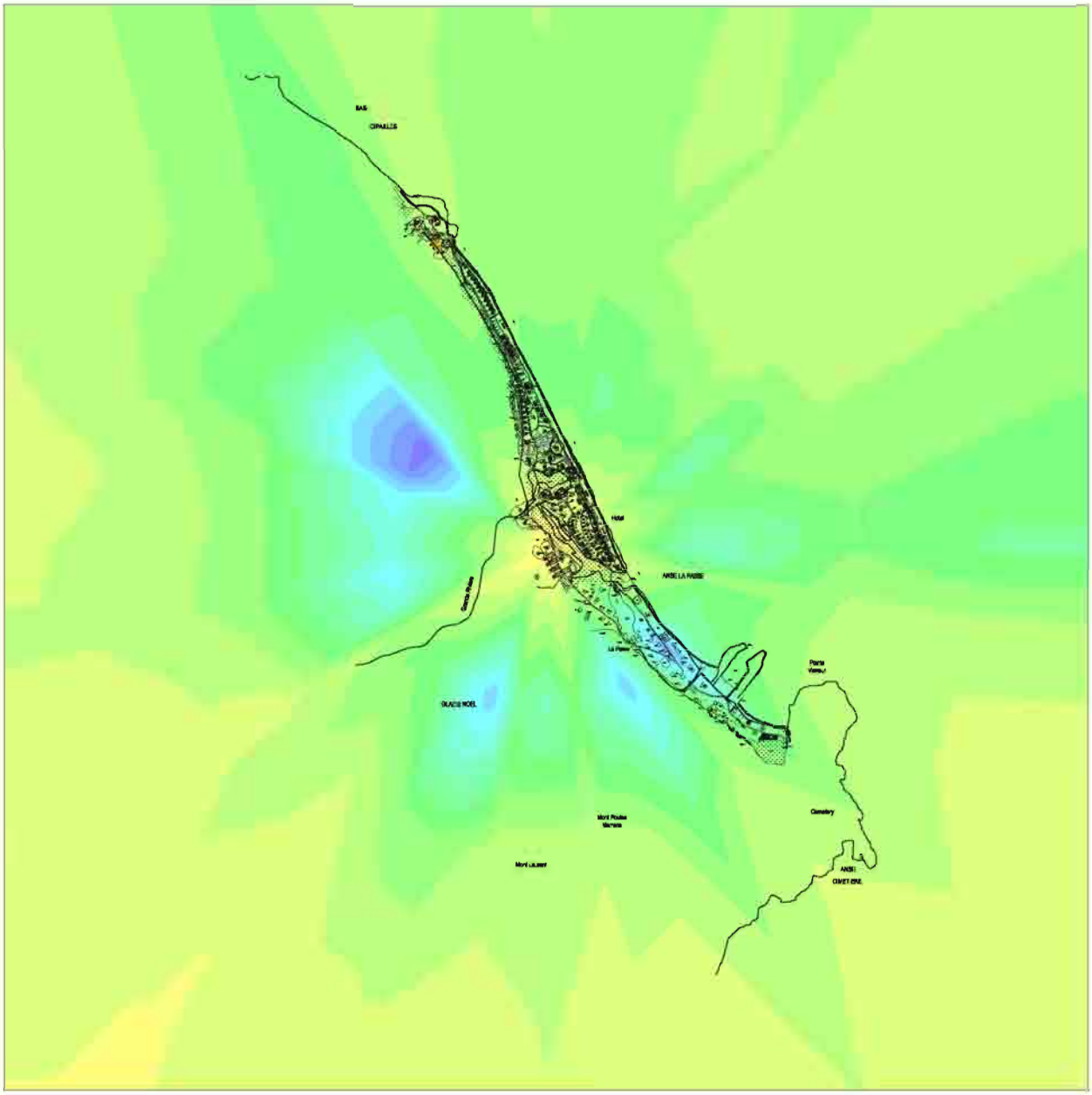


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0	1
	1	2
	2	3
	3	4
	4	5
	5	6
	6	7
	7	8
	8	9
	9	10
	10	11
	11	12
	12	13
	13	14
	14	15
	>15	

GENERATORS
Ambient Pollutant : NOx
Stack Dimensions - HEIGHT : 15m
Averaging Time : ANNUAL

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Oxides of Nitrogen Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS

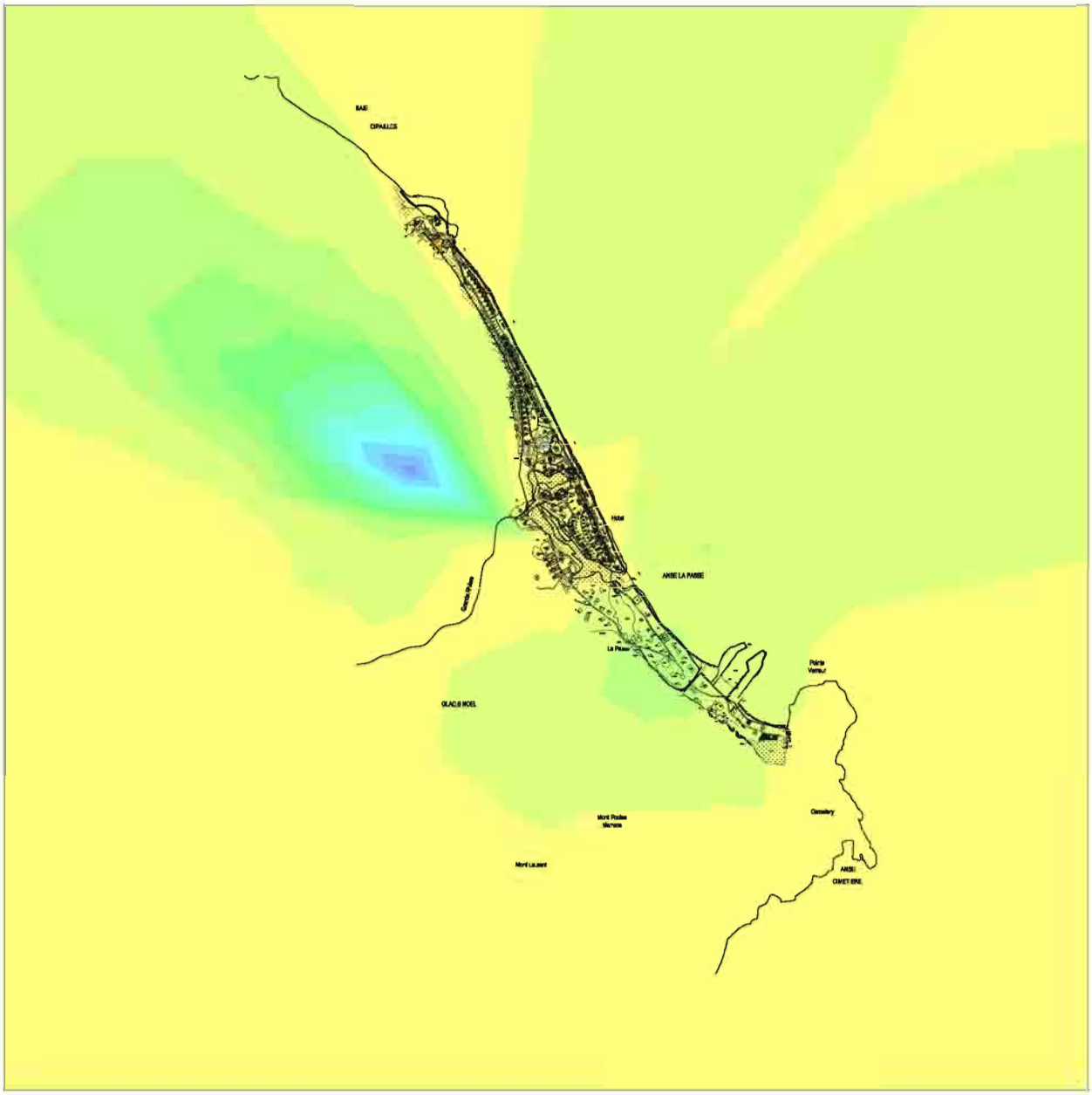


Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0.0	0.5
	0.5	1.0
	1.0	1.5
	1.5	2.0
	2.0	2.5
	2.5	3.0
	3.0	3.5
	3.5	4.0
	4.0	4.5
	4.5	5.0
	5.0	5.5
	5.5	6.0
	6.0	6.5
	6.5	7.0
	7.0	7.5
	>7.5	

GENERATORS
Ambient Pollutant : SO_2
Stack Dimensions - HEIGHT : 15m
Averaging Time : 24 HOURS

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Sulphur Dioxide Concentration

S.I.G.M.A. - Ove Arup & Partners - Associated Consulting Engineers - Port Louis - MAURITIUS



Color	Range Beg. (µg/m³)	Range End (µg/m³)
	0.0	0.1
	0.1	0.2
	0.2	0.3
	0.3	0.4
	0.4	0.5
	0.5	0.6
	0.6	0.7
	0.7	0.8
	0.8	0.9
	0.9	1.0
	1.0	1.1
	1.1	1.2
	1.2	1.3
	1.3	1.4
	1.4	1.5
	>1.5	

GENERATORS
Ambient Pollutant : SO_2
Stack Dimensions - HEIGHT : 15m
Averaging Time : ANNUAL

CONSTRUCTION & OPERATION OF A BEACH RESORT at Silhouette Island, Seychelles
AMBIENT AIR QUALITY ON SITE - Polar Distribution of Sulphur Dioxide Concentration

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SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Appendix E: IDC Brief on Water Supply

Silhouette Island Resort .. Fresh Water Production from Natural Source and by Desalination Plants.

1. The fresh potable water for the whole of Silhouette Island will be produced from a combined filtration / desalination plant . The water from the river which at present supplies the water for all the residents and guests of the former Silhouette Island Lodge will be contained by a small barrage wall which will in turn deliver the raw water to a sedimentation tank from where after a settling process the flow will enter the bulk raw water storage reservoir.
The raw water will flow from the raw water storage reservoir by gravity to the filtration plant where a constant pressure will be maintained through the filters by small pumps which will in turn after filtration and UV treatment deliver the clean filtered water to the fresh water storage reservoirs.
A secondary water treatment system comprising of desalination plants will be installed to supplement the water supply in the dry months.

2. The average water consumption for a resort of this standard can be considered to be between 1,5 to 2,5m^3 per day per guest room including staff and guest facilities. Therefore the water production plant should have a capacity to produce between 175m^3 to 300m^3 per day based on the resort having 116 guest rooms..The local resident population of 100 persons are allocated 300 litres per person per day.This equates to an additional 30m^3 per day. This demand will be reduced taking into consideration the recycling of the grey-water for WC flushing which will reduce the fresh water consumption.

3. To support this design flow tests were carried out in January 2004 by the Public Utilities Company of Seychelles and the results of these tests has been used as a basis for the supply of natural river water for the resort. It is the intention to monitor the river flow with further tests over a period and establish an annual flow pattern. It is to be noted however that this source of water has consistently in the past supplied sufficient water throughout the year to support the resident and lodge population of on average ***100 people***.

4. The average flow measured over a 10 hour period at the pipe supplying the existing tanks was recorded at 9,6 l/s which converts to 34,56 m^3/hr.
The existing barrage will be rebuilt and improved as necessary and a new gravity flow pipe line installed from the barrage to a 34m^3 Braithwaite type sedimentation tank which is specially constructed with baffles to improve the settling rate of any particles suspended in the river water. The outlet water from the sedimentation tank will flow by gravity to the Hydrex Raw water storage reservoir which has a capacity of 332m^3.The 30 metre difference in height between the sedimentation tank and the raw water reservoir allows a gravity flow of 34m^3/hr at a pressure in excess of 2,5bar allowing for pipe losses.

5. The two Culligan UF48 water filters will be supplied from the raw water reservoir by two separate pipelines at a static head pressure of 2,4bar which when assisted by two small pumps will together give an outlet flow rate after the filters and UV treatment unit ***of 20m^3/hr ..which equates to 480m^3/day***.

6. The filtered and treated water from the filtration plants will be piped to the two 519m^3 fresh water storage tanks with a combined usable capacity of over 1000m^3.

7. The backwash water from the Culligan UF 48 water filters will be discharged by the brine reject pumps.

8. **Desalination Plants..** the requirements of the resort in the dry period will be met by two desalination plants each with a capacity to produce $100m^3$ per day.
   The $24m^3$ salt water tank will be supplied from a series of salt water wells on the foreshore at the Southern end of the resort and in turn will provide the salt water to the desalination plants. The fresh water produced will be piped to the fresh water reservoirs for storage.
   The reject brine water will be piped to the $24m^3$ brine reject tank from where it will be pumped out to sea at the far Southern end of the IDC village.

   Full details and specifications of the desalination plants will be provided by the supplier.

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Appendix F: Details of Sewerage Treatment Plant

Technical Report nr.: 3158

Sewage treatment plant for

Silhouette Island (Seychelles) tourist facilities

25 / 03 / 2005

Made by:

ISEA S.p.a.

Technical Department

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GENERAL INDEX

ATTACHMENTS

- ATTACHMENT 1: GRAPHS
  TAB. 01 – Plant lines layout
  TAB. 02 – General plant floor plan
  TAB. 03 – Plant flow layout
  TAB. 04 – Lateral plant view

1. OVERVIEW

1.1 General Considerations

This technical report details the technical and functional characteristics of the water treatment plant for the tourist complex situated on the Silhouette Island in the Seychelles.

It consists of a hotel complex with the capacity of housing of about 550 inhabitants.

The waste water which feeds the plant is from a domestic source, made up of water from kitchens, showers, etc. (greywater) and from the bathrooms (blackwater).

The need to guarantee that the waste conforms to the qualitative and restrictive requirements in keeping with reusable practices of the Committee for the treated effluent (irrigation of green areas with sprinkler system, reuse in the bathroom facilities, (limited to toilets) requires an innovative technology.

This technology is based on the combination of biological aeration MBBR with physical-mechanical treatment such as pressure filtration on quartzite and active carbon, or by the division of the plant in two completely different and independent lines of treatment, one exclusively for greywater and the other exclusively for blackwater.

Great care has been taken in the selection and choice of treatment processes, even in management aspects, favouring solutions that minimize maintenance.

In addition, the need for supplies, materials and parts which are often difficult to obtain was kept to the strictest minimum.

The purpose of the present study is two fold:

- define the technological and functional aspects of the plant, detailing the particulars of the tanks, electromechanical equipment and the control and monitoring systems envisaged;
- SUPPLY THE NECESSARY BASIC INDICATIONS FOR ITS MANAGEMENT BY PROVIDING DESCRIPTION FOR MAINTENANCE OPERATIONS AND THE CONTROLS TO ENSURE THE PROPER FUNCTIONING OF THE PLANT.

THIS TECHNICAL REPORT, ALONG WITH THE GRAPHS, CONSTITUTES AN INTEGRAL PART OF THE TECHNICAL DOCUMENTATION FOR THE PROJECT.

1.2 Characteristics of the treatable waste

The main feature of the treatable waste is that it is mainly made up of water from the kitchens, sinks, showers, etc. –from now on referred to as greywater- as opposed to those that are mainly contaminated in a prevalently organic way –blackwater.

The quantity of greywater is three times greater than the aliquot of exclusively blackwater.

The average blackwater contribution, calculated for a 24 hour period, is estimated to be equal to::

- Q_{Nm} = 2.3 m^3/hour;

in relation to a greywater contribution in the order of

- Q_{Nm} = 6.9 m^3/hour.

The above values were determined assuming a per capita contribution – referring to inhabitant equivalent- equal to:

- 300 l/inhabitant/day, for the grey composition of the waste;
- 100 l/inhabitant/day, for the black composition of the waste.

Besides the specific use – hotel complex – there is a definite noticeable variability, in quantitative terms, of the treatable waste, with significant deviations in the waste to be treated. Waste contributions vary on a daily and on a seasonal basis, to the point that they create situations that are not compatible with traditional biological processes.

1.3 Requirements for final effluent

When the final effluent leaves the treatment plant it is reused for the following purposes:

- an aliquot is used in bathroom facilities (limited to toilets);
- an aliquot may be stored and used as a fire prevention reservoir;
- the remaining part is used for irrigation of the green landscaped area.

The Committee has required that the green landscaped areas be watered using a sprinkling system for which very demanding final effluent qualitative standards are necessary to prevent possible microbiological contamination.

The qualitative requisites for the final effluent are reported in table A as follows:

Tab. 1 - Limits of waste

Parameter	Unit of Measure	Value
pH	//	5.5 – 8.5
Suspended Solids	mg/l	30
BOD	mg/l	30
COD	mg/l	80
Phosphates	mg/l	5
Animal and vegetable oils and fats	mg/l	10
Free chlorine (Cl_2)	mg/l	0,5
Nitrates	mg/l	15
Nitrites	mg/l	1
Total coliforms	Per 100 ml	500
Faecal coliforms	Per 100 ml	100
Faecal streptococci	Per 100 ml	100

Salmonella	Per 100 ml	Absent

2. PLANT CONFIGURATION AND PROJECT OPTIONS

2.1 Project Options

The plant must be able to solve the following challenges:

- variability such as – quantity of waste to treat, with important variations of volume;
- larger quantity of greywater, - characterized by the presence of polluting substances constituted mainly by tensioactives, animal and vegetable fats, foams, etc, - in relation to the blackwater, characterized as being mainly organic.
- Treated returns which must be of the highest quality are very difficult to obtain using the traditional systems and process plant engineering. These returns are needed considering the different uses the treated effluent will have. Especially since the reuse of the effluent for the irrigation of the green areas with a sprinkler system requires a very high efficiency level of the final disinfecting phase.
- Stability across time of the treated returns: the recycling of the treated water described in the preceding paragraph requires that treatment standards be kept constant as mentioned above.
- Independent management of the plant: this must be carried out without the use of raw materials and/or expendable items difficult to find on location.
- Simplified regular maintenance procedures so as not to require the help of very specialized manpower and/or parts difficult to obtain on location.

Taking the above into account, we have opted for a plant configuration made up of two completely separate lines operating in parallel: one line for greywater exclusively and another one for blackwater only.

Each line is made up of the exact same phases differing only in size taking into account that they carry different volume intakes.

The main benefits derived from this configuration may be summarized as:

1. possibility of tare for each line depending on the incoming wastewater. So that the qualitative characteristics of the grey and black liquids, considered separately, are maintained constant through time, the two lines can be exactly calibrated in relation to the incoming polluted wastewater, without the negative effects of the mixing of the two different types of waste (that instead would have to be verified in only one treatment line used for the combined waste).
2. Maximum management flexibility in case of damage and/or technical halt of one of the lines since it is possible to temporarily use only one treatment line for both types of outflow. This allows for the continuity of the treatment service as well as that of the recycling of the treated water.

3. Possibility of sharing the majority of necessary parts since both lines are made up of identical components.

In order to manage the quantitative variability of the waste volume, be they grey or black, each line is provided with a large deposit/equalization basin which serves the purpose of levelling off flow peaks of the eventual polluted water load.

To achieve the qualitative final effluent standards required by the Committee and also to maintain them constant throughout time, a plant process system is put in place which uses biological aeration and active sludge of the MBBR type which is then continued downstream by a pressure filtration phase on quartzite and active carbon.

MBBR technology combines the advantages of the traditional systems of active sludge and suspended biomass with that of the most advanced systems of fixed biomass to fluidized beds. The problems associated with systems relying uniquely on fluidized beds – uneven distribution of the fluidized bed and packing of the same, etc. – are eliminated by combining with the most popular and approved systems of biomass suspension.

At the same time, the limits of the process plant – in terms of treated returns – which is almost physiological in nature, of the biomass suspension system are controlled by the introduction of a fixed biomass component.

2.2 Plant process configuration

Based on the consideration described in the preceding paragraph, the plant consists of two distinct lines which operate in parallel:

1. greywater line ;
2. blackwater line.

Each line is set up in the following manner:

- pre-treatment;
- deposit/equalization and re-launch of waste compartment;
- biological aeration with MBBR technology compartment;
- final sedimentation compartment;
- deposit compartment for the pressure filtration stage;

- pressure filtration on quartzite and active carbon unit;
- disinfectant solution preparation unit;
- disinfection of outgoing effluent from pressure filtration (with continuous chlorine concentration control) unit;
- final deposit compartment;
- pressure filtration for water to be reused in bathrooms (toilets) unit.

Line 1 is capable of handling a peak flow equal to 10 m^3/hour.

Line 2 is capable of handling a peak flow equal to approximately 21 m^3/hour.

Both lines are connected at the inlet sections for the equalization compartments by means of a by-pass collector which can inject greywater to the blackwater installation and vice versa.

The by-pass is regulated by motorized valves in risers to deviate the flow according to need.

Pre-treatment for line 1 consists mainly of a de-fatting/degreasing unit; that of line 2 consists of the Imhoff biological type.

In Attachment 1 find plant lines layout (table 1) of the two lines which makeup the plant.

2.3 Treatment cycle

The semi-liquid waste arriving from pre-treatment, differentiated as grey and black water, arrive at the inside of their respective equalization/aeration and pumping unit.

These compartments help in levelling the peak load, both polluting and hydraulic, within the great usable volumes available.

The equalization basins are maintained in aerobic conditions by means of air diffusers powered by blowing compressors.

Air serves a dual fundamental purpose: it maintains the semi-liquid waste aerated preventing anoxic phenomena and at the same time ensuring the necessary mixing conditions.

Inside these basins there are submersible electro-pumps whose role is to re-launch the semi-liquid waste to the next biological treatment.

The pumping station thus helps provide the semi-liquid waste with the altimetric elevation necessary for feeding the same liquid within the successive compartments which constitute the plant. Once the elevation necessary for entrance at the initial section of the biological compartment is reached, the semi-liquid waste flows down by gravity from one treatment compartment to the other until the final deposit.

Downstream from the equalization basins we find the biological aeration compartments; where the biological process responsible for the biodegradable organic substance takes place. This is transformed into CO_2 e H_2O by the aerobic bacterial flora naturally growing within the compartment; such processes allow the micro-organisms to require the necessary energy for its own sustainability and also for the growth of new organisms. The concentration of micro-organisms within the biological compartments is such that the mixture of water + biomass acquires the name of active sludge.
The biological compartments use a special treatment combination of the traditional solution with the suspended biomass, the MBBR innovative technology described in the following chapter.

AERATION REQUIRES THE PRESENCE OF OXYGEN SINCE IT IS AN AEROBIC PROCESS; FOR THIS PURPOSE THE AERATION SYSTEMS ARE MADE UP OF FINE BUBBLE DIFFUSERS POWERED BY BLOWING COMPRESSORS.

Exiting from the MBBR biological section, the semi-liquid waste arrives at the deposit compartment for the final filtration unit.

The deposit compartments function as water "reservoirs" necessary to ensure a complete functioning cycle of the filtration unit.

Water within the compartments is picked up by means of centrifugal self-priming pumps and it is subject to the pressure filtration stage on quartzite and active carbon so as to make a radical removal of the dissolved and suspended substances that may still be present.

The outgoing water from the filtration unit is doused with a disinfecting solution in order to achieve a more radical removal of pathogens that might still be present.

The quantitative control of the disinfectant solution poured in the water is achieved by using a measuring devise for dissolved chlorine (chlorine – residumeter) placed downstream. For the disinfecting action to be fully effective it is necessary that a portion of the disinfectant remain even in the final effluent, always within the limits allowed for this parameter.

The treated and disinfected water finally arrives at a final deposit compartment to be then picked up and sent to the different areas for use. These may include:

- irrigation of green areas (limited to the landscaped areas);
- reuse in bathroom facilities, limited to the toilets and only after an additional filtration of the water;
- fire prevention reservoir;
- etc.

water destined for use in toilets is further pressure filtered on quartzite and active carbon.

2.4 Project data

Data used for the dimensions of the two treatment lines are summarized in Table B detailed below.

Tab. B – Project data

SIZE	UNIT OF MEASURE	VALUE
Equivalent population	/	550
Per capita water availability only for greywater	lt/inhabitant/day	300
Pro capita water availability only for blackwater	lt/inhabitant/day	100
Average greywater daily flow	m3/d	165
Average greywater hourly flow	m3/h	6.9
Average daily blackwater flow	m3/d	55
Average hourly blackwater flow	m3/h	2.3
Peak coefficient		3

Sewer inflow coefficient	/	1
Instantaneous blackwater peak flow	m3/h	7
Instantaneous greywater peak flow	m3/h	21
SST per capita contribution	gr/inh./d.	60
BOD5 per capita contribution	gr/inh./d.	60
TKN per capita contribution	gr/inh./d.	15
Outflow limits	See Table A	

3. DESCRIPTION OF CONSTRUCTION AND FUNCTIONAL CHARACTERISTICS

The two treatment lines, greywater and blackwater, have the same plant configuration and differ only in the capacity of some of the tanks and in the power of the electromechanical devices installed.

The two lines are completely independent of each other and are able to function with full autonomy: indeed they do not share any of the devices nor any of the treatment tanks.

All the equipment – with the exception of the submersible pumps placed inside the two prefabricated units, one for each line, as indicated in the graphs reported in Attachment 1.

Following is a separate description of the two lines.

3.1 Greywater line

This line consists of the following treatment phases:

- aerated equalization and pumping of semi-liquid waste;
- biological aeration and final sedimentation;
- deposit for filtration;
- pressure filtration;
- disinfection;
- filtered and disinfected water deposit.

The process plant engineering is later completed by the services unit.

3.1.1 Aerated equalisation and pumping of semi-liquid waste

The waste coming from the pre-treatment located along the sewer network reaches the deposit/equalization section. This is composed of two compartments which are connected between themselves, each of which has the following characteristics:

- construction material: reinforced fibreglass (PRFV);
- geometric shape: cylindrical;

- length: 890 cm;
- diameter: 244 cm;
- total volume: 40 m^3 .

The total volume of the deposit/equalization section is equal to 80 m^3.

The two compartments are connected at the boom tip around the bottom of the basins- by means of two collectors of ϕ 160 connection.

The interior of the basin comes with reinforcing septums made from PRFV ensuring the rigidity to the structure.

Each compartment has four inspection points with 2 manholes ϕ 600 and of 2 inspection holes ϕ 300.

The two units are completely below ground, with the elevation for placement depending on the arrival elevation of the final sewage collector.

To ensure access to the compartments, inspection holes must be provided for all the manholes that the compartments come with.

For the aeration of the semi-liquid waste a system of four medium bubbles diffusers is used (so as to foster the combined action of the mixing-aeration as opposed to only the oxygenation action), subdivided in two groups of two diffusers each, found within each compartment.

The injection of air serves two main purposes:

- maintain the liquid mass in aerobic condition;
- mix the incoming semi-liquid preventing sedimentation of the organic portion necessary for the next stage of biological aeration.

The aeration system is powered by a blowing compressor with the following characteristics:

- type: with lateral channels;
- power: 3.5 kW, 380 V

Each line of diffusers is provided with a shut off valve for the regulation of the air flow.

For the pumping of the semi-liquid waste, inside one of the compartment for the deposit/equalization there are two submersible electro-pumps (1 – 1 on active reserve) that are used to convey the semi-liquid waste to the next biological aeration phase (please refer to graphs in Attachment 1).

The characteristics of the two machines are as follows:

- type: submersible centrifugal;
- power: 1.50 kW, 380 V;
- rotor: "Vortex" type for wastewater;
- working point: about 20 m^3/hour at 10 m.

The pumps are controlled by floating level sensors, connected to the electrical control panel. This controls the start up of the pumps in such a way that they all start functioning in turn, so as to uniformly distribute the work load ensuring the long lasting functioning of the machines.
On the discharge line for each pump there is a regulating gate valve with manual control and a non return valve.
Each pump guarantees a volume equal to at least 20 m^3/hour; considering peak volumes equal to 21 m^3/hour, and ensures that even a single pump be able to handle the evacuation of the incoming peak volume.

3.1.2 Biological aeration and final sedimentation section

As in the preceding paragraph, the semi-liquid waste from the pumping arrives at the biological aeration section.

It is positioned completely above ground – to a height that will allow the progressive movement by gravity of the semi-liquid waste – it consists of 1 PRFV compartments of 40 m^3.

These compartments are similar to the ones used for deposit/equalization purposes and have the following characteristics:

- construction material: reinforced fibreglass (PRFV);
- geometric shape: cylindrical;
- length: 890 cm;
- diameter: 244 cm;
- total volume: 40 m^3 .

MBBR process pros are:

· Low sludge load values (Cf < 0,1 [kgBOD5/kgSS/d]) and high sludge age values (> 20 [d]).

· Good ammonia nitrification.

· Low excess sludge production.

· The biological tank volume allows to buffer occasional organic load peaks.

Waters enter the biological reactor. Inert carriers are added in the aeration volume and bacteria adhere to them. The medium is kept in suspension in the up flow turbulence generated by the aeration system (an air blower feeding air to the piping system assures a uniform and complete liquid mass oxygenation). Coarse bubbles escaping from perforated pipes (laid on the bottom of the tank) achieve the aeration, providing both the correct oxygen concentration in the overall volume and the necessary turbulence. A comfortable habitat is created for micro-organisms performing depuration; they grow in number and therefore in quantity.

To obtain the parameters values fixed by local laws, the needed quantity of K3 inert carriers is set to 15 m3; needed air quantity is 90 Nm3/h, with a peak of 130 Nm3/h; sludge production quantity is about 17-20 kg TSS/d.

In this section of the treatment, organic matter is transformed in CO2 and H2O by aerobic microorganisms. The biochemical reactions taking place provide energy supply for bacterial growth, while organic matter proves to be a good substrate for new cells creation.

Dissolved oxygen in oxidation tank is about 6 mg/l and it is obtained by blowing air through perforated pipes at the bottom of the tank itself. Necessary air is blown by an air-blower (power 4 kW), which works with a timer that is controlled by a PLC that is included in the control panel. On the delivery pipe, a coupling and a gate are foreseen in order to be able to remove air-blower.

When the biological reaction has been completed, water and air mixture passes on to the secondary settling phase, where the separation of suspended sludge and excess floating biofilm from clean water takes place. In this phase, excess sludge settles at the bottom of the tank, while excess floating biofilm gathers in the upper part of the tank.

Excess floating biofilm is recirculated to the oxidation phase by an appropriate system.

Sludge (excess + recirculating) are extracted by an air-lift device which manage to:

· re-launch the recirculating sludge to the biological tank, to keep biomass concentration constant;

· send the excess sludge to a dedicated line, formed for example by an appropriate filter-press for sludge thickening (given as an optional in the present offer).

The on/off timing is set by a timer regulated by a PLC installed in the control panel, and it's set in order to avoid unnecessary turbulence that any cause non perfect settlement. The sludge flow to the oxidation tank may be diverted to sludge removal system by operating on manual valves installed on pipes.

By opening and closing valves the following happens:

1. All sludge is recirculated to the oxidation tank: recirculation valve open and extraction valve closed.

2. All sludge is removed: recirculation valve closed and extraction valve open.

3. Some of the sludge to the oxidation tank and some of the sludge to the extraction: partial closure of both valves.

Treated water leaves the plant passing to the storage tank for pressurised filtration phase.

3.1.3 Deposit for filtration

The treated water exiting from the biological compartments arrives by means of gravity to the deposit compartment.

The compartment has the following characteristics:

- construction material: reinforced fibreglass (PRFV);
- geometric shape: cylindrical;
- length: 890 cm;
- diameter: 244 cm;
- total volume: 40 m^3 .

The unit is subdivided – by means of an internal septum - in two equal parts, of which one (20 m^3) serves as a deposit for water to be filtered and the second one, with a volume of 20 m^3, serves as a deposit for filtered and disinfected water.

Inside the compartment of water for filtration there are level sensors; these regulate the activation of the self-priming pumps supplying the filters which are described in the paragraph below.

3.1.4 Pressure filtration

Pressure filtration aims to achieve the forced removal of suspended and dissolved solids that cannot otherwise be removed through biological or physical processes (sedimentation).

With regards to the size of the filtration system, one must remember that the commonly applied criteria refer to formulas that link together the main parameters of the filter bed, height, load loss, filling characteristics, hydraulic load and/or the apparent filtration speed.

The main problem with these formulas is that many of them have been determined for filtration motion with no solid deposits.

These formulas consequently need empirical adjustment as the hydraulic characteristics of a filter bed can almost be considered as a long passage. Indeed, in most cases the hydraulic characteristics only provide for the rational application of the formulas at the beginning (clean bed) and at the end of the filtration process (fully clogged up bed).

Some of the possible formulas are shown below as examples):

- *Darcy:*

$H = v_f * h/K$ [with $K = 150*(0.72 + 0.028\ T)\ f^3\ \Phi n^2 * \psi^2$]

- *Ives (simplified):*

$H = H_0 + K_i * \beta_i * C_0 * v_f * t_c$

Dove:

- H_0 loss of global load;
- v_f = apparent filtration speed;
- h = apparent height of bed;
- C_0 = ingoing concentration;
- T = cycle time;
- f = material porosity;
- ψ = degree of filtering means' globosity;
- Φn = nominal size.

The ratio below instead allows the amount of adsorbent material needed for the treatment of a certain quantity of adsorbed material to be calculated; specifically:

- $q = K * C^a$

Where:

q = kg of adsorbed/kg adsorbent material (in saturation to balance conditions);

K, a = constants depending on the type of sub-layer;

C = kg adsorbed/kg fluid.

Adsorption is started up by attraction powers that are so strong that the material dissolved during the fluid phase (adsorbed) goes to position itself permanently inside the adsorbent sub-layer.

The adsorption process takes places in three different phases:

1. the solute passes from the liquid phase to the surface of the adsorbent sub-layer;
2. the solute spreads into the pores that make up the sub-layer (active sites);
3. the solute fixes itself inside the pore, and becomes adsorbed material.

An essential part of the adsorption process is the porosity of the adsorbent sub-layer, which provides the latter with a large specific contact surface, scaled to the weight unit.

The active carbon is characterised by an extremely large contact surface: on average equal to 1,000 m^2/gr with pores that vary from 5 to 1000 Å.

Another important aspect is the distribution of the adsorbent sub-layer's pore diameter; this size should lie within a narrow range.

In this specific case, the filtration section comprises 2 feeding pumps and the filtration unit, made up of a group of 6 filters divided into 2 lines with three filters each, that work in parallel and are which are organised into the sequence:

- *quartzite / quartzite / active carbon.*

The pumps serve to take the water to be treated from the specific deposit compartment and to feed it to the filters with pre-set capacity and pressure values.

The features of the two machines are as follows:

1. type: self-priming centrifuge;
2. power: 1.5 kW, 380 V;
3. working capacity: about 10 m^3/hour;
4. working pressure: about 6 bar.

The delivery line to each pump is connected to the feeder manifold that serves the pressure filters.

These are 4 filters – quartzite and 2 active carbon and each have the following features:

- material used: hot-galvanised steel;
- shape: cylindrical;
- height: cm 215;
- diameter: cm 90;
- inspection points: n°2
- filter bed: quartzite and active carbon (powder)
- treatable capacity: 10 m^3/hour.

Each filter is made up of a cylindrical galvanised steel container with active carbon and quartzite filter beds inside them, arranged in layers.

The incoming water is fed under pressure (approximately between 3 and 4 bar) into the filter, with the aim of beating the resistance placed by the filtering bed. The filtration performance is optimised in this way as is the performance of the removal of suspended solids (and substances associated with them: COD, BOD_5 etc) present in the incoming water.

The incidence needed for the water to pass through the inside of the filter is guaranteed by the centrifuge pump described above.

The filter bed needs regular cleaning, as mentioned above, as the material removed from the water is treated in the filter bed itself, which therefore tends to become saturated.

The filter bed is cleaned by inverting the direction of the water flow that feeds the filter: in this way the material deposited in the bed is "captured" by the back washing water and is disposed of with it.

The water coming from the cleaning operation (back washing water) is re-circulated to the top of the sewage treatment plant.

The direction of the water flow in the filter is inverted by acting on the sectioning valves that are in the feeder manifold. These are started up automatically by an air compressor that is located inside the service room (see graphs).

The filter load manifold comprises a set of pipes with sectioning valves in-between them that can be controlled either manually or by a pneumatic actuator that can divert the incoming water flow towards one of the following destinations:

- loading entrance for the standard filtration cycle;
- loading entrance for filter back washing.

This is in order to allow the back washing operations to be carried out automatically, which is necessary for maintaining the filters in perfect working order.

The loading pump's work/rest cycles are regulated by level sensors placed inside the deposit compartment.

In this way, the pump is only activated when there is a sufficient amount of water in the compartment for a suitable work cycle (this limits the number of times the motor starts up/stops).

The pump turns off as soon as the level inside the deposit compartment falls below a pre-set threshold.

The entire system is controlled by an electrical panel that is also placed inside the service room.

The panel can be used to set the filter back washing time and to check that all the equipment installed works correctly.

3.1.5 Final disinfection

The disinfection process must be able to make all pathogen agents present in the water coming out of the plant inactive, in the least time possible and using small doses, without causing the formation of residues or by-products that can potentially damage the final catcher basin.

Disinfection systems for small-medium sized areas must have some basic requisites:

- Capacity to treat widely differing amounts of water over a period of time;
- Request for limited or no surveillance;
- The least amount of and most simple maintenance and running interventions possible;
- Limited running costs.

With regards to disinfection by chlorination, only chlorine compounds that contain active chlorine have disinfectant properties: gaseous chlorine, chlorine dioxide, and hypochlorites.

When the chlorine (or a chlorine compound) dissolves in water it is quickly hydrolysed, according to the following reaction for example:

❖ $Cl_2 + H_2O \leftrightarrow H^+ + Cl + H_20$

The hypochlorous acid that forms as a consequence of this hydrolysis reaction is then in turn ionised according to the following reaction:

❖ $HClO \leftarrow pH \rightarrow H^+ + ClO$

With the formation of hydrogen ions and hypochlorite ions.

This second reaction, like the first, is reversible and its direction depends on the water's pH value. The reaction moves to the right for high pH values and to the left for low pH values.

With a pH value of a little over 5, the chlorine is all in a hypochlorous acid form, while the solution contains equal amounts of undissociated hypochlorous acid and hypochlorite ions with a pH value of 7.4. With a pH value > 9.5 almost all the chlorine is present as a hypochlorite.

The bactericidal action is due to the hypochlorous acid (HClO) which prevents the essential enzymes from cellular metabolism and destroys the cellular elements.

As semi-liquid waste normally has a pH value > 7, it can be supposed that the chlorine is normally present as hypochlorous acid and as hypochlorite ions during disinfection.

The chlorine also has a high chemical activity rate, therefore, in addition to the hydrolysis reactions mentioned above when it is introduced into the water it also produces a series of reactions that affect the organic and inorganic parts.

The presence of organic substances, of ammonia ions and of oxidable substances (also inorganic) that can interact with the chlorine to make products and which can be called residual chlorine cause the situation described by the break point curve.

More specifically, initially all the chlorine added to the water is used up without producing residual chlorine, then immediately afterwards it begins to react with the ammoniacal nitrogen and with other organic compounds that may be present.

When the amount of chlorine is increased, the added chlorine will react with the unstable compounds present, progressively destroying them. It does not however affect the stable compounds. At break point, only any stable but inactive chlorine compounds will remain and any further addition of chlorine causes an equivalent increase of residual chlorine as free residual chlorine.

Under normal working conditions the sewage treatment plant does not operate close to break point conditions (marginal chlorination).

The plant's disinfection system involves sodium hypochlorite treatment (NaClO) of water once it has completed the filtration phase. The injection point is located immediately before the static mixer whose function is to improve water contact – disinfectant solution. The disinfected water is then transferred to the deposit tank described in the paragraph below.

The "raw material" used to produce the disinfectant reagent is seawater. A special apparatus is installed which extracts hypochlorite by partial hydrolysis of the sodium chloride contained in seawater.

This process takes place inside an electrochemical cell.

NaCl solution (seawater) is passed through a chamber containing a series of anode-cathode sets, made of suitable material, causing the following overall reaction:

- $2\ NaCl + H_2O \rightarrow NaClO + NaCl + H_2 \uparrow$

  energy

The size of the apparatus has been specially determined for use with seawater.

The flow density, chloride concentration, capacity and surface area of the electrodes have all been calculated to maximize the transformation yield of chloride in Cl_2.

The system does not require storage of the solution produced. In fact, hypochlorite is dosed continuously and the amount of NaClO generated is regulated according to the immediate requirements of the process.

In particular, reagent dosage is regulated continuously by a gauge measuring dissolved chlorine (residual chlorine gauge), installed after the point of injection.

This instrument measures the concentration of residual chlorine online (which must fall within the outflow limits for this parameter – see table A), by regulating the supply of disinfectant solution to the treated water issuing from the filters.

This continuous regulation means that only the required quantity of NaClO is produced, preventing excessive doses, which, as well as being uneconomical, also make it more difficult to stay within the outflow limits set by law.

In addition to avoiding the need for intermediate storage of the product, on site production of NaClO carries a number of other advantages:

- no transport or storage problems; user does not have to rely on suppliers, who are not always available locally;
- with no intermediate storage, the danger of H_2 build-up developing from the solution in the tank is avoided;
- prevents problem related to deterioration of hypochlorite during storage, which causes a decline in its oxidising strength (and hence its disinfecting power) and possibly the formation of undesirable substances.

3.1.6 Deposit of filtered and disinfected water

The deposit tank for filtered and disinfected water has been constructed in the same section as described in paragraph 3.1.3.

The available volume is 20 m^3.

From this structure, the water then makes its way to another deposit tank – not included in supply – where it remains until it is used.

3.1.7 Service unit

The service unit consists of a double-walled insulated container made of steel sheeting, with the following dimensions:

W x D x H = 600 x 240 x 240 cm.

Access is gained through a double-leaf lockable door. It also contains two movable walls allowing easy access to the filtering unit.

The structure contains the following apparatus:

- blowers;
- air compressor operating pneumatic valves;
- self-priming centrifugal pumps;
- electric control panel;
- disinfectant preparation and dosing unit;
- quartzite and active carbon filters.
- Air-conditioning system for the unit.

The unit has electric current, air-conditioning and interior lighting.

3.2 Blackwater line

The following treatment phases are involved:

- ventilated equalisation and raising of semi-liquid waste;
- biological aeration and final sedimentation;
- deposit for filtration;
- pressure filtration;
- disinfection;
- Deposit of filtered and disinfected water
- final filtration.

The electromechanical apparatus is located inside the service unit, as in the case of the grey water treatment line.

3.2.1 Aerated equalisation and pumping of semi-liquid waste

Waste from pre-treatment systems along the sewage system reaches the deposit/aerated equalisation section. This section has the following characteristics:

- construction material: reinforced glass fibre (GRP);
- geometrical form: cylindrical;
- length: 890cm;
- diameter: 244cm;
- overall volume: 40m^3.

The tank contains reinforcement sections in GRP placed crosswise, whose function is to strengthen and stabilise the structure. The chamber has 4 inspection points, consisting of 2x ϕ 600 manholes and 2x ϕ 300 inspection holes.

The structure is completely below ground level. The foundation level depends on the level of the main sewer. For this reason, in order to guarantee access to the structure, it is important to construct a series of inspection pits corresponding to each of the manholes.

The black liquid is medium-bubble aerated thanks to two sets of diffusers.

The aeration system is supplied by a blower with the same characteristics as the one used on the greywater line.

A stop valve is placed in line with each set of diffusers to regulate the flow of air.

2 submersible electropumps are responsible for pumping the semi-liquid waste (1 + 1 active spare). These pumps send the manure to the biological aeration stage (see diagrams in annex 1).

The pumps have the following characteristics:

- type: submersible, centrifugal;

- power: 0.88 kW, 380 V;
- impeller: "Vortex" for waste water;
- operating point: approx. 10 m^3/hr at 10 m.

The pumps are driven by float level sensors, connected to the electric control panel. The panel is responsible for starting the pumps, activating each in turn, so that the specific workload of the machines is uniformly distributed, and wear and tear is thus reduced.
The delivery line of each pump has a manually controlled sluice valve and a non-return valve.
Each pump guarantees a capacity of at least 10 m^3/hr. Given that the maximum capacity level is 10 m^3/hr, as a consequence, only one pump would suffice to guarantee evacuation of the maximum delivery capacity.

3.2.2 Biological aeration and final sedimentation section

The biological treatment section has the same construction and functional characteristics as the greywater line, with the difference that, the black liquid line has two chamber with a volume of 40 m^3 each, total 80 m^3

MBBR process pros are:

· Low sludge load values (Cf < 0,1 [kgBOD5/kgSS/d]) and high sludge age values (> 20 [d]).

· Good ammonia nitrification.

· Low excess sludge production.

· The biological tank volume allows to buffer occasional organic load peaks.

Waters enter the biological reactor. Inert carriers are added in the aeration volume and bacteria adhere to them. The medium is kept in suspension in the up flow turbulence generated by the aeration system (an air blower feeding air to the piping system assures a uniform and complete liquid mass oxygenation). Coarse bubbles escaping from perforated pipes (laid on the bottom of the tank) achieve the aeration, providing both the correct oxygen concentration in the overall volume and the necessary turbulence. A comfortable habitat is created for micro-organisms performing depuration; they grow in number and therefore in quantity.

To obtain the parameters values fixed by local laws, the needed quantity of K3 inert carriers is set to 20 m3; needed air quantity is 200 Nm3/h, with a peak of 390 Nm3/h; sludge production quantity is about 20 kg TSS/d. In the oxidation tank, a pre-denitrification zone will be created to control nitrates concentration; this zone will be aerated only in case of peak loads.

In this section of the treatment, organic matter is transformed in CO2 and H2O by aerobic microorganisms. The biochemical reactions taking place provide energy supply for bacterial growth, while organic matter proves to be a good substrate for new cells creation.

Dissolved oxygen in oxidation tank is about 6 mg/l and it is obtained by blowing air through perforated pipes at the bottom of the tank itself. Necessary air is blown by an air-blower (power 5,5 kW), which works with a timer that is controlled by a PLC that is included in the control panel. On the delivery pipe, a coupling and a gate are foreseen in order to be able to remove air-blower.

When the biological reaction has been completed, water and air mixture passes on to the secondary settling phase, where the separation of suspended sludge and excess floating biofilm from clean water takes place. In this phase, excess sludge settles at the bottom of the tank, while excess floating biofilm gathers in the upper part of the tank.

Excess floating biofilm is recirculated to the oxidation phase by an appropriate system.

Sludge (excess + recirculating) are extracted by an air-lift device which manage to:

· re-launch the recirculating sludge to the biological tank, to keep biomass concentration constant;

· send the excess sludge to a dedicated line, formed for example by an appropriate filter-press for sludge thickening (given as an optional in the present offer).

The on/off timing is set by a timer regulated by a PLC installed in the control panel, and it's set in order to avoid unnecessary turbulence that any cause non perfect settlement. The sludge flow to the oxidation tank may be diverted to sludge removal system by operating on manual valves installed on pipes.

By opening and closing valves the following happens:

4. All sludge is recirculated to the oxidation tank: recirculation valve open and extraction valve closed.

5. All sludge is removed: recirculation valve closed and extraction valve open.

6. Some of the sludge to the oxidation tank and some of the sludge to the extraction: partial closure of both valves.

Treated water leaves the plant passing to the storage tank for pressurised filtration phase.

3.2.3 Deposit for filtration

Treated water leaving the biological section passes into the deposit tank by the force of gravity.

The tank has the following characteristics:

- construction materials: reinforced glass fibre (GRP);
- geometrical form: cylindrical;
- length: 890cm;
- diameter: 244cm;
- overall volume: 20 m^3.

The structure is divided by an internal wall into two equal sections measuring 10 m^3 each. The first of these sections is a deposit for water before filtering and the second is a deposit for filtered and disinfected water.

The deposit for water for filtration contains level sensors, which regulate activation of the self-priming pumps, which supply the filters as described in the next paragraph.

3.2.4 Pressure Filtration

In addition to the units for treating greywater, the filtration section is made up of two feeding pumps. The filtration unit is equipped with a six-filter battery, sub-divided into two lines, each with three filters. These lines operate on a parallel basis and are organized in the following sequence:

- *quartzite / quartzite / active carbon.*

The pumps must remove the water to be treated from the proper accumulation compartment and propel the water to the filters. The filters have pre-set values for range and pressure. The characteristics of the two machines are as follows:

– type: self -priming centrifuge;
– power: 1,5 kW, 380 V;
– processing range approximately 5 m^3/hour
– processing pressure: approximately 6 bar

The propelling line for each pump is connected to a feeding collector that supply the pressure filters. These are 4 – quartzite and 2 active carbon - with the following features:

- construction materials: zinc-coated steel
- geometric shape: cylinder
- height: cm 215;
- diameter: cm 70;
- inspections: n°2
- filtration bed:: quartzite and active carbon in powder form
- treatable range: 5 m^3//hour.

For information regarding the structural features of the filters, load collectors and the need to perform counter-washing procedures, please see paragraph 3.1.4.

The entire system is controlled from an electronic control board, located inside of the service areas. The counter-washing timetable for the filters can be set on the control board. Additionally, it is possible to control all of the functions of all the installed devices.

3.2.5 Final Disinfection

The purified waters are disinfected by using a set of specific dosages of a sodium hypochlorite mixture identical to that used in the greywater treatment line.

Therefore, please see paragraph 3.1.5 for a description of the system.

3.2.6 Deposit of Filtered and Disinfected Water

The accumulation compartment used specifically for filtered and disinfected water was placed inside of the same compartment specified in paragraph 3.2.3.

The available volume is equal to 10 m^3.

From this system, the water can be sent either to the final filtration phase, described in the next paragraph below, or to another accumulation compartment – not included in the supply – where it remains until needed.

3.2.7 Final Filtration

The final filtration section is exclusively used for treated water that is reused in lavatory facilities (WC).

It is comprised of:

- 2 self-priming centrifuge pumps;
- 2 quartzite and active carbon pressure filters;
- 1 autoclave.

The centrifuge pumps have the following features:

- type: self-priming centrifuge;
- power: 0,5 kW, 380 V;
- range of use: approximately 2.5 m^3//hour
- processing pressure: approximately 6 bar

The propelling line for each pump is connected to a feeding collector serving two pressure filters. These are of the mixed bed type - quartzite and active carbon - each with the following features:

- construction materials: zinc-coated steel
- geometric shape: cylinder
- height: cm 215;
- diameter: cm 35;
- inspections: n°2
- filtration bed:: quartzite and active carbon in powder form
- treatable range: 2.5 m/hour.

The feeding lines for the filters in this example also have dividing valves equipped with a pneumatic activator, enabling counter washing procedures to take place automatically.

The counter washed water is recirculated in the plant's head.

An autoclave is installed downstream from the pressure filters. Its function is to act like a "lung" prior to the water being sent to the lavatory facilities network.

3.2.8 Service Unit

The service unit, identical to the one used in line 1 – greywater, consists of a double-walled, insulated container made of steel-coated, with the following dimensions:

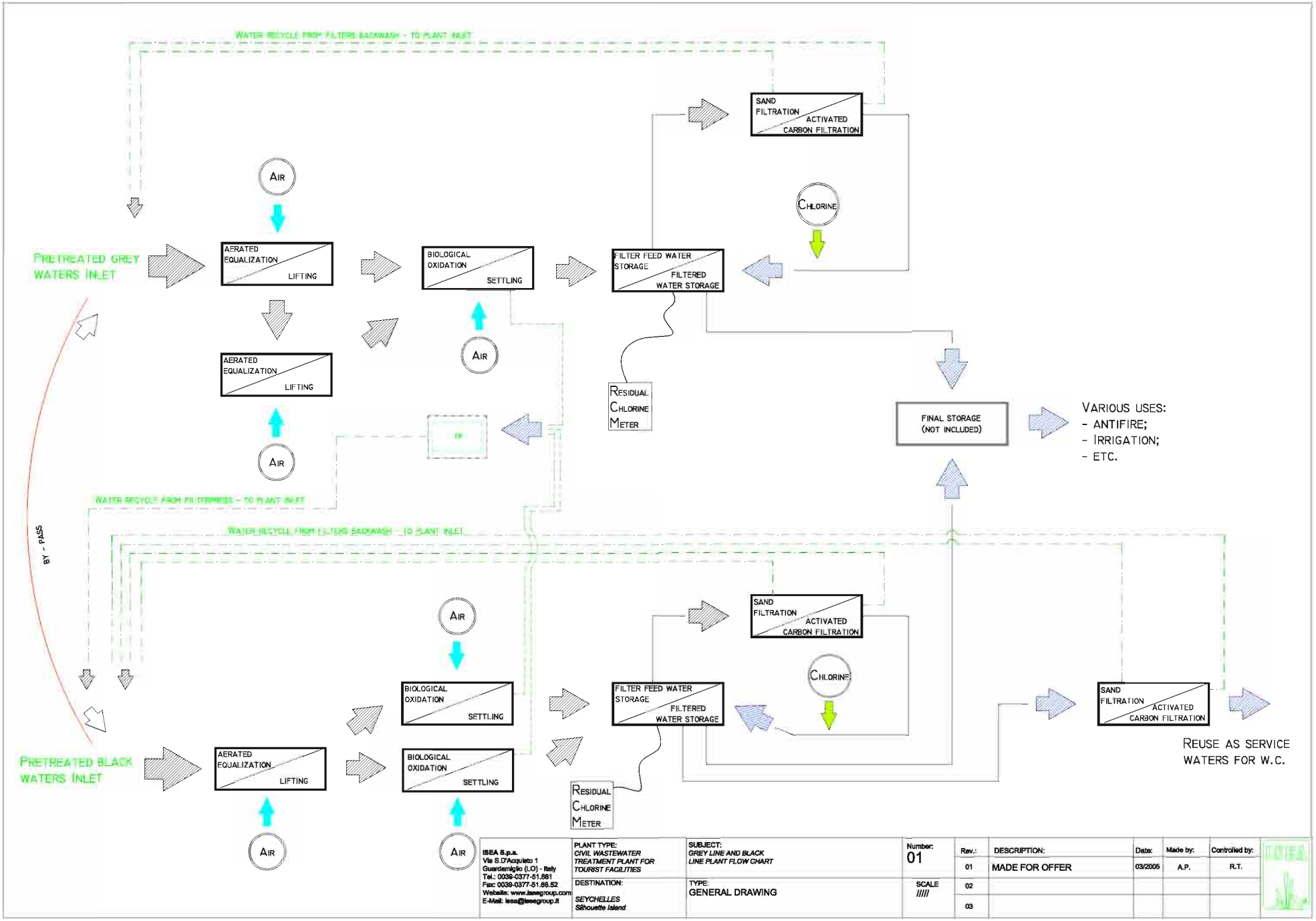
L x P x H = cm 600 x 240 x 240.

Accessibility is guaranteed by a double door, equipped with a key lock. Additionally, two moveable walls were provided for, providing optimal access to the filtration unit.

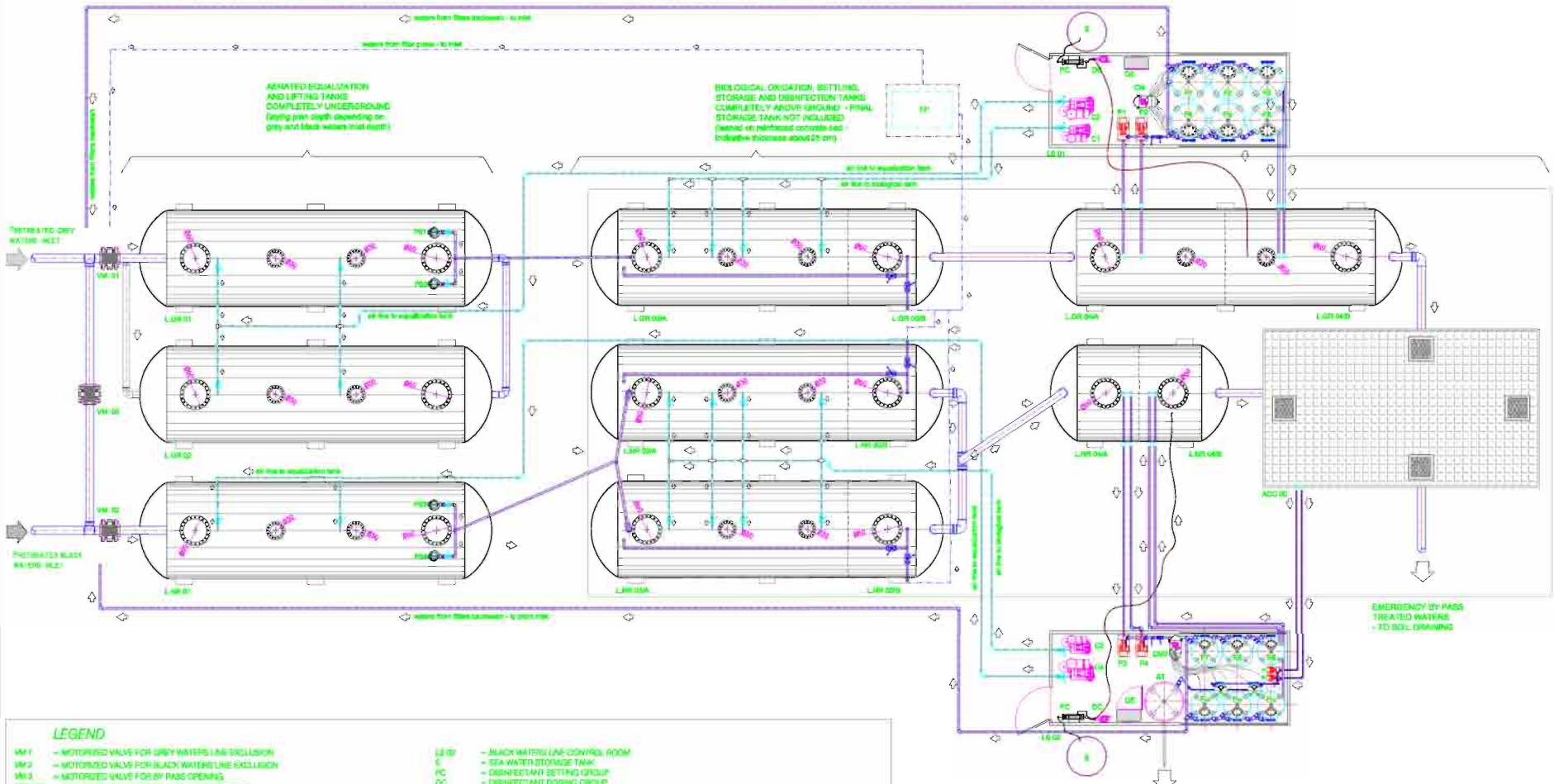
The following pieces of equipment are located inside of the system:

- blow compressors;
- air compressors for activating the pneumatic valves:
- self-priming centrifuge pumps for the main filtration unit;
- principal filtration unit;
- electric command board;
- disinfectant preparation and dosage set;
- self-priming centrifuge pumps for final filtration;
- final filtration unit;
- autoclave;
- cooler.

The system is equipped with an electrical generator, cooler and internal lighting.



ISEA S.p.a. Via S.D'Acquisto 1 Guardamiglio (LO) - Italy Tel.: 0039-0377-51.881 Fax: 0039-0377-51.88.52 Website: www.iseagroup.com E-Mail: isea@iseagroup.it	PLANT TYPE: *CIVIL WASTEWATER TREATMENT PLANT FOR TOURIST FACILITIES*	SUBJECT: *GREY LINE AND BLACK LINE PLANT FLOW CHART*	Number: 01	Rev.:	DESCRIPTION:	Date:	Made by:	Controlled by:
				01	MADE FOR OFFER	03/2005	A.P.	R.T.
	DESTINATION: *SEYCHELLES* *Silhouette Island*	TYPE: GENERAL DRAWING	SCALE /////	02				
				03				



LEGEND

VM 1 – MOTORIZED VALVE FOR GREY WATERS LINE EXCLUSION
VM 2 – MOTORIZED VALVE FOR BLACK WATERS LINE EXCLUSION
VM 3 – MOTORIZED VALVE FOR BY PASS OPENING
PSW1/2E – SUBMERSIBLE PUMPS FOR GREY WATERS LIFTING
PSG/3/4 – SUBMERSIBLE PUMPS FOR BLACK WATERS LIFTING
L.GR 01 – GREY WATERS AERATED EQUALIZATION TANK NR 1
L.GR 02 – GREY WATERS AERATED EQUALIZATION / LIFTING TANK NR 1
L.NR 01 – BLACK WATERS AERATED EQUALIZATION / LIFTING TANK
L.GR 03 – GREY WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B)
L.GR 04 – GREY WATERS FILTERS FEED STORAGE TANK (A) / FILTERED GREY WATERS STORAGE TANK (B)
L.NR 02 – BLACK WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B) NR 1
L.NR 03 – BLACK WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B) NR 2
L.NR 04 – BLACK WATERS FILTERS FEED STORAGE TANK (A) / FILTERED BLACK WATERS STORAGE TANK (B)
ACC.0 – FINAL STORAGE TANK (NOT INCLUDED)

LS 01 – GREY WATERS LINE CONTROL ROOM
S – SEA WATER STORAGE TANK
PC – DISINFECTANT SETTING GROUP
DC – DISINFECTANT DOSING GROUP
QE – CONTROL PANEL
CM – VALVES OPERATION COMPRESSOR WITH PNEUMATIC ACTUATOR
C1 – AIR BLOWER FOR BIOLOGICAL TANKS
C2 – AIR BLOWER FOR AERATED EQUALIZATION TANK
P1/2 – SELF PRIMING PUMPS FOR FILTERS FEED (F7 TO F8)
F7/8/9/10/11 – SAND FILTERS FOR 5 m/h EACH
F3/6 – ACTIVATED CARBON FILTERS FOR 4 m/h EACH

LS 02 – BLACK WATERS LINE CONTROL ROOM
S – SEA WATER STORAGE TANK
PC – DISINFECTANT SETTING GROUP
DC – DISINFECTANT DOSING GROUP
QE – CONTROL PANEL
CM – VALVES OPERATION COMPRESSOR WITH PNEUMATIC ACTUATOR
C4 – AIR BLOWER FOR BIOLOGICAL TANKS
C3 – AIR BLOWER FOR AERATED EQUALIZATION TANK
P3/4 – SELF-PRIMING PUMPS FOR FILTERS FEED (F7 TO F12)
F7/8/10/11 – SAND FILTERS FROM 5 m/h EACH
F9/12 – ACTIVATED CARBON FILTERS FOR 6 m/h EACH
P5/6 – SELF PRIMING PUMPS FOR FILTERS FEED (F13 AND F14)
F13/14 – ACTIVATED CARBON FILTERS FOR WATERS TO BE REUSED IN SANITARY FITTINGS (W.C.)
AT – AUTOCLAVE FOR WATERS TO BE REUSED IN SANITARY FITTINGS (W.C.)

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E-Mail: isea@iseagroup.it

PLANT TYPE: *CIVIL WASTEWATER TREATMENT PLANT FOR TOURIST FACILITIES*

SUBJECT: *GREY LINE AND BLACK LINE PLANT FLOW SCHEME*

Number: 03

DESTINATION: *SEYCHELLES Silhouette Island*

TYPE: GENERAL DRAWING

SCALE 1:50

Rev.:	DESCRIPTION:	Date:	Made by:	Approved by:
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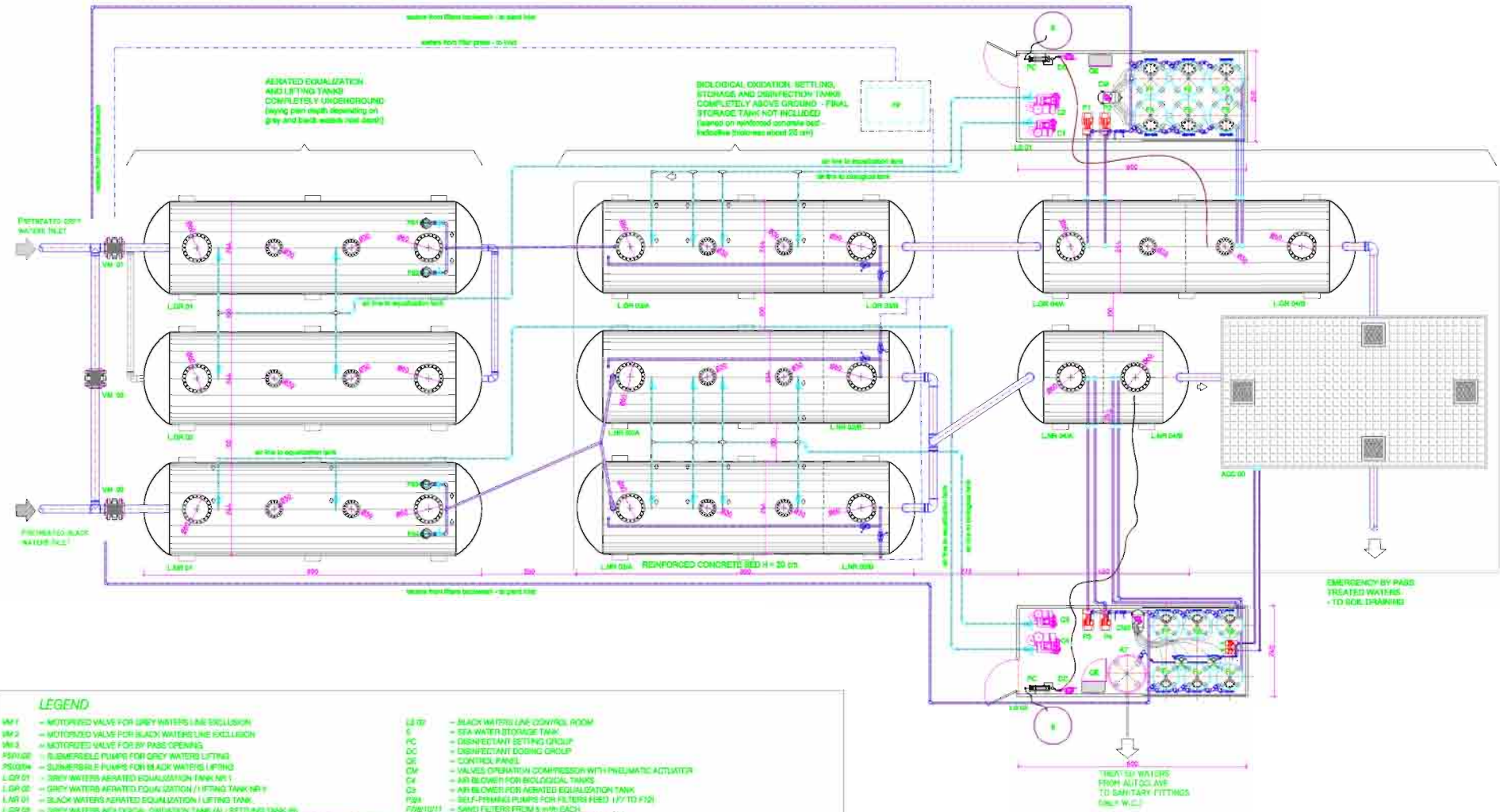
03				



LEGEND

VM 1	= MOTORIZED VALVE FOR GREY WATERS LINE EXCLUSION
VM 2	= MOTORIZED VALVE FOR BLACK WATERS LINE EXCLUSION
VM 3	= MOTORIZED VALVE FOR BY PASS OPENING
PSW1/2E	= SUBMERSIBLE PUMPS FOR GREY WATERS LIFTING
PSG3/4	= SUBMERSIBLE PUMPS FOR BLACK WATERS LIFTING
L.GR 01	= GREY WATERS AERATED EQUALIZATION TANK N° 1
L.GR 02	= GREY WATERS AERATED EQUALIZATION / LIFTING TANK N° 1
L.NR 01	= BLACK WATERS AERATED EQUALIZATION / LIFTING TANK
L.GR 03	= GREY WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B)
L.GR 04	= GREY WATERS FILTERS FEED STORAGE TANK (A) / FILTERED GREY WATERS STORAGE TANK (B)
L.NR 02	= BLACK WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B) NR 1
L.NR 03	= BLACK WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B) NR 2
L.NR 04	= BLACK WATERS FILTERS FEED STORAGE TANK (A) / FILTERED BLACK WATERS STORAGE TANK (B)
ACC.0	= FINAL STORAGE TANK (NOT INCLUDED)
LS 01	= GREY WATERS LINE CONTROL ROOM
S	= SEA WATER STORAGE TANK
PC	= DISINFECTANT SETTING GROUP
DC	= DISINFECTANT DOSING GROUP
QE	= CONTROL PANEL
CM	= VALVES OPERATION COMPRESSOR WITH PNEUMATIC ACTUATOR
C1	= AIR BLOWER FOR BIOLOGICAL TANKS
C2	= AIR BLOWER FOR AERATED EQUALIZATION TANK
P1/2	= SELF PRIMING PUMPS FOR FILTERS FEED (F1 TO F6)
F1/2/5/6	= SAND FILTERS FOR 4 m/h EACH
F3/6	= ACTIVATED CARBON FILTERS FOR 4 m/h EACH
LS 02	= BLACK WATERS LINE CONTROL ROOM
S	= SEA WATER STORAGE TANK
PC	= DISINFECTANT SETTING GROUP
DC	= DISINFECTANT DOSING GROUP
QE	= CONTROL PANEL
CM	= VALVES OPERATION COMPRESSOR WITH PNEUMATIC ACTUATOR
C4	= AIR BLOWER FOR BIOLOGICAL TANKS
C3	= AIR BLOWER FOR AERATED EQUALIZATION TANK
P3/4	= SELF-PRIMING PUMPS FOR FILTERS FEED (F7 TO F12)
F7/8/10/11	= SAND FILTERS FROM 5 m/h EACH
F9/12	= ACTIVATED CARBON FILTERS FOR 6 m/h EACH
P5/6	= SELF PRIMING PUMPS FOR FILTERS FEED (F13 AND F14)
F13/14	= ACTIVATED CARBON FILTERS FOR WATERS TO BE REUSED IN SANITARY FITTINGS (W.C.)
AT	= AUTOCLAVE FOR WATERS TO BE REUSED IN SANITARY FITTINGS (W.C.)

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PLANT TYPE:	*CIVIL WASTEWATER TREATMENT PLANT FOR TOURIST FACILITIES*
SUBJECT:	*GREY LINE AND BLACK LINE PLANT GENERAL PLANIMETRY*
Number:	02
DESTINATION:	*SEYCHELLES Silhouette Island*
TYPE:	GENERAL DRAWING
SCALE	1:50

Rev.:	DESCRIPTION:	Date:	Made by:	Approved by:
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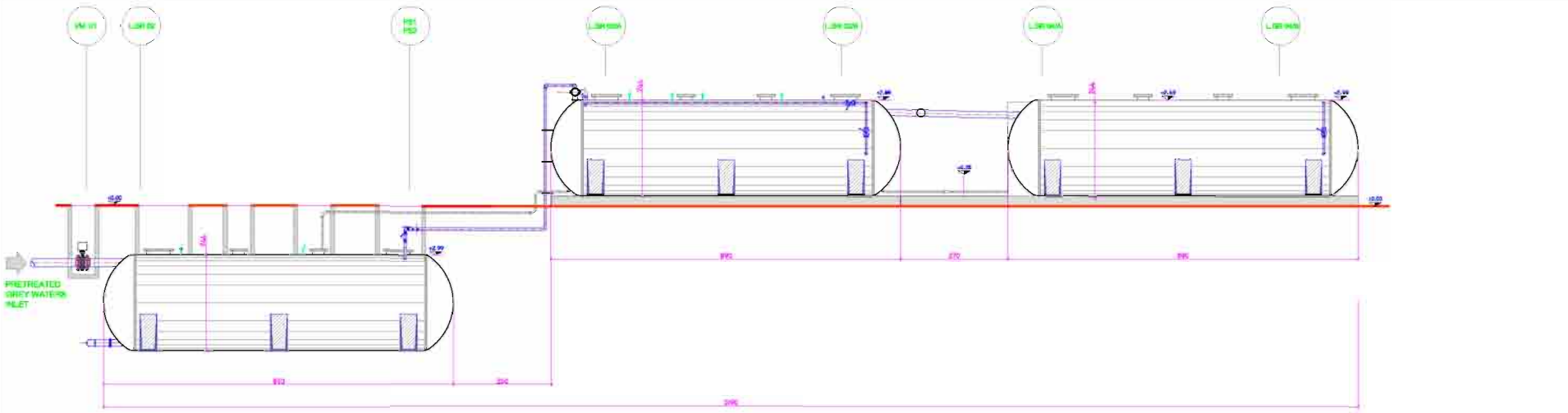
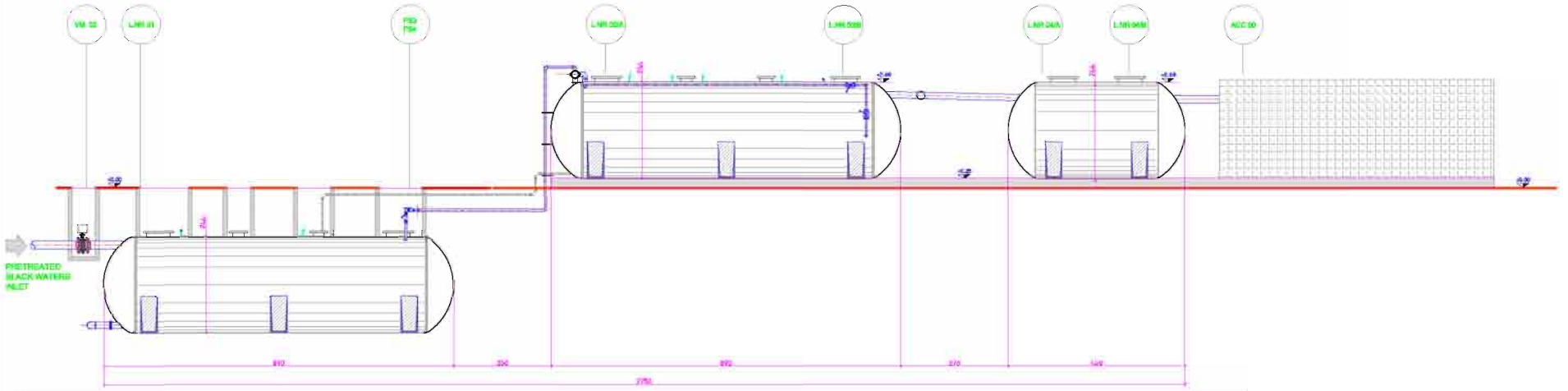
03				





LEGEND

VM 1 = MOTORIZED VALVE FOR GREY WATERS LINE EXCLUSION
VM 2 = MOTORIZED VALVE FOR BLACK WATERS LINE EXCLUSION
VM 3 = MOTORIZED VALVE FOR BY PASS OPENING
PS1/3/5 = SUBMERSIBLE PUMPS FOR GREY WATERS LIFTING
PS2/4/6 = SUBMERSIBLE PUMPS FOR BLACK WATERS LIFTING
L.GR 01 = GREY WATERS AERATED EQUALIZATION TANK NR 1
L.GR 02 = GREY WATERS AERATED EQUALIZATION / LIFTING TANK NR 2
L.NR 01 = BLACK WATERS AERATED EQUALIZATION / LIFTING TANK
L.GR 03 = GREY WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B)
L.GR 04 = GREY WATERS FILTERS FEED STORAGE TANK (A) / FILTERED GREY WATERS STORAGE TANK (B)
L.NR 02 = BLACK WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B) NR 1
L.NR 03 = BLACK WATERS BIOLOGICAL OXIDATION TANK (A) / SETTLING TANK (B) NR 2
L.NR 04 = BLACK WATERS FILTERS FEED STORAGE TANK (A) / FILTERED BLACK WATERS STORAGE TANK (B)
ACC 2 = FINAL STORAGE TANK (NOT INCLUDED)

LS 01 = GREY WATERS LINE CONTROL ROOM
S = SEA WATER STORAGE TANK
FC = DISINFECTANT SETTING GROUP
DC = DISINFECTANT DOSING GROUP
QE = CONTROL PANEL
CM = VALVES OPERATION COMPRESSOR WITH PNEUMATIC ACTUATOR
C1 = AIR BLOWER FOR BIOLOGICAL TANKS
C2 = AIR BLOWER FOR AERATED EQUALIZATION TANK
F1/3 = SELF-PRIMING PUMPS FOR FILTERS FEED (F1 TO F6)
F1/2/5/6 = SAND FILTERS FOR 7 m³/h EACH
F 3/4 = ACTIVATED CARBON FILTERS FOR 9 m³/h EACH

LS 02 = BLACK WATERS LINE CONTROL ROOM
S = SEA WATER STORAGE TANK
FC = DISINFECTANT SETTING GROUP
DC = DISINFECTANT DOSING GROUP
QE = CONTROL PANEL
CM = VALVES OPERATION COMPRESSOR WITH PNEUMATIC ACTUATOR
C1 = AIR BLOWER FOR BIOLOGICAL TANKS
C3 = AIR BLOWER FOR AERATED EQUALIZATION TANK
F3/4 = SELF-PRIMING PUMPS FOR FILTERS FEED (F7 TO F12)
F1/2/5/6 = SAND FILTERS FROM 5 m³/h EACH
F 5/12 = ACTIVATED CARBON FILTERS FOR 9 m³/h EACH
F5/6 = SELF-PRIMING PUMPS FOR FILTERS FEED (F13 AND F14)
F13/14 = SAND AND ACTIVATED CARBON FILTERS FOR WATERS TO BE REUSED IN SANITARY FITTINGS (W.C.)
AT = AUTOCLAVE FOR WATERS TO BE REUSED IN SANITARY FITTINGS (W.C.)

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PLANT TYPE:
CIVIL WASTEWATER TREATMENT PLANT FOR TOURIST FACILITIES

DESTINATION:
SEYCHELLES
Silhouette Island

SUBJECT:
GREY LINE AND BLACK LINE PLANT LATERAL VIEW

TYPE:
GENERAL DRAWING

Number: 04

SCALE 1:50

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01	MADE FOR OFFER	03/2005	A.P.	R.T.
02				
03				

SILHOUETTE ISLAND RESORT
Construction and Operation of a Beach Resort
Silhouette Island, Republic of Seychelles

ENVIRONMENTAL IMPACT ASSESSMENT

Appendix G: Details of Incinerator

SAUBATECH PTY LTD

Formerly a division of Safurnco

2003/004281/07

Write to: P.O. Box 170,Northriding,2162, South Africa

Telephone: (011) 794 8798

Fax: (011) 794 8747

Cell: 082 457 6858

Email: andreas@saubatech.com

Our ref.: APT/1000/seychelles 07/12/2004

IDC
Attention: Mr. T Cole

Dear Sirs,

PROPOSED INCINERATOR INSTALLATION

We would like to thank you for your recent enquiry and have pleasure in submitting our offer for:

1 X MACROburn INCINERATOR MODEL 100B

We have at this stage, offered you our STANDARD INCINERATOR with 3CR12 steel Chimney, oil Burners and Control Panel which can burn about 70kg/hour of general hotel waste .

LAYOUT

A general layout drawing is enclosed on our pamphlet which gives overall dimensions of the model offered and shows the space required for installation. Please refer to our web-site. www.saubatech.com

CONTROLS

The Control Panel is fitted to the side of the incinerator and is fully automatic in operation. The start and shutdown push buttons are the only parts which have to be activated by the operator when starting the unit in the morning and shutting it down after the burn has been completed. It includes a pyrometer temperature controller with thermostat control to keep the burner cool. Panel pilot lamps indicating power on/off, fan running, ignition on/off and burner on/off.

The incinerator incorporates as standard many excellent features such as:

AUTOMATIC EMISSION CONTROL which ensures smokeless operation.

AUTOMATIC PYROMETER CONTROL mentioned above, which switches the burner off on achieving the set point temperature, thus saving valuable fuel.

AUTOMATIC AIR CONTROL SYSTEM which ensures smokeless operation of the incinerator, even under extreme working conditions. This is achieved without any moving parts or any alteration to the air chamber settings

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REFRACTORY LINING

The MACROburn uses a 49% Alumina Monolithic refractory, capable of withstanding temperatures in excess of 1500 °C, specially selected to give a maximum durability under conditions of sudden and severe thermal shock. Bake-out of the incinerator lining will take a period of nearly three days, raising the temperature within controlled time limits to the maximum working temperature. The benefits are not immediately evident but this process ensures a very much longer refractory life. Provided the incinerator is not abused in any way, the refractory lining will last for at least ten years without replacement.

FLAME INTENSIFIER SYSTEM

We have offered the MACROburn with the all new and revolutionary Flame Intensifier System, which depending on the waste type and regular loading, can give you substantial fuel savings over and above the fuel savings with standard pyrometer control. A detailed test result, available on request, proves a fuel saving of 75,4% on a incinerator burning animal carcasses which is a very wet waste.

FEED RAM

We have included our "underfeed" or "low level" type.

These rams feed through a smaller opening low down in the front plate of the incinerator and cause the waste to enter from below the level of the hearth. Control of the combustion rate and burning characteristics is much improved by this type of unit.

Incinerators with underfeed rams have special hearths with a pyramid shape halfway up the hearth which slopes up from the ram towards the fire grates. The pyramid has the effect of distributing the continuous plug or "sausage" of waste which leaves the feed ram. The hearth slabs are usually perforated to admit force draught underfire air into the waste from below.

The underfeed ram has a cutting edge at the top front of the ram which, together with another cutting edge on the bottom front of the hopper, has a limited capacity of chopping off excess waste.

The above mentioned feed ram system utilises hydraulic oil under high pressure to activate the ram. It is therefore obvious that they all require hydraulic power packs with tanks, pumps, motors, filters etc. On any incinerator which has such an hydraulic system it is relatively easy to install an additional hydraulic mechanism for riddling or shaking the grate. This is extremely effective and does wonders for getting rid of burnt out ash and increasing the burning rate which would otherwise be reduced due to burnt out ash blocking the fire grates.

The standard material of construction is mild steel with a zinc sprayed finish for corrosion protection. Zinc sprayed components develop a polished surface which enables the ram to slide very nicely in the tube. Other more exotic materials such as corten steel, 3CR12, 304 or even 316 stainless steel could be used and can be offered if required.

PRICE AND DELIVERY
1 x Incinerator Model 100B
1 x Standard Mild Steel Chimney
2 x oil Burner
1 x Control Panel
1 x flame intensifier

PRICE:
Automatic feeder

OPTIONAL EXTRAS

Commissioning excl. transport ZAR2600p.day
And accommodation

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DELIVERY

Approx. 24 working weeks from receipt of confirmed order. We will confirm later as present workload is very high.

PRICE BASIS

The price is nett to you and is firm for a period of 60 days. After this period of time, the price is subject to escalation.

TERMS OF PAYMENT

- 25% deposit
- 75% on delivery ex works

The above is required prior to the manufacturing of the equipment

VALIDITY
Our offer is open for acceptance for a period of 60 days from the date of this quotation. After this date it will become subject to confirmation.

OPERATING INSTRUCTIONS

Three copies of our operating instructions will be supplied with the equipment. Further copies are available on request and these will be charged for as an extra.

GUARANTEE

Should any product prove to be defective within 12 months from date of despatch by reason of faulty materials, workmanship, or design, such defects being established and accepted by the Company, the defective part will be replaced or repaired (at the discretion of the Company) free of charge ex works Johannesburg provided that:

The product is found to fail through faults of workmanship or faulty material and is returned to our works for inspection.

The defect(s) has arisen under proper use of the product, such use being in accordance with the Company's Operating and Maintenance Instructions, and does not arise from ordinary wear and tear, improper handling or storage, or overload, or damage caused by associated plant provided by the Purchaser.

In the case of defective goods not manufactured by the Company, no liability is accepted for replacement or repair but the Company will claim on behalf of the Purchaser any benefit available under the warranty of the supplier.

COMMISSIONING

We strongly suggest to use the services of one of our fully qualified commissioning engineers to commission the equipment offered and instruct your operating personnel. The cost for one of our technicians is about ZAR2600 per day excluding all travel and other costs. We estimate 4-5 days.

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PAINTING

Painting of the product will be to our standard specification unless otherwise specified in our quotation. Painting can be carried out to your specification and any extra cost will be for your account.

EXCLUSIONS

* Electrical site wiring.
* Delivery, erection, commissioning
* Platform and stairways.
* Foundation / civil work of any kind.
* Off loading at site.
* Final site painting.
* Translations of operating instruction / drawings.
* Fuel supply and connection to burners.
* Electrical connection.

We trust our offer is in line with your requirements, and look forward to receiving your order.

Yours faithfully

A P THIEME

SAUBATECH (PTY) LTD

INCINERATOR SPECIFICATION

MACROburn INCINERATOR

MODEL: 100B

CHIMNEY AND BREECHING	Description	:	Standard top type Self-supporting
PERFORMANCE	Capacity	:	70 kg/hr (or 100kg/hr)
	Refuse		Hospital Waste – max 15% Plastic (or dry paper)
	Average Moisture	:	15-20% on first one
DIMENSIONS	Height	:	1985 mm
	Length	:	1740 mm
	Width	:	1820 mm
	Loading door opening	:	600 mm x 600 mm
	Grate/Hearth area	:	0,93 m2
	Primary Chamber volume	:	0,89 m3
	Secondary Chamber - total volume	:	1,01 m3
	Minimum stack	:	470 mm diameter
	Approximate weight	:	5600 kg
	Stack height from ground	:	11735mm
MATERIALS	Casing	:	5.0 mm mild steel plate
	Bracing	:	Mild steel channels & angles
	Grate	:	High grade cast iron
	Ashing door	:	High grade cast iron
	Loading door	:	mild steel plate lined with monolithic castable refractory & vermiculite based insulation
	Grate/Hearth support	:	Heavy mild steel sections
	Refractory	:	High Alumina Monolithic
	Insulation - walls	:	Vermiculite based monolithic Castable & calcium silicate
	- roof	:	Calcium Silicate Boards and Airgap
CONTROLS	Draught Control	:	Door operated draught reducer & natural induction

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CONTROLS	Air supply	:	Primary – quarl induction, Vortex interruption & door Operated limitter
		:	Secondary – natural &
		:	venturi induction
	Electric	:	Control Panel, relays,
		:	Isolator, contactors
		:	Circuit breakers
		:	Switches, digital indicating
		:	temperature controller, Pilot
		:	lamps, Pyrometer (indicating)
AUXILIARY FIRING	Fuel	:	Diesel Oil (or natural gas or LPG)
	Primary Burner	:	FBR GX4S or equivalent
	Output	:	236 KW max
	Secondary Burner	:	FBR GX3S or equivalent
	Output	:	168 KW max
EMISSION CONTROL	Macroburn System	:	Automatic regulation of air Distribution, air quantity & Rate of combustion
	Particulates & Fly ash	:	Heated refractory screen
		:	Low velocity grit settling Minimisation of entrainment
ANCILLARY EQUIPMENT	Firing Tools	:	Rake, Straight Poker
:	Peep holes	:	Optional, air cooled, glass Fronted viewing port in Loading door or rear wall
PAINTING	Casing	:	hammerite deep green
	Roof	:	hammerite silver grey
	Stack – mild steel	:	hammerite silver grey
	- 3CR12	:	pickled and passivated
SITE REQUIREMENTS	Foundation	:	Flat & Level concrete base Under the incinerator
	Shelter	:	Weather protection over the Incinerator, in particular the Control panel & burner Optional chimney flashing Cone by Macrotech. Upstand Around hole in roof by others
	Electric Power	:	1phase/220v/10amp/50hz to Isolator in the control panel
	Fuel Supply	:	10mm gravity feed connected To fire valve on the incinerator
	Access	:	Reasonable access to permit the entry of all components of the incinerator and chimney stack to be ensured by others.