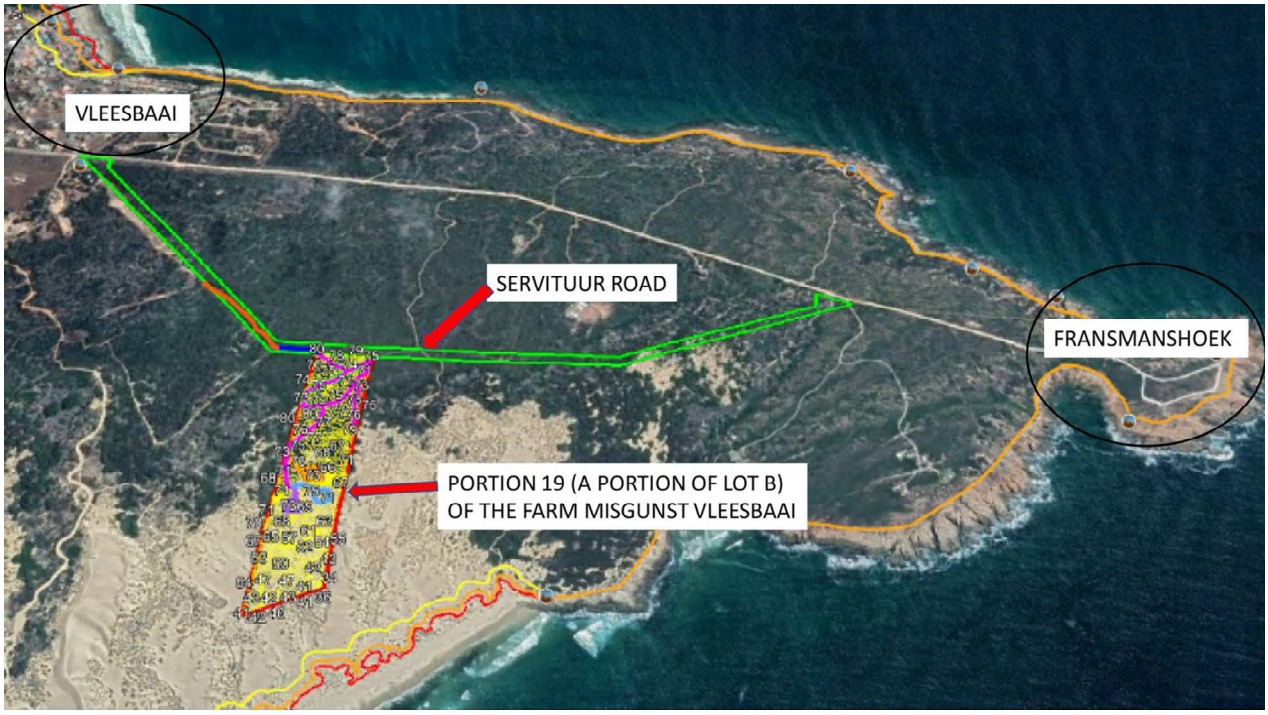
PROPOSED RESIDENTIAL HOUSE ON PORTION 19 (A PORTION OF LOT B) OF THE FARM MISGUNST AAN DE GOURITZ RIVIER, MOSSEL BAY, WESTERN CAPE



B 1043 REVISION 02

NOVEMBER 2020

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Table 1 Current report version

Report Title:	PROPOSED RESIDENTIAL HOUSE ON PORTION 19 (A PORTION OF LOT B) OF THE FARM MISGUNST AAN DE GOURITZ RIVIER, MOSSEL BAY, WESTERN CAPE
Client:	AQUIFER RESOURCE MANAGEMENT (PROPRIETARY) LIMITED
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Table 2 Report revision history

Date	**Rev**	**Written By**	**Issued to**		**Distribution**	**Format**
			Name	**Institution**		
8 April 2020	00	Cobus Louw	Gerhard Steenekamp	Aquifer Resource Management (Pty) Limited	E-mail	.pdf
9 April 2020	01	Cobus Louw	Gerhard Steenekamp	Aquifer Resource Management (Pty) Limited	E-mail	.pdf
23 November 2020	02	Cobus Louw	Gerhard Steenekamp	Aquifer Resource Management (Pty) Limited	E-mail	.pdf

EXECUTIVE SUMMARY

This report presents a brief overview on existing services at the proposed site. Different options of the services involved in the proposed new development are addressed.

Contents

LIST OF FIGURES

1 INTRODUCTION

Cobus Louw Professional Engineer was appointed by Gerhard Steenekamp to prepare the necessary Civil Engineering Service Report for the proposed building of two (2) residential houses on the farm Portion 19, (a Portion of Lot B) of the Farm Misgunst Aan De Gouritz Rivier, Mossel Bay, Western Cape near Vleesbaai in the Municipal District of Mossel Bay Municipality.

The total size of the property is 8,425ha (10.064 morgen).

The development consists of a residential house with a footprint area of less than 500m². This residence will be provided by a basic access road, off grid electricity, water, and on-site sewerage disposal.

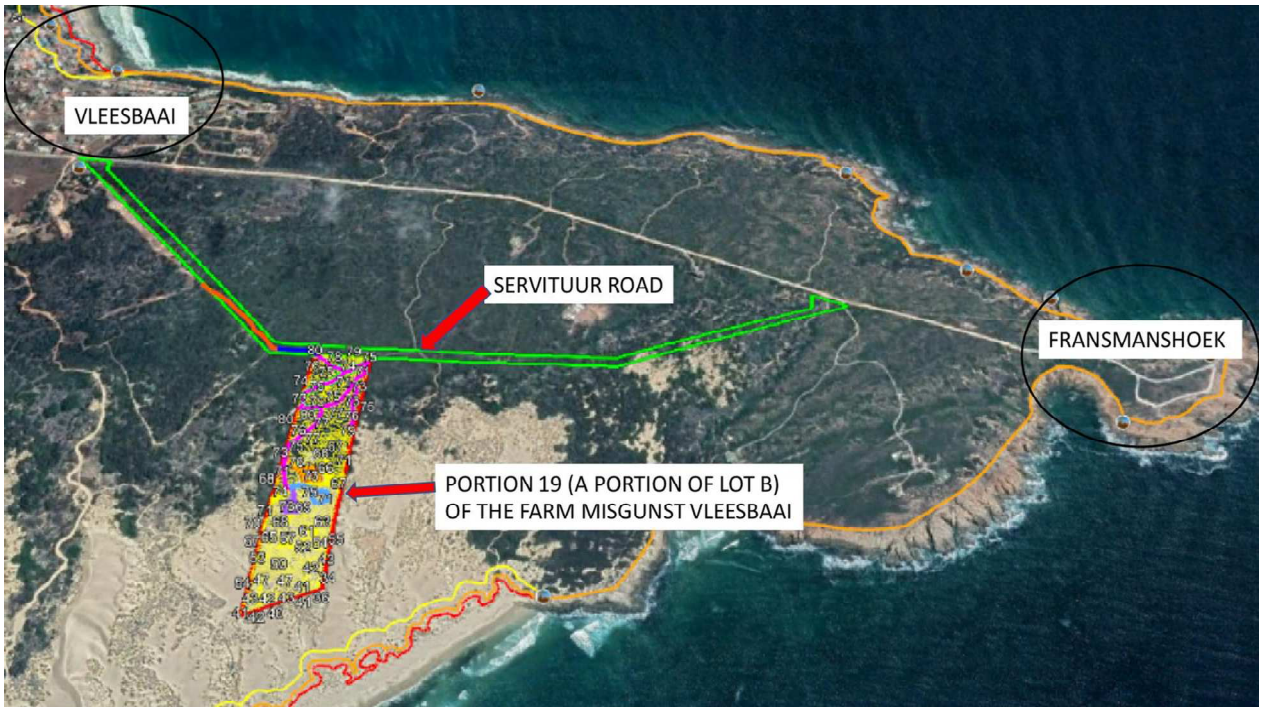

Figure 1 Locality map

2 LAND USE

2.1 Site Development Plan

Currently the zoning is Agricultural 1 (AGR1) for the total area. Application will be made for a consent use under Agriculture I. No rezoning is required.

3 EXISTING SERVICES

3.1 Buildings

None.

3.2 Water

A borehole does exist on the property. The salt content does not make the water suitable for human consumption without a proper desalination proses.

3.3 Sewerage

None.

3.4 Access and Roads

A servitude road exists on the Northern boundary of the property running in an East - West direction connecting to the existing District road from Vleesbaai to Fransmanshoek at both intersections.

The servitude road is nothing more than a Jeep Track. From the Servitude road existing Jeep tracks exist leading to a Southern direction.

3.5 Storm water

None.

The area is naturally drained to a Southern direction with several local low and high points all over the property. Typical of natural dune habitat. Several local depressions create a situation that almost all stormwater runoff will drain via the in-situ sandy soil conditions into the underground.

4 IN-SITU GROUND CONDITIONS

The in-situ soil types encountered are fine grained non plastic sands with a Typical Permeability Class of Moderate to High (600 – 6 000) mm/day.

The bearing capacity of the in-situ soil will typically range from 50-200kPa depending on the depth below natural ground level. At ±2 000mm below natural ground level 200kPa bearing capacity could be expected.

5 PROPOSED CIVIL ENGINERING SERVICES

5.1 House construction

The house structure will consist of a conventional foundation and surface bed structure with lightweight drywall structure above surface bed level. Walls will exist of a combination of fibre cement planks and treated sheet metal.

Figure 2 Typical fibre cement wall cladding

Figure 3 Typical sheet metal wall cladding

The roof will either be a klip-lok or IBR sheet metal profile on a CCA treated timber truss structure.

Figure 4 Typical klip-lok roof sheeting

Figure 5 Typical IBR roof sheeting

5.2 Water

5.2.1 Water during the construction phase.

Due to the expected drywall construction of the proposed house limited water will be required. Water for compaction purposes will be utilized from the existing borehole.

5.2.2 Water for long term household use.

The expected water usage will be between 1 500 – 1 750 litres / day. Water usage network will be split between toilet usage and the rest of the residential usages. The toilet network will be able to function on the borehole water and the rest on harvested fresh water from the roofs.

The recommended freshwater storage capacity for household use is 50 000 litres.

The water storage tanks must be placed in such a way that it does not negatively influence the skyline. We are from the opinion that none of the higher lying areas will provide enough pressure for general household and fire requirements.

For this purpose, a pressure pump will be required for water distribution in and around the house to comply to the minimum residual head for general household purposes of 24m.

5.2.3 Water for Fire-flow design criteria

The area identified for the house could be classified as a low risk area regarding fire risk based on the existing vegetation in the area.

Low-risk areas required a fire flow rate of 900 litre / min for a period of 2 hours at a minimum residual head of 7m. Taking into consideration that the prescribed fire flow is for areas of less than 2 000 dwelling units, the fire flow is thus excessive for only one dwelling.

The average yield of the borehole is 2 000 litre / hour over a 24-hour period. By providing sufficient borehole water storage capacity combined with a short term of max 2 hours extraction from the borehole the required fire flow will be achievable.

5.2.4 General household recommendations

It is proposed that the residential units be equipped with the following water saving technology:

- **Dual Flush Toilets**
- **Low flow shower heads** – It is proposed that the residential units be equip with low flow shower heads, as these can not only reduce water consumption by up to 50%, but also the energy required for water heating by up to 50% (Eartheasy, 2008 - http://eartheasy.com/live_lowflow_aerators.htm). Low flow shower heads make use of either aerators or pulse systems to reduce the flow without compromising the quality of the shower. The choice of shower head is up to the homeowner but must have a flow of less than 7 litres per minute.
- **Low flow faucets** - Low flow faucets use aerators to reduce the flow of the water. These are either built into the faucet or added as an aftermarket product. The faucets in bathrooms should have a peak flow of less than 10 litres per minute.
- **Rainwater Tanks** - All houses should be fitted with rainwater collection tanks for use externally (landscaping, washing cars etc). Consideration should be given to provide solar pumps at each rainwater tank to supply the units more effectively. The overflow from tanks should be directed into the stormwater system. All water sources situated externally on buildings should be fed from these rainwater tanks.
- **Geyser and pipe insulation** - Apart from the savings in terms of energy as detailed above, insulating geysers and pipes save water, as shorter periods of running the tap to get hot water are required. Homeowners must be required to install geyser and pipe insulation; this must be included in their building guidelines.

5.3 Sewerage

The calculated sewerage and grey water generation from the development has been calculated as 500 - 750 litre / day.

It is recommended that all wastewater from the residential units been treated as follows:

- All grey water from bathrooms, laundry and kitchen areas be directly diverted to a constructed / artificial wetland system.
- The water from the constructed / artificial wetland system will be used for gardening purposes.
- All black water (organic products) from the bathrooms, laundry and kitchen areas be diverted to a bio-gas digester with an overflow to the constructed / artificial wetland system soak away system.
- The Bio-Gas Digester will have the following building functions
  - mixes the contents for increased gas generation efficiency
  - naturally decomposes biodegradable materials without additional chemicals
  - stores the biogas that is generated by this natural decomposition
  - generates an internal pressure which allows the biogas to be piped directly to the point of use
  - the digester mixing, gas storage and pressurisation are all achieved without any mechanical input at all i.e. no pumps or motors of any kind.

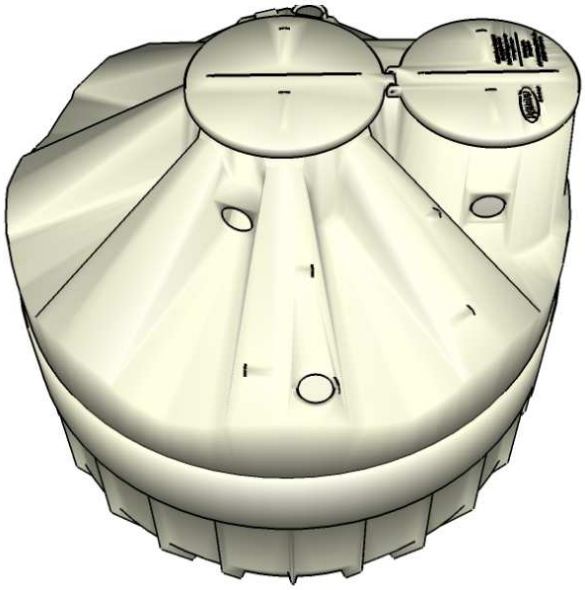

Figure 6 Typical on-site Bio-Gas Digester plant

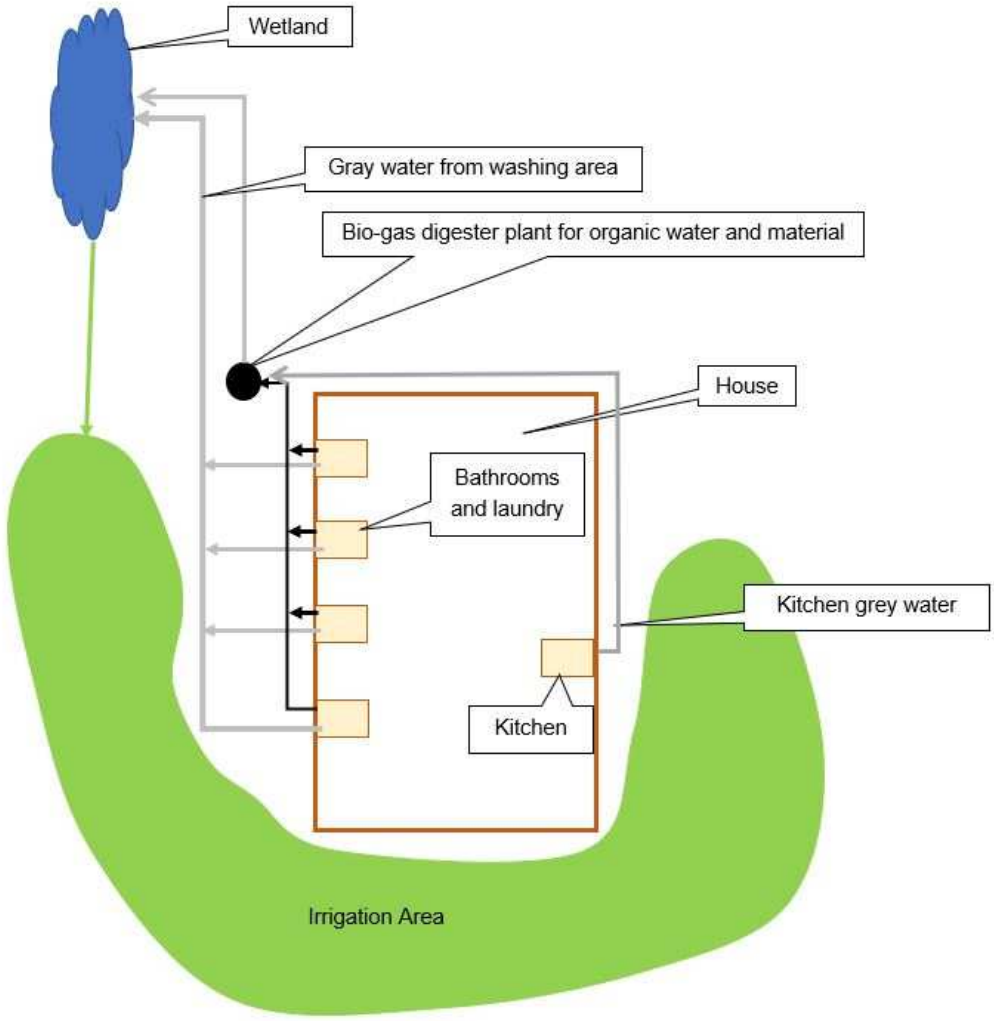

Figure 7 Schematic wastewater treatment on-site

5.4 Access and Roads

Access to and from Portion 19 (a Portion of Lot B) of the Farm Misgunst will be via the existing District Road between Vleesbaai and Fransmanshoek. A Servitude Road will provide access from the latter road to portion 19 of Misgunst.

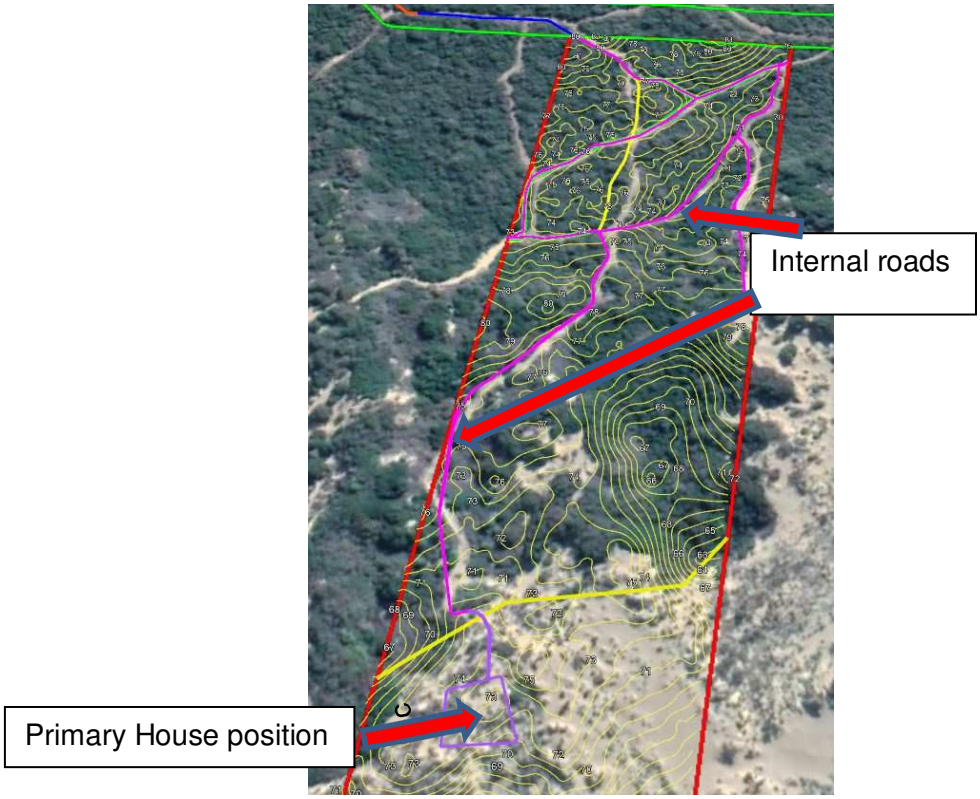

Figure 8 Internal roads on farm

New internal roads and the servitude road is a so called “Jeep Track” existing of 2 vehicle tracks with most of the time lower vegetation growing in between the two tracks. These tracks are 90% accessible with a normal 4 x 2 vehicle. The other 5% of tracks a 4 x 4 vehicle will be required and the last 5% a 4 x 4 vehicle will be required and a driver with good off-road driving skills.

We recommend that for the 10% of the roads where a 4 x 4 vehicle will be required roads are to be built with one or a combination of the following options. Each area will be evaluated to determine the most workable option and to protect the sides next to the road. The road width must not exceed 4m and will be limited to 4 x 2 vehicles.

1. Hyson Cells filled with 15MPa concrete.
2. Tracks build with 20MPa concrete to form 2 concrete tracks each 300mm wide with construction joints at 2m intervals to prevent unnecessary expansion cracks.
3. Grass block in the form off:
    - Concrete pre-cast grass blocks.
    - Tensar TriAx Geogrid for soil stabilisation and grass / low growing vegetation over for coverage.
    - Sudpave plastic grid pavers with grass / low growing vegetation over for coverage.

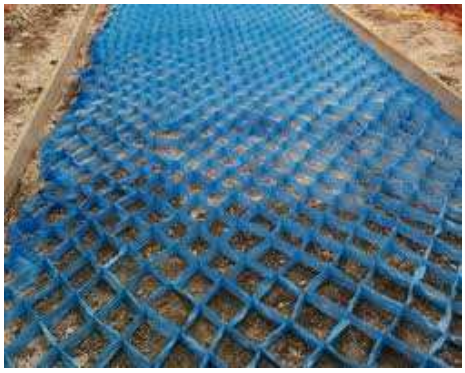

Figure 9 Unfilled Hyson Cells

Figure 10 Hyson Cells filled with concrete

Figure 11 Gravel road built with Hyson Cells.

Figure 12 Completed cement surfaced road built with Hyson Cells

Figure 13 Tensar TriAx Geogrid

Figure 14 Sudpave plastic grid paver (unfilled).

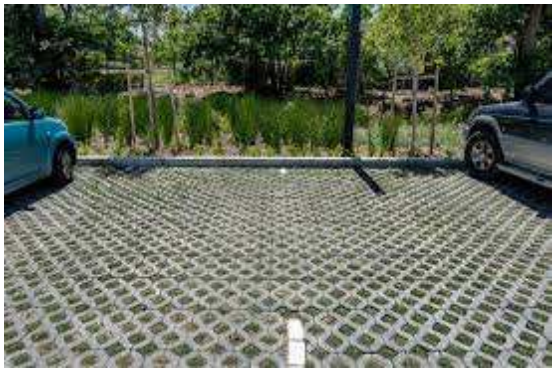

Figure 15 Pre-cast concrete grass blocks

The areas currently accessible with a normal 4 x 2 vehicle could be covered with wood chips harvested from the removal of alien vegetation. This is a non-official way of increasing the driving ability of roads in heavy sandy areas.

5.5 Storm water

The storm water system forms an integral part of the structure plan. The system rest on three legs, the minor system, the major system, and an emergency system. The minor storms are catered for in the road design by creating stormwater management structures for the minor floods while the major storms are routed through a linked system of road and public open spaces using attenuation techniques. The emergency system recognizes failure of the minor system by storms greater than provided for in the major system or in the event or malfunction of the minor system providing continuous overland flow routes as part of the major system to minimize flooding of buildings.

The natural slope of the proposed development is in a Southern direction.

- The minor disposal system will consist of several stormwater management structures build into the road design at the Hyson Cells sections. The rest of the roads will consist of the in-situ soil with good permeability abilities and limited to no disruption of the natural vegetation that act as a superb natural stormwater management entity.
- The major system will make use of the natural low points in the area where water will accumulate, drain, and evaporate over time.
- The emergency system will flow overland in a Southern direction.

The following design criteria will be used:

Minor System: 2 Year return period conveyed in the road design by providing stormwater management structures to prevent road erosion by enabling as much as possible water to naturally soak away.

Major System: 20 Year return period. The difference be-tween the 2 year and 20 year to be conveyed in the natural low points on the property. These low points will act as natural detention ponds from which water will drain and evaporate over time feeding the underground water source.

5.6 Stormwater management

To ensure the sustainability and environmental integrity of a stormwater management plan, it is advisable to consult *The South African Draft Guidelines for Sustainable Urban Drainage Systems*.

Sustainable Urban Drainage Systems (SuDS) focuses on sustainability by attempting to imitate the natural hydrological cycle, something that conventional drainage systems does not focus on. Once an area is developed, the natural permeability of the area is generally reduced as free draining surfaces are replaced with impermeable surfaces such as roofs, roads, and paved areas. This process, together with the fact that subsoil is usually compacted during development reduces the infiltration capacity of the area. As development also results in loss of vegetation, the evapotranspiration of the area is also reduced.

Conventional drainage systems are more focused on reducing flooding and possible flood damage to an area (flood attenuation). The focus of the SuDS process is on flood attenuation as well as promoting more natural, sustainable drainage systems.

5.6.1 SuDS Process

The SuDS principle can be broken up into the following three key areas:

i. Water quantity.
ii. Water quality
iii. Biodiversity

5.6.1.1 Water quantity management

Stormwater quantities can be managed through inter alia the following processes that will be implemented:

- Capturing rainwater for supplementary water uses on site.
- Detaining stormwater before subsequent release.
- Conveyance of stormwater (transfer from one location to another).
- Long-term storage in a specified infiltrating area in the form of a wetland which will
- drain slowly.
- Stormwater outlet structures to act as energy dissipation structures to protect receiving
- watercourses in the event of flooding.

5.6.1.2 Water quality management

Water quality is promoted through cleaning or polishing of stormwater. This can be achieved through inter alia the following processes that will be implemented:

- Sedimentation – reducing flow velocities of stormwater runoff to allow sediment particles to fall out of suspension.
- Removal of nutrients and metals through plant-uptake (wetland).
- Photosynthesis – breakdown of organic pollutants through extended exposure to ultraviolet light.

5.6.1.3 Biodiversity management

Biodiversity management is promoted through the following controls that will be implemented:

- Health and safety plans and implementation to prevent injury or death to people.
- Environmental risk assessment and management to promote longevity of the system.
- Recreation and aesthetics – enhancing visual appearance by creating attractive open spaces.
- Education and awareness – distribution of knowledge about stormwater management among interested and affected parties.

5.6.2 SuDS Selection

To successfully manage stormwater several treatment processes may be required. This multiple process treatment is referred to in the SuDS guideline as a treatment train. A variety of options or combinations of options may be necessary according to the individual requirements of the site. The three key points where intervention is required are as follows:

- Source controls – manage stormwater runoff as close to its source as possible.
- Local controls – manage stormwater runoff in the local area.
- Regional controls – manage combined stormwater runoff from several developments.

5.6.2.1 Source controls

Source control alternatives that were considered include:

- Green roofs are roofs covered in vegetation. The vegetation serves to delay runoff peaks as well as decrease runoff volumes. Green roofs also improve the biodiversity of post development areas. The limitations of this method of control includes a high set up cost due to the need to contract experienced professionals regarding the effects on the structure as well as vegetative requirements; the need for regular maintenance; and the possibility of roof failure if detained water leads to failure of waterproofing membranes. **Due to these limitations this alternative will not be implemented.**
- Sand filters are generally utilised to improve the quality of stormwater runoff. They comprise of a sedimentation chamber as well as a filtration chamber. Filtration through the sand bed coupled with microbial action in the medium leads to removal of suspended particles, heavy metals, and smaller particulates in stormwater runoff. Sand filters are expensive to implement, are generally unattractive and prone to clogging. **Due to these reasons this alternative will not be recommended.**
- Soakaways are excavated pits filled with a porous medium, like coarse aggregate. Soakaways are used for temporary storage of stormwater, which is then allowed to infiltrate into the ground. Soakaways are suitable in most climatic conditions; significantly reduces runoff volume; and has design lives of up to 20 years if maintained correctly. This control is only suitable to small areas where infiltrating water will not adversely affect foundations of adjacent structures. There is also a need for regular maintenance. **The overflow water collected from the roofs of the buildings need to be piped to a soakaway chamber system that does not negatively influence the foundation structure of the residential houses.**
- Stormwater collection and reuse reduces runoff which reduces the potable water consumption rates of a development. Stormwater collection is also a good way to attenuate flood peaks. Storage facilities are easy to find and quick to install but may not be aesthetically pleasing. **Water harvesting will therefore be implemented by means of water tanks that will be required at the proposed building on the site.**

5.6.2.2 Local controls

Local control alternatives that were considered inter alia include:

- Stormwater management structures as part of the hardened road construction sections.
- Make use of the natural vegetation and low points on the premises to act as natural energy dissipating structures and an
- Artificial wetland / detention pond being created on site.

Outlet structures from pipe- or channel stormwater systems will be designed in such a way to act as energy dissipating structures as well as a litter and sediment trap before water is been released into the ocean in the case of a major flood. This will only be applicable for runoff water from hardened surfaces around the primary house.

5.6.2.3 Regional controls

Not applicable to this area since the final run-off is discharged directly into the ocean and no regional controls are available downstream of the site.

5.6.3 Stormwater management plan

5.6.3.1 Water quantity management

To create a more sustainable stormwater management system, a source control in the form of stormwater collection tanks at the building, will be used on site for stormwater to be reused for irrigation and domestic purposes. These tanks will be placed “in-line” on the building’s gutter system. The tanks will make use of an inlet by-pass system which ensures that the initial roof runoff is not collected in the tanks. This ensures that any pollutant build up on roofs will not be flushed into the collection tanks by the first rains, the so-called first flush phenomenon.

The building will be equipped with a surrounding pipe network to accommodate downpipes. The remainder of the stormwater on site will be accumulated and disposed into the artificial wetland.

5.6.3.2 Water quality management

SuDS water quality design is based on the implementation of various control methods which forms a treatment train. If water goes through more than one treatment process, there is more chance of prevention of pollution at a particular site.

Utilising the concept of a treatment train, water quality will first be addressed by parking cleansing for removal of litter and sand sized particles.

Secondly a proper designed outlet structure will control pollution as well as flooding by causing energy loss of the water and the settlement of solids.

In addition to the above, the treatment train proposed for the building area will consist of stormwater collection and re-use tanks.

5.7 Solid Waste

The refuse generated will be of chemical nature.

Two types of refuse will be generated

- Normal household refuse
  Non-recyclable
  Recyclable
  } 0.12m³/Week
- Garden refuse

The following options for disposing of the refuse will be followed.

Normal Household refuse: A distinction will be made on the premises between recyclable and non-recyclable refuse. Both these types of refuse will be delivered to the refuse collection point outside Vleesbaai managed by Mossel Bay Municipality.

Garden refuse: Will be managed on-site by the resident of the home through a composting facility in such a way that it does not pose a fire hazard to the environment.

6 GENERAL

The whole development fall within the Master Planning for the greater Mossel Bay Municipal area.

For any further queries do not hesitate to contact Cobus Louw at 072 4233 208.

Yours truly,

JL LOUW Pr Eng.