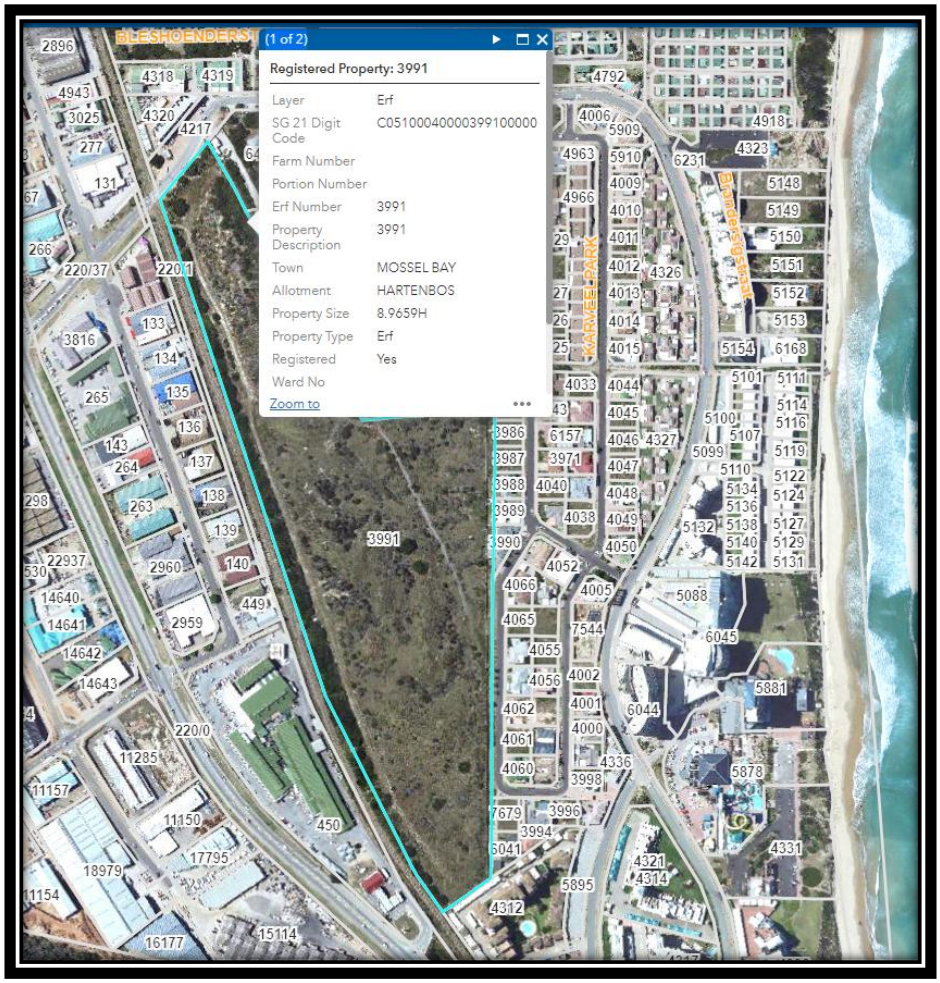
CIVIL ENGINEERING SERVICES REPORT FOR THE DEVELOPMENT OF ERF 3991, DIAS ESTATE, HARTENBOS, DIAS BEACH, MOSSEL BAY



PREPARED BY:	PREPARED FOR:
iThemba Project Managers and Consultants (Pty) Ltd 2012/212050/07	NEOTREND PROPERTIES 2 (PTY) LTD 2014/080944/07
No 26 Outeniqua Bluff, Glentana, 6525	33 York Street, GEORGE, 6529
P O Box 581 Great Brak River 6525	Contact Person: Gustav Gouws
Contact person: DH Gerrits	Tel: + 27 (44) 874 0711
Cell: +27 (082) 944 3654	Cell: +27 (82) 820 7805
info@ithembapmc.co.za	gustav@neotrend.co.za

REVISION 1: 1 JULY 2022

PROJECT DETAILS

PROJECT	***DEVELOPMENT OF ERF 3991, DIAS ESTATE, DIAS BEACH, MOSSEL BAY***
LOCATION	***MOSSEL BAY***
CONTENTS	***CIVIL ENGINEERING SERVICES REPORT***
REPORT STATUS	***REVISION 1***
DATE	***1 JULY 2022***

The purpose of this Civil Engineering Services Report is to prepare an overview of the existing civil engineering services on or around the site, propose civil engineering services for the development that comply with the requirements of Mossel Bay Municipality and provide other engineering input and recommendations.

Report Compiled by:	
Dawie Gerrits	*Date:* ***2022/06/20***
Civil Engineering Director Pr Tech Eng	***ECSA No 200670004***

This report was compiled and reviewed in accordance with iThemba Project Managers and Consultants (Pty) Ltd Internal Quality Management System.

This report is to be referred to as the preliminary civil engineering services report for the development of erf 3991, Dias Estate, Dias Beach, Mossel Bay.

Liability: Liability for this report and drawings will be applicable in terms of the professional services agreement. Liability will be limited to 3 years from the date of the completion of the professional services agreement. Liability will be limited to a maximum amount valued at twice the amount of fees payable to the consultant under the professional service agreement, excluding disbursements and expenses.

ITHEMBA
Project Managers & Consultants

TABLE OF CONTENTS

LIST OF FIGURES:

LIST OF TABLES:

LIST OF PRELIMINARY DESIGN DRAWINGS AS AN ANNEXURE TO THIS REPORT

211117.SW01	Stormwater Layout Preliminary Design Drawing and details
211117.S01	Sewer Layout Preliminary Design Drawing and details.
211117.W01	Water Layout Preliminary Design Drawing and details.
211117.R01	Streets and Parking Layout Preliminary Design Drawing and details.
211117.CS01	Civil Engineering Services Layout Preliminary Design Drawing.

1) INTRODUCTION

Ithemba Project Managers and Consultants were appointed by Neotrend Properties 2 as Civil Engineering Consultants. This report summarises the requirements to provide streets and civil engineering services for the proposed residential development on Erf 3991 known as Dias Estate. Information in this report was obtained from the following sources:

- Site Development Plan (SDP) – April 2022, Coetzee Alberts Architects (Lodewyk Coetzee)
- As-built information for the area from Mossel Bay GIS
- Topographical survey of Erf 3991 and surrounding areas – October 2018, Tommie Visagie
- Geotechnical Investigation Erf 3991 – January 2022, Outeniqua Geotechnical Services
- Report on the availability and capacity of bulk water and sewer services – GLS – May 2022
- Traffic Impact Assessment of Erf 3991 – Urban Engineering (Frans van Aardt)

The proposed development on erf 3991 would consist of 57 x 320m^2 erven, 53 x duplex units, 198 x apartment units (2 x bedroom + 2 x bathroom) and 55 affordable apartment units. At a density of 60 units per hectare, a 40% coverage with [(2x37) + ((15+20+23)/2)] = 103 parking's and a height restriction of 8,5m. Based on the Site Development Plan (SDP), a total of 350 residential units will be constructed on the 8.9659 ha property.

Based on our initial discussion with the Mossel Bay Municipality, Technical Department, (Streets, Stormwater, Water and Sewer) there is sufficient bulk service capacity to cater for the development demands as set out in "Guidelines for Human Settlement Planning & Design" (Red Book).

The objective of this report is to provide both the Municipality and the Developer with a general overview of the availability and capacity of existing bulk services with a view to servicing the proposed development. This report presents the findings of a preliminary desktop investigation relating to bulk services, and further sets out the criteria and standards for the internal services, design constraints and options for the provision of

civil engineering services for the proposed development for the Environmental Impact Assessment and Service Level Agreement required by the Developer.

Fig 1.1 Proposed layout of erf 3991 (SDP REV H)

2) STUDY AREA

Erf 3991 in Diaz Beach is an 8.9659 ha property located east of the N2 highway in Voorbaai, Mossel Bay at the coordinates 34° 09' 28.91" S and 22° 06' 23.96" E.

The site is bounded by:

- **North** – Beach Boulevard East
- **East** – Bardolino's development and Karveel Crescent
- **South** – Portobelo Development
- **West** – Transnet Railway line and light industry from Industrie Way, Voorbaai.

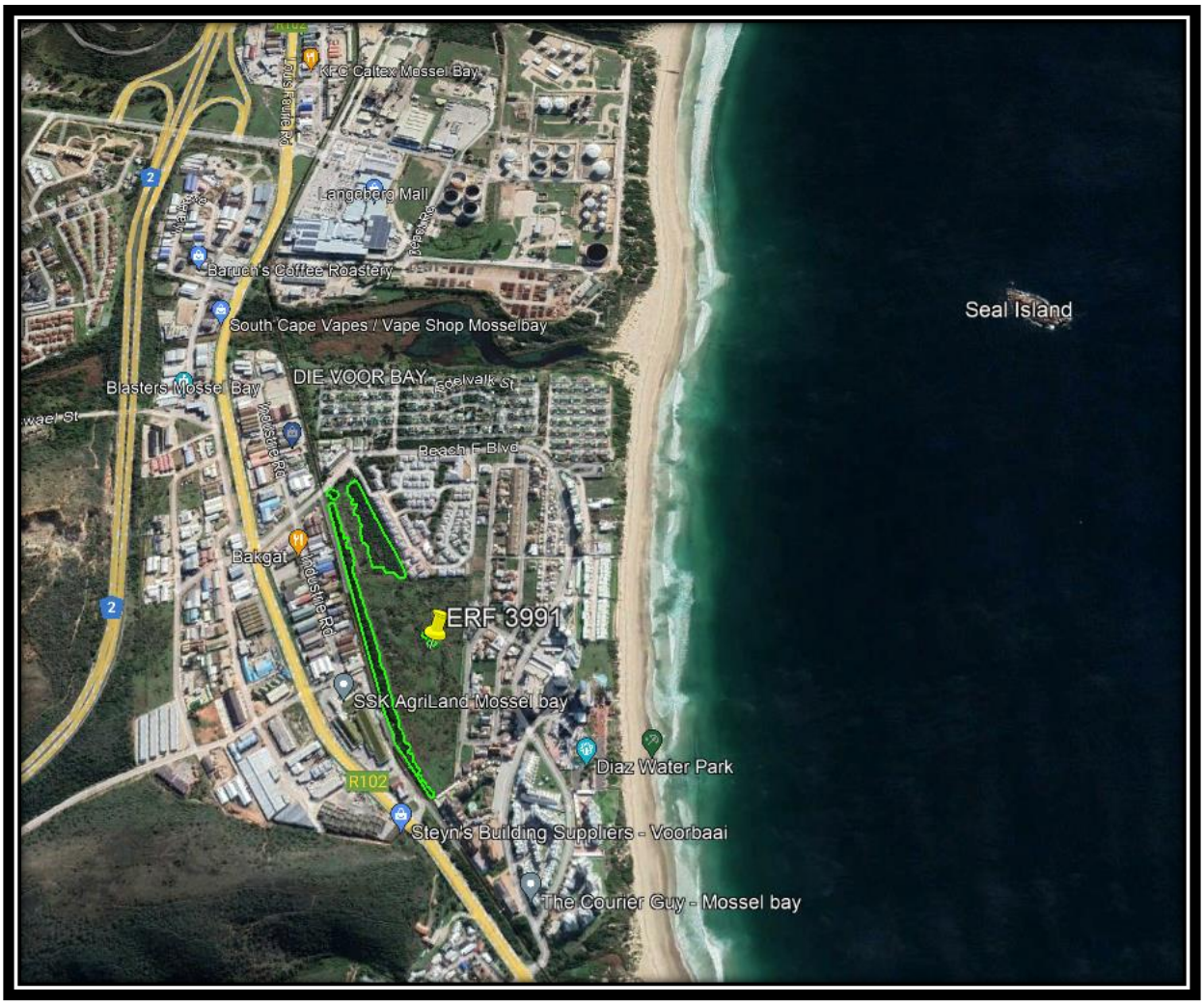


Fig 2.1 Locality of erf 3991 Dias Beach

3) SITE DESCRIPTION

Based on the available information, the following site characteristics are summarised:

- ✓ Access is easily obtainable from Beach Boulevard on the northern boundary and Karveel Cresent on the eastern boundary.
- ✓ The topography on the site is generally very gently sloping, draining generally to the north-east, the ground is hummocky / irregular, indicating some historical earthworks and rubble dumping on the site that would require earthworks to remove unsuitable material and to shape erf to natural slopes in these areas.
- ✓ The vegetation was found to consist of dense coastal fynbos shrubs and bushes and interspersed between patches of disturbed ground with long dry grass or transformed vegetation.

- ✓ The surface conditions are generally dry with no significant drainage features, such as rivers, streams, or marshes.
- ✓ A geotechnical investigation has been done on the property, indicating no significant geological hazards that were evident from observations of the ground surface or within test pits excavated.

4) EXISTING CIVIL ENGINEERING SERVICES

4.1 EXISITNG STORMWATER

Stormwater runoff from the site accumulates within a very small catchment area of 0,89km^2 north-west of erf 3991 with a height difference of 130 MSL – 3 MSL = 127 MSL and longest water course of 1688 m, this results in an average slope of 1.42% over the complete catchment area that can be classified as flat.

The stormwater travel over land approximately 1/3rd in natural habitat, it intersects both the N2 (highway) and Louise Fourie Road before it reaches erf 3991 (proposed Dias Estate development). The rest of the surrounding area is an existing formal street network provided with kerbs and channels and a railway line that runs along the western boundary.

Currently SMEC is busy with a Stormwater Master Plan for Mossel Bay Municipality covering the area East of the development known as Dias Beach. This is work in progress and no detail was available from this Master Plan at the time this report was written.

Erf 3991 is not connected to any formal or official stormwater network but has a natural low area that acts as a detention pond located on the property (mid-eastern boundary) with no overflow (water naturally soak away in this area).

- ➢ The stormwater runoff from erf 3991 is draining towards the existing surface catchment as a detention / retention facility until it naturally drains through the natural dune sand approximately 60 m long x 15 m wide which provides for Water Quality Volume (WQV) = 1 800 m^3 which could assist and extended detention period to satisfy channel protection volume (CPV) to the north-east of the

development with permanent “detention-soakaway” = up to 2m depth before discharging at an new outlet structure will further prevent any peak discharges into the adjoining properties.

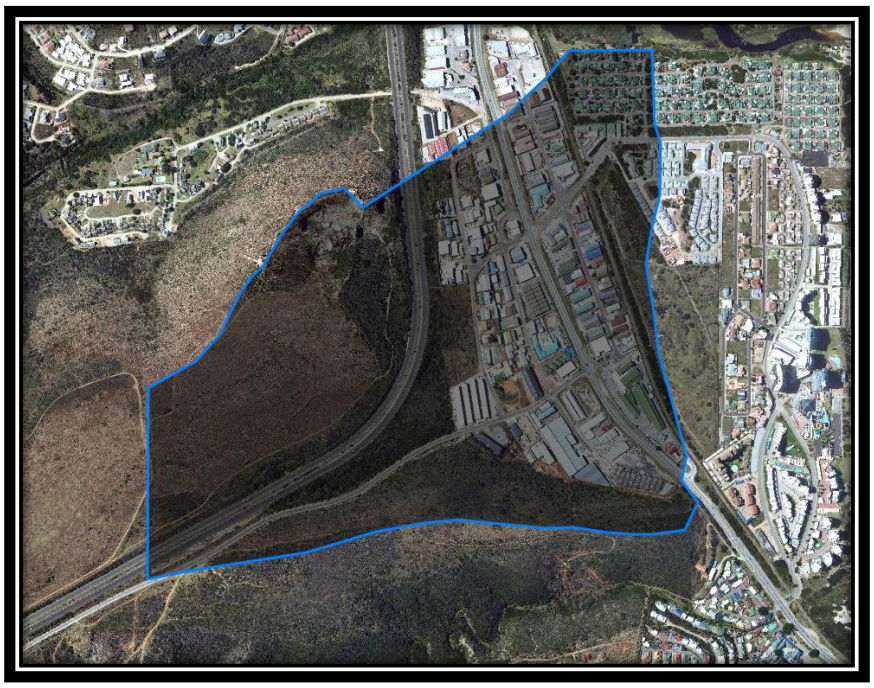


Fig 4.1.1 Catchment area for the development of Erf 3991

Fig 4.1.2 Catchment longest watercourse to the development (Erf 3991)

4.2 EXISTING SEWER

Erf 3991 is intersected by an existing 450mm outfall sewer pipeline, as illustrated in fig 4.2 below. It gravitates to the Voorbaai pumpstation located north of the proposed development from where the sewage is pumped to the Hartenbos WWTP. GLS report shows that the original sewer master plan calculation allowed for the peak day dry weather flow (PDDWF) of the vacant Erf 3991 as 3 kL/d.

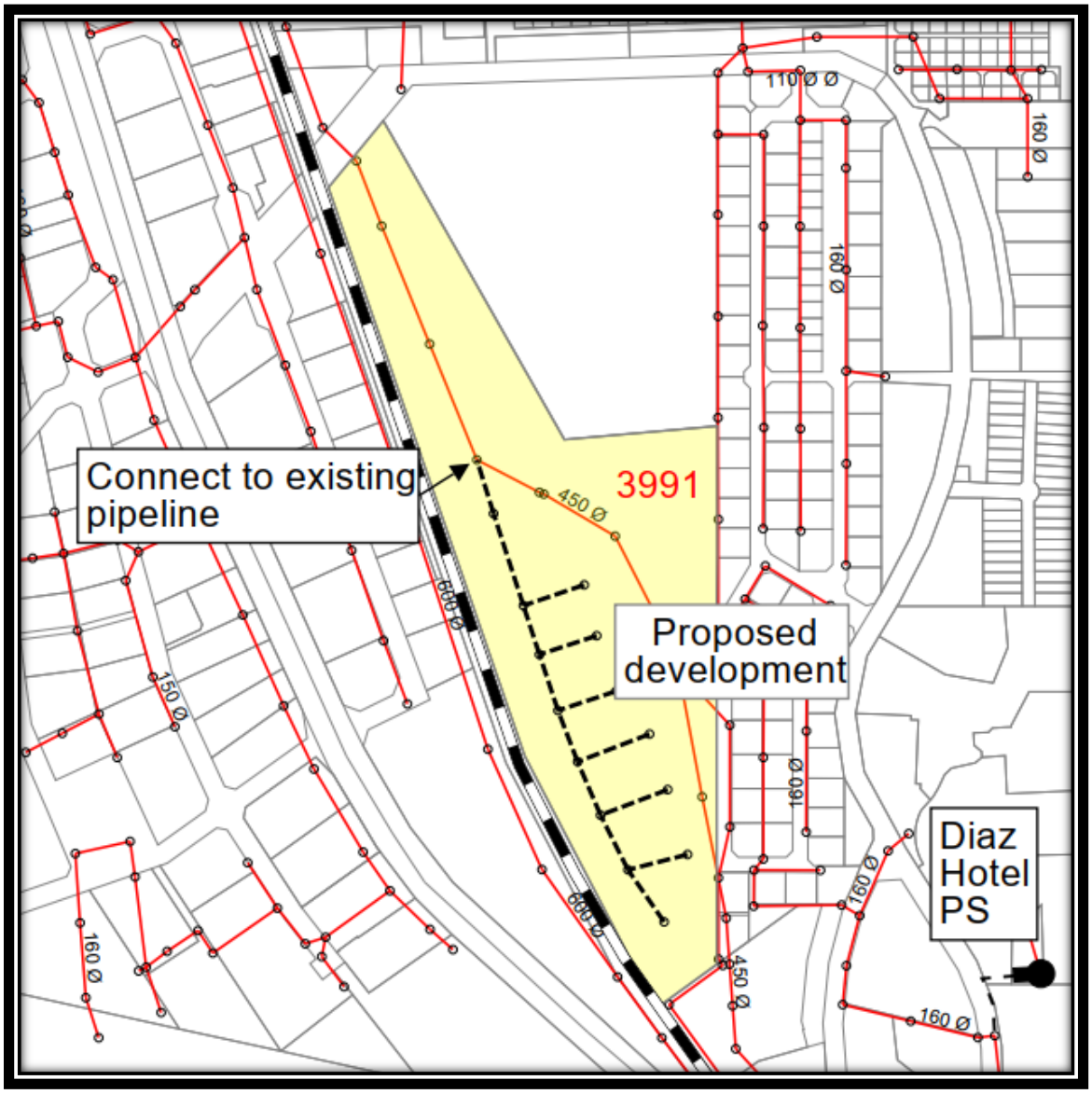


Fig 4.2 Existing Sewer Details from Mossel Bay Municipality

4.3 EXISTING WATER

The proposed development of Erf 3991 in Diaz Beach will be supplied from the Langeberg reservoirs, Top Water Level (TWL) = 80 m with a combined capacity of 17,400 kL. The Langeberg reservoirs are supplied by 2 x 400 mm Ø pumping mains from the Little Brak Water Treatment Plant. GLS report shaws no provision was made in the Master Plan for a future development on Erf 3991. The theoretical AADD allocated to the vacant land, zoned Govt_Institutional for the Master Plan, was 3.2 kL/d. An existing water reticulation network runs along all existing surrounding streets as illustrated in fig 4.3 below.

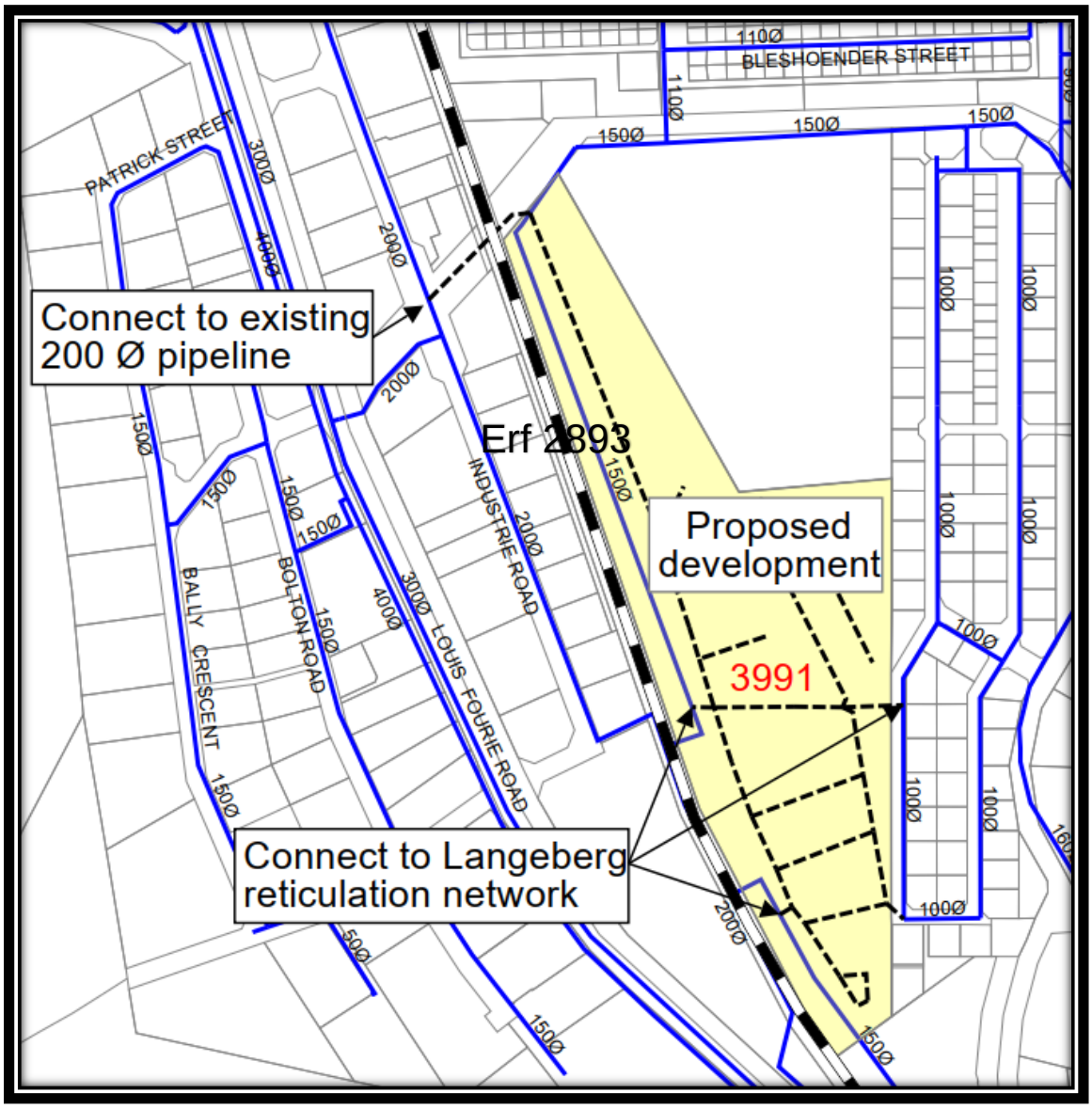


Fig 4.3 Existing Water details from Mossel Bay Municipality

4.4 EXISTING STREETS AND ACCESS

An existing asphalt street network surrounds erf 3991 and the N2 (direction Mossel Bay or George) can be accessed from Louis Fourie Avenue through Beach Boulevard East. The R328 to Oudtshoorn or Great Brak River (R102) can be reached through Louis Fourie Avenue that is currently undergoing major upgrades. A full TIA was done by Urban Engineering (Frans van Aardt (B.Ing, M.Ing, Pr.Eng)) and can ve viewed for more detail.

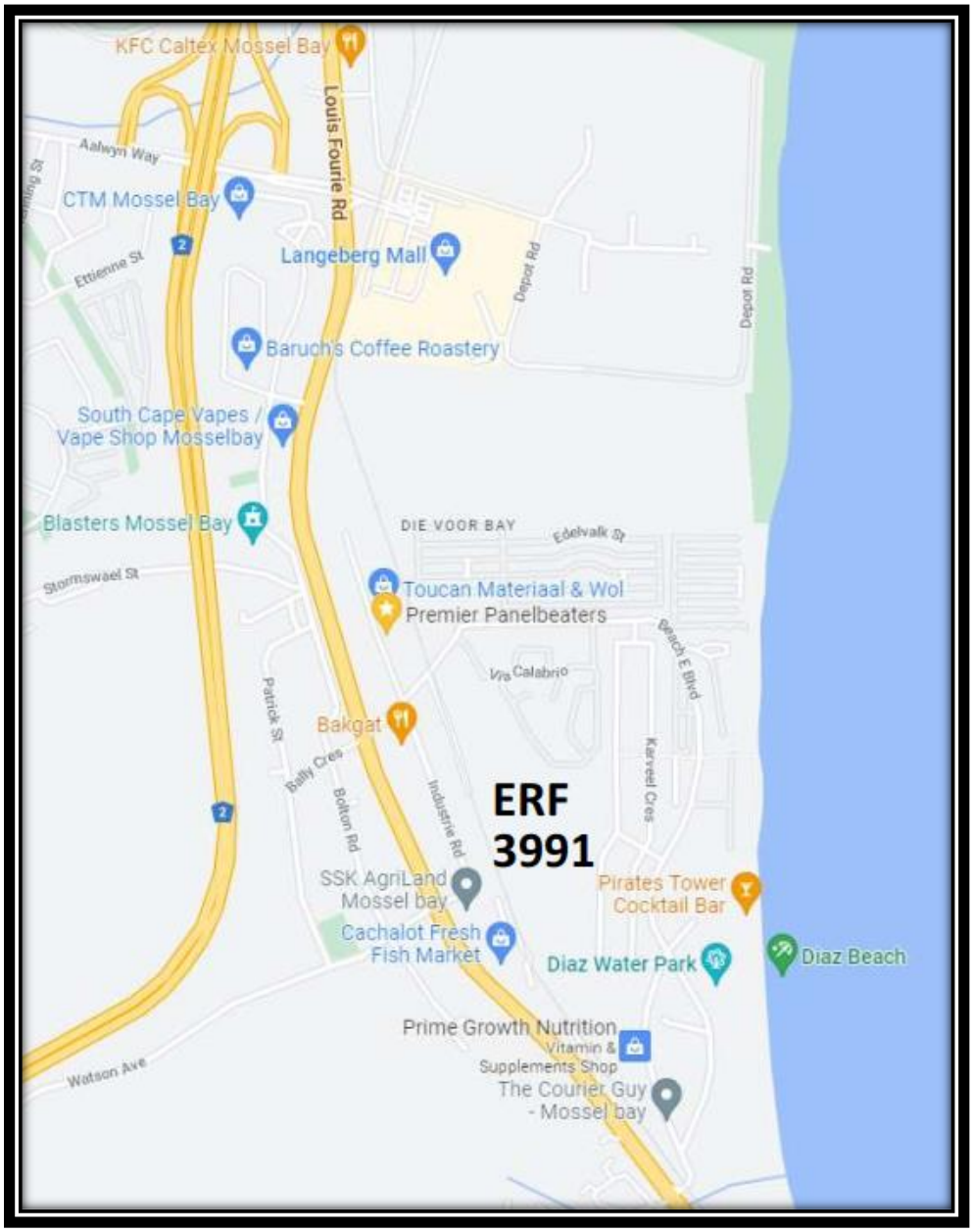


Fig 4.4 Existing Street network details from Google Maps

4.5 BULK SERVICE CONNECTIONS AND RELOCATION

The availability of bulk services is governed by various factors. The main factors relate to future demand and actual implementation dates of approved land-uses. Mossel Bay Municipality will have to update Master Plans for bulk and link services pertaining to streets, water, sewage and stormwater in the area after this development.

However, the development of erf 3991 in Hartenbos Dias Beach will not make a major impact on the Master Plans, as it was previously allowed for and included in the Hartenbos Dias Beach development plan. The development will make use of existing service connections and incorporate the existing as part of the development of the property.

No development may connect to the municipal system unless the necessary bulk and link services are in place. A Services Agreement must be concluded between the Mossel Bay Municipality and the Developer that sets out the services requirements in detail, responsibilities for the provision of the various services, the implementation and funding thereof. Note that information on bulk and link services may change during a long application and approval process as other developments are approved.

On request of Mossel Bay Municipality GLS was asked to provide a report on existing bulk water and sewer infrastructure taking into consideration the new development planned for erf 3991.

Current indications are:

1. Street access to erf 3991 will need to be upgraded (refer to TIA done by Urban Engineering).
2. No Bulk Water Supply upgrading will be required (refer to Capacity analysis of the bulk water & sewer services done by GLS).
3. No Bulk Outfall Sewer upgrading will be required (refer to Capacity analysis of the bulk water & sewer services done by GLS).
4. Stormwater will have to be dealt with on site as no Bulk Stormwater in the Master Plan was provided for.

5) PROPOSED STORMWATER

5.1 PRE-DEVELOPMENT RUNOFF

The runoff for the pre-developed site was calculated by using the flood frequency analysis rational method following hydrological and hydraulic parameters:

- ✓ Stormwater modelling: Excel Calculation Sheet
- ✓ Catchment area: 0,89 km^2
- ✓ Longest water course: 1,688 km
- ✓ Height Difference: 127 m
- ✓ Area: 40% Urban and 60% Rural
- ✓ Mean Annual Precipitation: 450mm
- ✓ Steepness: 100% area between 3 – 10% slope
- ✓ Permeability: 60% Semipermeable and 40% impermeable
- ✓ Vegetation: 60% Grassland and 40% Bare surface.
- ✓ Physical characteristics: 40% sandy flat, 40% heavy soil steep and 20% light industrial.
- ✓ Time of concentration: Tc 0.24

Design storms return period	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**	**1:200**
Average intensity (mm/h)	72	91	112	146	180	225
Peak Discharge (m^3/s)	4.297	5.703	7.499	11.110	15.454	19.319

Table 5.1 Pre-Development Runoff

The above is the configuration for existing site conditions prior to the streets and services installed for erf 3991 as described in this report.

5.2 POST DEVELOPMENT RUNOFF

The runoff for the post-developed site was calculated by altering the catchment parameters to include for the development of erf 3991 and surfacing of previously natural

ground covered areas. The impervious areas consist of proposed building footprints, proposed street and parking areas. The percentage impervious area per catchment is provided with post development results.

- ✓ Stormwater modelling: Excel Calculation Sheet
- ✓ Catchment area: 0,89 km^2
- ✓ Longest water course: 1,688 km
- ✓ Height Difference: 127 m
- ✓ Area: 40% Urban and 60% Rural
- ✓ Mean Annual Precipitation: 450mm
- ✓ Steepness: 100% area between 3 – 10% slope
- ✓ Permeability: 60% Semipermeable and 40% impermeable
- ✓ Vegetation: 60% Grassland and 40% Bare surface.
- ✓ Physical characteristics: 40% sandy flat, 40% heavy soil steep and 20% light industrial.
- ✓ Time of concentration: Tc 0.24

The un-attenuated Post development stormwater modelling results are provided below:

Design storms return period	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**	**1:200**
Average intensity (mm/h)	72	91	112	146	180	225
Peak Discharge (m^3/s)	4.949	6.489	8.401	12.079	16.379	20.474
Peak Discharge increase (m^3/s)	0.652	0.786	0.902	0.969	0.925	1.155

Table 5.2 Post-Development Runoff

5.3 MINOR SYSTEM

In order to satisfy the modern policy for the Management of Urban Stormwater impacts, the proposed stormwater system for the development will comply with the following criteria:

a) Minor storms will be managed through a network of kerb inlets, grid inlets, open channels and below-ground pipes in an on-site underground stormwater system designed to accommodate the more frequent storms up to 1:10 year RI.
b) Channels and pipes will be designed to flow 80% full (20% freeboard allowance) with self-cleansing velocity in the range of 0.75 – 1.0 m/s.
c) The developed site runoff is captured, routed and conveyed along internal streets and parking channels and is discharged into catch pits, connected to a minimum pipe diameter ø 600mm class 8kN/m² Spiral HDPE structured wall pipe (Capability at 2% slope of 0.966 m^3/s) transporting stormwater to an outlet at the first pond located on erf 3991.
d) Runoff quality management controls are provided in the form of upgrading the Stormwater ponds, enhanced swales, bio-retention area for soak away from dams to the natural ravine south-east of the property.
e) As such, new properly designed soakpits for stormwater shall be built, sized on the basis of 1 (one) cubic metre of clear volume to drain each and every 40 square metres of all roofed, paved or otherwise hardened areas on that site. In current calculations 80% percent of the area was used as Hard, impermeable so that makes 304m^2 / 40 m^2 = 7.6m^3 required for soakaway. Each soak away chamber can handle 0.4m^3 of runoff, making the number of chambers required 7.6/0.4 = 19 chambers per unit.
f) There are some alternatives to using soakpits and these include the provision of
g) rainwater tanks which can be used for watering gardens and/or engineered ponds.
h) These may be an attractive alternative to soakpits providing a stored source of irrigation water. The acceptable storage ratio in terms of using rainwater tanks as an alternative to soakpits is 60% of the volume of the tank. In other words, when calculating the volume of storage required (on the 1 m^3 to 40 m^2 area) then 60% of the rainwater tank volume may be claimed on the assumption that the tank is 40% full at any given time.
i) Refer to drawings for the proposed positions of runoff quality management controls. The mentioned controls (performance based) sized to reduce pollutant loads to 80% of Suspended Solids (SS), 45% of Total Phosphorus (TP).

5.4 MAJOR SYSTEM

The internal street network is utilised for the drainage of excess runoff not entering the underground system. The development of erf 3991 allows for overland stormwater to be channelled along streets and discharges into the provided stormwater management facility (ponds, swales and bio-retention areas).

- ✓ Major storms (1:50) will be managed through overland flow via roads and footways, and attenuation storage within public open spaces and within the street network, as appropriate.
- ✓ The street surface with CK1 kerb (Channel) makes allowance for stormwater runoff in excess of 1:10-year RI.
- ✓ Maximum use of SUDS encouraged: Swales (open grassed channels); permeable surfacing (where appropriate); water storage and re-use, etc.
- ✓ The bio-retention areas and stormwater ponds will be designed to manage the developed site's runoff and discharge the pre-development flows to existing and future planned stormwater systems (As per current Stormwater Master Plan by SMEC for the Dias Beach catchment area).
- ✓ No upstream stormwater flowing along the N2, Louis Fourie or Industry Road will be entering the development and no external stormwater routing would be necessary for the development will be able to deal with onsite Storm Water Management.

Refer to drawing 211117.SW01 Stormwater layout Preliminary Design as an annexure to this report.

6) PROPOSED SEWER

Sewage will be full waterborne sanitation from the proposed development and will flow to and be treated at the nearby Hartenbos WWTW. Capacity analysis of the bulk water & sewer services done by GLS confirmed that the additional flow generated by the development could at this stage be accommodated by the Bulk outfall sewer and Wastewater Treatment Works and that an upgrade of the capacity would not be required. Sewer flows are based on the master planning assumptions and analyses by GLS.

The internal sewer reticulation will provide:

- ✓ Optimum pipe gradients to ensure a self-cleansing system and reduce the maintenance on the system.
- ✓ Be water tight through using precast sewer manholes with sealed pipe connections to invert and reduce stormwater ingress into the system.
- ✓ Will accommodate internal peak sewer flows.

6.1 ASSUMPTIONS FOR SEWER MODELLING

The internal sewer is modelled on the following assumptions:

- ➢ The minimum design standards of the Mossel Bay Municipality are maintained.
- ➢ The Harmon Peak Factor method is used for design flow calculations.
- ➢ The maximum pipe capacity equals 80% of the full-bore flow.
- ➢ A minimum velocity of 0.7 m/s is achieved.
- ➢ Each unit contributes the following:

DEVELOPMENT TYPE	UNITS	ADF (l/s)
Stand 320 m^2	59	0.68
Duplex	54	0.47
Apartment 2B2B	182	1.27
Apartment Gap	55	0.29
Commercial (m^2)	800	0.004
TOTAL	**350**	**162 kL/d**

- ❖ Assuming 80% of water usage per dwelling unit.
- ❖ 350 units and a commercial unit for the completed site development.

6.2 SEWER MODELLING RESULTS

The sewer calculation results are as follows:

- ✓ AADF = 162 kL/d
- ✓ Estimated population = 2098
- ✓ Harmon Peak factor = 6.704
- ✓ PWWF = 7.710 l/s

6.3 SEWER PROPOSAL

Based on the results of the Sewer Model the following recommendations are made and the sewerage system will comply with the following criteria:

- ➢ New ø160mm sewer pipelines from erf 3991 will be installed and tie-in to the existing 450mm outfall sewer line on erf 3991, intersecting the development.
- ➢ An internal network of pipes, manholes and inspection eyes.
- ➢ Pipe material will be solid wall type uPVC class 34 (400kPa) To SANS 791 with spigot & socket ends.
- ➢ Pipe sizes will be Minimum ø 110mm and Maximum ø 200mm.
- ➢ All erf / unit connections will be ø 110mm.
- ➢ All manholes will be ø 1.5 m precast concrete manhole-rings with concrete covers and frames (medium duty covers for roadside verges and non-trafficked areas and heavy-duty concrete covers and frames for trafficked areas. It is recommended that all the joints on the precast rings be sealed for water ingress with a 100 mm wide Polyurethane Bandage (combiflex or similar).
- ➢ Minimum gradients for erf connections will be 1:60.
- ➢ Minimum gradients for Sewers main lines will be 1:150 dependent on number of house connections, pipe diameter and length of pipe.
- ➢ Pipe lengths will be 60m maximum between manholes and 40m from inspection eye to manhole.
- ➢ Minimum pipe cover will be 1.2m below roadways / footways and 0.8m elsewhere.
- ➢ All pipe lines will be bedded on a selected granular material. These materials will comply to Class B bedding and SABS 1200 LB and be non-cohesive and be free-draining.

- All internal drainage to structures and units will comply with the provisions of SANS 0252 Part 2: Drainage installations for buildings.

Refer to drawing 211117.S01 Sewer layout Preliminary Design as an annexure to this report.

7) WATER

The internal water reticulation will be provided to achieve the supply of potable water to residents and allow for the required fire flow conditions as guided by the "Guidelines for Human Settlement Planning and Design" as published by the CSIR. Capacity analysis of the bulk water & sewer services done by GLS confirmed that there is sufficient capacity in the existing water reticulation system to accommodate the proposed development.

The proposed development will be supplied from the Langeberg reservoirs, Top Water Level (TWL) = 80 m with a combined capacity of 17 400 kL. The Langeberg reservoirs are supplied by 2 x 400 mm Ø pumping mains from the Little Brak Water Treatment Plant.

7.1 ASSUMPTIONS FOR WATER MODELLING

The proposed water reticulation will be designed to accommodate the following:

- ✓ Domestic Water Demand AADD of 169.20 kL/d
- ✓ Fire Water Demand of 15 L/s

7.1.1 DOMESTIC WATER DEMAND

The proposed water model (domestic) is designed on:

- ✓ Maximum water head of 80m (under zero flow conditions).
- ✓ Minimum water head of 40m (under instantaneous peak demand based on pipe depth of 1.2m, building height of 8.5m and working pressure of 30m).
- ✓ An Average Annual Water Demand (AAWD) for the following:

DEVELOPMENT TYPE	UNITS	UWD (L/u/d)	AADD (kL/d)
Stand 320 m^2	59	0.600	35.19
Duplex	54	0.450	24.45
Apartment 2B2B	182	0.450	81.81
Apartment Gap	55	0.450	24.75
Commercial (m^2)	800	0.004	3
TOTAL	**350**		**169.20 kL/d**

The annual average daily water demand (AADD) for the proposed development as well as the existing stands (fully occupied) in the Langeberg reservoir zone was calculated as follows:

- ✓ Langeberg zone fully occupied = 2 430 kL/d
- ✓ Proposed development = 169.20 kL/d
- ✓ Total = 2 599.20 kL/d

The total occupied water demand of 2 599.20 kL/d amounts to a required reservoir storage capacity of 5 198.40 kL to comply with the required 48 hours of AADD reservoir storage capacity. The existing 17 400 kL Langeberg reservoirs have sufficient capacity to accommodate the existing fully occupied supply area including the proposed development. There is sufficient capacity at the existing Little Brak bulk pumpstation to meet the increased demand at the Langeberg reservoir. There is sufficient capacity in the Langeberg pipe network to accommodate the proposed development.

7.1.2 FIRE WATER DEMAND

At detail design stage the water reticulation for the development will be reviewed to confirm the service for fire flow conditions. The following fire flow conditions will be evaluated:

- Fire Risk Category = Low risk group 2
- Minimum fire flow demand = 500 l/min

- Fire flow duration = 1 hr
- Maximum hydrant spacing = 240 m
- Minimum hydrant flow rate = 500 l/min (8.33 l/s) with residual head of 7m
- Hydrants will not be provided off mains smaller than ø 110 mm.

7.2 WATER MODELLING RESULTS

The domestic water calculation results are as follows:

- AADD = 169.20 kL/d
- Number of Equivalent Erven equating 1000 l/day) = 169
- Instantaneous PF = 8.0 (based on the ee)
- Peak Domestic Water Demand = 8.03 l/s (instantaneous flow)
- Optimum Water Velocity = 0.6 to 1.2 m/s

7.3 WATER PROPOSAL

Based on the results of the Water Model the following recommendations are made and the water reticulation will comply with the following criteria:

- 4 x municipal connection is to be made as per GLS recommendation 3 on the Langeberg reticulation network (2 x 150mm diameter and 1 x 100mm diameter) and 1 x connection to a 200mm diameter distribution line in Beach Boulevard East, complete with water meters, valves and strainers.
- Internal pipe sizes range from ø 75 mm to ø 200 mm and will supply all the units in the development.
- The internal water reticulation system will comply with the following criteria and consist of the following:
  - Internal pipes will be sized to cater for the instantaneous peak demand and fire flow. The relevant peak factor is dependent upon the number of units served.
  - All water lines will comply with the requirements of SABS 1200 L: Medium Pressure Pipe lines. Flanges and accessories shall be drilled to comply with BS 4504, table 16/11 for working pressure of 1600 kPa.

- Reticulation network will have a ø 75mm – ø 200 mm uPVC Class 12 pipe to SANS 966. Pipe class (pressure rating): dictated by static water pressure (likely class 12).
- Erf connections – ø 32 mm and 20 mm PN12 HDPE to ISO 4427 and SANS 533 JASWIC approved.
- Metered connection to each unit with a Class C semi-positive displacement wet dial meter and end cap.
- Minimum residual pressure: 8m (peak flow) and 6m (peak + fire flow).
- All isolating gate valves shall be resilient seal valves, epoxy coated ductile iron, double "Euro" socketed, anticlockwise closing, with capped top and non-rising spindle for uPVC pipes. Position will comply with municipal standards and no valve will be installed in road surfaces.
- All cast iron fittings shall be Rilsan coated and after installation all fittings, specials, valves and the appurtenant nuts and bolts shall be covered with a protective paste (Densopaste or similar) and thereafter the smeared surfaces shall be wrapped in an impregnated tape (Densotape or similar). All bolts and nuts shall be stainless steel.
- Fire hydrants will be the London Bayonet type, spaced maximum 240m apart. Minimum flow rate = 8.33 l/s per hydrant at minimum residual head = 6m.
- All pipe lines will be bedded on a selected granular material. These materials shall comply to Class B bedding and SABS 1200 LB and be non-cohesive and be free-draining.
- Internal supply to buildings and structures will comply with the provisions of SANS 0252: Part 1: Water supply installations for building

Refer to drawing 211117.W01 Water layout Preliminary Design as an annexure to this report.

8) STREETS, ACCESS AND PARKING

The road hierarchy and access to the development are covered in a separate report and recommendations covered by Urban Engineering (Frans van Aardt). In short, the various components of this Transportation Investigation can be summarised as follows:

Road Classification: Based on the Mossel Bay Municipality Road Master Plan (Goba Hatch, Feb 2015) Street are classified as Class 4 Collector Roads

Road Widths: Beach Boulevard East Street is 7m wide, while Karveel Street is only approximately 5m wide.

Road Master Planning: The Mossel Bay Roads Master Plan (Goba Hatch, Feb 2015) indicates that in the future, Beach Boulevard East Street will provide an important transportation link between Hartenbos, Dias Beach and Mossel Bay.

Development Particulars: The proposed development is in the form of an estate consisting of 350 units.

8.1 ACCESS

This rest of this report deals with the internal streets and parking requirements within the development of erf 3991. Access to the erf 3991 proposed development is to be formalised off Beach Boulevard East Street along the north as a gated entrance and Karveel Crescent along the east boundary of the property will provided for emergency exit movement. The rest of the street layout is proposed in a P shape and is adequately sized to accommodate the movement of refuse and delivery trucks.

8.2 INTERNAL STREET NETWORK

The geometric design, cross section and structural design of the streets are based on accepted standards for the class of street proposed. All road surfacing will be brick paving in order to compliment the aesthetics and landscaping. Kerbing will be precast concrete MK10 edging and CK1 with channel for stormwater flow. The final road layer works will be finalised during the detail design stage of the project.

8.3 INTERNAL STREET PROPOSAL

Outeniqua Lab was requested to do a Geotechnical investigation and the full report is available separate from this report. The information in this report is based on the geotechnical report, visual appraisal of the site and our experience on developments with very similar soil conditions in the area. Based on these observations, it is our opinion that conventional road design and construction methods will suffice. Materials for road construction will be sourced from commercial sources. The subgrade beneath the access street and paved parking areas shall comprise of in-situ materials which, when compacted, will provide an excellent subgrade for paved areas. Final layer works will be dictated by municipal standards.

The proposed internal streets will comply with the following layer works design criteria:

- Roadbed surface will be tested and confirmed to be G7 type material, it will be excavated, ripped for at least 150 mm deep and be compacted to a 93% MOD AASHTO maximum dry density (if dune sand 100% MOD AASHTO is required). If CBR is less than 15% an additional 150mm thick G7 layer would be required
- Sub-Base layer will be a 150 mm thick G5 layer imported from commercial sources and compacted to 98% MOD AASHTO maximum dry density.
- The semi-permeable wearing surface of all the roads will consist of segmented paving blocks, 60 mm thick (30MPa) and placed on 20mm thick river sand bedding paved in herringbone pattern and edges constructed with a bevel edge header course against the kerb line of a different colour (to be confirmed with the client and architect).
- A minimum longitudinal fall of 0.75% will be the design goal to prevent ponding.

The proposed internal streets and parking will comply with the following geometric design criteria:

- Min centreline radius: 15m (widening at bends where appropriate).
- Min kerb radius: 8 m.
- Longitudinal gradients: 0.75% minimum and 12% maximum.
- Vertical curve minimum length - 20m.
- The minimum street crossfall will be 2.5% and be sloping against the natural gradient of the site, forming a V-drain swale for stormwater ingress.
- The internal road width will be 6 m wide kerb to kerb.
- Parking access shall comply with the municipal standards and requirements, parking's must be sized at a size of 2,75m wide x 5.5m long minimum.
- No provision for public transport infrastructure and amenities was made.

Refer to drawing 211117.R01 Streets layout Preliminary Design as an annexure to this report.

9) TELECOMMUNICATION / SLEEVES

The installation of cable sleeves and draw boxes will form part of the Civil Engineering services. The installation of all telecommunication sleeves will be in accordance with the requirements of SABS 1200 LC, with draw boxes and connections to all units. All (2 x) cable ducts will be 110 mm ø Kablbelflex pipes, with 600 x 600 mm junction boxes and 2 x 50 mm ø HDPE PN 4 pipe ducts will serve each individual unit. All manholes / draw boxes will be brick-built chambers with medium duty covers and lids, all outside the street reserve.

10) ELECTRICAL

Electrical services will be provided in accordance with a separate electrical services report compiled by BDE Consulting Engineers. The installation of electrical sleeves will be covered with the detail design of the development and electrical sleeves will form part of the construction of the services. The installation of electrical sleeves will be done in accordance with the construction standards specified within SABS 1200 LC and will be similar to item 9 above.

11) SOLID WASTE MANAGEMENT

The development of erf 3991 being a private gated development, will provide a suitable refuse area for the collection of solid waste generated in the development. This refuse area will be constructed along the northern boundary at the entrance of the property in Beach Boulevard East Street. The development will provide access in accordance with the municipal requirements that waste from the development be collected as part of the normal municipal service by Mossel Bay Municipality. The regional landfill site is assumed to have adequate capacity to cater for the proposed development.

Based on the guidelines for Human Settlement Planning and Design we summarise the solid waste to be as follows:

- Average solid waste per household: = 0.12 m^3 / week,
- Total solid waste (350 units): = 43.56 m^3 / week.
- Consideration could be given to a Load Lugger (skip loader) with 5 x bulk skips of 10m^3 (area for skips required 5 x 3.5m wide x 10m long).

The developer will provide a common collection point at the entrance to the property for collection by the Municipality.

12) CONCLUSIONS

The following guidelines and references were used as the basis for the assessment and compilation of the preliminary civil engineering service report for the streets, stormwater, water, sewage, and solid waste services for the proposed development on erf 3991:

- The “"Guidelines for Human Settlement Planning and Design” compiled under patronage of the Department of Housing by CSIR Building and Construction Technology"
- SANRAL drainage Manual, 5th Edition (October 2007).
- Generally applied standards, guidelines or standards as may be required by a Municipality, Provincial or National authority where applicable.

The findings and conclusions in this report are based on preliminary desktop studies and meetings with Neotrend Properties 2 (PTY) LTD (Developer), Mossel Bay Municipality, Delplan (Town planner), Cape-Eaprac (Environmental Specialist), Coetzee Alberts (Architects), Urban Engineering (Traffic Engineer), BDE Electrical Engineers. Note that information on bulk and link services as reported may be amended over an extended period of time if approvals take excessively long to conclude and no erven will connect to a municipal service unless the municipal capacity has been confirmed and approved by Mossel Bay Municipality.

12.1 Water for the proposed development can be provided by connecting to the existing municipal reticulation network as indicated in the GLS report.

12.2 Sewer for the proposed development can be provided by connecting to the existing municipal outfall sewer intersecting the erf. It was confirmed by GLS that the additional flow generated by the development could be accommodated by Outfall sewer line and the Hartenbos Wastewater Treatment Works.

12.3 Stormwater generated by the development will be managed within the site to ensure the runoff rates for the full spectrum of design storms do not exceed the runoff rates from the pre-developed site, where feasible. The minor storms will

be managed with a formal stormwater system comprising of a combination of SuDS, catch pits, inlets, channels and pipes. The major storms will be conveyed and managed overland via the streets and public open spaces. Three types of proposed stormwater structures, with incorporated erosion protection measures, have been considered: swales (open grassed channels), bio-retention areas and a stormwater detention pond.

12.4 Access, streets and parking will be provided from the existing street network, comprising the access to the property from Beach Boulevard East Street (Detail from Urban Engineering report) and emergency entrance / exits in Karveel Cerement. Semi-permeable Concrete block paving will be used on constructed road layerworks and formal kerbing to achieve vertical and horizontal design standards.

12.5 Solid Waste generated by the development will be collected and managed by Mossel Bay Municipality as part of the normal municipal service.

12.6 Based on the findings of this report the conclusion can be drawn that suitable civil engineering services can be provided for the development of erf 3991, Hartenbos, Dias Beach, Mossel Bay and that we do not foresee any major engineering constraints, which will make the property unsuitable for residential development in the foreseeable future.

Yours sincerely

Dawie Gerrits

Pr Tech Eng and Pr CPM

Technical Director

for Ithemba Project Managers and Consultants (Pty) Ltd

Cel: +27829443654

email: dawie@ithembapmc.co.za

LIST OF REFERENCES

- ***Georgia Stormwater Management Manual – Vol.1: Stormwater Policy Guidebook.*** *Prepared for Atlanta Regional Commission, August 2001*
- ***Georgia Stormwater Management Manual – Vol.2: Technical Handbook.*** *Prepared for Atlanta Regional Commission, August 2001*
- ***Management of Urban Stormwater Impacts Policy – Version 1.1.*** *Prepared for Catchment, Stormwater and River Management Branch, City of Cape Town: Transport Streets & Stormwater Directorate, May 2009.*
- ***Floodplain and River Corridor Management Policy – Version 2.1.*** *Prepared for Catchment, Stormwater and River Management Branch, City of Cape Town: Transport Streets & Stormwater Directorate, May 2009.*
- ***Guidelines for Human Settlement Planning and Design.*** *Prepared for The Department of Housing, Republic of South Africa.*
- ***Green-Ampt Infiltration Parameters for Soils Data.*** *Prepared for Journal of Hydraulic Engineering, American Society of Civil Engineers, January 1983.*
- ***Visual SCS-SA: User Manual – Version 1.*** *Prepared for School of Bio-resource Engineering & Environmental Hydrology, University of Kwazulu Natal, September 2004.*
- ***Urban Hydrology for Small Watersheds.*** *Technical Release 55, U.S. Department of Agriculture, Washington, DC.*
- ***Stormwater Management Model (SWMM): User Manual – Version 2.*** *Prepared for Water Supply & Water Resources Divisions, US Environmental Protection Agency, November 2004.*
- ***Transportation Investigation Report.*** Prepared by Urban Engineering (Frans van Aardt)