Remainder of Farm 479, Oakhill

Remainder of Farm 479, Oakhill, Plettenberg Bay, Western Cape

Civil Engineering Services Report

Revision: C (*September 2024*)

Prepared for:	Prepared by:
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Table of Contents

List of Appendixes

List of Figures

List of Tables

1. Executive Summary

VITA Consulting Engineers has been appointed by Sleep-over ZA (Pty) Ltd as the Civil Engineering Consultants for the proposed development on Remainder of Farm 479, Plettenberg Bay.

The proposed development is classified as a Greenfields Development, consisting of the following amenities:

- Resort Zone 1 (*Group Housing*) – 50 Units (*30m²*)
- Entrance facility/guardhouse/maintenance and storeroom – 3 Units (*90m² total*)
- Clubhouse and Entertainment Area – 2 Units (*282m² total*)

The objective of this report is to address all civil engineering issues generated by the proposed development and to provide sufficient information to the local and provincial authorities in terms of the required roads- and civil engineering infrastructure for the proposed residential development.

The following documents and guidelines have been used in the civil services infrastructure design and management implementation of this development:

- The Topographical Survey
- The Site Development plan compiled by Meyfin Projects (*dated 22 August 2024*)
- Municipal Services Capacity Analysis Report compiled by GLS Consulting (*18 March 2024*)
- Traffic Statement compiled by Urban Engineering Consultants (*dated 17 August 2024*)
- Guidelines for Human Settlement Planning and Design (CSIR "Red Book")
- The South African National Roads Agency Limited: Drainage Manual

2. Locality

The development site is situated on the Remainder of Farm 479, Plettenberg Bay. The development site comprises of an area of approximately 1.89 hectares of the total 54.41ha of Farm 479. The development site is situated on the north-eastern outskirts of Plettenberg Bay, approximately 15km from the CBD, between the Crags and Nature's Valley. The development is located within the Bitou Municipal district.

The proposed development site is situated on a trapezoidal shaped portion of approximately 18,970m² inside the boundaries of Farm 479. Access to the site will be gained through the existing intersection (*off the N2*) to the Plett Puzzle Park along the western boundary of the site.

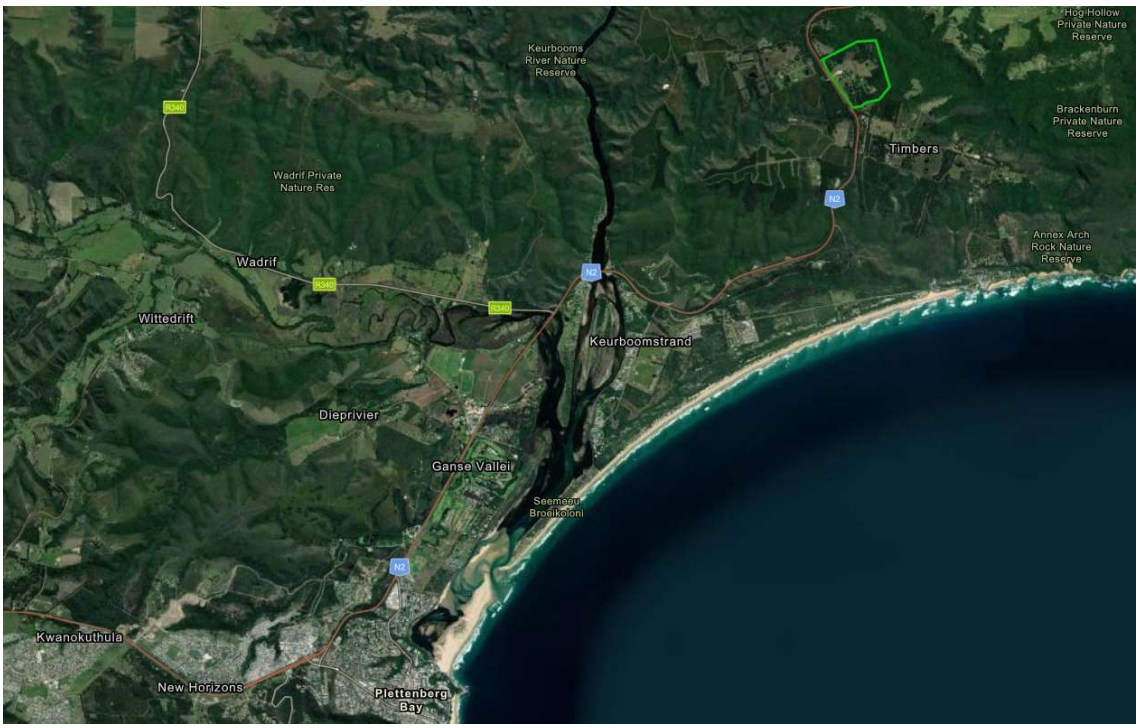

Figure 2-1: Locality – Remainder of Farm 479, Plettenberg Bay *(Cape Farm Mapper)*

3. Pre-Development Conditions

3.1 Site Topography

The topographical survey indicates that the property has a varying topography, sloping in a northern direction. The lower lying northern portion has fairly steep slopes (*approximately 20 - 25%*), while the higher lying southern portion has more gradual slopes (*approximately 4 - 7%*). The highest portion on the southern boundary is approximately 217msl and the lowest portion on the north-eastern corner of the site is approximately 190msl.

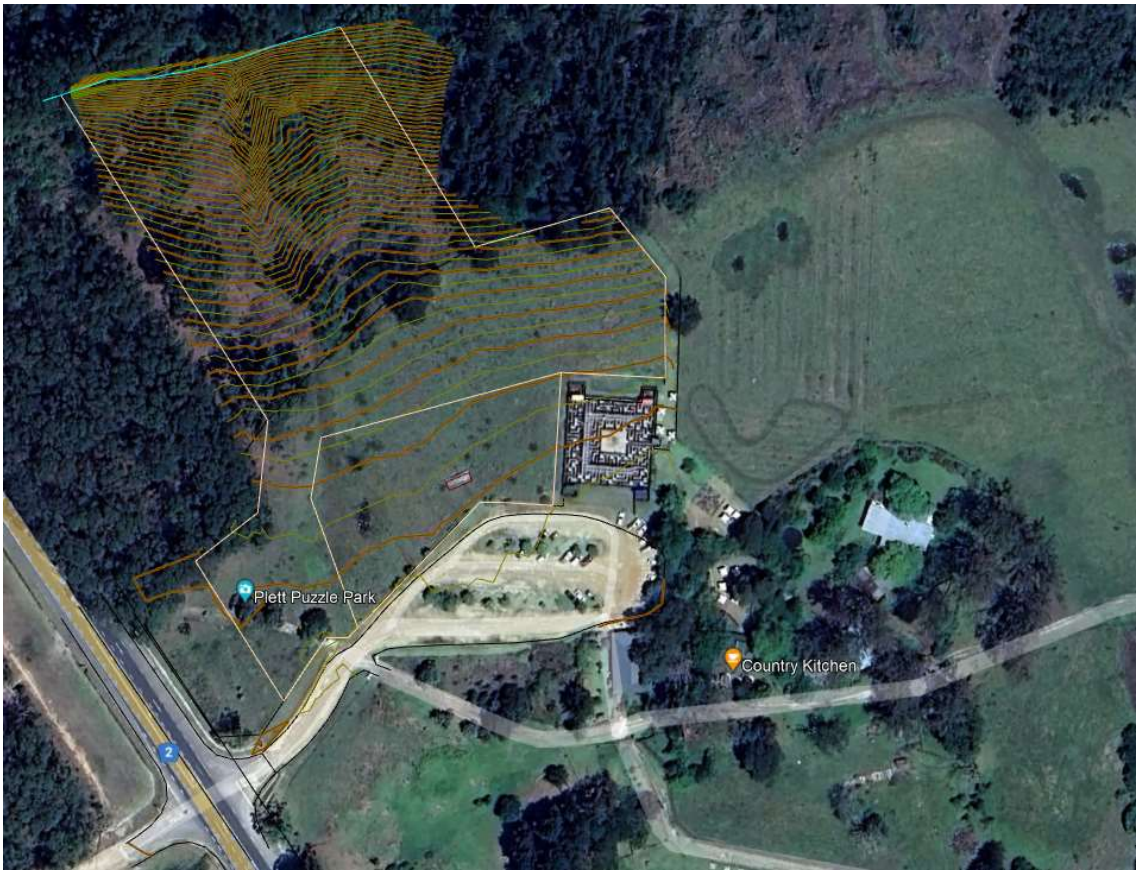

Figure 3-1: Topographical Contours – 0.5m intervals

3.2 Site Vegetation

The site is covered by grasslands (*southern portion*) and a large Bluegum Tree forest (*northern portion*) with scattered shrubs, indigenous fynbos and alien vegetation. The biodiversity map shows that the site falls within the Garden Route Biosphere reserve and therefore the proposed SDP layout ensures that the housing units and roads/civil services infrastructure do not encroach into environmentally sensitive areas.

3.3 Site Geology

The site is situated on the Ceres sub-group (*Cape supergroup*). The insitu materials on site is characterized by a relatively consistent soils profile.

The insitu material consists of dark brown silty sand and sandy clays. A dense root-bed with organic rich topsoil of approximately 0mm - 300mm thickness make up the top portion of the natural soil profile.

The insitu soils have an expected bearing capacity of approximately 100-125kPA, which will/must be confirmed by a suitable structural engineer for each individual units' foundations.

The road and erven footprint will be cleared of vegetation and the top 0 - 300mm of organic rich topsoil will be stripped and stockpiled for re-use as part of the landscaping.

4. Description of the Proposed Development

The proposed development will consist of the rezoning of a portion of Remainder Farm 479, Oakhill, to Resort Zone 1. The Resort Zone 1 will make provision for the following:

- Phase 1: 30 x Holiday Resort/ Hospitality Units (*28m² each*)
- Phase 2: 10 x Holiday Resort / Hospitality Units (*28m² each*)
- Phase 2: 10 x Holiday Resort / Hospitality Units (*28m² each*)

Figure 4-1: Proposed Site Development Plan (*Meyfin Projects*)

Each individual unit will be approximately 28m² in size and will consist of a single bedroom and bathroom.

The remainder of the development will consist of the following (*implemented in phase 1*):

- Clubhouse / Café: 163m²
- Covered Entertainment Area: 119m²
- Manager Unit: 27m²
- Security /Staff Quarters: 22m²
- Storeroom: 40m²
- Roads: 2,092m²
- Footpaths: 920m²
- Parking Bays (*1 per unit*): 50 bays (*934m²*)

5. Site Clearance

All road footprints and services corridors will be cleared of vegetation and the top 0 - 300mm of organic rich topsoil will be stripped and stockpiled for re-use as part of the landscaping.

In order to preserve the natural vegetation on site, care will/must be taken to not disturb any areas outside of the required civil works footprint.

6. Roads and Parking Areas

6.1 External Roads

Access to the proposed development will follow the existing entrance to Plett Puzzle Park, situated off the N2 which falls under the jurisdiction of SANRAL.

Figure 6-1: N2 Intersection (*aerial view*)

The existing intersection layout has dedicated left- and right- turn lanes, with the access situated on a straight alignment in both the horizontal and vertical direction. Sufficient sight distances of *more than 500m* is available in both directions and no upgrades to the existing intersections is required (*as per UEC Traffic Impact Statement*).

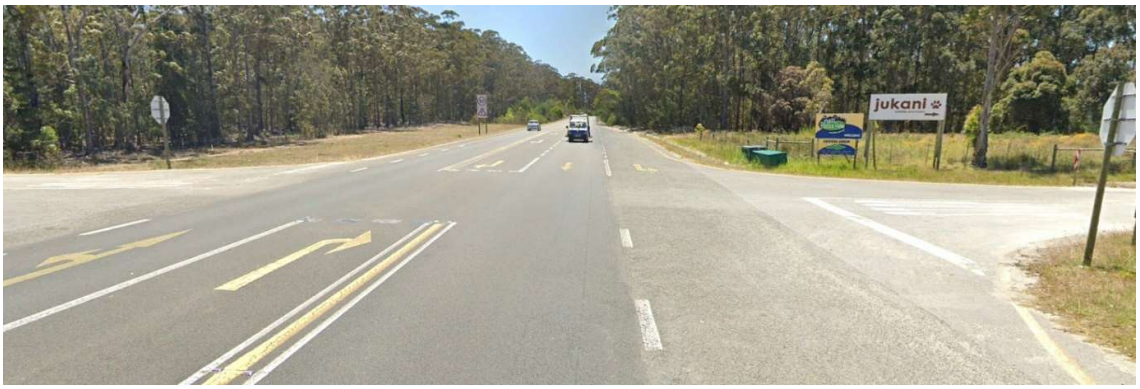

Figure 6-2: N2 Intersection (*eastern approach*)

6.2 Internal Roads and Parking Areas

The design philosophy for the proposed internal road network will be similar to that of a typical urban road network, which includes a minimum 2.0% crossfall and 0.5% longitudinal slope. This road network will consist out of 5.5m wide gravel roads with roadside channels and a stormwater drainage network.

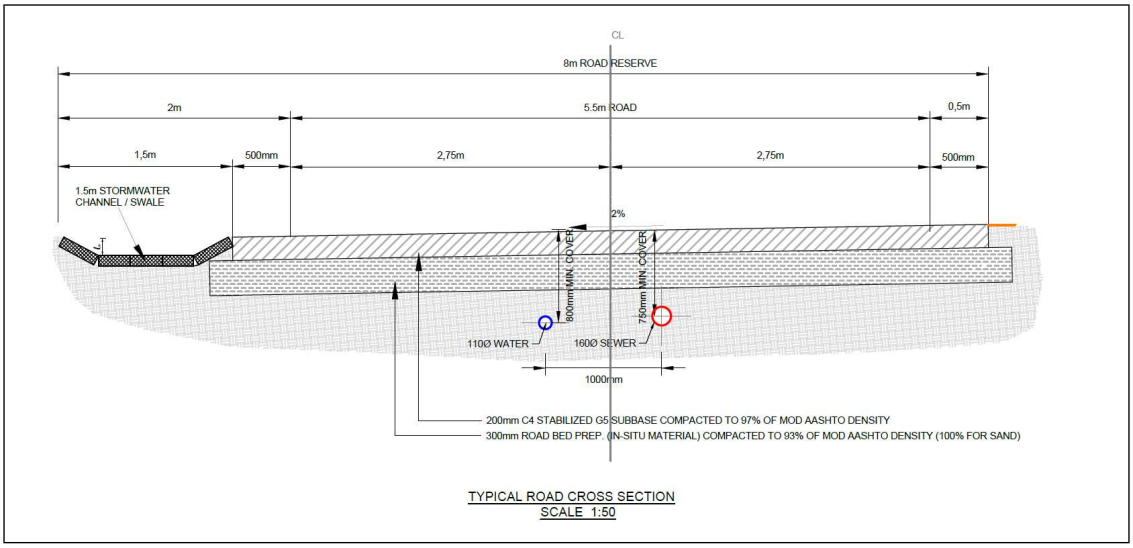

Figure 6-3: Road Cross Section

The internal roads/parking areas have been designed for low heavy vehicle traffic (*construction vehicles, furniture removal and refuse trucks*) and makes allowance for the insitu subgrade conditions.

- Road Category C/D (TRH4) or UC (UTG)
- Pavement Class ES 0.1 (TRH4).
- Structural design period 20 years
- Surface finish: Gravel / G5 subbase

The internal roads will form part of the Body Corporate's maintenance responsibility.

7. Stormwater Drainage

7.1 Existing Municipal Stormwater Network

The pre-development site drains from the higher lying southern portion towards the north-eastern boundary.

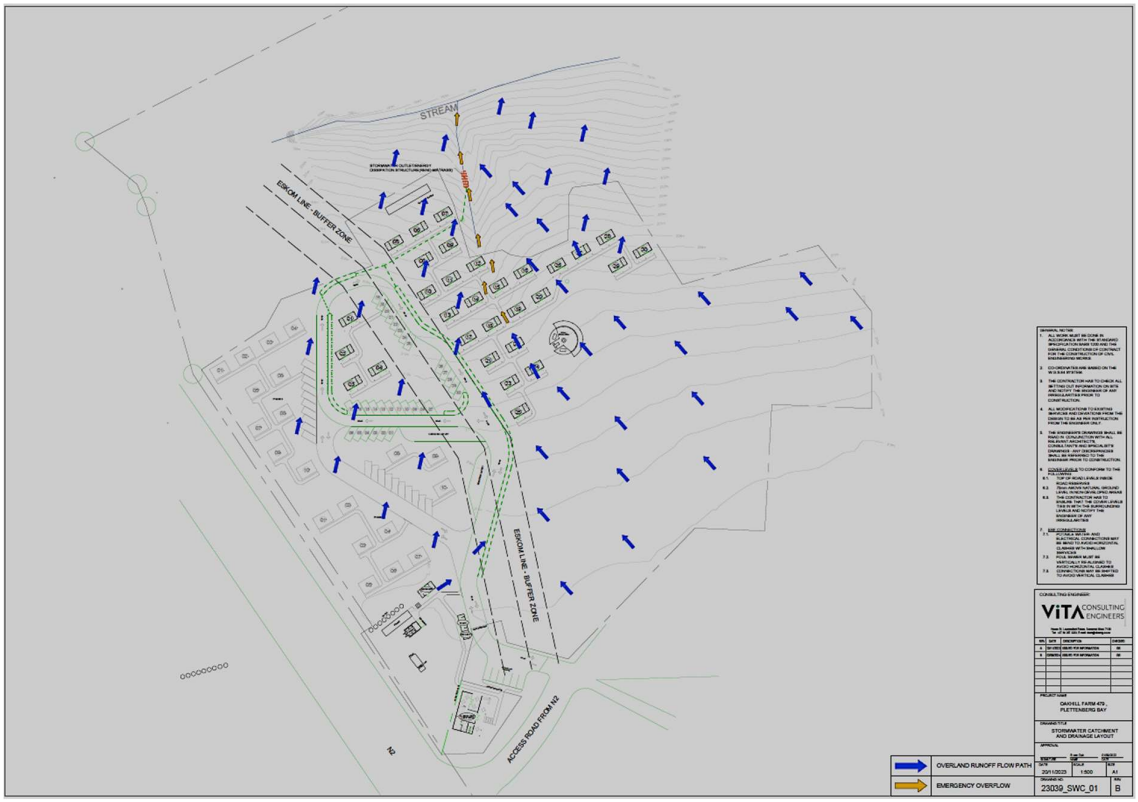

Figure 7-1: Overland drainage patterns.

There is no formal bulk municipal stormwater infrastructure in the vicinity of the site and all stormwater run-off generated from the development site will be discharged into the existing natural drainage course on the central northern boundary.

The permeability of the insitu soils will ensure that stormwater run-off permeates into the subsoil layers and a formalised bulk stormwater connection for the development is therefore not required.

An energy dissipation structure, constructed from gabion baskets which will create two weirs, will be installed where the velocity/energy of the run-off will be lowered in order to prevent downstream erosion.

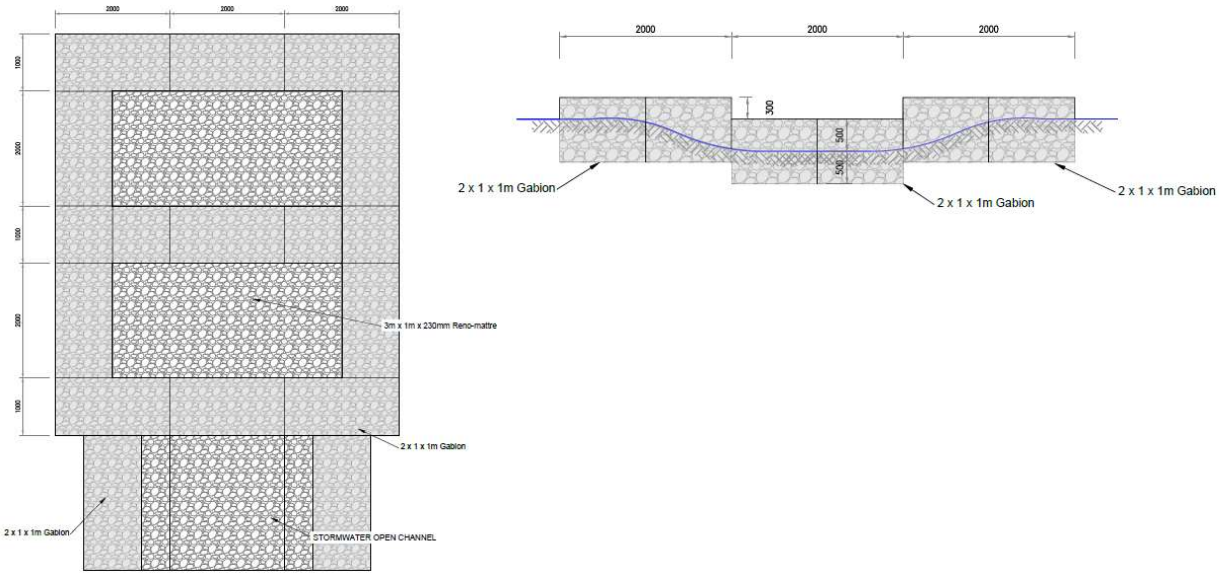

Figure 7-2: Typical gabions energy dissipation structure.

7.2 Hydrological Data

The nearest SAWB weather station to the development site is Plettenberg Bay (POL).

Weather Service Station			Plettenberg Bay (POL)			
Weather Station Number			0014633W			
Mean Annual Precipitation			647mm			
Coordinates (*Longitude and Latitude*)			Long: 34°3′ Lat: 23°22′			
Return Period	1:2yr	1:5yr	1:10yr	1:20yr	1:50yr	1:100yr
1 Day	56mm	83mm	104mm	128mm	163mm	194mm

Table 1: SAWB 0014633W: Plettenberg Bay *(Lat: 34° 3′ Long: 23° 22′)*

The hydrological rainfall data of rainfall station, Plettenberg Bay (POL), was used for all stormwater run-off calculations.

7.3 Run-off Factors

The pre-development topography, soil conditions and undergrowth were used to calculate the following pre-development run-off factors:

$$C_{pre} = (C_s + C_p + C_v) \times D_F \times F_t$$

Return Period	1:2yr	1:5yr	1:10yr	1:20yr	1:50yr	1:100yr
Run-off factor C	0.111	0.122	0.133	0.149	0.184	0.222

Table 2: Pre-development Run-off Coefficient

The development will not add substantial hard/impermeable surfaces to the catchment area (*less than 10%*) and will therefore have little impact on the run-off coefficients. The post-development run-off coefficients were calculated to be:

$$C_{post} = (C_{lawn} + C_{Residential} + C_{industry} + C_{business}) \times F_t$$

Return Period	1:2yr	1:5yr	1:10yr	1:20yr	1:50yr	1:100yr
Run-off factor C	0.134	0.147	0.161	0.179	0.222	0.268

Table 3: Post-development Run-off Coefficients

7.4 Peak Flows

The pre- and post-development peak flows were calculated to be:

$$Q = \frac{C \times I \times A}{3600}$$

Return Period	1:2yr	1:5yr	1:10yr	1:20yr	1:50yr	1:100yr
Pre-development (1.89ha)	0.028	0.052	0.074	0.103	0.159	0.221
Post-development (1.89ha)	0.034	0.063	0.090	0.124	0.192	0.266

Table 4: Peak Flow rates in m^3/s

7.5 Internal Stormwater Network

The standard stormwater design principle, as set out in section 1 will be implemented in the planning and design of the internal stormwater system.

The following minimum design specifications will be implemented:

- Minimum pipe specification: Class 75 D Concrete spigot & socket pipes
- Minimum pipe diameter: 375mm Nominal diameter
- Minimum design flow: 1.0m/s inside a half-full pipe
- Maximum spacing between manholes/inlets: 80m

An open swale stormwater network will be designed to have sufficient capacity to adequately manage and convey up to a 1:5 year rainfall event. The open swales network will follow the road network and will have inlet structures and pipe culverts at road crossings. For rainfall events with a return period larger than 1:5 year, the internal roadways will act as overland flow routes which will convey stormwater run-off towards the natural watercourses.

The cohesion of the insitu soil is expected to be poor and will therefore be very susceptible to erosion. The following erosion preventative measures will be incorporated in the detail stormwater design:

- Concentration of stormwater will be minimised to prevent high volume/flow rates
- Hard surface run-off (*driveways*) will be routed into swales via the internal roadways
- Sheetflow into open swales will be promoted to maximise contact time with insitu soils
- All channels with an internal velocity higher than 1m/s will be formalised (*armorflex*)
- All unlined channels will be landscaped with appropriate vegetation
- Energy dissipation structures will be installed at high energy discharge points

Due to the likely occurrence of a seasonal perched ground water table, provision will be made for a subsoil drainage network beneath the roads. The subsoil drainage network will consist of a 110mm diameter perforated pipe network installed 800mm below the final road level.

8. Sanitation

8.1 Existing Municipal Foul Sewer

GLS Consulting confirmed that there is no existing municipal sewer infrastructure in the vicinity of the site and a conservancy tank system is the only viable option. This was discussed and by Bitou municipality (*email dated 5 April 2024*).

A central conservancy tank and on-site wastewater treatment plant will be constructed in accordance with the following minimum requirements:

- Conservancy tank storage volume will be equal to a minimum of 3 x days peak flow (*27,000litres*).
- Location will be easily accessible for sewage removal vehicles, with provision for suitable turning circles.
- Appropriate internal and external waterproofing to prevent subsoil contamination.
- High level alarm
- Maintenance contract for regular sewage removal by an acceptable sewage removal company will be included as part of the Service Level Agreement with Bitou Municipality

8.2 Internal Sewage Network

The estimated sewage yield generated from the proposed development will be:

- Annual Average Daily Sewage Yield: 16m^3 per day
- Peak Daily Wet Weather Sewage Yield (*Peak Factor - 3.5*): 0.65 l/s

The internal sewage infrastructure will consist of a 160mm diameter uPVC Class 34 gravity pipe network and round precast concrete ring manholes in the road reserves. The internal infrastructure will drain towards a pumpstation which will be situated near the lowest portion on the northern boundary. The pumpstation will convey all sewage from the development via a 75mm rising main towards a new underground wastewater treatment plant.

The underground pumpstation will have the following minimum requirements:

- The pumpstation will be equipped with duty- and standby pumpsets
- The pumpstation will have back-up power (*genset or invertor/batteries*)
- The pumpstation sump will have an emergency back-up volume equal to the 8-hour peak flow

8.3 Wastewater Treatment Plant

A small wastewater treatment plant will be installed near the refuse area. The WWTP will have the treatment capacity for 20m^3 per day. The WWTP will use a combination of conventional treatment (*natural bacteria*) and membrane technology (*microfiltration*) to treat the sewage effluent to comply with water limits within regulation stipulated by the Department of Water Affairs.

Parameter	General Limit
COD (mg COD/l)	75
Ammonia as Nitrogen (mg N/l)	3
Nitrate as Nitrogen (mg N/l)	15
Orthophosphates (mg P/l)	10
Total Suspended Solids (mg TSS/l)	25
pH	5.5 – 9.5
Faecal Coliform (per 100ml)	1000

Table 5: Treated Water Quality Objectives

All the treated effluent will be re-used for irrigation purposed in order to minimise the load on the borehole water supply. 4 x 10kilo-liter dedicated irrigation storage tanks will be installed next to the wastewater treatment plant.

The efficacy of the WWTP will rely on regular maintenance and a signed service agreement between the developer and a qualified service provider will be submitted as part of the Service Level Agreement with Bitou Municipality.

In addition to regular maintenance, a stringent testing schedule will be required to ensure the treated effluent complies with DWAF limits. A wellpoint/shallow borehole (*10m deep*) will be installed on site for the purposes of monitoring the groundwater quality (*ensuring the irrigation with the treated effluent does not adversely affect the groundwater quality*). It is recommended that a sample of the treated effluent must be tested twice per month and a sample of the groundwater should be tested once per month. The test results must be submitted to DWAF and Bitou Municipality. Failure to comply with the prescribed limits will result in hefty fines and/or prosecution.

Refer to Appendix E for the Operation and Maintenance Manual of the proposed Calcamite Wastewater Treatment Plant.

9. Water Reticulation

9.1 Existing Bulk Municipal Network

GLS Consulting was commissioned to undertake a re-analysis of the bulk municipal water infrastructure capacity and the impact of the proposed development on the existing network. GLS formalised their findings in a report (*18 March 2024*) which was presented to Bitou Municipality for approval.

The GLS report concluded the following:

- There are no formal bulk water infrastructure in the vicinity of the site
- There are two possibilities to supply the development with potable water from the bulk Bitou municipal network:

    - Option 1: A potable water connection to the Kurland (*north-east*) system
        - Option 1 would require the installation of a new 200mm diameter watermain with a length of approximately 7,5km (*refer GLS Figure 1 Item BKW B7a*)
        - The estimated cost for option 1 is approximately R9,986,000 (*incl VAT*)

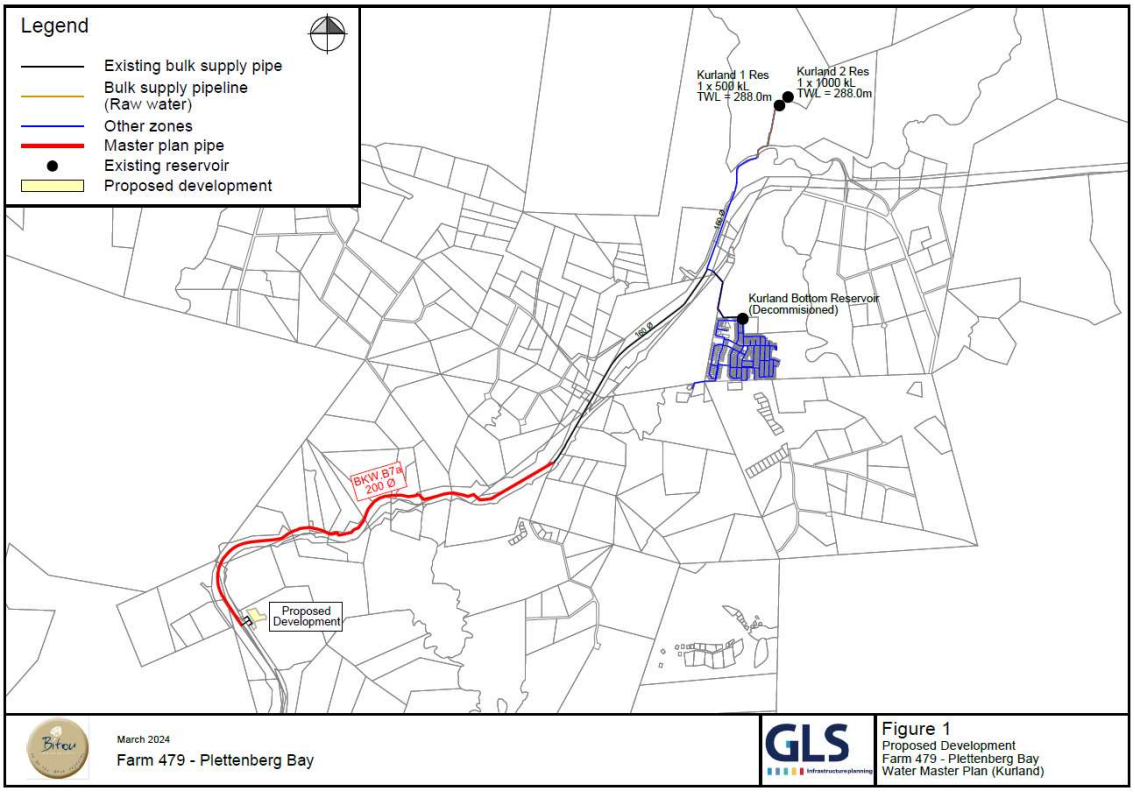

Figure 9-1: Extract from GLS Consulting (March 2024) Option 1: Figure 1 Item BKW.B7a

- Option 2: A water connection to the Plettenberg Bay (*south-west*) system
  - Option 2 would require the installation of a new 200mm diameter watermain with a length of approximately 4,2km (*refer GLS Figure 2 Item BKW B7b*)
  - Various other bulk water amenities (*refer GLS Items BKW.B3, BKW.B4, and BKW.7b*) will have to be constructed/upgraded as part of Option 2
  - The estimated cost for Option 2 is approximately R13,340,000 (*incl VAT*)

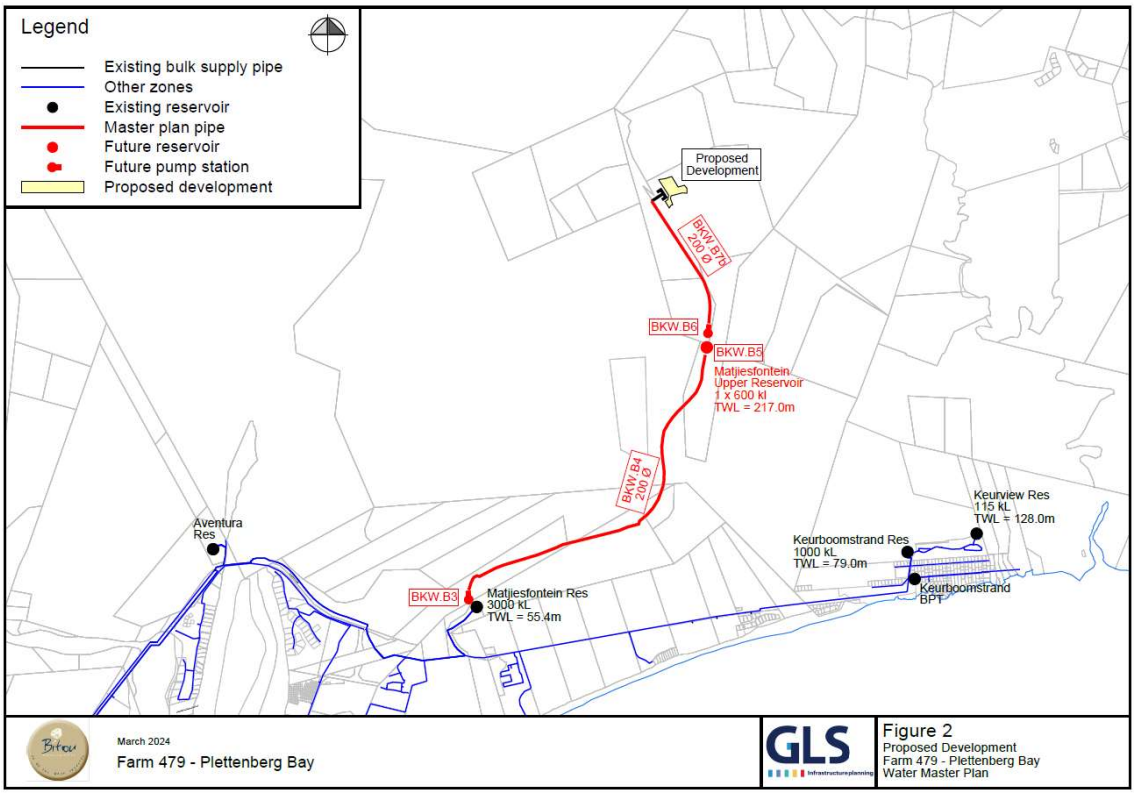

Figure 9-2: Extract from GLS Consulting (March 2024) Option 2: Figure 2

The financial implications associated with Options 1 and 2 will render the development unfeasible and the development will therefore require an "off-grid" solution, i.e. an existing borehole supply with an on-site water treatment plant.

9.2 Water Treatment Plant

A potable water treatment plant will be installed which will treat raw water from an existing borehole feed. The borehole tests confirmed a sustainable yield of 1 kilo-litre per hour. Water from the borehole will be pumped to 5 x 10 000 litre tanks, before it will pass through the on-site Water Treatment Plant.

The treatment process required to treat the borehole water to SANS 241 Class 1 drinking water standards will be determined once the borehole sample analysis results are released.

	Risk	STANDARD LIMITS
Physical and Aesthetic Determinands		
Colour (mg/l as Pt-Co)	Aesthetic	≤15
Conductivity (at 25 ºC)	Aesthetic	≤170
Total Dissolved Solids (mg/l)	Aesthetic	≤1200
Turbidity (NTU)	Operational [a]	≤1
	Aesthetic	≤5
pH (at 25 ºC) [b]	Operational	≥5 to ≤9.7
Chemical Determinands – Macro Determinands		
Free Chlorine (mg/l as Cl_2) [d]	Chronic Health	≤5
Monochloromine (mg/l) [cd]	Chronic Health	≤3
Nitrate (mg/l as N) [ef]	Acute Health	≤11
Nitrite (mg/l as N) [efg]	Acute Health	≤0.9
Combined Nitrate plus Nitrite (mg/l) [efg]	Acute Health	≤1
Sulphate (mg/l as SO_4^{2-})	Acute Health	≤500
	Aesthetic	≤250
Fluoride (mg/l as F^-)	Chronic Health	≤1.5
Ammonia (mg/l as N)	Aesthetic	≤1.5
Chloride (mg/l as Cl^-)	Aesthetic	≤300
Sodium (mg/l as Na)	Aesthetic	≤200
Zinc (mg/l as Zn)	Aesthetic	≤5
Chemical Determinands – Micro Determinands		
Antimony (µg/l as Sb)	Chronic Health	≤20
Arsenic (µg/l as As)	Chronic Health	≤10
Barium (µg/l as Ba)	Chronic Health	≤700
Boron (µg/l as B)	Chronic Health	≤2400
Cadmium (µg/l as Cd)	Chronic Health	≤3
Total Chromium (µg/l as Cr)	Chronic Health	≤50
Copper (µg/l as Cu)	Chronic Health	≤2000
Cyanide (recoverable) (µg/l as CN^-)	Acute Health	≤200
Iron (µg/l as Fe)	Chronic Health	≤2000
	Aesthetic	≤300
Lead (µg/l as Pb)	Chronic Health	≤10

Table 6: SANS 241 (2015) Drinking Water Limits

The water treatment plant will be equipped with a skid-mounted booster pumpset (*with variable frequency drives*) to adhere to the instantaneous potable water peak demand as well as the fire flow requirement.

9.3 Internal Water Reticulation

The potable water demand for the development will be:

- Gross Annual Average Daily Demand: 20m^3 per day
- Instantaneous Peak Demand (*Peak Factor - 16*): 3.7 l/s
- Fire flow criteria (*low risk*): 15l/s @ 20m

The proposed internal metered water reticulation network will consist of a combined domestic and fire water reticulation network consisting of a 75mm diameter uPVC Class 12 potable water main.

The water reticulation network will adhere to the following design requirements:

- Minimum pipe size – 75mm diameter
- Minimum pipe class – uPVC Class 12 / HDPE PE100 Class 12.5
- Specials & Fittings – As per Bitou Municipal Engineering Standards
- The bedding and blanket material will comply with SABS 1200 regulations for Class C bedding and blanket
- Fire hydrants will be spaced for low-risk areas

9.4 Irrigation Network

Irrigation to gardens and road verge landscaping will be done with treated effluent from the on-site wastewater treatment plant. A separate underground irrigation network will be installed to cater for the development's irrigation requirements. The peak effluent yield from the on-site wastewater treatment plant will be 20m^3 per day.

10. Solid Waste

The minimum requirements for domestic waste collection (*as per the National Domestic Collection Standards, 2011*) will be applicable to this development. The proposed development will generate approximately 20kg of solid waste per unit per week.

The development's Body Corporate will administrate the collection of the domestic waste from each unit towards a communal refuse storage facility located at the entrance to the proposed development. The refuge storage area will be adequately sized to accommodate the correct amount of 240l refuge bins for organic waste as well as make allowance for waste separation bins for temporary storage of recycling. Recycled waste to be collected by a registered Bitou Municipality service provider. A minimum target of 50% diversion of organic waste to be implemented by the Body Corporate.

Allowance will be made for adequate turning space at the entrance to the proposed development to accommodate the turning movement of a standard refuse truck.

11. Maintenance for Roads and Civil Services Infrastructure

The completed development will be handed over to a Body Corporate, who will except responsibility for the daily operations and maintenance of all civil infrastructure within the development.

The maintenance of the civil infrastructure will be explained to the Body Corporate and they will be furnished with engineering checklists (*weekly and monthly*).

It is advised that a professional engineer inspect and assess the civil services infrastructure on a yearly basis to ensure that the structural integrity and functionality of the civil amenities are intact.

Provision must be made for at least 2.5% of the total initial capital expenditure for the installation of the civil and roads infrastructure to be allocated for maintenance purposes.

All maintenance works must be carried out in accordance with all provisions of the Occupational Health and Safety Act (*Act 85 of 1993*). Maintenance staff must be well educated on the operation of the civil services network as a whole and potential safety hazards should be identified before any maintenance/remedial works are carried out. All maintenance personnel must always be equipped with the necessary protective gear (*PPE*).

12. Conclusion

The findings of this Civil Engineering Services Report provide sufficient evidence to **support** the application for

"The rezoning of Remainder of Farm 479, Oakhill from 'Agriculture Zone I' to 'Resort Zone I' for a hospitality development in terms of Section 15(2)(a) of the Bitou Municipality Land Use Planning Bylaw, 2015"

A Services Level Agreement, between the Developer and Bitou Municipality, will be required to confirm the Augmentation Levee's payable (*if any)* and also to confirm the water- and wastewater quality standards to be upheld by the developer/Body Corporate.

The Service Level Agreement must clearly stipulate the following:

- The phasing of the proposed development
- If Augmentation Levee's are applicable/payable for the development
- Maintenance requirements/procedures for the water- and wastewater treatment plants
- Applicable standards and testing schedule for the water- and wastewater treatment plant

Riaan van Dyk (*Pr Eng 20150503*)
for Vita Consulting Engineers

Oakhill Farm 479, Plettenberg Bay

SleepOver Development

Potable Water Demand Calculation

Date: 05/07/2024

Item	Description	Area			Water demand per day			Total
					Per unit litre per unit/room	Area litre per 10 m²	Per person litre per person	
1	Group Housing - Resort Zone							
1.1	Less than 100m²	±	30	No	400	-	200	12,000
2	Managers Office	±	50	m²	-	40	-	200
3	Clubhouse / shop	±	160	m²	-	40	-	640

Gross annual average daily water demand (GAADD)	**12,840 l/day**	**0.1 l/s**
Instantaneous Peak Demand {P(i) = 15}		**1.8 l/s**

Design Methodology:

a Units: Yield in litre per unit per day - SANS 10252-1 (table 1) and CSIR Red Book Table 9.14

b Peak factor calculation:
Peak factor calculation as per Red Book Fig 9.11 Chapter 9. Peak factor = 15

*c Fire Flow (Moderate Risk Area): 6000l/min = 100 l/s **Exact demand to be determined by Fire Consultants*

d Suggested Watermeter Sizing - 100mm Watermeter

Oakhill Farm 479, Plettenberg Bay

SleepOver Development

Sewage Yield Calculation

Date: 05/07/2024

Item	Description	Area			Sewage Yield per day			Total	
					Per unit litre per unit/room	Area litre per 10 m²	Per person litre per person		
1	Group Housing - Resort Zone								
1.1	Less than 100m²	±	30	No	360	-	180	10,800	
2	Managers Office	±	50	m²	-	36	-	180	
3	Clubhouse / shop	±	160	m²	-	36	-	576	
					Annual Average Daily Sewage Yield (AADSY)			**11,556 l/day**	**0.1 l/s**
					Peak Factor = 3.5 **Peak Daily Dry Weather Sewage Yield (PDDWSY)**			**0.47 l/s**	
					Infiltration = 15% **Peak Daily Wet weather Sewage Yield (PDWWSY)**			**0.54 l/s**	

Design Methodology:

a Units: Yield in litre per unit per day CSIR Red Book Table C.1

b Suggested pumpstation sump sizing - 8 hours storage: 4m³ *(2 x 2 x 1m)*

c Peak factor calculation:
(3 persons per unit) = 90 people
Red Book Fig C.1 Chapter 10 Appendix C - Peak Factor = 3.5

d Assume infiltration of 15%: During Heavy Rainfall in Winter

CIVIL ENGINEERING SERVICES LEGEND

- 160mm ØPVC-U 25.40m@1:49.2 — 160mm Ø FOULSEWER (uPVC Heavy Duty class 34) SLOPE AND LENGTH SHOWN
- FS9 — FOUL SEWER MANHOLE COVER AND INVERT LEVEL SHOWN
- RE9 — FOUL SEWER RODDING EYE
- FOUL SEWER RISING MAIN
- POTABLE WATER SIZES AS SHOWN (uPVC CLASS 12)
- FH — GATE VALVE AND FIRE HYDRANT (TYPE 4)
- W — DOUBLE AND SINGLE ERF CONNECTIONS
- W2 — WATER SETTING OUT NODES
- 1500mm WIDE STORMWATER CHANNEL
- STORMWATER LINE (SPIGOT & SOCKET CLASS 75D) 375mm Ø (UNLESS OTHERWISE SHOWN)
- SW 1 — SW MANHOLE
- STORMWATER DOUBLE KERB INLET

GENERAL NOTES:

1. ALL WORK MUST BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATION SABS 1200 AND THE GENERAL CONDITIONS OF CONTRACT FOR THE CONSTRUCTION OF CIVIL ENGINEERING WORKS.
2. CO-ORDINATES ARE BASED ON THE W.G.S.84 SYSTEM.
3. THE CONTRACTOR HAS TO CHECK ALL SETTING OUT INFORMATION ON SITE AND NOTIFY THE ENGINEER OF ANY IRREGULARITIES PRIOR TO CONSTRUCTION.
4. ALL MODIFICATIONS TO EXISTING SERVICES AND DEVIATIONS FROM THE DESIGN TO BE AS PER INSTRUCTION FROM THE ENGINEER ONLY.
5. THE ENGINEER'S DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S, CONSULTANT'S AND SPECIALIST'S DRAWINGS - ANY DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER PRIOR TO CONSTRUCTION.
6. COVER LEVELS TO CONFORM TO THE FOLLOWING:
   - 6.1. TOP OF ROAD LEVELS INSIDE ROAD RESERVES
   - 6.2. 75mm ABOVE NATURAL GROUND LEVEL IN NON-DEVELOPED AREAS
   - 6.3. THE CONTRACTOR HAS TO ENSURE THAT THE COVER LEVELS TIES IN WITH THE SURROUNDING LEVELS AND NOTIFY THE ENGINEER OF ANY IRREGULARITIES
7. ERF CONNECTIONS:
   - 7.1. POTABLE WATER- AND ELECTRICAL CONNECTIONS MAY BE BEND TO AVOID HORIZONTAL CLASHES WITH SHALLOW SERVICES
   - 7.2. FOUL SEWER MUST BE VERTICALLY RE-ALIGNED TO AVOID HORIZONTAL CLASHES
   - 7.3. CONNECTIONS MAY BE SHIFTED TO AVOID VERTICAL CLASHES

CONSULTING ENGINEER:

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REV	DATE	DESCRIPTION	CHECKED
A	23/11/2023	ISSUED FOR INFORMATION	GS
B	02/09/2024	ISSUED FOR INFORMATION	GS

PROJECT NAME

OAKHILL FARM 479 , PLETTENBERG BAY

DRAWING TITLE

COMBINED SERVICES LAYOUT

APPROVAL

SIGNATURE: _____ NAME: R van Dyk DATE: 01/09/2022

DATE	SCALE	SIZE
20/11/2023	1:500	A1

DRAWING NO.	REV
23039_CIV_01	B

GENERAL NOTES:

1. ALL WORK MUST BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATION SABS 1200 AND THE GENERAL CONDITIONS OF CONTRACT FOR THE CONSTRUCTION OF CIVIL ENGINEERING WORKS.
2. CO-ORDINATES ARE BASED ON THE W.G.S.84 SYSTEM.
3. THE CONTRACTOR HAS TO CHECK ALL SETTING OUT INFORMATION ON SITE AND NOTIFY THE ENGINEER OF ANY IRREGULARITIES PRIOR TO CONSTRUCTION.
4. ALL MODIFICATIONS TO EXISTING SERVICES AND DEVIATIONS FROM THE DESIGN TO BE AS PER INSTRUCTION FROM THE ENGINEER ONLY.
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	OVERLAND RUNOFF FLOW PATH
	EMERGENCY OVERFLOW

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REV	DATE	DESCRIPTION	CHECKED
A	23/11/2023	ISSUED FOR INFORMATION	GS
B	02/09/2024	ISSUED FOR INFORMATION	GS

PROJECT NAME

OAKHILL FARM 479 ,
PLETTENBERG BAY

DRAWING TITLE

STORMWATER CATCHMENT AND DRAINAGE LAYOUT

APPROVAL

SIGNATURE: _____ NAME: R van Dyk DATE: 01/09/2022

DATE	SCALE	SIZE
20/11/2023	1:500	A1

DRAWING NO.	REV
23039_SWC_01	B

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SANITATION + WASTEWATER
Operated and Owned by JoJo

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A: Plot 2 No 15
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0200

WASTEWATER TREATMENT PLANT

INSTALLATION INSTRUCTIONS

NOTE: Calcamite tanks are not designed to be buried more than 0.5m below ground level. If depths are greater than 0.5m please refer to site engineer/architect or Calcamite technical personnel. A "deep installation guide" is available on request. Calcamite will not be liable for products incorrectly installed.

NOTE: If a high-water table exists or where Abnormal soil conditions prevail such as Clay, contact Calcamite or Site Engineer and Architect for special installation instructions for these conditions.

CAUTION: These instructions assume no more than pedestrian duty loadings will be applied to the final installation. Traffic or other heavy superimposed loads must not be transferred through the walls of the tank. This implies a max invert depth of 500mm from the incoming sewer pipe to ground level. For deeper installations please refer to an Engineer for final instruction. Vehicles should not be permitted within a distance equal to the depth of the unit, unless suitable structural projection has been provided. Before installation commences check that the tank(s) are free from damages and always handle with care. Avoid excessive impact and rough handling.

Site selection

Select a site that allows for the system to be installed with the incoming sewer pipe to be laid at a gradient of between 1:40 and 1:60 ratio, (for every sixty meters in length one meter in depth) and adequate access must be provided for routine desludging and maintenance. Usually, the unit should be sighted within 20m of a hard standing area suitable for a 10-ton Vacuum tanker.

Excavations

The size of the excavation should be approximately 400 mm larger (all around) than the size of the Wastewater Treatment Plant. The depth of the invert level should not exceed that of the Wastewater Treatment Plant's inlet approximately 560 mm below NGL. Allow approximately 100mm of the plants lid extensions to protrude from the soil surface.

This is important for monitoring the plants health and to prevent soil and storm water entering the plant. The hole to be excavated should be in line with the proposed sewer pipe and to a depth that allows for the above gradient to be attained.

Once the hole has been dug, remove any sharp objects from the excavation and begin to back fill with first layering a 100mm thick layer of compacted soilcrete on the floor of the hole. (below ground WWTP require a cement slab; the slab should be 200mm thick and an area covering the total excavation area).

Lower the unit carefully into the excavation so as not to damage the tank(s) and their components such as plumbing and pump(s). Ensure that the tanks are level by placing a spirit level across the lid section of the tanks and take two readings 90 degrees of each other.

Connect the incoming pipe to the inlet of the Wastewater Treatment Plant unit and the outlet from the pump to the dispersion pipe (note: 22mm diameter minimum).

Fill all the tanks one quarter full of water. Once the water has reached this level backfill with moist river sand and cement in a minimum of 10:1 ratio (well mixed) and compact with an inert granular material (e.g. river sand) that has been mixed with cement in that ratio of ten parts sand and one part cement until the level of the water has been matched.

Never backfill with clay soil or with sand that has stones larger than 20mm. Do not use soil from the excavation.

With the bases of the tanks firmly anchored you can now begin backfilling and compacting.

This is done by simultaneously filling the tanks with water and filling in the excavation with the backfill material. The level of the water should always be close to that of the backfill. Compaction of the backfill should be done every 250-300mm. Once the outlet level is reached you can stop filling with water and can now fill to ground level with backfill. Should high ground water, clay soil or other abnormal conditions exist the tanks will require cement stabilization and should be referred to an engineer for approval.

Cast a slab of concrete 1m x 1m (50mm thick) per blower housing. The location of the housing should be adjacent to the Bio-Mite and preferably not further than 5 meters.

Power supply

A dedicated and surge protected electrical supply is to be provided to allow connection of the pump(s), blower(s) and Ozone Unit (if relevant).

- Mount the blower housing on top of the septic tank opening and not on the pumping and disinfection chamber opening. This will make accessing and changing the chlorine cartridge easier.

- Connect air blower to the diffuser pipe (housed inside the Bio-Reactor module) using 20mm pipe and push lock fitting provided. There should be no sharp bends or kinks causing airflow restriction. Plug the blower and submersible pump into the connection (provided by client). The plant is now ready for use.

Note:

- Only switch on the blower(s) when there is water in the Bioreactor(s)
- Ozone Pumping chamber (if relevant): Only switch on the submersible pump when there is water in the chamber or the pump will be running dry and may fail, when this is done, switch on the Ozone unit to allow venturi to access the Ozone.
- The final pumping chamber submersible pump can be switched on at any time as it works on a float switch and will only engage when water is in the tank.

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WASTEWATER TREATMENT PLANT

OWNERS OPERATION AND MAINTENANCE MANUAL

TABLE OF CONTENTS

1. INTRODUCTION

Thank you for choosing the Calcamite Wastewater Treatment Plant as part of your on-site wastewater treatment system. The Calcamite Wastewater Treatment Plant was developed to be added onto your existing septic system or as part of a new wastewater treatment system.

Calcamite has been in the field of Sanitation since 1967 and has been manufacturing prefabricated On-site Sanitation Systems since 1984. Calcamite holds several patents in this regard and continues to develop and improve its technology.

2. HOW THE WASTEWATER TREATMENT PLANT WORKS

The wastewater treatment plant incorporates a biological process to clean incoming wastewater. In this process a biomass of bacteria breaks down biodegradable waste and converts it into carbon dioxide and water. Any non-biodegradable matter collects at the bottom of the tank and is periodically removed when the septic tank is pumped out. The biomass is a colony of self-regenerating bacteria that will survive as long as they have a suitable food source (the waste) and a comfortable environment (sufficient oxygen and no biocides or harsh chemicals).

The primary tank provides the food source while the Bio-reactor provides the comfortable environment for the bacteria. Inside the Bio-reactor is a matrix of plastic media upon which the bacteria attach to. As the wastewater circulates through the media, food is delivered to the bacteria. A remotely mounted air blower aerates the wastewater via a fine bubble diffuser, introducing oxygen into the system. If the effluent is to be used for irrigation, disinfecting the waste stream is necessary to eliminate any potential pathogens.

This is done in the specially constructed disinfection chamber provided for this purpose. Where chlorine is used, the onus will be on the homeowner to replace the cartridges from time to time (approximately every 1.5 months or 35 000L of wastewater). Where ozone is used the onus will be on the owner to ensure it is running and kept in good working condition. Once the waste has been treated it then can be passed into a drain field or be used for irrigation.

3. SYSTEM DESIGN

The wastewater treatment plant system has been specifically designed to treat domestic effluent only. It is important that the system operates within its designed treatment parameters i.e. the B.O.D loading and volume of wastewater per day. Overloading of the system will result in the waste stream being partially treated.

4. WARNINGS AND DANGERS

- Individuals are advised not to attempt servicing their wastewater treatment plant on their own. It is recommended to always call an authorised service technician for assistance.

- Removal of media in the Bio-reactor by untrained or unauthorised persons may lead to the injury or death from potentially hazardous gases and or waste matter.
- Do not allow children to play with the blower housing or any electrical or plumbing components.
- Do not leave manhole covers off the tanks as someone can fall in and drown. The electrical wiring should be installed by a qualified electrician.
- The risk of death or injury from electrocution will exist should the electrical components be flooded or be exposed to excessive moisture.
- Always ensure that the blower housing is securely closed at all times.
- Should anybody be exposed to waste matter rinse all exposed areas with soap and water.

SAFETY:

Manhole covers must be filled with cement so that children cannot remove them from the tank and accidently fall into the tank and drown.

5. CORRECT USE OF THE SYSTEM

The wastewater treatment plant relies on the biomass/bacteria to treat the waste stream. Do not introduce any harmful substances (substances that are harmful to humans, animals and plants) into the system that could kill or harm the biomass bacteria. **A reduction in the biomass and or hydraulic overloading (water leaks into the system) will result in the incomplete treatment of the waste stream.**

5.1 System limits and Hydraulic overloading:

The system is designed based on the average dry weather flow and as such must be operated close to the design point. Though the plant design factors in peak flows, continued operation of the plant above higher than designed peak flows will lead to partially treated wastewater. Should the need arise to operate the plant at a higher average dry weather flow and or Peak flow, Calcamite should be contacted for upgrades.

Never allow the volume of the water flowing into the system to exceed the volume of the primary tank within a 24-hour period. (e.g. a 3000L tank must never receive more than 3000L of water in 24 hours). Repair all faulty taps and flush valves as soon as possible, even the smallest leak will increase the hydraulic loading and may affect the treatment process.

5.2 Never introduce the following:

- Substances that are not biodegradable such as plastic, condoms, sanitary towels, nappies, wipes etc. as these will collect and fill the primary tank reducing retention time.
- Hydrocarbons such as motor oil, petrol, paint, and or paint thinners.
- Toxic substances such as pesticides, strong disinfectants (*Jeyes Blue*) and caustic soda.
- Ammonia based cleaners such as *Handy Andy* or bleach.
- Large amounts of paper kitchen towels or synthetic fibre-reinforced based products.
- Any products that are antibacterial or antibiotic (cleaning products which “kills 99% of germs”).
- Liquid fabric softeners.

- Commercial laundry chemicals i.e hotels and lodges.
- Chemicals such as herbicides, pesticides or pool acid.
- Never backwash swimming pool water into the system (high chlorine content).

Fats, oil, and grease (FOG)

Managing fats, oil, and grease (FOG) in wastewater treatment poses multifaceted challenges affecting operational efficiency and regulatory compliance. FOG in wastewater streams leads to clogged infrastructure and reduced treatment effectiveness. Below are common problems caused by FOG.

- **Clogging:** FOG can solidify and accumulate in pipes, pumps, and equipment, leading to clogging and reduced efficiency in wastewater flow.
- **Reduced Treatment Efficiency**: FOG can interfere with biological treatment processes by creating a barrier that reduces oxygen transfer and inhibits microbial activity, leading to reduced treatment efficiency.
- **Odor Issues**: Decomposition of FOG can produce foul odours, which can be unpleasant for workers and nearby residents.
- **Maintenance Costs**: Regular cleaning and maintenance of equipment to remove FOG buildup increases operational costs for wastewater treatment plants.

5.3 The following substances may be used regularly:

- Dishwashing detergents without bleach, that contain low levels of sodium and low phosphorous (eg. Green Sunlight liquid);
- We recommend the green dishwasher soaps and enzyme-based washing powders be used to clean toilet bowls. This is done by adding some powder into a bucket of water and using a toilet brush to clean the toilet pan. Leave the brush in the bowl and flush water out, cleaning toilet and brush together;
- Food garbage disposal units are not recommended for this system. Compost all food scraps if possible. Left-over food should be scraped into a waste bin before rinsing plates off. A grease trap is recommended between the kitchen and the wastewater treatment plant;
- Laundry detergents without bleach;
- Toilet paper;
- General household cleaners containing sodium bicarbonate, sodium carbonate and sodium borate;
- Biological and biodegradable cleaning and sanitation products are strongly advised to support and enhance the performance of your wastewater treatment plant;
- Check labels on products before you buy to see if they are pro-bacterial or septic tank friendly. Most products indicate whether they are safe for use in septic tanks.

5.4 The following may be introduced in limited quantities:

- Toilet bowl cleaner such as *Toilet Duck* (ortho-phenyl phenol based);
- Automatic dishwasher detergents;
- General household cleaners;
- Anti-bacterial hand soap (only for washing hands and in small quantities).

6. ELECTRICAL COMPONENTS

6.1 Submersible pump:

The submersible pump provided has been designed to lift treated effluent from the Wastewater Treatment Plant to either an irrigation holding tank or for direct dispersion via a **22mm minimum** diameter hose and a pyramid type sprinkler. The max pumping distance from the wastewater treatment plant is 30m and not more than 8m total head height. The pump carries a **one-year warranty** and is subject to **terms and conditions** (refer to *limited warranties document* for more detail).

CAUTION:

As a risk of electrical shock, only an electrician or suitably qualified person should perform the task of removing and/or reinstalling the submersible pump.

6.2 Blowers:

Never turn off the blowers which aerate the Bio-reactors as the air they introduce is critical to the forming of the required biomass, essential for the treatment of the waste stream.

Turning of the blowers will suffocate the bacteria and in return result in a partially treated waste stream.

7. MAINTENANCE OF THE WASTEWATER TREATMENT PLANT

A service/maintenance contract can be entered into:

Daily

A visual and audible inspection of the plant should be undertaken to ensure that all electrical components are working and that nothing out of the ordinary is coming from the plant. *(sound, sight and smell).*

Weekly

The operator should check the levels of chlorine in the chlorine unit. Refill if necessary.

Monthly

- Check the airlines and water pipes for possible leaks.
- Check the air filters on the blower units, replace if necessary.
- Check that the float switch on the pump is working properly.

Yearly

- Service the Septic tank / Bio-reactors by vacuum tanker once yearly if necessary.
- Service pumps and air blowers if necessary.
- Check the operation of the ozone unit and service if necessary.
- The air filter of the blower should be replaced or cleaned once a year or more frequently in dusty climates.

The following tasks are performed at each service:

- Check all electrical equipment including ozone generator where applicable.
- Check the airlines for possible leaks.
- Check the condition of the air filters on the blowers.
- Inspection of the primary tank effluent for scum overflow
- Inspection of the biological reactor with regard to the biomass formation/aeration (bubbles).
- An immediate notification to the owner in writing of any improper observation which cannot readily be repaired. This notification will or shall advise the owner of the problem.
- Any loose pipe fittings, broken piping, incorrect water flows, chlorine function.
- Check for collapsed chambers.

8. TROUBLE SHOOTING OF THE WASTEWATER TREATMENT PLANT

Septic tank

- Open the lid and check if the effluent is flowing from the 110mm pipe through to the Bio-reactor.
- Check for any blockages in the 110mm pipe.
- Check the angle of the pipe from the septic tank to the Bio-reactor.
- Check the sludge level in the Primary tank regularly. The primary tank should be cleaned when the sludge level is ± 700mm from the bottom of the tank or at least every second year.

Bio-Reactor

- Open the Bio-reactor tanks lid and see if the bubbles are bubbling profusely or just in a small spot only.
- Switch off the aerator at the plugs and wait for the water to settle. You should be able to see the fins of the media pack and the gaps between the fins. For a healthy system the bacteria should be a mustard colour to light grey.
- The smell from the bioreactor should be a sweet smell with a very slight septic smell.
- Check the quality of the diffusers to ensure that they are not clogged.

IF the Bio-reactor:

- is murky and never settles or;
- the bacteria are black or;
- there are strings of sludge floating or;
- you cannot see the gaps between the fins of the media in the Bio-reactor or;
- there is not a 100 – 200mm float of water level above the media pack or fins are sticking out above the water level;
- The smell is a septic smell or stench.

Then call Calcamite for a technician to come and assist or advise accordingly.

Pumping chamber

- **Smell:** There should be a sweet smell from the chamber.
- **Colour:** Drop a bottle on a piece of string into the chamber and draw a sample of the water. The water should be clear or close to clear.

- Check if the **chlorine unit** is spraying back into the chamber with a small stream.
- Check if the **float switch** is switching on and off correctly and does get stuck or jammed.

Water back-up

- Check that the submissible pump is operating correctly and is not restricted or not running.
- If a field drain is installed: check that it has not blocked up or failed (surface ponding will be evidence of this).

Call a plumber or Calcamite for advice (012) 742 0900.

9. CHLORINATION UNIT – REFILL PROCEDURE

- Remove the lid of the storage tank that houses the chlorination unit.
- Remove the grey PVC lid from the chlorination unit by counterclockwise rotation.
- Remove the inner cartridge and replace with refill pack. Use only Klorman brand refills. Dispose of empty containers in a waste receptacle. If you are unsure about the procedure, refer to the user's manual provided or contact Calcamite.
- Ensure that the spring is still in the bottom of the Klorman unit.
- Turn the grey PVC lid two full revolutions clockwise. This will ensure correct chlorine usage.
- Each refill pack should disinfect 35 000 litres of wastewater.

10. OZONE CHECK (IF APPLICABLE)

Check that power is supplied to the unit and that the green operation light is on. Unplug the silicone hose in front of the non-return valve and place into a glass of water. The pipe should bubble ozone gas into the water, if no bubbles appear then the ozone unit is faulty. A sharp smell, similar to that emitted during a welding process, is typical of the ozone gas.

CAUTION:

Ozone is dangerous and over exposure is toxic. Never allow anyone to come into contact for a prolonged period.

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