WATER USE LICENCE APPLICATION SUMMARY REPORT

In terms of the National Water Act, 1998 (Act No. 36 of 1998) and the Water Use Licence Application and Appeals Regulations, 2017

Proposed rezoning and subdivision of a Portion of Erf 134, Infanta for the establishment of a residential development

Cape Infanta

November 2025

Prepared for:
Westerhelling Investments CC

Department of Water and Sanitation Reference: WU42464

DJEC Project Number:
2010/14

Author:
Lian Roos
lian@dougjeff.co.za

DOUGJEFFERY
ENVIRONMENTAL CONSULTANTS
High Acres Farm, Simondium Road, Klapmuts
P.O. Box 44, Klapmuts 7625
021 875 5272
dougjeff.co.za

REPORT DETAILS

Project Title:	Proposed rezoning and subdivision of a portion of Erf 134, Infanta for the establishment of a residential development.
Water Use Authorisation / Process:	Water Use Licence application
Report Type:	Water Use Licence application Summary Report
Report Date:	November 2025
Applicant:	Westerhelling Investments CC
Environmental Assessment Practitioner (EAP):	Doug Jeffery Environmental Consultants (Pty) Ltd
DWS / eWULAAS Reference:	WU42464
DJEC Reference:	2010/14

Authored by:	Lian Roos
Qualifications:	BSc Environmental Science [UP]; BSc (App Sci) Hons Water Utilisation [UP]
Experience:	Lian has more than seven years of experience in conducting Environmental Assessments and Water Use Authorisation applications for developments across multiple sectors in various provinces, including Mpumalanga, Gauteng, Limpopo, Northern Cape, KwaZulu-Natal, and the Western Cape.
Professional Registrations & Affiliations:	Reg. EAP (EAPASA): 2022/4550 Professional Environnemental Scientist (SACNASP): 151023 Member of IAIAsa

ABBREVIATIONS AND ACRONYMS

CMA	Catchment Management Agency
DWS	Department of Water and Sanitation
NWA	National Water Act
PPP	Public Participation Process
WUA	Water Use Association
WUL	Water Use License
WULA	Water Use License application

TABLE OF CONTENTS

REPORT DETAILS 2
TABLE OF CONTENTS 3
1. Applicant details 4
2. Person submitting application 4
3. Background and purpose 4
4. Location of water uses 4
5. Project description 7
a. Administrative Documents 9
b. Reports and other technical documents 9
6. Methods Statement (only for c and i activity) 13
7. Stormwater Management Plan 13
8. Rehabilitation Plan 13
8.1 Ecological buffer control 13
8.2 Alien vegetation control 14
8.3 Erosion control 14
8.4 Fire control 15
9. Water Uses Applied For 16
10. Impact and Mitigation Measures 18
11. Water Demand and Supply 21
12. Public Participation 21
13. Section 27 of the National Water Act, 1998 (Act 36 of 1998) 21
APPENDICES 22

1. APPLICANT DETAILS

Table 1: Applicant details

Name of applicant	Westerhelling Investments CC
Postal address	P.O. Box 10071, The Falls, Northmead, Benoni, 1522
Office number	011 425 2420
E-mail address	jarjininv@gmail.com

2. PERSON SUBMITTING APPLICATION

This document was compiled by Lian Roos, an Environmental and Water Consultant with over seven years of experience in environmental and water resource management. He holds a BSc Hons (App Sci) in Water Utilisation and a BSc in Environmental Science from the University of Pretoria. Lian is a registered Professional Natural Scientist with SACNASP (151023) and a Registered Environmental Assessment Practitioner with EAPASA (Reg. No. 2022/4550). He specialises in Water Use Authorisations, including Water Use Licence applications and General Authorisation registrations, supporting developments across agricultural, residential, mining, and renewable sectors.

3. BACKGROUND AND PURPOSE

Westerhelling Investments CC proposes to rezone a 3.04-hectare portion of Erf 134, Infanta, from Agricultural Zone (AZ) to Subdivisional Area in terms of Section 15(2)(a) of the Swellendam Municipal Planning By-law (November 2020). This rezoning will allow for the establishment of 20 additional single-dwelling units, resulting in a total of 21 units on the property. The units will require potable water and sanitation. As the proposed development involves water-related infrastructure and activities that constitute a water use in terms of the National Water Act (Act No. 36 of 1998), a Water Use Licence application was submitted to the Department of Water and Sanitation to obtain the necessary authorisation. The application was received on 14 March 2025 under reference number WU42464.

4. LOCATION OF WATER USES

Table 2: Location details

Province	Western Cape	
Magisterial district	Swellendam RD	
Nearest town/city/township	Infanta	
Property description	Erf 134	
Quaternary catchment	H70K	
Water Management Area (WMA)	Breede-Gouritz Water Management Area	
Property size (ha)	87.07	
Coordinates (latitude and longitude)	34.418464°S	20.853553°E
Access to the site	Access to Erf 134 is gained from Main Road 268 (the district road).	

Figure 1: Locality Map

Table 3: Property details

Property description	Title Deed number	Owner
Erf 134, Swellendam RD	T43211/1980	Westerhelling Inv Cc

Figure 2: Development layout on a portion of Erf 134. Footprint indicated by the white polygon in the image above.

5. PROJECT DESCRIPTION

The applicant proposes to use groundwater from a borehole on Erf 134 to meet the development's water demand. An end-point filtration and disinfection unit will be installed at each of the 21 units/dwellings to treat groundwater to drinking water quality standards (SANS 241:2015). Each unit will also have a small wastewater package treatment plant to manage sewage from domestic activities.

Water Demand and Supply

The estimated **Annual Average Daily Demand (AADD)** for the development is:

- **21 single residential erven (small):** 800 ℓ/unit/day = 16.8 m³/day

Two boreholes (134A and 134C) are located on Erf 134. A 72-hour pumping test on borehole 134C (Van Biljon, 2014) confirmed a sustainable yield of 25 m³/day, with a maximum of 48 m³/day under optimal conditions. This yield exceeds the development's estimated potable demand of 16.8 m³/day (≈ 6,312 m³/a). Including provision for fire-fighting, the total annual water demand is estimated at 7,665 m³/a.

With a Mean Annual Precipitation (MAP) of 430 mm/year, an average roof size of 215 m², and an 80% efficiency rate, each unit is expected to harvest approximately 74 m³ of rainwater annually. Each household will be required to install a 5.0 m³rainwater harvesting tank for additional potable use.

The property falls within the H70K catchment, where General Authorisation thresholds permit abstraction of 150 m³/ha/a. For Erf 134 (≈ 87 ha), this equates to a maximum allowable abstraction of 13,050 m³/a, well above the development's requirements. This confirms that sufficient groundwater resources are available, particularly as the dwellings are unlikely to be occupied year-round. The abstraction of groundwater for the development constitutes a Section 21(a) water use activity.

Groundwater will be abstracted from borehole 134C, located south of Main Road 268, and pumped into a proposed SBS Tank reservoir. It is recommended that this reservoir to be constructed near the unused borehole 134A. The reservoir size (130 kℓ) has been determined based on the required firefighting capacity (108 kℓ) plus the estimated daily demand of 16,8 kℓ /day. To ensure that sufficient firefighting capabilities exist, the supply pipeline from the reservoir to the development will consist of a 125mm Ø Class 9 uPVC water main complete with isolating valves, fire hydrants and erf connections.

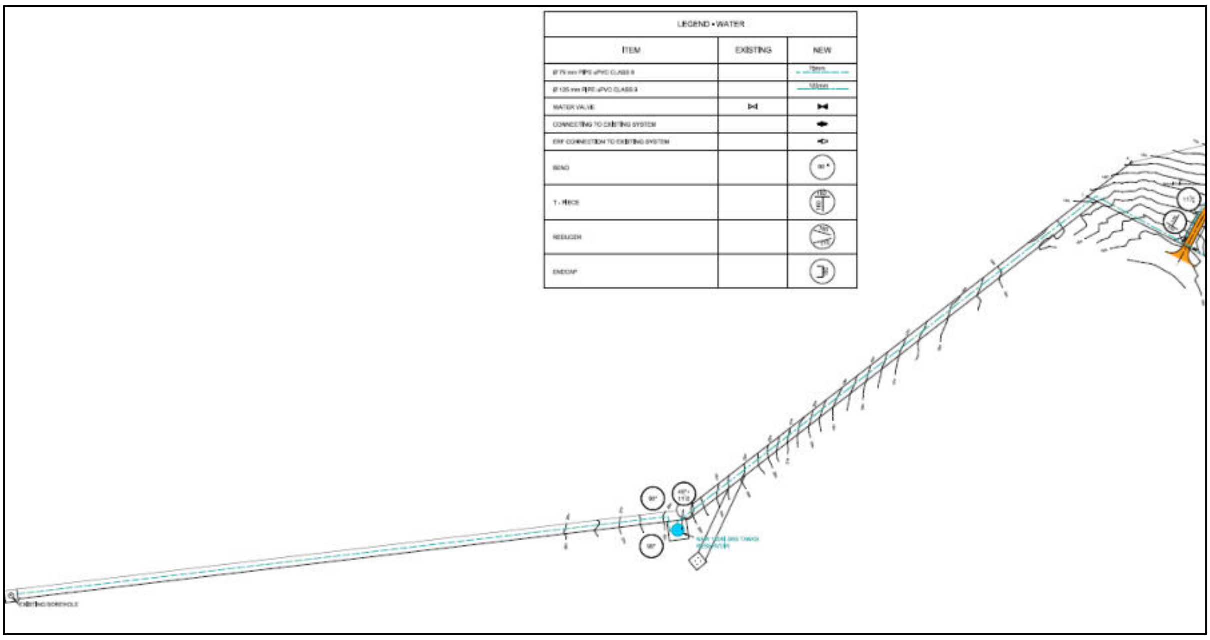


Figure 3: Borehole 134C, reservoir and water main (pipeline) to development

Wastewater Management

A total of 21 wastewater package treatment plants, one per unit, is proposed instead of conservancy tanks. These units will treat domestic sewage generated by the development. Of the 16.8 m³/day water demand, approximately 13.44 m³/day of sewage (≈ 4,905.6 m³/a) will be produced collectively.

Each residential unit will operate its own wastewater package treatment plants, but all units will be registered collectively under a single Section 21(g) water use activity to be managed by the Homeowners' Association (HOA) in terms of its constitution.

Treated effluent will be:

- Recycled for non-potable uses (e.g. toilet flushing); and/or
- Discharged underground via soak-aways.

Water Main

From the reservoir, water will be conveyed to the development units via a water main, which will branch at specific points to service individual units. A dry watercourse passes through the site, with fifteen units located north of the watercourse and the remaining five units to the south. The water main was initially planned to be installed within the 5 m building line, crossing the watercourse at an existing road (Main Road 268). However, following a site visit with officials from the Department of Water and Sanitation (DWS), it was recommended that the pipeline be relocated entirely within the property boundary, running parallel to the road rather than within its building line. This adjustment avoids placing the pipeline in the road, thereby reducing potential risks from future road maintenance or surfacing activities that could compromise the water main. This alignment of the water main constitutes a Section 21(c) water use activity, for which authorisation will be sought.

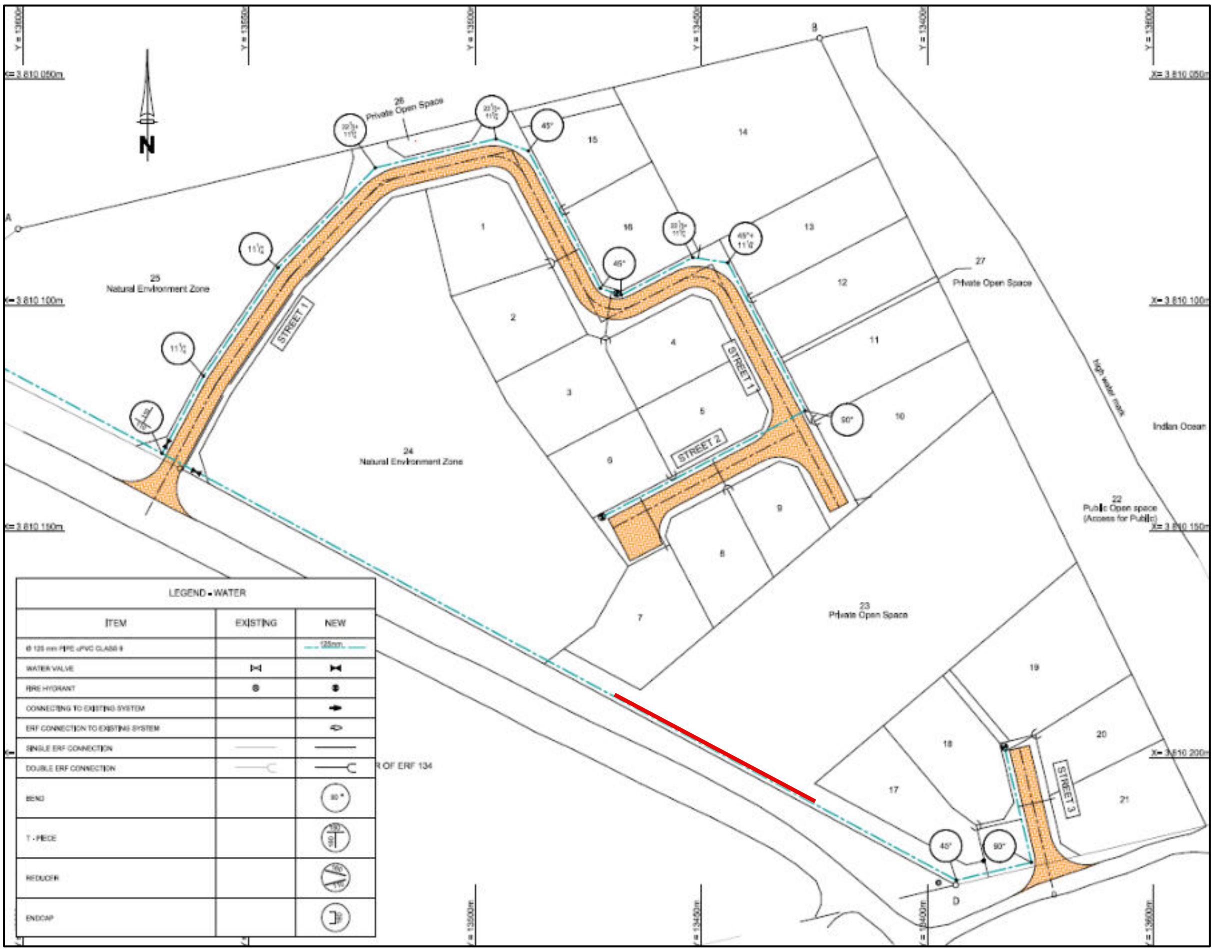


Figure 4: Water main layout, with the section of pipeline crossing the watercourse highlighted in red

Administrative documents and technical reports submitted by applicants

a. Administrative Documents

Administrative documents, including identity documents, title deeds, company registration documents, etc., will be submitted along with the Water Use Licence application:

b. Reports and other technical documents

The following technical documents will be submitted along with the Water Use Licence Application. A brief summary of the findings from each assessment or required document is provided below. The associated impacts and proposed mitigation measures are discussed in more detail in **Section 11 – Impacts and Mitigation Measures** of this report.

Geohydrological Impact Assessment & Aquifer testing (pump test)

The Geohydrological Impact Assessment conducted in September 2025 by Geo Pollution Technologies (Pty) Ltd (GPT) is attached as Appendix A for reference. A brief summary of its contents is provided below.

Hydrogeology

The site is underlain by fractured rock aquifers that can store and transmit groundwater. Water from deeper Table Mountain Group rocks is usually very good, while the shallower Bokkeveld Group, which is mostly at the site, tends to be moderately salty, likely due to past marine influence. Local testing of boreholes shows that borehole 134C can provide between 25,000 and 48,000 liters per day, which is more than enough for the development's needs of 16,800 liters per day. This borehole is also located away from other groundwater users, making it a preferred source. Overall, the site has a reliable but moderately saline groundwater source. Borehole 134C alone can meet the development's water needs without affecting surrounding users.

Hydrocenus

A hydrocensus in July 2025 found seven (7) boreholes and two (2) springs within 1 km radius of the site, with groundwater levels averaging 4.35 m below ground and flowing generally northeast toward the ocean. Water quality tests on three boreholes showed moderately saline conditions, with sodium and chloride above aesthetic limits. BH07 also had elevated iron and E. coli, while BH05 and BH07 showed high total coliform counts, likely from soil or nearby drainage. Overall, the groundwater is usable with treatment, but some localized bacterial contamination and salinity need to be managed.

Aquifer testing

Borehole BH134C at the site was tested in June 2020 with a 48-hour pumping program, including a Stepped Discharge Test, Constant Discharge Test, and Recovery Monitoring, to assess its productivity and aquifer properties. The tests determined the sustainable yield, calculated using the FC-Method, at 32.4 m^3/day (11,826 m^3/year). Water quality analysis showed elevated salinity (Na, Cl, EC, TDS) typical of the Bokkeveld Group and total coliforms above operational limits, indicating microbial contamination. The borehole can supply sufficient water for the development but requires treatment for potable use.

Borehole 134C Water Quality

Two groundwater samples were taken from the borehole—one in June 2020 and a second on 12 September 2025—for major anion, cation, and microbial analysis, with the latter sample including additional micro-determinants. Results were compared against the SANS 241-1:2015 drinking water standards.

Key observations from the September 2025 results include:

- Electrical conductivity (EC) & total dissolved solids (TDS): exceeded aesthetic limits
- Sodium (Na) & Chloride (Cl): exceeded aesthetic limits, indicating saline water typical of the Bokkeveld Group

- Iron (Fe): exceeded aesthetic limits, likely from steel casing corrosion
- Total coliforms: exceeded operational limits, likely due to stagnant borehole conditions

Overall, water quality has remained stable and similar to the 2020 results. Elevated iron and coliforms are expected to decrease with regular borehole use.

Reserve determination

The reserve determination assesses how much groundwater can be used from the site while still meeting basic human needs and protecting the environment. The property falls within the H70K quaternary catchment, which is currently classified as low-stress, meaning water use is well below recharge levels. The planned water demand for the development is 6,132 m³ per year, well within the general authorisation limit of 12,975 m³/year and below the sustainable yield of 11,826 m³/year. Recharge on the property is estimated at 12,283 m³/year. Resource Quality Objectives ensure that abstraction does not reduce groundwater levels for neighbouring users or compromise base flow to local rivers. Overall, the proposed water use.

Monitoring

A groundwater monitoring network is proposed to track water levels, abstraction volumes, and water quality on a quarterly basis to detect potential impacts and ensure sustainable use. Borehole BH134C will serve as the main abstraction and monitoring point, with BH134A, BH05, BH06, BH07, and BH09 used for additional level and quality monitoring. Key variables include groundwater levels, pumping volumes, major ions, pH, EC, TDS, and possible contaminants such as hydrocarbons and coliforms. The network will remain flexible to accommodate future changes or risks.

Table 4: Details of the monitoring boreholes

Borehole ID	Latitude (S)	Longitude (E)	Requirement	Frequency	Existing/New
BH134C	34° 25′ 15.35″	20° 50′ 40.01″	Abstraction, Water Level & Quality Monitoring	Quarterly	Existing
BH134A	34° 25′ 14.3040″	20° 50′ 57.0624″	Water Level & Quality Monitoring	Quarterly	Existing
BH05	34° 25′ 12.3060″	20° 50′ 55.8096″	Water Level	Quarterly	Existing
BH06	34° 25′ 12.1548″	20° 50′ 55.4644″	Water Level	Quarterly	Existing
BH07	34° 25′ 15.6952″	20° 51′ 17.9658″	Water Level	Quarterly	Existing
BH09	34° 25′ 12.2236″	20° 51′ 16.4459″	Water Level	Quarterly	Existing

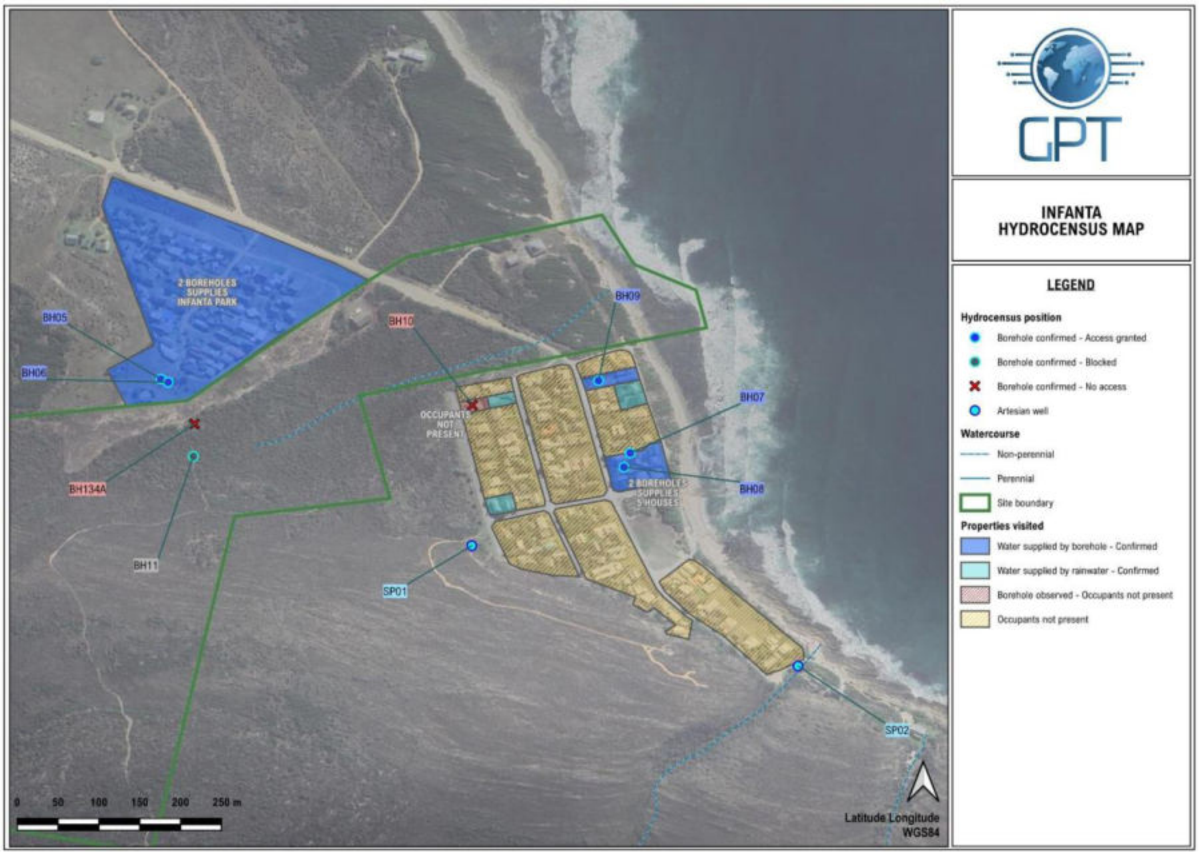


Figure 5: Hydrocensus Map

Freshwater Impact Assessment

The Freshwater Impact Assessment, prepared by Freshwater Consulting (Pty) Ltd in December 2024, is attached as Appendix B for reference. A brief summary of the key findings is provided below.

Hydrology and Watercourse Characteristics

A small, unnamed ephemeral (temporary/seasonal) stream crosses Erf 134, entering along the south-eastern boundary and flowing approximately 4 km to the sea. The stream forms part of the Breede River catchment (Lower Breede River sub-WMA, quaternary catchment H70K) and is dry most of the time, flowing only after heavy rainfall. Within the property, the stream channel is sandy, while upstream it includes bedrock and cobble. The stream is heavily invaded by *Acacia cyclops*, and surrounding vegetation comprises De Hoop Limestone Fynbos and Overberg Dune Strandveld, both of which are least threatened due to protection within De Hoop Nature Reserve.

Figure 6: Aerial photograph of Cape Infanta, showing the watercourse (blue line) and its recommended ecological buffer (purple outline). The 1:100 year floodline falls within the buffer.

The ecological condition and sensitivity of the stream were assessed following the Department of Water and Sanitation's (DWS) Resource Directed Measures (RDM) and EcoClassification approaches. These methods evaluate the Present Ecological State (PES), which reflects the system's integrity compared to its natural condition, and the Ecological Importance and Sensitivity (EIS), which indicates its biodiversity value and vulnerability to disturbance.

Results show that the stream is in a natural condition (PES Category A) for both instream (94%) and riparian (91%) habitats, indicating minimal human modification. Its ecological importance and sensitivity (EIS) are rated as High (2.5), reflecting its sensitivity to changes in flow and water quality and its connection to the De Hoop Nature Reserve. The stream's ecological management class is B, meaning only minimal alteration should be permitted.

Recommend ecological buffer

To protect the stream, a 20 m ecological buffer is recommended on both sides, measured from the centreline of the watercourse due to the absence of a clearly defined channel. This buffer was determined using the MacFarlane and Bredin (2017) method and is based on the stream's PES and EIS results. The existing sparse, shrubby vegetation within the buffer provides some protection, although denser vegetation such as grasses or sedges would enhance sediment and pollutant filtration. Maintaining this buffer during both construction and operational phases is considered sufficient to safeguard the stream and prevent deterioration of its current ecological condition.

Development layout

The preferred development layout for Erf 134 comprises 21 erven, all positioned outside the 40 m-wide ecological corridor that includes the 20 m stream buffer and the 1:100-year floodline. This corridor protects the stream, surrounding dune habitat, and associated terrestrial biodiversity. A conservation area of just over 6,000 m² in the north-western corner preserves sensitive limestone fynbos.

Freshwater ecology & impact significance

From a freshwater ecological perspective, the preferred layout provides multiple benefits. Open spaces allow infiltration of runoff and precipitation, the hardened footprint is minimised to reduce stormwater generation, and the watercourse corridor maintains habitat connectivity for fauna and flora. Construction impacts, such as the potential introduction of alien plants, are mitigated through careful sourcing of topsoil and adherence to the Environmental Management Programme (EMPr).

Operational impacts, including stormwater, wastewater management, and groundwater abstraction, are considered low to medium in significance before mitigation and low after mitigation. Mitigation measures include proper placement of package treatment plants or septic systems outside the corridor, use of rainwater tanks, and planting of indigenous species to maintain ecological connectivity. Overall, the preferred layout balances development needs with protection of freshwater and terrestrial habitats on site.

6. METHODS STATEMENT (ONLY FOR C AND I ACTIVITY)

A method statement will be provided to DWS upon request and included as a technical document if required. It will outline how the development and associated infrastructure, such as the water main, will be constructed across or adjacent to the water resource without compromising its integrity.

7. STORMWATER MANAGEMENT PLAN

The Civil Engineering Services Report, prepared by G. Pepler in March 2024, is attached as Appendix C for reference. A summary of the key findings is provided below. The report details the proposed Stormwater Management Plan for Erf 134, Cape Infanta, including post-development runoff estimates, attenuation measures, stormwater discharge design, and compliance with Swellendam Municipality's standards. It also incorporates the floodline determination and associated infrastructure specifications.

The 100-year floodline, as determined by Pr. Eng. A.L. Fraser, is located outside the proposed development footprint, confirming that the development area lies above the flood-prone zone and will not be directly affected by flood events.

8. REHABILITATION PLAN

The rehabilitation plan seeks to ensure the restoration and long-term ecological stability of areas disturbed during the construction of the development, with particular focus on the ecological buffer surrounding the watercourse. By adhering to the recommended 20 m buffer, no activities will occur within this zone except for the installation of the water pipeline. Trenching for the pipeline may temporarily disturb vegetation and mobilise sediment into the watercourse or downstream into the ocean, particularly during heavy rainfall events. The rehabilitation plan provides guidance for restoring these disturbed areas under the supervision of a qualified botanist, aiming to re-establish native vegetation, prevent erosion, and maintain the ecological function of the watercourse corridor.

8.1 Ecological buffer control

Management Outcome:	Protect the 20 m ecological buffer along the watercourse to maintain ecological function, biodiversity
Management Actions:	
a) Maintain a strict 20 m buffer from the watercourse centreline; no activities should occur within this zone except for the pipeline crossing. b) During pipeline installation, minimise disturbance by hand-excavating the trench and backfilling promptly to reduce soil exposure and sediment mobilisation. c) Replant indigenous vegetation along the disturbed pipeline corridor and within the buffer to restore high basal cover and stabilise soils.	

d) Prevent encroachment, dumping, or other disturbances in the buffer outside of the pipeline area. e) Monitor and control alien or invasive plant species within the buffer, including areas disturbed by the pipeline. f) Limit pedestrian access; provide boardwalks or designated pathways if access is required. g) Ensure the buffer protects not only the watercourse but also surrounding slopes that supply runoff from rainfall and upstream areas.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Bi-annual inspections to assess buffer condition, vegetation health, and the effectiveness of rehabilitation along the pipeline corridor.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	The license holder will be required to do annual internal audits on the conditions of the license as well as appoint an independent consultant to undertake external audits.

8.2 Alien vegetation control

Management Outcome:	Maintain and restore indigenous vegetation within the 20 m ecological buffer and prevent the establishment or spread of alien species.
Management Actions:	
a) Identify and remove alien or invasive plants, prioritising manual methods (pulling, cutting, digging) to minimise disturbance to native vegetation. If unsure, please contact a qualified botanist or CapeNature for assistance; b) Replant cleared areas with appropriate indigenous species. c) Monitor regrowth regularly and remove seedlings before they mature to prevent seed spread. d) Ensure existing indigenous vegetation along the watercourse and buffer is retained. e) Prohibit the use of invasive species in landscaping, e.g., Kikuyu grass.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Conduct site inspections or vegetation surveys bi-annually with a Botanist or Vegetation Specialist.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	The license holder will be required to do annual internal audits on the conditions of the license as well as appoint an independent consultant to undertake external audits.

8.3 Erosion control

Management Outcome:	Ensure soil stability, prevent erosion, and protect the ecological integrity of the 20 m watercourse buffer.
Management Actions:	
a) Replant indigenous vegetation on bare or eroded areas (pipeline trenches and around units) to stabilise soil and reduce runoff.	

b) Cover exposed soil with biodegradable mats (jute or coir) to support vegetation growth. c) Maintain or enhance dense vegetation along watercourse edges to slow water and trap sediment. d) Apply mulch and fast-growing indigenous seed to quickly stabilise eroded areas.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Conduct site inspections or vegetation surveys bi-annually with a Botanist or Vegetation Specialist.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	The license holder will be required to do annual internal audits on the conditions of the license as well as appoint an independent consultant to undertake external audits.

8.4 Fire control

Management Outcome:	Reduce the risk of fire and protect residents, infrastructure, and natural areas.
Management Actions:	
a) Maintain cleared firebreaks around residential units and along the ecological buffer. b) Keep vegetation in open spaces and along watercourse edges well-managed to reduce fuel load. c) Ensure all residents are aware of fire safety procedures. d) Prohibit burning of waste or garden material on site. e) Maintain access for emergency vehicles throughout the development.	
Implementation:	
Responsible party:	License holder
Timeframe for implementation:	After construction and throughout the operational phase
Monitoring:	
Method of monitoring:	Conduct regular inspections to ensure firebreaks and vegetation management are maintained.
Frequency of monitoring:	Bi-annually
Mechanism for monitoring compliance:	Annual internal audits by the license holder, supported by independent external audits as required.

9. WATER USES APPLIED FOR

Any activity listed under Section 21 of the National Water Act (Act 36 of 1998) constitutes a water use. Such water use activities must be authorised through a Water Use Licence or other relevant Water Use Authorisation issued by the Department of Water and Sanitation before the activity can legally proceed. Below is a concise table summarising the Section 21 water use activities under the National Water Act (Act 36 of 1998):

Table 5: Section 21 Water Use Activities under the National Water Act

Water Use	Description
21(a)	Taking water from a water resource.
21(b)	Storing water.
21(c)	Impeding or diverting the flow of water in a watercourse.
21(d)	Engaging in a stream flow reduction activity (reducing water flow in a watercourse).
21(e)	Engaging in a controlled activity identified as such in section 37(1) or declared under section 28(1) of the NWA.
21(f)	Discharging waste or water containing waste into a water resource.
21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource.
21(h)	Disposing of waste in a manner which contains waste from or which has been heated in any industrial or power generation process.
21(i)	Altering the bed, banks, courses or characteristics of a watercourse.
21(j)	Removing, discharging or disposing of water found underground if it is necessary of the efficient continuation of an activity or for the safety of the people.
21(k)	Using water for recreational purpose.

Table 6: Water Use Applied for

Water Use Activities	Purpose	Capacity/Volume (m^3, tonnes and/or m^3/annum)/ dimension	Property description	Coordinates
Section 21 (a)				
Abstraction of groundwater through borehole (134C)	To supply water for domestic use and for fire-fighting capacity	7,665 m^3/a	Erf 134	34° 25' 15.35" S 20° 50' 40.01" E
Section 21 (c)				
Constructing and operating a water main that crosses a watercourse within the property	To convey water for domestic use to the development's units	125 mm Ø Class 9 uPVC water main	Erf 134	34° 25' 9.98" S 20° 51' 12.86" E
Section 21 (g)				
Each of the 21 residential units will have its own small-scale wastewater package treatment plant, collectively registered under a single Section 21(g) water use activity	To treat domestic sewage from each unit for safe reuse and/or disposal	4,905.6 m^3/a	Erf 134	34° 25' 7.59"S 20° 51' 13.22"E

10. IMPACT AND MITIGATION MEASURES

The potential impacts and mitigation measures that are expected from the proposed activities are presented in the table below:

Table 7: Summary of impacts and mitigation measures

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
Construction phase			
S21 (c) Trenching within the ecological corridor for laying of bulk water pipeline. Constructing and operating a water main that crosses a watercourse within the property.	Mobilisation of sediment into the watercourse or ocean, especially during high rainfall events; short-term loss of natural vegetation within the working area	Negative impact on ecological corridor and stream habitat; deterioration in stream Present Ecological State; sedimentation in the tidal zone and smothering of vegetation in the watercourse	o Keep construction footprint to a minimum o Excavate trenches by hand, not machinery o Conduct trenching during the dry season o Fill opened trenches as quickly as possible; avoid opening within three days of predicted heavy rainfall o The watercourse corridor must be well marked during the pre-construction phase. o Rehabilitate disturbed areas with input from a botanist
S21 (g) Earthworks for installation of 21 small-scale wastewater package treatment plants, each serving a residential unit	Disturbance of land and soil during installation; potential accidental spillage of construction materials	Localised contamination of soil or nearby watercourses; short-term disturbance to vegetation and habitats	o Install package plants outside the recommended ecological buffer zones o Follow proper construction procedures to avoid spills o Limit soil disturbance and footprint of construction o Immediate clean-up of any accidental spills o Protect nearby watercourses with sediment control measures

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
Operational phase			
Section 21 (a) Lowering of groundwater levels (drawdown of water table)	Pumping of groundwater from the borehole for operational use	Decline in groundwater levels; potential reduced availability for other users; temporary ecological impacts	o Monitor groundwater levels according to the monitoring plan o Record pumped water volumes at production boreholes monthly o Record water levels monthly; reduce pumping if declining trends are observed until stabilized o Adhere to recommended yields and pumping cycles o Record rainfall readings
Section 21 (a) Spread of groundwater contamination	Contaminants like stormwater, etc entering boreholes	Contamination of groundwater; reduced water quality for other users; potential health and ecological risks	o Design and install sewerage systems according to development demand o Maintain sewerage systems to prevent contamination o Divert stormwater away from abstraction boreholes o Line contamination sources (workshops, etc.) to prevent groundwater contamination o Conduct water quality sampling as specified in the monitoring requirements
S21(g) On-site treatment of wastewater (package plants and septic tanks)	Pollution of watercourse, groundwater, and coastline due to operation of on-site wastewater treatment systems	Deterioration of water quality in watercourse, groundwater, and coastal areas; potential minor ecological impacts	o Do not use treated wastewater for irrigation; it may be used for flushing toilets only o Place all septic tanks and package plants outside the 40 m ecological corridor o Inspect package plants, septic tanks, and soakaways at least annually to ensure proper functioning

Water Use Activity	Possible Cause Of Impacts Of The Activities To The Water Resource	Possible Impacts To The Water Resource And Other Water Users	Mitigation Measures
			o Educate residents on appropriate use of household chemicals, detergents, and solvents to avoid impairing septic tank efficiency (e.g., avoid bleaches that destroy bacterial communities)

11. WATER DEMAND AND SUPPLY

The estimated Annual Average Daily Demand (AADD) for the development is:

- 21 single residential erven (small): 800 ℓ/unit/day = 16.8 m³/day

Two boreholes (134A and 134C) are located on Erf 134. A 72-hour pumping test on borehole 134C (Van Biljon, 2014) confirmed a sustainable yield of 25 m³/day, with a maximum of 48 m³/day under optimal conditions. This yield exceeds the development's estimated potable demand of 16.8 m³/day (≈ 6,312 m³/a). Including provision for fire-fighting, the total annual water demand is estimated at 7,665 m³/a.

Borehole BH134C at the site was tested in June 2020 with a 48-hour pumping program, including a Stepped Discharge Test, Constant Discharge Test, and Recovery Monitoring, to assess its productivity and aquifer properties. The tests determined the sustainable yield, calculated using the FC-Method, at 32.4 m³/day (11,826 m³/year). Water quality analysis showed elevated salinity (Na, Cl, EC, TDS) typical of the Bokkeveld Group and total coliforms above operational limits, indicating microbial contamination from soil. The borehole can supply sufficient water for the development but requires treatment for potable use.

The property falls within the H70K catchment, where General Authorisation thresholds permit abstraction of 150 m³/ha/a. For Erf 134 (≈ 87 ha), this equates to a maximum allowable abstraction of 13,050 m³/a, well above the development's requirements. This confirms that sufficient groundwater resources are available, particularly as the dwellings are unlikely to be occupied year-round.

12. PUBLIC PARTICIPATION

The public participation process will be undertaken in accordance with Section 41(4) of the National Water Act, 1998 (Act No. 36 of 1998). The Water Use License application (WULA) Summary Report and its supporting appendices will be made available to the public — including adjacent landowners, relevant authorities, organs of state, and other interested stakeholders — for review and comment.

The 60-day public commenting period required for the Water Use Authorisation process, i.e. the WULA will be divided into two 30-day period phases to align with the public participation requirements of the NEMA Environmental Impact Assessment (EIA) Regulations, as the Water Use Authorisation process is being processed concurrently with an Environmental Authorisation process.

The application will be advertised in a local newspaper, and site notices containing public participation details will be placed at or near the site. Following the commenting period, all submissions received will be captured and addressed in a Comment and Response Report, compiled either as an appendix table or a stand-alone document.

13. SECTION 27 OF THE NATIONAL WATER ACT, 1998 (ACT 36 OF 1998)

The requirements contained in Section 27(1) of the National Water Act, 1998 (Act 36 of 1998) have been considered and are discussed in the **Section 27 Motivation Report** attached as **Appendix D.**

APPENDICES

Appendix A: Geohydrological Impact Assessment/Report

Appendix B: Freshwater Impact Assessment/Report

Appendix C: Civil Engineering Services Report

Appendix D: Section 27 Motivation Report

Consulting Environmental Scientists

ISO 9001:2015 | B-BBEE Level Two

www.gptglobal.com

Department:

Inorganic Business Unit

Project Name:

Hydrogeological Study for the Infanta Development

Client:

Doug Jeffery Environmental Consultants

GPT Ref No:

DJINF-25-13509

Version:

Final

Offices in: Gauteng, Western Cape, KwaZulu-Natal & Mozambique

Report Type:	Hydrogeological Study for Water Use License Application
Project Title:	Hydrogeological Study for the Infanta Development
Site Name:	Infanta
Site Location:	Infanta, Western Cape
Compiled For:	Doug Jefferies Consulting (Pty) Ltd
Compiled By:	Marius Terblanche
GPT Reference:	DJINF-25-13509
Client Reference:	N/A
Version:	Final
Date:	September 2025
Distribution List (Current Version):	Mr Lian Roos
Reviewed by:	Marius Terblanche

Disclaimer:

The results and conclusions of this report are limited to the Scope of Work agreed between GEM-GPT and the Client for whom this investigation has been conducted. All assumptions made and all information contained within this report and its attachments depend on the accessibility to and reliability of relevant information, including maps, previous reports and word-of-mouth, from the Client and Contractors.

Declaration:

I hereby declare:

- I have no vested interest (present or prospective) in the project that is the subject of this report as well as its attachments. I have no personal interest with respect to the parties involved in this project.
- I have no bias with regard to this project or towards the various stakeholders involved in this project.
- I have not received, nor have I been offered, any significant form of inappropriate reward for compiling this report.

(*electronic signature)*

M. Terblanche, BSc Hons. Pr.Sci.Nat. Professional Natural Scientist (No 400081/17)

Geo Pollutions Technology – Gauteng (Pty) Ltd – GPT office: Pretoria

(*electronic signature)*

H.C. Dreyer, B.Sc. Hons; Pr. Sci. Nat (138930)

Geo Pollutions Technology – Gauteng (Pty) Ltd – GPT office: Pretoria

Customer Satisfaction:

Feedback regarding the technical quality of this report (i.e. methodology used, results discussed and recommendations made), as well as other aspects, such as timeous completion of project and value of services rendered, can be posted onto GPT's website at www.gptglobal.com.

EXECUTIVE SUMMARY

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Doug Jeffery Environmental Consultants (Pty) Ltd to conduct a hydrogeological study in support of the water use license to be applied for the by the client on behalf of the proposed Infanta Development.

The site is located in Infanta near Witsand, in the Western Cape.

The area is characterised by a gently undulating topography and in the area of the site the slope is more or less in the order of 3% (0.03).

Locally drainage is towards the Indian Ocean as well as the Brëe River that flows from northwest to southeast to the north of the site.

Climatic data was obtained from the GRDM V4.0 database as developed by the DWA and FetWater. The average annual rainfall is approximately 458mm/a.

The site is underlain by light grey to red sandy soil and calcrete with alluvium deposits to the coastline. Furthermore, the underlying geology in the region consist of the Skurweberg Formation as well as the Rietvlei Formation of the Nardouw Subgroup, Table Mountain Group, as well as the Robberg Formation of the Uitenhage Group. The Skurweberg Formation mainly comprises of light grey quarzitic sandstone. The Reitvlei Formation consists of light grey feldspathic sandstone with occasional thin siltstone and shale beds. The Robberg Formation consists of silicified sandstone and conglomerate. These formations all strike in an east west direction with a northward dip of between 30 and 40 degrees.

According to Meyer (2001), the Table Mountain Group (TMG), notably the often-fractured arenaceous components, is largely anisotropic and thus does not display uniform aquifer characteristics. An intricate network of fissures, joints, fractures and even cavities govern the infiltration, storage and transmission of groundwater in the largely competent and brittle natured arenaceous units of the TMG. The TMG generally constitutes the mountainous areas which, in turn influence precipitation to a significant extent. An abundance of springs is a further characteristic of the TMG

A hydrocensus was conducted on the 28 & 29th of July 2025 within a 1km radius form the property boundary. Seven (7) operational boreholes were located as well as two (2) springs. The hydrocensus recorded an average groundwater level of 4.35 m below ground level (mbgl), with measured depths ranging from 3.60 mbgl to 5.04 mbgl. The general groundwater flow direction is towards the northeast in the direction of the ocean. Boreholes BH05, BH07 and BH09 were selected to be tested for groundwater quality. The water quality results are compared with the SANS 241-1: 2015 target water quality limits.

A Stepped Discharge Test, Constant Discharge Test & Recovery Monitoring was performed on borehole 134C. Based on the available data, it can be concluded that a total volume of 32.4 m^3/day can be abstracted from the tested borehole.

The GDT calculated a vulnerability value of 58% for the aquifer which is classified as medium. Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a “Minor Aquifer System”, based on the fact that the local population is not dependent on groundwater. A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a medium level of groundwater protection is required for the aquifer.

The general authorisation volume for the area is calculated at 12 975 m^3/year, while the planned water demand is 6 132 m^3/year. Therefore, it can be concluded that the proposed demand falls within the scope of a general authorisation. If the maximum volume that can be abstracted, according to the sustainable yield calculations (Section 7.2) of 32.4 m^3/day or 11 826 m^3/year, is applied for, this volume still remains within the general authorisation allowance.

Recommendations:

The following actions are recommended to be implemented during the construction and the implementation phases:

- Groundwater quality exceedances in the boreholes above the SANS 241 drinking water standards indicated that the groundwater at the site is not suitable for use as potable water without prior treatment. The exceedances in total coliforms can be addressed by improving sanitation systems and ensuring human or animal wastes are properly disposed of.
- The monitoring as recommended in the report should be established prior to operation. The water level monitoring should be conducted weekly for the first three months of operation and if no significant water level decline is observed, the monitoring can be conducted on a monthly basis. Alternatively, automatic water level measurement in the form of pressure transducers can be installed to aid in this process. Logs of flow meter readings should also be kept and the flowmeter should also be read once per month.
- Seawater intrusion may become a concern during extended abstraction periods and should be monitored.
- A rainfall gauge should be installed on the site and rainfall readings should be taken after every rainfall event and the time and date of the reading recorded.
- The monitoring data (water levels, rainfall and chemistry) should be kept in an electronic database for further analysis should this be required.
- The recommended pump cycle for the borehole is 12 hours per day. If the pump cycle is to be extended, the maximum daily volume for each borehole must not be exceeded and the pumping rate must be reduced to sustainable rates. Refer to management recommendations in Table 22.
- It is recommended that the hydrocensus be repeated once every 2 years to ensure that no new groundwater users are affected. The hydrocensus should extend to a 1km radius around the site boundary.
- The regional groundwater table must be maintained to:
    - Ensure that schedule 1 water users adjacent to the site have adequate water supply to basic human need.
    - Ensure that adequate water is available to maintain base flow in the tributaries of the Breede River.

TABLE OF CONTENTS

Page

1 INTRODUCTION 1

2 SCOPE OF WORK 1

3 METHODOLOGY 1

3.1 DESK STUDY 1

3.2 HYDROCENSUS 1

4 GEOGRAPHICAL SETTING 1

4.1 SITE LOCATION, TOPOGRAPHY AND DRAINAGE 1

4.2 CLIMATE 4

5 PREVAILING GROUNDWATER CONDITIONS 4

5.1 GEOLOGY 4

5.2 HYDROGEOLOGY 4

5.3 GROUNDWATER RECHARGE CALCULATIONS 6

6 HYDROCENSUS 8

6.1 HYDROCENSUS FINDINGS AND GROUNDWATER FLOW DIRECTION 8

6.2 HYDROCENSUS GROUNDWATER QUALITY 12

7 AQUIFER TESTING 14

7.1 DESCRIPTION OF A PUMP TEST 14

7.2 CALCULATING THE SUSTAINABLE YIELD OF THE BOREHOLE 15

7.3 GROUNDWATER QUALITY OF BH134C 16

8 AQUIFER CHARACTERISATION 18

9 RESERVE DETERMINATION 22

9.1 INTRODUCTION 22

9.2 APPROACH 22
9.3 DESCRIPTION OF THE STUDY AREA 22
9.4 PRESENT WATER DEMAND 23
9.5 RESERVE DIRECTED MEASURES ASSESSMENT 23
10 RISK ASSESSMENT 26
10.1 CURRENT GROUNDWATER CONDITIONS 26
10.2 RISK ASSESSMENT 26
10.3 MITIGATION MEASURES 34
11 GROUNDWATER MONITORING SYSTEM 36
11.1 GROUNDWATER MONITORING NETWORK 36
11.2 MONITORING PARAMETERS 36
11.3 MONITORING NETWORK 37
12 CONCLUSIONS AND RECOMMENDATIONS 38
12.1 RECOMMENDATIONS 39

LIST OF FIGURES

Page

FIGURE 1: SITE LOCATION AND QUATERNARY CATCHMENT BOUNDARIES. 2
FIGURE 2: SITE TOPOGRAPHY. 3
FIGURE 3: REGIONAL GEOLOGY MAP (1:250 000 GEOLOGY SERIES MAP). 7
FIGURE 4: HYDROCENSUS MAP. 10
FIGURE 5: GROUNDWATER FLOW DIRECTION MAP.... 11

LIST OF TABLES

Page

TABLE 3: RECHARGE CALCULATION FOR THE AQUIFER. 6
TABLE 2: DETAILS OF THE HYDROCENSUS BOREHOLES. 9
TABLE 5: WATER QUALITIES COMPARED TO SANS 241-1:2015 GUIDELINES FOR HYDROCENSUS BOREHOLES.... 12
TABLE 4: RESULTS OF THE SUSTAINABLE YIELD CALCULATIONS. 15
TABLE 5: WATER QUALITIES COMPARED TO SANS 241-1:2015 GUIDELINES FOR BH134C. 17
TABLE 6: RATINGS – AQUIFER SYSTEM MANAGEMENT AND SECOND VARIABLE CLASSIFICATIONS.... 19
TABLE 7: RATINGS - GROUNDWATER QUALITY MANAGEMENT (GQM) CLASSIFICATION SYSTEM 20
TABLE 8: GQM INDEX FOR THE STUDY AREA.... 21
TABLE 9: CATCHMENT STRESS INDEX TABLE.... 23
TABLE 10: MOST SALIENT PARAMETERS RELEVANT TO THE CATCHMENT.... 23
TABLE 12: RECHARGE TO THE PROPERTY 24
TABLE 11: A SUMMARY OF THE RESERVE FOR THE QUATERNARY CATCHMENT H70K 24
TABLE 13: EXPLANATION OF THE EIA CRITERIA 27
TABLE 14: IMPACT EXTENT 29
TABLE 15: IMPACT DURATION 30
TABLE 16: IMPACT INTENSITY 31
TABLE 17: IMPACT PROBABILITY 32
TABLE 18: IMPACT SIGNIFICANCE 33
TABLE 19: MITIGATION MEASURES FOR THE MANAGEMENT OF LOWERING OF GROUNDWATER LEVEL 34
TABLE 20: MITIGATION MEASURES FOR THE MANAGEMENT OF THE SPREAD OF GROUNDWATER CONTAMINATION.... 35
TABLE 21: DETAILS OF THE MONITORING BOREHOLES 37
TABLE 22: MANAGEMENT RECOMMENDATIONS FOR THE INFANTA PRODUCTION BOREHOLE.... 40

LIST OF APPENDICES

		Page
APPENDIX I:	**HYDROCENSUS DATA**	41
APPENDIX II:	**WATER QUALITY DATA**	42
APPENDIX III:	**PUMPTESTING FIELD DATA**	43
APPENDIX IV:	**FC INTERPRETED PUMP TEST DATA**	44

LIST OF ABBREVIATIONS

Abbreviation	Explanation
EC	Electrical Conductivity
km^2	Square kilometre
L/s	Litres per second
GRDM	Groundwater Resource Directed Measures
mamsl	Metres above mean sea level
Mm^3/a	Milicubes per year
m	metre
mm	Millimetre
mm/a	Millimetres per annum
mS/m	Millisiemens per metre
m^3	Cubic metre
MAP	Mean Annual Precipitation
NWA	National Water Act (Act No. 36 of 1998)
RDM	Resource Directed Measures
RQO	Resource Quality Objective
TDS	Total Dissolved Solids
WMA	Water Management Area
WMP	Water Management Plan

DEFINITIONS

Definition	Explanation
Aquifer	A geological formation which has structures or textures that hold water or permit appreciable water movement through them. Source: National Water Act (Act No. 36 of 1998).
Borehole	Includes a well, excavation, or any other artificially constructed or improved underground cavity which can be used for the purpose of intercepting, collecting or storing water in or removing water from an aquifer; observing and collecting data and information on water in an aquifer; or recharging an aquifer. Source: National Water Act (Act No. 36 of 1998).
Drawdown	The distance between the static water level and the surface of the cone of depression.
Fractured Aquifer	An aquifer that owes its water-bearing properties to fracturing.
Groundwater	Water found in the subsurface in the saturated zone below the water table.
Groundwater Flow	The movement of water through openings in sediment and rock; occurs in the zone of saturation in the direction of the hydraulic gradient.
Hydraulic Conductivity	Measure of the ease with which water will pass through the earth's material; defined as the rate of flow through a cross-section of one square metre under a unit hydraulic gradient at right angles to the direction of flow (m/d).
Intergranular Aquifer	A term used in the South African map series referring to aquifers in which groundwater flows in openings and void spaces between grains and weathered rock.
Monitoring	The regular or routine collection of groundwater data (e.g. water levels, water quality and water use) to provide a record of the aquifer response over time.
Observation Borehole	A borehole used to measure the response of the groundwater system to an aquifer test.
Production Borehole	A borehole specifically designed to be pumped as a source of water supply.
Recharge	The addition of water to the saturated zone, either by the downward percolation of precipitation or surface water and/or the lateral migration of groundwater from adjacent aquifers.
Transmissivity	Transmissivity is the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is expressed as the product of the average hydraulic conductivity and thickness of the saturated portion of an aquifer.
Unsaturated Zone (Also Termed Vadose Zone)	That part of the geological stratum above the water table where interstices and voids contain a combination of air and water.
Watershed (Also Termed Catchment)	Catchment in relation to watercourse or watercourses or part of a watercourse means the area from which any rainfall will drain into the watercourses or part of a watercourse through surface flow to a common point or points. Source: National Water Act (Act No. 36 of 1998).
Water Table	The upper surface of the saturated zone of an unconfined aquifer at which pore pressure is equal to that of the atmosphere.

HYDROGEOLOGICAL STUDY

INFANTA

1 INTRODUCTION

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Doug Jefferies Consulting (Pty) Ltd to update a hydrogeological study that will form part of the Environmental Impact Assessment for the use of groundwater for water supply purposes for the proposed development of 21 houses.

The report is structured according to the requirements of the National Water Act, 1998 Regulations regarding the procedural requirements for water use licence applications and appeals 24 March 2017, Act No. R. 267.

2 SCOPE OF WORK

Within the scope of work the groundwater study aimed to address the requirements of the planned water use license application for the abstraction of groundwater for irrigation purposes.

3 METHODOLOGY

3.1 Desk Study

This entailed the gathering of information through the collation, scrutiny and evaluation of available and relevant meteorological, geographical, geological, hydrogeological and water quality data.

3.2 Hydrocensus

A hydrocensus was conducted within a 500 m radius of the site boundary to gather data of legitimate groundwater users in the area.

4 GEOGRAPHICAL SETTING

4.1 Site Location, Topography and Drainage

The site is located near Witsand, in the Western Cape. (Figure 1).

The area (shown in Figure 2) is characterised by a gently undulating topography and in the area of the site the slope is more or less in the order of 3% (0.03).

Locally drainage is towards the Indian Ocean as well as the Breede River that flows from northwest to southeast to the north of the site.

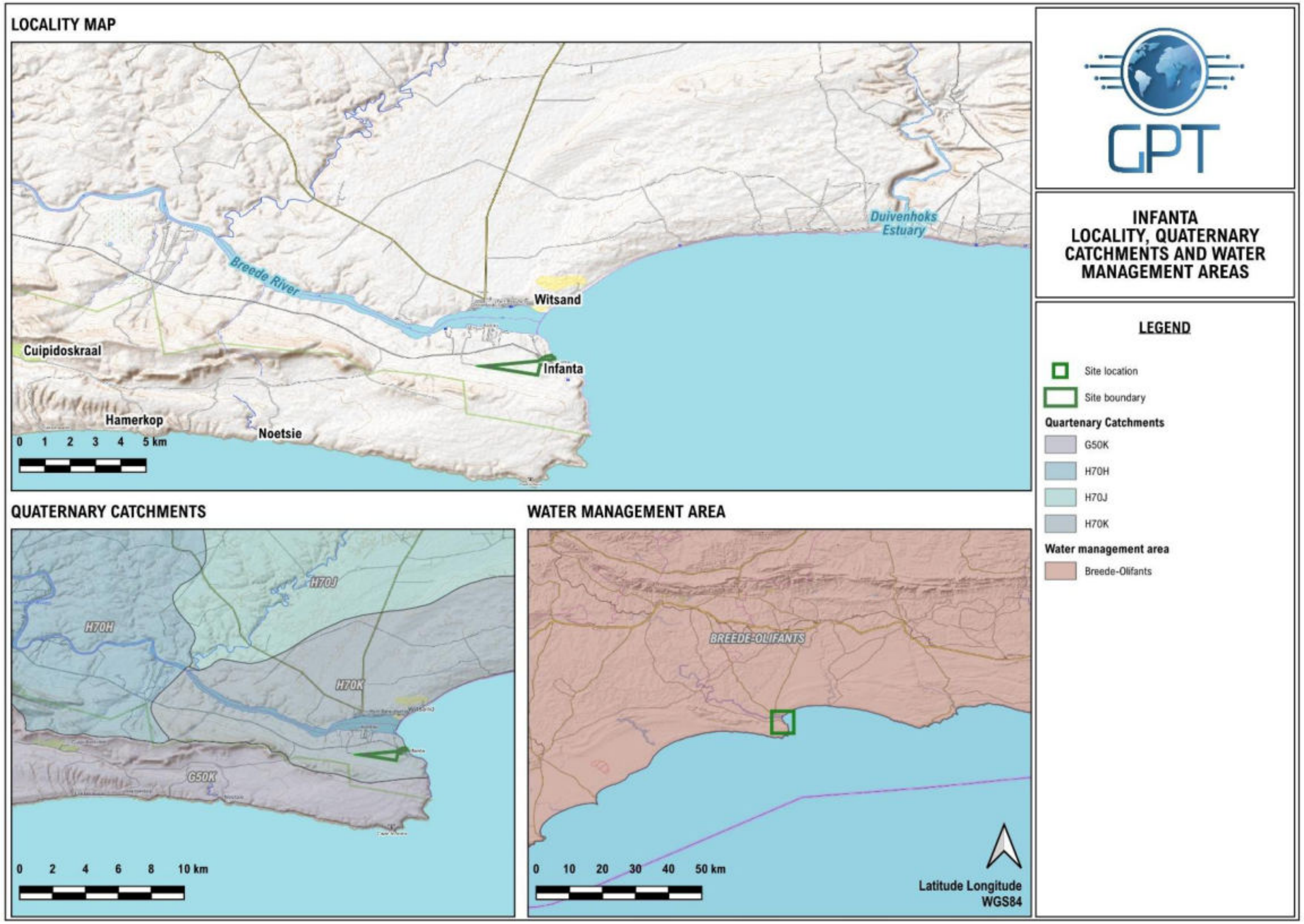


Figure 1: Site Location and Quaternary Catchment Boundaries.

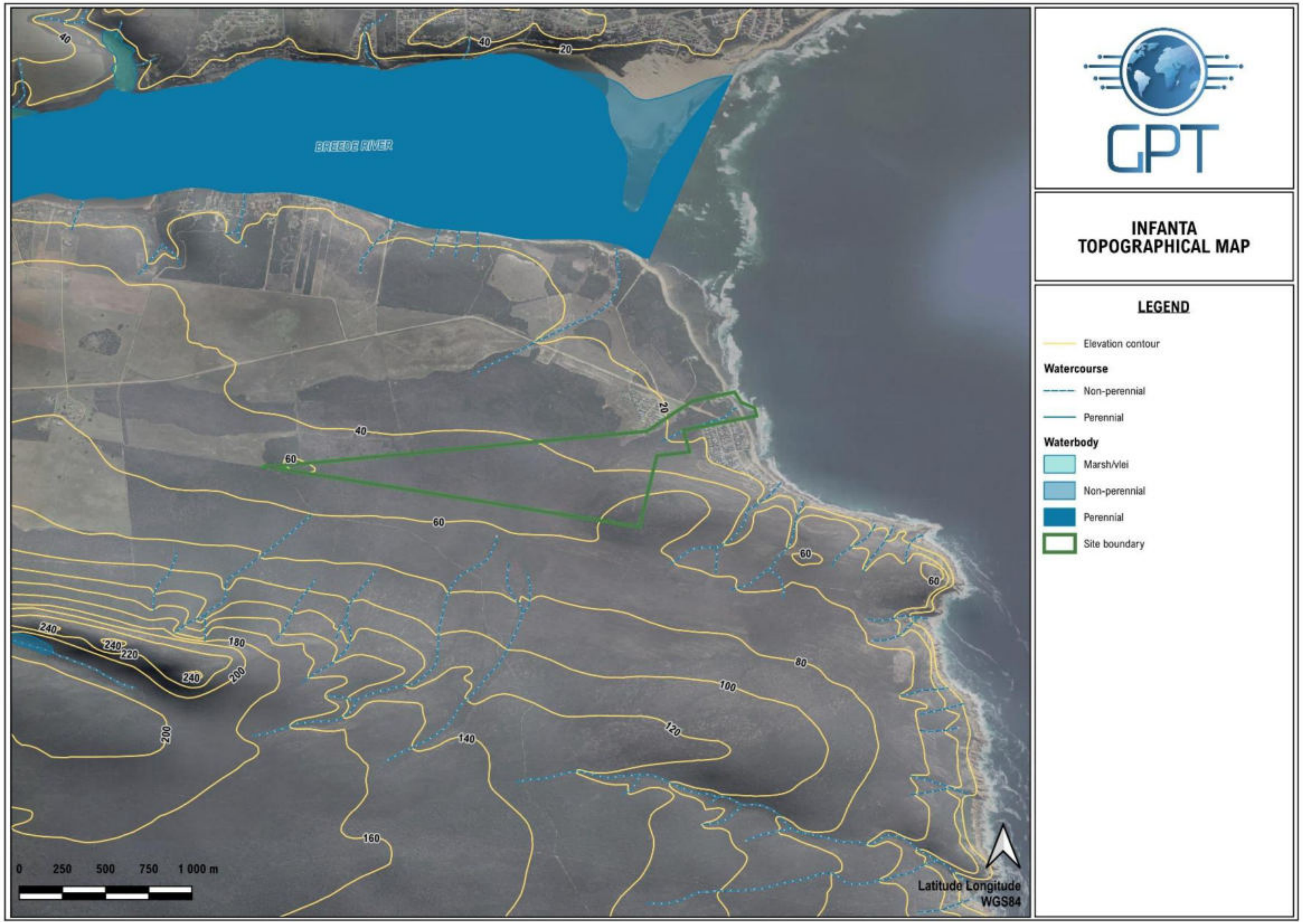


Figure 2: Site Topography.

4.2 Climate

Climatic data was obtained from the GRDM V4.0 database as developed by the DWA and FetWater[1]. The average annual rainfall is approximately 458mm/a.

5 PREVAILING GROUNDWATER CONDITIONS

5.1 Geology

5.1.1 Regional Geology

The investigated area falls within the 1:250 000 series geology map (3420 Riverdale). An extract of this map is shown in Figure 3. According to the map the site is underlain by light grey to red sandy soil and calcrete with alluvium deposits to the coastline. Furthermore the underlying geology in the region consist of the Skurweberg Formation as well as the Rietvlei Formation of the Nardouw Subgroup, Table Mountain Group, as well as the Robberg Formation of the Uitenhage Group. The Skurweberg Formation mainly comprises of light grey quarzitic sandstone. The Reitvlei Formation consists of light grey feldspathic sandstone with occasional thin siltstone and shale beds. The Robberg Formation consists of silicified sandstone and conglomerate. These formations all strike in an east west direction with a northward dip of between 30 and 40 degrees.

5.1.2 Local Geology

Based on the published data and the Parsons (2006) report[2], the site is underlain by Quaternary soil with unknown thicknesses. Underneath these recent sediments the Rietvlei and Skurweberg Formations of the Table Mountain Group can be found. The latter formation is regarded as an extensive aquifer that could support large scale abstraction. However, the 1:250 000 series maps are not detailed enough to accurately represent the geology of the site as it is evident that the site is underlain by the shales of the Bokkeveld Group. Outcrops of the Bokkeveld geology can be seen along the shoreline of the property, where it underlies the younger conglomerate and calcrete lithologies found at the site.

5.2 Hydrogeology

5.2.1 Regional Hydrogeology

According the 1:500 000 hydrogeological map (3317 Cape Town), the site is underlain by a fractured aquifer. The mean yield for a successful borehole in this aquifer is between 0.5 and 2 l/s and this was confirmed by previous reports that included drilling of a new borehole. The previous work by Parsons and Associates (2006) estimates the sustainable yield from 134A at 0.7 l/s when pumped for 12 hours a day, with 134C yielding 1 l/s when pumped for 18 hours a day.

[1] Groundwater Reserve Directed Measured. Department of Water Affairs (2010), developed by FetWater.

[2] Parsons, 2006. Geohydrological Assessment of the Planned Development at Erf 124, Infanta. Parsons and Associates.

As the Bokkeveld Group overlies the Table Mountain Group , the hydrogeology of the THM could be relevant at deeper depths. According to Meyer[3], the Table Mountain Group (TMG), notably the often fractured arenaceous components, is largely anisotropic and thus does not display uniform aquifer characteristics. An intricate network of fissures, joints, fractures and even cavities govern the infiltration, storage and transmission of groundwater in the largely competent and brittle natured arenaceous units of the TMG. The TMG generally constitutes the mountainous areas which, in turn influence precipitation to a significant extent. An abundance of springs is a further characteristic of the TMG. Three kinds of springs can be distinguished:

1. Fault and major structure controlled, generally deep circulating springs, often with large constant supplies

2. Lithologically controlled, relatively shallow circulating springs. These springs issue due to the presence of impeding shale layers such as the Cederberg Shale Formation. Yields from these springs are less constant and seasonal yield fluctuations are a distinctive feature. The bulk of the perennial springs issuing from the TMG are likely to be lithologically controlled.

3. Springs are seeping from numerous small fractures and joints. They are very evident during and shortly after rainy periods and are responsible for the myriad of springs in the TMG. They are however highly seasonal and cease to exist with the onset of dry weather conditions.

The quality of groundwater from the TMG is excellent with electrical conductivities generally ranging between 5 and 70mS/m. However, groundwater with EC's of up to 180mS/m can occasionally be procured from boreholes drilled into interbedded shaly layers. Groundwater is generally of a sodium chloride nature.

In the case of the Bokkeveld Group which is found predominantly at the site, the groundwater found within this lithology is generally poor in terms of hight TDS[4] and typically has EC values between 70-300 mS/m. The groundwater found in this unit at Cape Infanta has been found to be moderately saline with EC values between 133-222 mS/m, which has been attributed to possible marine influence[5].

5.2.2 Local Hydrogeology

The previous work by Parsons and Associates (2006) estimates the sustainable yield from 134A at 0.7 l/s when pumped for 12 hours a day, with 134C yielding 1 l/s when pumped for 18 hours a day. These yields are aligned with the published information and support the statement in the Parsons and Associates report that the initial pumping tests that indicated 5 l/s yields were an overestimation.

Following a request from the then Breede Overberg Catchment Management Agency (BOCMA) in 2014, a 72 hour pumping test was conducted on borehole 134C to determine the sustainable yield. At first a step test was performed to find the required pumping rate for a constant discharge test. The first step was pumped at 0.32 l/s for one hour yielding a drawdown of 4.9 m. The second step was pumped at 0.78 l/s and resulted in a final drawdown of 20.81 m, while the third step was conducted at 1.48 l/s with a final drawdown of 56.03 m after another hour. The 72-hour constant discharge test was then conducted at a pumping rate of 0.92 l/s.

[3] Meyer P.S (2001), An explanation of the 1:500 000 general hydrogeological map Cape Town 3317

[4] Hartnady, C.J.H. and Jones, M.Q.W., 2007. Geothermal studies of the Table Mountain Group aquifer systems. Water Research Commission, Report, (1403/1), p.07.

[5] Papini G, 2002. Groundwater Assessment for the Breede River Basin Study. Department of Water Affairs and Forestry.

The data was analysed using the FC method as detailed in the update of 18 August 2014. The average sustainable yield was determined to be 0.29 l/s for pumping 24 hours per day every day for 100 years. This is regarded as being a very conservative approach, since the use of the borehole is likely to be seasonal. The sustainable conservative yield of the borehole is calculated to be 25000 l/day. For the best case scenario the yield goes up to 48000 l/day. This relates to between 750 and 1440 m^3/month. The development is designed to use 690 m^3/month. This test once again shows that sufficient water is available in borehole 134C for the whole development, without using borehole 134A.

Using the proposed pumping rates the sustainable yield exceeds the required 23 m^3/day requirement as stated by Fraser (2014). The current proposal is to use 134C, since this borehole will have sufficient yield for the planned 23 units and it is situated further away from any other groundwater users.

The Parsons (2006) report estimated the use of groundwater in the vicinity of the proposed development to be 15 300 m3/a. The harvest potential for Erf 134 was calculated as 48 700 m^3/a. Using the reported harvest potential and a 2 km radius around the site an approximate 4 km^2 is available and this would equate to 226 400 m^3/a being available through the groundwater resource in the area.

Parsons (2006) cites a 1999 study by Toens and Partners recorded 37 boreholes in Infanta Village, but found no threat due to saline intrusion at the time of the study. Bacteriological contamination was only observed where TMG rock outcrops were found. Water quality was found to be acceptable for human consumption with EC levels ranging from 170 to 220 mS/m.

5.3 Groundwater Recharge Calculations

Recharge to the shallow, unconfined aquifer was calculated using the RECHARGE program developed by the Institute for Groundwater Studies at the University of the Free State, South Africa. The calculated recharge excluded the recharge indicated by the soil information and the geology and Vegter maps due to the low uncertainty; the recharge percentage equates to approximately 3.1%.

Table 1: Recharge calculation for the aquifer.

Recharge Estimation			
Method	mm/a	% of rainfall	Certainty (Very High = 5; Low = 1)
Soil	126.0	29.4	1
Geology	33.9	7.9	2
Vegter	32.0	7.5	2
Acru	15.0	3.5	4
Harvest Potential	12.0	2.8	4

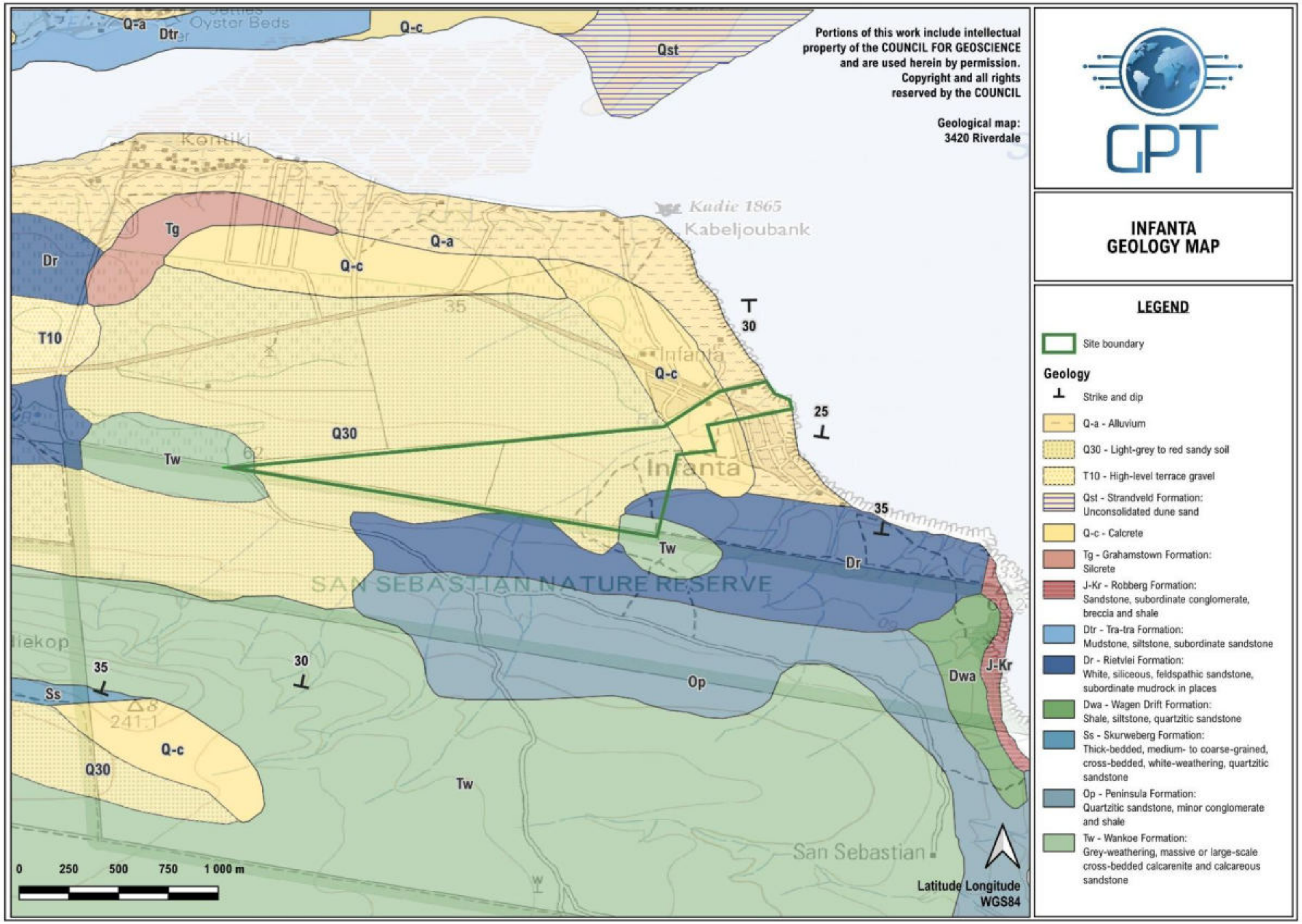


Figure 3: Regional Geology Map (1:250 000 geology series map).

6 Hydrocensus

6.1 Hydrocensus findings and groundwater flow direction

A hydrocensus was conducted on the 28 & 29th of July 2025 within a 1km radius form the property boundary. Seven (7) operational boreholes were located as well as two (2) springs. The majority of the homeowners in Infanta village was not home during the hydrocensus and a number of residents use rainwater as a water supply for domestic use. A summary of the field data is presented in Table 2 below. The hydrocensus data is also plotted on a map presented in Figure 4.

The hydrocensus recorded an average groundwater level of 4.35 m below ground level (mbgl), with measured depths ranging from 3.60 mbgl to 5.04 mbgl. In addition, two free-flowing springs were identified at ground surface. One spring was heavily overgrown and inaccessible for direct measurement, while another could only be visually confirmed. It is possible that these springs represent artesian discharges resulting from historical drilling into a confined aquifer with a high-pressure head; however, this could not be confirmed. Regional hydrogeological data indicate the natural occurrence of springs in the area, and the observed features may also be attributed to these natural conditions.

A groundwater flow direction map was created from the boreholes and can be seen in Figure 5. The general flow direction at Infanta is towards the northeast in the direction of the ocean and flow more towards the inland is in a norther direction.

Table 2: Details of the hydrocensus boreholes.

New Label	LONGITUDE	LATITUDE	Owner	WL (mbcl)	Collar	WL (mbgl)	Pump Installed	Water use	Notes
BH05	20° 50' 55.8096" E	34° 25' 12.3060" S	Infant Park	4.51	0.15	4.36	Submersible	Domestic & Garden	Supplies Infanta Park with water, up to 18 families.
BH06	20° 50' 55.4644" E	34° 25' 12.1548" S	Infant Park	3.71	0.11	3.6	Submersible	Domestic, Garden, Livestock & Agriculture	Water also sold to municipality for ablutions
BH07	20° 51' 17.9658" E	34° 25' 15.6952" S	Sea Cottage Trust	-	-	-	Submersible	Garden	No Access through pump capping.
BH08	20° 51' 17.6683" E	34° 25' 16.3768" S	Ika van Niekerk	4.81	-0.23	5.04	No pump	No Use	No pump installed
BH09	20° 51' 16.4459" E	34° 25' 12.2236" S	Unknown	4.2	-0.23	4.43	Submersible	Unknown	Permission granted for data gathering from neighbour
BH10	20° 51' 10.4005" E	34° 25' 13.4005" S	Elsa	-	-	-	Submersible	-	Could not collect data, nobody home, BH seen from the fence
BH134C	20° 50' 40.03" E	34° 25' 14.84" S	Mark De Agrella	11.07	0.3	10.77	No pump	Proposed Domestic Use Supply	Test pumped in June 2020.
BH11	20° 50' 57.0156" E	34° 25' 15.8592" S	Abandoned borehole, blocked @ 1.5mbgl						
BH134A	20° 50' 57.0624" E	34° 25' 14.3040" S	No Access (pump house locked) & Owner not present						
SP01	20° 51' 10.3680" E	34° 25' 20.1468" S	Artesian Well						
SP02	20° 51' 26.0136" E	34° 25' 25.9140" S	Artesian Well						

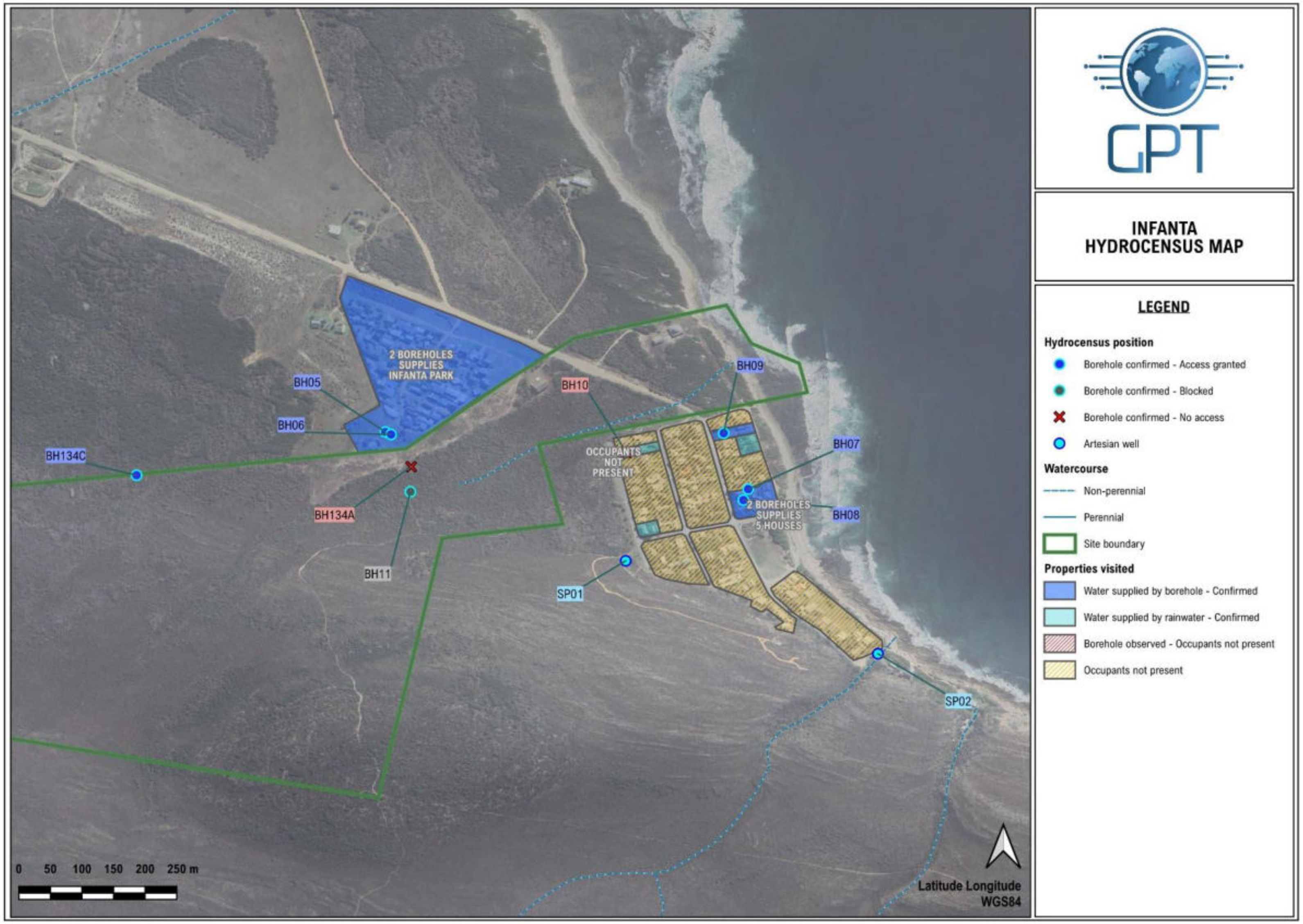


Figure 4: Hydrocensus Map.

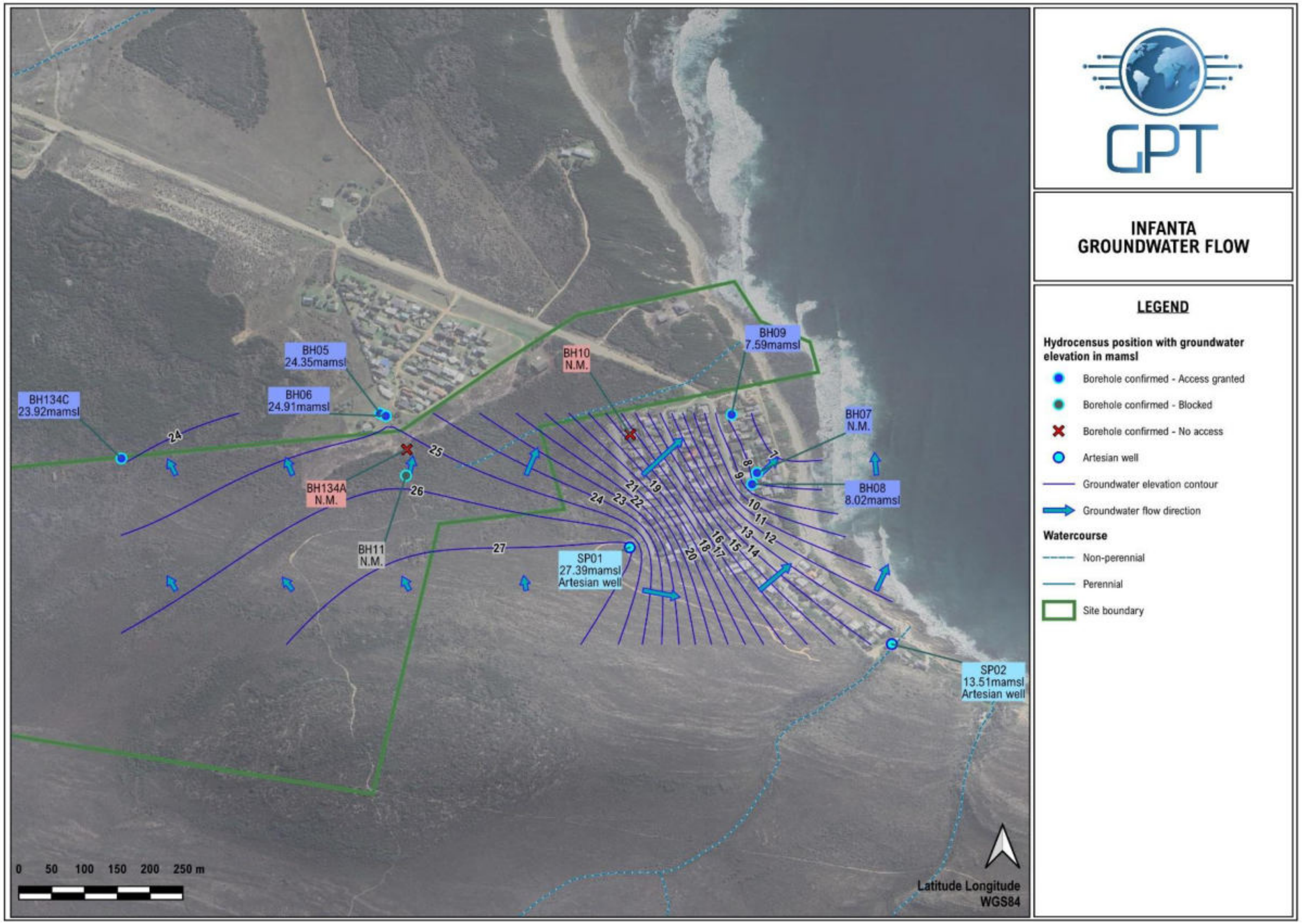


Figure 5: Groundwater Flow Direction Map

6.2 Hydrocensus Groundwater Quality

Three (3) boreholes were selected from the operational boreholes to be tested for groundwater quality. Boreholes BH05, BH07 and BH09 were selected from the hydrocensus. Borehole 134C was also sampled after the hydrocensus and results is provided in the following section. The samples were submitted to a SANS accredited laboratory for major anion and cation analysis as well as microbial analysis. The water quality results are compared with the maximum recommended concentrations for drinking water as defined by the SANS 241-1: 2015 target water quality limits. The SANS 241-1: 2015 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is acceptable for lifetime consumption. Colours of individual cells refer to the drinking water classification of the specific groundwater sample.

The results of the screening for groundwater are presented in Table 3 and discussed in the sections below:

- Conductivity and TDS in all three boreholes exceed aesthetic limits.
- Sodium (Na) and Chloride (Cl) concentrations exceed aesthetic limits in all three boreholes.
- Iron levels in BH07 exceed the aesthetic limit.
- E. coli in BH07 exceeds the acute health limit.
- Total coliform counts in BH05 and BH07 exceed operational limits.

The exceedances of Na and Cl are indicative of saline water which is associated with the Bokkeveld Group. The high EC and TDS in turn can be related to the high salt load in the groundwater. Total coliforms are bacteria that are found in soils. E. coli is associated with soils and groundwater that has been affected by the faecal matter of warm-blooded animals, possibly due to french drains.

Table 3: Water qualities compared to SANS 241-1:2015 guidelines for Hydrocensus Boreholes.

Determinant	Risk	Unit	Standard limits	BH05	BH07	BH09
Physical and aesthetic determinants						
Conductivity at 25 °C	Aesthetic	mS/m	170	238.8	197.3	181.9
Total dissolved solids	Aesthetic	mg/L	1 200	1672	1381	1273
pH at 25 °C [b]	Operational	pH units	5 to 9.7	7.94	7.3	8.06
Chemical determinants — macro-determinants						
Nitrate as N (NO_3 - N)	Acute health	mg/L	11	BDL	BDL	BDL
Nitrite as N (NO_2 - N)	Acute health	mg/L	0.9	BDL	BDL	BDL
Sulfate as SO_4^{2-}	Acute health	mg/L	500	53.57	44.46	56.5
	Aesthetic	mg/L	250	53.57	44.46	56.5
Fluoride as F^-	Chronic health	mg/L	1.5	0.15	0.26	0.29
Ammonia as N	Aesthetic	mg/L	1.5	0.14	BDL	0.08
Chloride as Cl^-	Aesthetic	mg/L	300	582.1	457.4	427.9
Sodium as Na	Aesthetic	mg/L	200	287.7	237.4	230.8
Zinc as Zn	Aesthetic	mg/L	5	BDL	BDL	0.1
Chemical determinants — micro-determinants						
Arsenic as As	Chronic health	mg/L	0.01	BDL	BDL	BDL
Boron as B	Chronic health	mg/L	2.4	0.62	BDL	0.59
Total chromium as Cr	Chronic health	mg/L	0.05	BDL	BDL	BDL
Copper as Cu	Chronic health	mg/L	2	BDL	BDL	BDL
Iron as Fe	Aesthetic	mg/L	0.3	0.06	0.44	BDL
Lead as Pb	Chronic health	mg/L	0.01	BDL	BDL	BDL
Manganese as Mn	Aesthetic	mg/L	0.1	BDL	0.09	BDL
Nickel as Ni	Chronic health	mg/L	0.07	BDL	BDL	BDL
Aluminium as Al	Operational	mg/L	0.3	0.2	0.08	0.16
Microbiological determinants						
E. coli [a] or faecal coliforms [b]	Acute health	cfu/100 mL	0	0	6	0
Total coliforms [d]	Operational	cfu/100 mL	10	16	900	0
BDL = Below Detection Limit						

7 AQUIFER TESTING

A 48-hour pumping test was conducted on borehole BH134C, located on the site, by Pumpcor from Riversdale in June 2020.

A Stepped Discharge Test, Constant Discharge Test & Recovery Monitoring was performed on the borehole. Background information on the details of pump testing is presented in the following paragraphs.

7.1 Description of a pump test

The efficient operation and utilisation of a borehole requires insight into and an awareness of its productivity and that of the groundwater resource from which it draws water. This activity, which is also known as test pumping, provides a means of identifying potential constraints on the performance of a borehole and on the exploitation of the groundwater resource. It also provides data to calculate aquifer parameters such as Transmissivity (T) values.

The following tests were performed on the boreholes: (1) Stepped Discharge Test; (2) Constant Discharge Test and (3) Recovery Monitoring.

7.1.1 Stepped Discharge Test

Also known as a step drawdown test, it is performed to assess the productivity of a borehole. It also serves to more clearly define the optimum yield at which the borehole can be subjected to constant discharge testing. The test involves pumping the borehole at three or more sequentially higher pumping rates each maintained for an equal length of time, generally not less than 60 minutes. The magnitude of the water level drawdown in the borehole in response to each of these pumping rates is measured and recorded in accordance with a prescribed time schedule.

7.1.2 Constant Discharge Test

A constant discharge test is performed to assess the productivity of the aquifer according to its response to the abstraction of water. This test entails pumping the borehole at a single pumping rate which is kept constant for an extended period of time. The test duration is usually between 8 and 72 hours.

7.1.3 Recovery Monitoring

This test provides an indication of the ability of a borehole and groundwater system to recover from the stress of abstraction. This ability can again be analysed to provide information with regards to the hydraulic properties of the groundwater system and arrive at an optimum yield for the medium to long term utilisation of the borehole.

7.2 Calculating the sustainable yield of the borehole

Data acquired during pump testing of the borehole was used to calculate the sustainable yield of the tested borehole. The sustainable yield of a borehole can be defined as the discharge rate that will not cause the water level to drop below the major fracture network supplying water to the borehole. The distance between the static water level and this position is also generally referred to as the available drawdown (AD). The major water strike is obtained through observation during drilling supervision or can be more accurately detected from diagnostic plots compiled from the pumping test data. The water level in the borehole should never drop below the position of the main fracture.

The Flow Characterisation Method (more commonly referred to as the "FC-Method") developed by the Institute of Groundwater Studies at the University of the Free State was used to calculate the sustainable yield of the boreholes. The FC-Method calculates the sustainable yield of a borehole by using recharge, derivatives, boundary information and error propagation. The results of the calculation of the sustainable yield are presented in Table 4.

Table 4: Results of the sustainable yield calculations.

Borehole nr.	Coordinates (WGS 84)	Depth (m)	Static Water Level (m)	Available Drawdown (m)	Sustainable Yield (l/h) Pumping 15 hours/day	Volume/day (m^3)
BH 134C	S34.420930° E20.844446°	79.4	15.47	30	2 160	32.4
				TOTAL VOLUME/DAY (m^3)		**32.4**

Based on the available data, it can be concluded that a total volume of 32.4 **m^3/day** can be abstracted from the tested borehole.

7.3 Groundwater Quality of BH134C

A water sample was taken at the end of the pump tests (June 2020) and submitted to a SANS accredited laboratory for major anion and cation analysis as well as microbial analysis. A second sample was taken during on the 12th of September 2025 and also submitted for major anion and cation analysis as well as microbial analysis. A number of micro determinants were also analysed in the most recent sampling that was not analysed for during the first sampling.

The water quality results are compared with the maximum recommended concentrations for drinking water as defined by the SANS 241-1: 2015 target water quality limits. The SANS 241-1: 2015 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is acceptable for lifetime consumption. Colours of individual cells refer to the drinking water classification of the specific groundwater sample.

The results of the screening for groundwater are presented in Table 4. Exceedances and observations for the most recent results (Sep 2025) are discussed in the section below:

- EC conductivity & TDS exceeded aesthetic limits.
- Na & Cl exceeded aesthetic limits.
- Fe exceeds aesthetic limits.
- Total Coliforms exceeded operational limits.

The exceedances of Na and Cl are indicative of saline water which is associated with the Bokkeveld Group. The high EC and TDS in turn can be related to the high salt load in the groundwater. Total coliforms are bacteria that are found in soils.

Overall, constituent concentrations have remained stable and are within similar ranges to those observed in the June 2020 analysis. The increase in total coliforms is most likely due to the stagnant conditions in the borehole, which has not been in use since the test pumping. The newly elevated iron concentration may also be attributed to rust formation on the steel casing. In both cases, these higher concentrations are expected to decrease once regular abstraction takes place.

Table 5: Water qualities compared to SANS 241-1:2015 guidelines for BH134C.

Determinant	Risk	Unit	Standard limits	134C June 2020	134C September 2025
Physical and aesthetic determinants					
Conductivity at 25 °C	Aesthetic	mS/m	170	189	224.4
Total dissolved solids	Aesthetic	mg/L	1 200	1230	1571
pH at 25 °C [b]	Operational	pH units	5 to 9.7	7.9	7.39
Chemical determinants — macro-determinants					
Nitrate as N (NO_3 - N)	Acute health	mg/L	11	0.21	<0.5
Nitrite as N (NO_2 - N)	Acute health	mg/L	0.9	<0.03	<0.13
Sulfate as SO_4^{2-}	Acute health	mg/L	500	44.3	46.2
	Aesthetic	mg/L	250	44.3	46.2
Fluoride as F^-	Chronic health	mg/L	1.5	<0.20	0.09
Ammonia as N	Aesthetic	mg/L	1.5	<0.05	0.67
Chloride as Cl^-	Aesthetic	mg/L	300	422	497.5
Sodium as Na	Aesthetic	mg/L	200	220	272.5
Zinc as Zn	Aesthetic	mg/L	5	<0.17	<0.05
Chemical determinants — micro-determinants					
Arsenic as As	Chronic health	mg/L	0.01	NA	<0.05
Boron as B	Chronic health	mg/L	2.4	0.2	<0.5
Copper as Cu	Chronic health	mg/L	2	<0.04	<0.05
Iron as Fe	Aesthetic	mg/L	0.3	0.12	1.36
Lead as Pb	Chronic health	mg/L	0.01	NA	<0.05
Manganese as Mn	Aesthetic	mg/L	0.1	<0.04	<0.05
Nickel as Ni	Chronic health	mg/L	0.07	NA	<0.05
Aluminium as Al	Operational	mg/L	0.3	NA	0.07
Microbiological determinants					
E. coli [or] faecal coliforms [b]	Acute health	cfu/100 mL	0	<1	0
Total coliforms [d]	Operational	cfu/100 mL	10	33	9400
< = Below Detection Limit					
NA = Constituent not analysed.					

8 AQUIFER CHARACTERISATION

The term aquifer refers to a strata or group of interconnected strata comprising of saturated earth material capable of conducting groundwater and of yielding usable quantities of groundwater to boreholes and /or springs (Vegter, 1994). In the light of South Africa's limited water resources, it is important to discuss the aquifer sensitivity in terms of the boundaries of the aquifer, its vulnerability, classification and finally protection classification, as this will help to provide a framework in the groundwater management process.

8.1 Aquifer Vulnerability

Aquifer vulnerability assessment indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Stated in another way, it is a measure of the degree of insulation that the natural and manmade factors provide to keep contamination away from groundwater.

- Vulnerability is high if natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Vulnerability is low if natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.

The following factors have an effect on groundwater vulnerability:

- Depth to groundwater: Indicates the distance and time required for pollutants to move through the unsaturated zone to the aquifer.
- Recharge: The primary source of groundwater is precipitation, which aids the movement of a pollutant to the aquifer.
- Aquifer media: The rock matrices and fractures which serve as water bearing units.
- Soil media: The soil media (consisting of the upper portion of the vadose zone) affects the rate at which the pollutants migrate to groundwater.
- Topography: Indicates whether pollutants will run off or remain on the surface allowing for infiltration to groundwater to occur.
- Impact of the vadose zone: The part of the geological profile beneath the earth's surface and above the first principal water-bearing aquifer. The vadose zone can retard the progress of the contaminants.

The Groundwater Decision Tool (GDT) was used to quantify the vulnerability of the aquifer underlying the site using the below assumptions.

- Depth to groundwater below the site was estimated from water levels measured during the hydrocensus inferred to be at mean of ~4.35 mbgl.
- Groundwater recharge of ~12.87 mm/a (~3.1% recharge),
- Sandy vadose zone
- Gradient of 3% were assumed and used in the estimation.

The aquifer vulnerability for a contaminant released from surface to a specified position in the groundwater system after introduction at some location above the uppermost aquifer was determined using the criteria described below and assuming a worst-case scenario:

- Highly vulnerable (> 60), the natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Medium Vulnerable = 30 to 60%, the natural factors provide some protection to shield groundwater from contaminating activities at the land surface, however based on the contaminant toxicity mitigation measures will be required to prevent any surface contamination from reaching the groundwater table.
- Low Vulnerability (< 30 %), natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation
- The GDT calculated a vulnerability value of 58%, which is medium.

8.2 Aquifer Classification

The aquifer(s) underlying the subject area were classified in accordance with “A South African Aquifer System Management Classification, December 1995.”

The main aquifers underlying the area were classified in accordance with the Aquifer System Management Classification document[6]. The aquifers were classified by using the following definitions:

- Sole Aquifer System: An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- Major Aquifer System: Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (Electrical Conductivity of less than 150 mS/m).
- Minor Aquifer System: These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.
- Non-Aquifer System: These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a “Minor Aquifer System”, based on the fact that the local population is not dependent on groundwater.

In order to achieve the Aquifer System Management and Second Variable Classifications, as well as the Groundwater Quality Management Index, a points scoring system as presented in Table 6 and Table 7 was used.

Table 6: Ratings – Aquifer System Management and Second Variable Classifications

---

[6] Department of Water Affairs and Forestry & Water Research Commission (1995). A South African Aquifer System Management Classification. WRC Report No. KV77/95.

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Second Variable Classification (Weathering/Fracturing)		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

Table 7: Ratings - Groundwater Quality Management (GQM) Classification System

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Aquifer Vulnerability Classification		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

As part of the aquifer classification, a Groundwater Quality Management (GQM) Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. The GQM index for the study area is presented in Table 8.

The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as **medium.**

The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index = Aquifer System Management x Aquifer Vulnerability

=2 x 2 = 4

Table 8: GQM Index for the Study Area

GQM Index	Level of Protection	Study Area
<1	Limited	
1 – 3	Low Level	
3 - 6	Medium Level	4
6 – 10	High Level	
>10	Strictly Non-Degradation	

8.3 Aquifer Protection Classification

A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a **medium level of groundwater protection** is required for the aquifer. Reasonable and sound groundwater protection measures based on the modelling will therefore be recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that measures must be taken to limit the risk to the following environments.

- The protection of the underlying aquifer.

9 RESERVE DETERMINATION

9.1 Introduction

Definition of Reserve: *"The quantity and quality of water required to supply basic needs of people to be supplied with water from that resource and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of water resources".*

To be able to quantify the groundwater component of the Reserve, the following relationship has to be solved:

$$GW_{allocate} = (Re + GW_{in} - GW_{out}) - BHN - GW_{Bf}$$

where:

$GW_{allocate}$	=	groundwater allocation
Re	=	recharge
GW_{in}	=	groundwater inflow
GW_{out}	=	groundwater outflow
BHN	=	basic human needs
GW_{Bf}	=	groundwater contribution to baseflow

Under the National Water Act (Act No. 36 of 1998) the bulk water uses at Infanta must be authorised. The water will be abstracted from boreholes and used for irrigation and construction purposes. Under these circumstances, the following (ground) water use is recognised as being relevant to the licence application:

- Section 21 (a) – taking water from a resource.

9.2 Approach

The assessment was done on a "rapid" level using the software GRDM version 4.0.0.0. The data used for the calculation was derived from the WRC90 dataset contained in the "GRDM" software driven by the Resource Directed Measures from the Department of Water Affairs and FET water. The local catchment falls within the H70K quaternary catchment as shown in Figure 1. The default values were used in the assessment in order to develop some guidance on the potential impact of the proposed abstraction on the overall groundwater use in the catchment.

9.3 Description of the Study Area

The property, hereafter referred to as Infanta, has a total area of 10ha. The local catchment within which the site is located falls within the H70K quaternary catchment. The quaternary catchment has a total area of 207.3 km^2 and the catchment falls within the Breede River Water Management Area.

The dominant vegetation type is mountain Fynbos. Locally drainage is towards the Indian Ocean as well as the Bree River that flows from north east to south west to the north of the site.

9.4 Present Water Demand

A maximum projection of the planned water demand from the borehole is 16.8m^3/day (0.194 l/s) or 6132 m^3/annum.

9.5 Reserve Directed Measures Assessment

9.5.1 Classification

Groundwater classification is currently based on a Stress Index which relates water use to recharge. The quaternary catchments in which the study area falls is classified as category B which indicates low levels of stress in terms of abstraction/recharge (respectively). The resource is unstressed or slightly stressed. At this stage Classification is not directly linked to potential abstraction but is only indicative of the current situation.

Table 9: Catchment Stress Index Table

Present Status Category	Description	Stress Index (abstraction/recharge)
A	Unstressed or slightly stressed	<0.05
B		0.05-0.2
C	Moderately Stressed	0.2-0.4
D		0.4-0.65
E	Highly Stressed	0.65-0.95
F	Critically Stressed	>0.95

9.5.2 Reserve

The following table summarises the most salient parameters relevant to this catchment:

Table 10: Most salient parameters relevant to the catchment.

Quaternary Catchment	Area km^2	Population (2010)	General Authorisation (m^3/ha/a)	Rainfall (mm/a)	Recharge (mm/a)	Current Use (2010) (Mm^3/a)
H70K	207.3	500	150	458	14.2	0.06

*Groundwater recharge calculated as 3.1% of rainfall, see section 5.3.

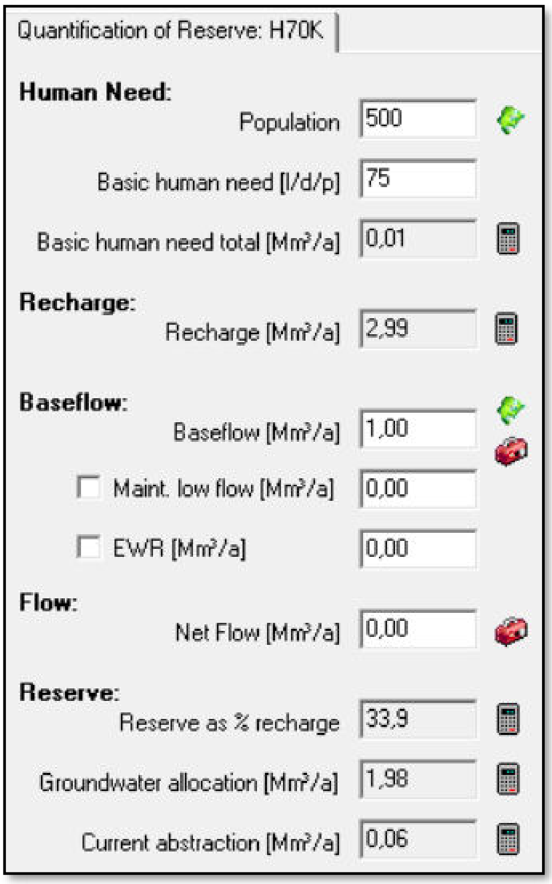
If the recharge is calculated on the actual area of the property within the affected quaternary catchments, the following emerges:

Table 11: Recharge to the property

Catchment	Actual area (ha) of property	Recharge in Quartenary Catchment (mm/a)	Recharge on property	
H70K	86.5	14.2	12283	m^3/a
Total	*86.5*	14.2	12283	m^3/a
			0.012	Mm^3/a
			34	m^3/day
			0.39	l/second

The following tables summarizes the Reserve for the catchment.

Table 12: A summary of the Reserve for the quaternary catchment H70K


Quantification of Reserve: H70K
Human Need:
Population 500
Basic human need [l/d/p] 75
Basic human need total [Mm³/a] 0,01
Recharge:
Recharge [Mm³/a] 2,99
Baseflow:
Baseflow [Mm³/a] 1,00
Maint. low flow [Mm³/a] 0,00
EWR [Mm³/a] 0,00
Flow:
Net Flow [Mm³/a] 0,00
Reserve:
Reserve as % recharge 33,9
Groundwater allocation [Mm³/a] 1,98
Current abstraction [Mm³/a] 0,06

9.5.3 Water Use Authorization

The table below estimated the general authorization allowance.

Actual area of property (ha)	General Authorisation (m3/ha/a)	General Authorisation Volume Allowance on property (m3/a)
86.5	150	12975

The general authorisation volume for the area is calculated at 12 975 m^3/year, while the planned water demand is 6 132 m^3/year. Therefore, it can be concluded that the proposed demand falls within the scope of a general authorisation.

If the maximum volume that can be abstracted, according to the sustainable yield calculations (Section 7.2) of 32.4 m^3/day or 11 826 m^3/year, is applied for, this volume still remains within the general authorisation allowance.

9.5.4 Resource Quality Objectives

The Resource Quality Objectives are numerical or descriptive limits set out to maintain and protect the groundwater resource while also taking into account the need to develop and use a water resource[7].

Maintain regional groundwater table to:

- Ensure that schedule 1 water users adjacent to the site have adequate water supply to basic human need.
- Ensure that adequate water is available to maintain base flow in the tributaries of the Bree River.

[7] Department of Water Affairs and Forestry (DWAF). 2007. Resource directed management of water quality: management instruments. Volume 4.2.2: guideline for determining Resource Water Quality Objectives (RWQOs), allocatable water quality and the stress of the water resource. Training manual. Pretoria.

10 RISK ASSESSMENT

The groundwater risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk (source term), the pathway along which the risk propagates, and finally the target that experiences the risk (receptor). The risk assessment approach is therefore aimed at describing and defining the relationship between cause and effect. In the absence of any one of the three components, it is possible to conclude that groundwater risk does not exist.

10.1 Current Groundwater Conditions

The current groundwater conditions at the site are described in sections 5.2 and 0.

10.2 Risk Assessment

10.2.1 Assessment Criteria

The criteria for the description and assessment of groundwater impacts were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the NEMA[8].

In order to determine the significance of an impact, the following criteria would be used: extent, duration, intensity and probability. The extent and probability criteria have five parameters, with a scaling of 1 to 5. Intensity also has five parameters, but with a weighted scaling.

The assessment of the intensity of the impact is a relative evaluation within the context of all the activities and other impacts within the framework of the project. The intensity rating is weighted as 2 since this is the critical issue in terms of the overall risk and impact assessment (thus the scaling of 2 to 10, with intervals of 2). The intensity is thus measured as the degree to which the project affects or changes the environment.

The level of detail as depicted in the EIA regulations was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes, each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. An explanation of the impact assessment criteria is defined below in Table 13.

[8] Guideline document EIA regulations (April 1998): Implementation of sections 21, 22 and 26 of the environment conservation act.

Table 13: Explanation of the EIA criteria

Criteria	Description
Nature	Includes a description of what causes the effect, what will be affected and how it will be affected.
Extent	The physical and spatial scale of the impact.
Duration	The lifetime of the impact is measured in relation to the lifetime of the proposed development.
Intensity	Examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself.
Probability	This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the lifecycle of the activity, and not at any given time.
Status	Description of the impact as positive, negative or neutral.
Significance	A synthesis of the characteristics described above and assessed as low, medium or high. A distinction will be made for the significance rating without the implementation of mitigation measures and with the implementation of mitigation measures.
Confidence	This is the level of knowledge/information that the environmental impact practitioner or a specialist had in his/her judgement.
Reversibility	Examining whether the impacted environment can be returned to its pre-impacted state once the cause of the impact has been removed.
Replaceability	Examining if an irreplaceable resource is impacted upon
Cumulative	Synthesis of different impacts in concert, considering the knock-on impacts thereof.

10.2.2 Nature and Status

The nature of the impact is the consideration of what the impact will be and how it will be affected. This description is qualitative and gives an overview of what is specifically being considered. That is, the nature considers ‘what is the cause, what is affected, and how is it affected. The status is thus given as being positive, negative or neutral, and is deemed to be either direct or indirect in impact.

10.2.3 Extent

The physical and spatial scale of the impact is classified in Table 14.

10.2.4 Duration

The lifetime of the impact is measured in relation to the lifetime of the project, as per Table 15.

10.2.5 Intensity

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project, as per Table 16.

10.2.6 Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the lifecycle of the activity, and not at any given time. The probability classes are rated in Table 17.

10.2.7 Level of Significance

The level of significance is expressed as the sum of the area exposed to the risk (extent), the length of time that exposure may occur over in total (duration), the severity of the exposure (intensity) and the likelihood of the event occurring (probability). This leads to a range of significance values running from ‘no impact’ to ‘extreme’.

The significance of the impacts has been determined as the consequence of the impact occurring (reflection of chance of occurring, what will be affected (extent), how long will it be affected, and how intense is the impact) as affected by the probability of it occurring, this translates to the following formula:

Significance value = (Extent + Duration + Intensity) x Probability

Each impact is considered in turn and assigned a rating calculated using the results of this formula and presented as a final rating classification according to Table 16. A distinction will be made for the significance rating of (a) without the implementation of mitigation measures, and, (b) with the implementation of mitigation measures.

10.2.8 Identifying Potential Impacts with Mitigation Measures

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact. Significance with mitigation is rated on the following scale as contemplated in Table 16 below.

Low (L): The impact is mitigated to the point where it is of limited importance.

Medium (M): Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.

High (H): The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

10.2.9 Impact Assessment

Based on the impact assessment criteria as detailed in the preceding paragraph an impact rating is given in Table 18. The table also summarises all the groundwater related EMP’s and should be implemented during the operation of the development.

Table 14: Impact Extent

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1	3	2
Site	The impact could affect the whole, or a significant portion of the site.	2		
Local	Impact could affect the adjacent landowners.	3		
Regional	Impact could affect the wider area around the site, that is, from a few kilometres, up to the wider Council region	4		
National	Impact could have an effect that expands throughout a significant portion of South Africa - that is, as a minimum has an impact across provincial borders.	5		
With Mitigation (WM)				
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1	1	1
Site	The impact could affect the whole, or a significant portion of the site.	2		
Local	Impact could affect the adjacent landowners.	3		
Regional	Impact could affect the wider area around the site, that is, from a few kilometres, up to the wider Council region	4		
National	Impact could have an effect that expands throughout a significant portion of South Africa - that is, as a minimum has an impact across provincial borders.	5		

Table 15: Impact Duration

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than any of the development phases (i.e. less than 2 years).	1	4	4
Short to Medium term	The impact will be relevant through to the end of the construction phase (i.e. less than 5 years).	2		
Medium term	Impact will last up to the end of the development phases, where after it will be entirely negated (i.e. related to each phase development thus less than 10 years).	3		
Long term	The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter (i.e. during decommissioning) (i.e. more than 10 years, or a maximum of 60 years).	4		
Permanent	This is the only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient (i.e. will remain once the site is closed).	5		
With Mitigation (WM)				
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than any of the development phases (i.e. less than 2 years).	1	4	4
Short to Medium term	The impact will be relevant through to the end of the construction phase (i.e. less than 5 years).	2		
Medium term	Impact will last up to the end of the development phases, where after it will be entirely negated (i.e. related to each phase development thus less than 10 years).	3		
Long term	The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter (i.e. during decommissioning) (i.e. more than 10 years, or a maximum of 60 years).	4		
Permanent	This is the only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient (i.e. will remain once the site is closed).	5		

Table 16: Impact Intensity

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	2	4	4
Low-Medium	The impact alters the affected environment in such a way that the natural processes or functions are slightly affected.	4		
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.	6		
Medium-High	The affected environment is altered, and the functions and processes are modified immensely.	8		
High	Function or process of the affected environment is disturbed to the extent where the function or process temporarily or permanently ceases.	10		
With Mitigation (WM)				
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	2	2	2
Low-Medium	The impact alters the affected environment in such a way that the natural processes or functions are slightly affected.	4		
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.	6		
Medium-High	The affected environment is altered, and the functions and processes are modified immensely.	8		
High	Function or process of the affected environment is disturbed to the extent where the function or process temporarily or permanently ceases.	10		

Table 17: Impact Probability

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience (less than 24% chance of occurring).	1	3	3
Possible	The possibility of the impact occurring is very low, either due to the circumstances,	2		
Likely	There is a possibility that the impact will occur to the extent that provisions must	3		
Highly likely	It is most likely that the impacts will occur at some stage of the Development. Plans must be drawn up before carrying out the activity (70 – 89%).	4		
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied upon (90 – 100%).	5		
With Mitigation (WM)				
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience (less than 24% chance of occurring).	1	2	2
Possible	The possibility of the impact occurring is very low, either due to the circumstances,	2		
Likely	There is a possibility that the impact will occur to the extent that provisions must	3		
Highly likely	It is most likely that the impacts will occur at some stage of the Development. Plans must be drawn up before carrying out the activity (70 – 89%).	4		
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied upon (90 – 100%).	5		

Table 18: Impact Significance

Criteria	Description	Scoring	Lowering of Groundwater Levels	Groundwater Contamination
Without Mitigation (WOM)				
No Impact	There is no impact.	0-9	33	30
Low	The impacts are less important, but some mitigation is required to reduce the negative impacts.	10 - 24		
Medium	The impacts are important and require attention; mitigation is required to reduce the negative impacts.	30 - 49		
Medium to High	The impacts are of medium to high importance; mitigation is necessary to reduce negative impacts.	50 - 74		
High	The impacts are of high importance and mitigation is essential to reduce the negative impacts	75 - 89		
Extreme	The impacts present a fatal flaw, and alternatives must be considered.	90 - 100		
With Mitigation (WM)				
No Impact	There is no impact.	0-9	14	14
Low	The impacts are less important, but some mitigation is required to reduce the negative impacts.	10 - 24		
Medium	The impacts are important and require attention; mitigation is required to reduce the negative impacts.	30 -49		
Medium to High	The impacts are of medium to high importance; mitigation is necessary to reduce negative impacts.	50 - 74		
High	The impacts are of high importance and mitigation is essential to reduce the negative impacts	75 - 89		
Extreme	The impacts present a fatal flaw, and alternatives must be considered.	90 - 100		

10.3 Mitigation Measures

The suggested mitigation measures for the operation are summarised in the following paragraphs based on the risk assessment performed.

10.3.1 Lowering of Groundwater Levels

The mitigation measures/management measures applicable to the lowering of groundwater levels during operations are listed in Table 19.

Table 19: Mitigation Measures for the Management of Lowering of Groundwater Level

Lowering of Groundwater Levels			
Significance Rating (WOM)	**Impact**	**Management Options**	**Significance Rating (WM)**
33	Drawdown of water table	Groundwater levels should be monitored on the frequency as specified in the monitoring plan	14
		Pumped water volumes should be recorded at the production boreholes on a monthly basis	
		Water levels in production boreholes should be recorded on a monthly basis. If a declining trend in water levels is observed, the pumping volumes should be reduced until the water level is stabilized.	
		Recommended yields and pumping cycles should be adhered to	
		Rainfall readings should be recorded	

10.3.2 Spread of Groundwater Pollution

The mitigation measures/management measures applicable to the spread of groundwater contamination after operations are listed in Table 20.

Table 20: Mitigation Measures for the Management of the Spread of Groundwater Contamination

Groundwater Contamination			
Significance Rating (WOM)		**Management Options**	**Significance Rating (WM)**
30	Groundwater contamination	Appropriate sewerage systems should be designed according to the development's demand and installed	14
		Sewerage systems must be maintained in order to prevent groundwater contamination	
		Storm water must be diverted away from abstraction boreholes to prevent any contamination from entering the boreholes	
		Contamination sources such as workshops etc should be lined in order to prevent groundwater contamination	
		Water quality sampling should be conducted as specified in the monitoring requirements	

11 GROUNDWATER MONITORING SYSTEM

11.1 Groundwater Monitoring Network

A groundwater monitoring system has to adhere to the criteria mentioned below. As a result, the system should be developed accordingly.

11.1.1 Impact and background monitoring

A groundwater monitoring network should contain monitoring positions which can assess the groundwater status at certain areas. The boreholes can be grouped classification according to the following purposes:

- **Impact monitoring:** Monitoring of possible impacts of contaminated groundwater on sensitive ecosystems or other receptors. These monitoring points are also installed as early warning systems for contamination break-through at areas of concern.
- **Background monitoring:** Background groundwater levels is essential to evaluate the impact of a specific action on the groundwater level.

11.1.2 System Response Monitoring Network

Groundwater levels: The response of water levels to abstraction is monitored. Static water levels are also used to determine the flow direction and hydraulic gradient within an aquifer. Where possible all of the above-mentioned borehole's water levels need to be recorded during each monitoring event.

11.1.3 Monitoring Frequency

Quarterly monitoring of groundwater levels and measurement of pumped volumes is recommended. It is important to note that a groundwater-monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of potential contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources.

11.2 Monitoring Parameters

Physical Parameters:

- Groundwater levels
- Pumping volumes

Chemical Parameters:

- Laboratory analyses:
  - Anions and cations (Ca, Mg, Na, K, NO3, Cl, SO4, F, Fe, Mn, Al, & Alkalinity)
  - Other parameters (pH, EC, TDS)
  - Petroleum hydrocarbon contaminants (where applicable, near workshops and petroleum handling facilities)
  - Sewage related contaminants (E.Coli, faecal coliforms) in borehole in proximity to septic tanks or sewage plants

11.3 Monitoring Network

DWAF (1998) states that "A monitoring hole must be such that the section of the groundwater most likely to be polluted first, is suitably penetrated to ensure the most realistic monitoring result."[9]

The abstraction borehole located on the Infanta site as well as the hydrocensus boreholes will serve as monitoring points. The details for the borehole can be seen in Table 21 below.

Table 21: Details of the monitoring boreholes

ID	Latitude (South)	Longitude (East)	Requirement	Frequency	Existing/New
BH134C	34° 25′ 15.35″	20° 50′ 40.01″	Abstraction, Water Level & Quality Monitoring	Quarterly	Existing
BH134A	34° 25' 14.3040"	20° 50' 57.0624"	Water Level & Quality Monitoring	Quarterly	Existing
BH05	34° 25' 12.3060"	20° 50' 55.8096"	Water Level	Quarterly	Existing
BH06	34° 25' 12.1548"	20° 50' 55.4644"	Water Level	Quarterly	Existing
BH07	34° 25' 15.6952"	20° 51' 17.9658"	Water Level	Quarterly	Existing
BH09	34° 25' 12.2236"	20° 51' 16.4459"	Water Level	Quarterly	Existing

9 Department of Water Affairs and Forestry (DWAF). (1998). Minimum Requirements for the Water Monitoring at Waste Management Facilities. CTP Book Printers. Cape Town.

12 CONCLUSIONS AND RECOMMENDATIONS

Geo Pollution Technologies (Pty) Ltd (GPT) was appointed by Doug Jefferies Consulting (Pty) Ltd to conduct a hydrogeological study in support of the water use license to be applied for the by the client on behalf of the proposed Infanta Development.

The site is located in Infanta near Witsand, in the Western Cape.

The area is characterised by a gently undulating topography and in the area of the site the slope is more or less in the order of 3% (0.03).

Locally drainage is towards the Indian Ocean as well as the Bree River that flows from northwest to southeast to the north of the site.

Climatic data was obtained from the GRDM V4.0 database as developed by the DWA and FetWater. The average annual rainfall is approximately 458mm/a.

The site is underlain by light grey to red sandy soil and calcrete with alluvium deposits to the coastline. Furthermore, the underlying geology in the region consist of the Skurweberg Formation as well as the Rietvlei Formation of the Nardouw Subgroup, Table Mountain Group, as well as the Robberg Formation of the Uitenhage Group. The Skurweberg Formation mainly comprises of light grey quarzitic sandstone. The Reitvlei Formation consists of light grey feldspathic sandstone with occasional thin siltstone and shale beds. The Robberg Formation consists of silicified sandstone and conglomerate. These formations all strike in an east west direction with a northward dip of between 30 and 40 degrees.

According to Meyer (2001), the Table Mountain Group (TMG), notably the often fractured arenaceous components, is largely anisotropic and thus does not display uniform aquifer characteristics. An intricate network of fissures, joints, fractures and even cavities govern the infiltration, storage and transmission of groundwater in the largely competent and brittle natured arenaceous units of the TMG. The TMG generally constitutes the mountainous areas which, in turn influence precipitation to a significant extent. An abundance of springs is a further characteristic of the TMG

A hydrocensus was conducted on the 28 & 29th of July 2025 within a 1km radius form the property boundary. Seven (7) operational boreholes were located as well as two (2) springs. The hydrocensus recorded an average groundwater level of 4.35 m below ground level (mbgl), with measured depths ranging from 3.60 mbgl to 5.04 mbgl. The general groundwater flow direction is towards the northeast in the direction of the ocean. Boreholes BH05, BH07 and BH09 were selected to be tested for groundwater quality. The water quality results are compared with the SANS 241-1: 2015 target water quality limits.

A Stepped Discharge Test, Constant Discharge Test & Recovery Monitoring was performed on borehole 134C. Based on the available data, it can be concluded that a total volume of 32.4 m^3/day can be abstracted from the tested borehole. The water quality were sampled and results are compared with the SANS 241-1: 2015 target water quality limits.

The GDT calculated a vulnerability value of 58% for the aquifer which is classified as medium. Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a “Minor Aquifer System”, based on the fact that the local population is not dependent on groundwater. A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a medium level of groundwater protection is required for the aquifer.

The general authorisation volume for the area is calculated at 12 975 m^3/year, while the planned water demand is 6 132 m^3/year. Therefore, it can be concluded that the proposed demand falls within the scope of a general authorisation. If the maximum volume that can be abstracted, according to the sustainable yield calculations (Section 7.2) of 32.4 m^3/day or 11 826 m^3/year, is applied for, this volume still remains within the general authorisation allowance.

12.1 Recommendations

The following actions are recommended to be implemented during the construction and the implementation phases:

- Groundwater quality exceedances in the boreholes above the SANS 241 drinking water standards indicated that the groundwater at the site is not suitable for use as potable water without prior treatment. The exceedances in total coliforms can be addressed by improving sanitation systems and ensuring human or animal wastes are properly disposed of.
- The monitoring as recommended in the report should be established prior to operation. The water level monitoring should be conducted weekly for the first three months of operation and if no significant water level decline is observed, the monitoring can be conducted on a monthly basis. Alternatively, automatic water level measurement in the form of pressure transducers can be installed to aid in this process. Logs of flow meter readings should also be kept and the flowmeter should also be read once per month.
- Seawater intrusion may become a concern during extended abstraction periods and should be monitored.
- A rainfall gauge should be installed on the site and rainfall readings should be taken after every rainfall event and the time and date of the reading recorded.
- The monitoring data (water levels, rainfall and chemistry) should be kept in an electronic database for further analysis should this be required.
- The recommended pump cycle for the borehole is 12 hours per day. If the pump cycle is to be extended, the maximum daily volume for each borehole must not be exceeded and the pumping rate must be reduced to sustainable rates. Refer to management recommendations in Table 22.
- It is recommended that the hydrocensus be repeated once every 2 years to ensure that no new groundwater users are affected. The hydrocensus should extend to a 1km radius around the site boundary.
- The regional groundwater table must be maintained to:
    - Ensure that schedule 1 water users adjacent to the site have adequate water supply to basic human need.
    - Ensure that adequate water is available to maintain base flow in the tributaries of the Breede River.

Table 22: Management Recommendations for the Infanta Production Borehole

Borehole nr.	Coordinates (WGS84)		Depth (m)	Static Water Level (m)	#Dynamic WL (m)	Diameter (mm)	Sustainable Yield (l/h) Pumping 16 hours/day	Volume/day (m^3)	Proposed depth of pump installation (m)	Maximum Volume per Day (m^3)
	S	E								
BH134C	25.79058	29.48482	74.5	15.47	45	165	2160	34.6	60	34.6
					Total Volume/Day (m^3)			**34.6**		

 # Dynamic water level - Level at which the water level in the borehole stabilises after continuous pumping. To be used to calculate hydraulic heads when sizing submersible pumps.

APPENDIX I: HYDROCENSUS DATA

APPENDIX II: WATER QUALITY DATA

APPENDIX III: PUMPTESTING FIELD DATA

APPENDIX IV: FC INTERPRETED PUMP TEST DATA

Freshwater Consulting

Environmental Impact Assessment for erf 134, Cape Infanta: Inland Aquatic Ecosystems and Aquatic Biodiversity

DECEMBER 2024

DRAFT FOR DISCUSSION

Compiled by: K. Snaddon,
The Freshwater Consulting Group, P O Box 43935, Scarborough, 7975

Submitted to: Doug Jeffery Environmental Consultants

TABLE OF CONTENTS

TABLE OF CONTENTS 2

1 INTRODUCTION 4

1.1 Background and Approach 4

1.2 Assumptions and limitations 5

1.3 Use of this Report 5

1.4 Declaration of Independence 5

1.5 Specialist Details 5

2 DESCRIPTION OF THE AFFECTED INLAND AQUATIC ECOSYSTEMS 6

2.1 Overview 6

2.2 Watercourse delineation 7

3 SITE SENSITIVITY VERIFICATION 9

4 ASSESSMENT OF THE CONDITION AND SENSITIVITY OF THE STREAM 10

4.1 Introduction 10

4.2 Methods 10

4.3 Results of assessment 12

5 DESCRIPTION OF THE PROPOSED DEVELOPMENT 14

5.1 General description of the development 14

5.2 Internal Roads 16

5.3 Water supply 16

5.4 Stormwater Management 17

5.5 Sewage Management 17

6 LEGISLATION GOVERNING THE CONSERVATION AND MANAGEMENT OF WETLANDS AND RIVERS IN SOUTH AFRICA 19

6.1 National Environmental Management Act (Act 107 of 1998, as amended by Act 62 of 2008) 19

6.2 Conservation of Agricultural Resources Act (Act 43 of 1983) 19

6.3 Cape Nature Conservation Ordinance (Ordinance 19 of 1974; amended in 2000) 19

6.4 National Water Act (1998) 19

6.5 Western Cape Provincial Spatial Development Framework (March, 2014) 20

6.6 Western Cape Biodiversity Spatial Plan (2017) 21

6.7 Swellendam Spatial Development Framework (2020) 21

6.8 National Environmental Management: Biodiversity Act (Act 10 of 2004) 22

7 DESCRIPTION AND ASSESSMENT OF EXPECTED IMPACTS 23

7.1 Description of impacts and mitigation measures 23

7.1.1 Development Phase (design and construction) 23

7.1.2 Operational Phase 25

7.2 Recommended ecological buffer for the watercourse 27

7.3 Methods for the assessment of impacts 28

7.4 Results of Assessment 29

7.4.1 Development phase (design and construction) 29

7.4.2 Operational Phase 34

8 SUMMARY AND CONCLUSIONS 42

9 REFERENCES 45

1 INTRODUCTION

1.1 Background and Approach

The Freshwater Consulting Group (FCG) was commissioned by Doug Jeffery Environmental Consultants to undertake an environmental impact assessment (EIA) of the inland aquatic ecosystems potentially affected by the proposed residential development of a portion of erf 134 at Cape Infanta, Western Cape. Erf 134 is located in the Stellenbosch Municipality and the Overberg District Municipality; the erf is currently zoned Agriculture 1, and is 3.04 ha in area.

Three alternative development layouts are proposed. Alternative 1 (13th April 2012) comprises 23 erven, 16 of which would be single storey and 7 double storey, Alternative 2 (26th August 2013) comprises 21 erven, 15 of which are single storey and 5 double storey and lastly, Alternative 3 (9th May 2023, updated November 2024) also with 21 erven.

The specific aims of the inland aquatic ecological input to the EIA, and our approach, were as follows:

Phase 1: Baseline study

- Assess the opportunities and constraints on and outside the site for development and depict these visually (if appropriate). In order to do this, the site was visited on the 25th August 2010 (winter). All inland aquatic ecosystems (watercourses and wetlands) on and surrounding (within 1km) the site were mapped on an aerial photograph of the area, and ground-truthed for those ecosystems directly impacted by the development (i.e. within the development footprint). The present ecological status (PES) and ecological importance and sensitivity (EIS) of the affected inland aquatic ecosystems was assessed, using accepted methods. The local context of the inland aquatic ecosystems was taken into account in this assessment, including interaction with groundwater. The watercourse passing through the site was dry at the time of the field visit, and there is anecdotal evidence that it flows only after major rain events. Collection of primary data (such as water quality and macroinvertebrates) from such ephemeral systems is challenged by the fact that they are seldom inundated for any length of time. The precautionary principle is advised in these circumstances, and the assumption made that water quality is good, and the aquatic fauna sensitive and important.
- Compile a baseline report describing and briefly assessing the extent and severity of the expected impacts of the development, to be used in Phase 2 (Environmental Impact Assessment), that will highlight concerns, and make recommendations regarding mitigation measures required. Opportunities for the incorporation of the stream into the development, while not impacting on riverine functioning, will be proposed.
- Attend meetings of the project team for integration purposes; and
- Prepare for and attend the public open house in order to present the summary of the baseline report.

Phase 2: Aquatic Biodiversity Specialist Assessment

- A site sensitivity verification was done for erf 134, in order to determine the sensitivity of the site with regards to aquatic biodiversity. The site is almost entirely rated as "very high sensitivity", thus an Aquatic Biodiversity Specialist Assessment was deemed to be necessary for the development.
- The baseline report was updated to an Aquatic Biodiversity Specialist Assessment report, including a detailed assessment of the significance of the impacts associated with the three

development layouts, and the no development option. Specific management and monitoring requirements, to be used as the basis of conditions for the Environmental Authorisation (should it be granted), and a subsequent Environmental Management Programme, are provided.

1.2 Assumptions and limitations

The stream that crosses erf 134 is an ephemeral stream and was dry at the time of the site visit in 2010. It appears that the stream flows only after heavy rains. Collection of primary data (such as water quality and macroinvertebrates) from such ephemeral systems is challenged by the fact that they are seldom inundated for any length of time. The precautionary principle is advised in these circumstances, and the assumptions made that water quality is good, and the aquatic fauna sensitive and important. This elevates the overall sensitivity and importance of the stream, in the absence of data to prove otherwise.

1.3 Use of this Report

This report reflects the professional opinions of its author. It is the policy of FCG that the full and unedited contents of this report should be presented to the client, and that any summary of the findings should only be produced in consultation with the first author.

1.4 Declaration of Independence

This is to confirm that Kate Snaddon, the specialist consultant who is responsible for undertaking this study and preparing this environmental impact assessment report, is independent, and has no vested interests, financial or otherwise, in the proposed activity under consideration.

1.5 Specialist Details

The author of this report is an independent specialist consultant, with 25 years of experience in the field of freshwater ecology, registered with the South African Council for Natural Scientific Professions (registration number 400225/06).

2 DESCRIPTION OF THE AFFECTED INLAND AQUATIC ECOSYSTEMS

2.1 Overview

A small, unnamed ephemeral stream crosses the property, entering erf 134 along its south-eastern border. The stream flows along the southern portion of the property before entering the sea. At the time of the site visit, the stream was dry and, by all accounts, it flows only rarely, after heavy rains. The stream lies in the Breede River catchment and Breede River Water Management Area (WMA) (Lower Breede River sub-WMA), in quaternary catchment H70K, which incorporates the lower Breede River and some of the coastline to the east of the Breede River mouth. Erf 134 lies in the Overberg District Municipality, and within the Southern Coastal Belt Level 1 ecoregion, which has the following characteristics (from Kleynhans *et al*., 2005):

Closed hills and mountains with moderate to high relief are characteristic of this ecoregion, but plains are also significant. South and Southwest Coast Renosterveld vegetation types are dominant.

- MAP (mm): 300 to 1000
- Coefficient of Variation (% of annual precipitation): <20 to 40
- Rainfall concentration index: <15 to 50
- Rainfall seasonality: Winter to all year
- Mean annual temp. (°C): 10 to 20
- Mean daily max. temp. (°C): February - 22 to 30
- Mean daily max. temp. (°C): July - 12 to 20
- Mean daily min. temp. (°C): February - 10 to 18
- Mean daily min temp. (°C): July - 4 to 10
- Median annual simulated runoff (mm) for quaternary catchment: 10 to >250

The stream is short, rising on the slopes of the Potberg Mountain, just to the east of Kadiekop (Figure 2.1) and flowing for approximately 4 km to the sea. To the west of the site, the stream channel comprises bedrock and some cobble but mostly sand, but once the stream enters erf 134, the channel comprises only sand. The stream is supposed to flow under the road in a single pipe, but this pipe was completely blocked by sand and silt at the time of the site visit. Stormwater runoff from the road enters the property at several points. The stream channel is heavily invaded by *Acacia cyclops*.

Photo 1 Dirt road to Cape Infanta, showing one of the stormwater "swales" carrying runoff from the road onto erf 134.

The surrounding vegetation on erf 134 is either De Hoop Limestone Fynbos (least threatened) and Overberg Dune Strandveld (least threatened) along the coast (Mucina & Rutherford, 2006; Rebelo *et al*., 2006). The least threatened status of these vegetation types is largely due to the protection of large tracts within the De Hoop Nature Reserve.

Electrical conductivity of the local groundwater varies between 130 and 410 mS/m, with EC increasing towards the coastline as one moves from groundwater originating in the Skurweberg Formation (composed of inert quartzitic rocks resistant to weathering) through to that originating from the Rietvlei Formation (consisting of occasional siltstone and shale beds) (Parsons, 2005). Groundwater was found by Parsons (2005) to be virtually uncontaminated, despite the use of septic tanks and soakaways in Cape Infanta and Infanta Park. It is likely that the groundwater resources of the area are separated from surface runoff by relatively impermeable shale in the vicinity of the town (Parsons, 2005). An exception to this was found by Toens & Partners (1999) to be bacterial contamination in areas where Table Mountain Group formations outcrop, as the quartzites in the TMG formations are more permeable than shale.

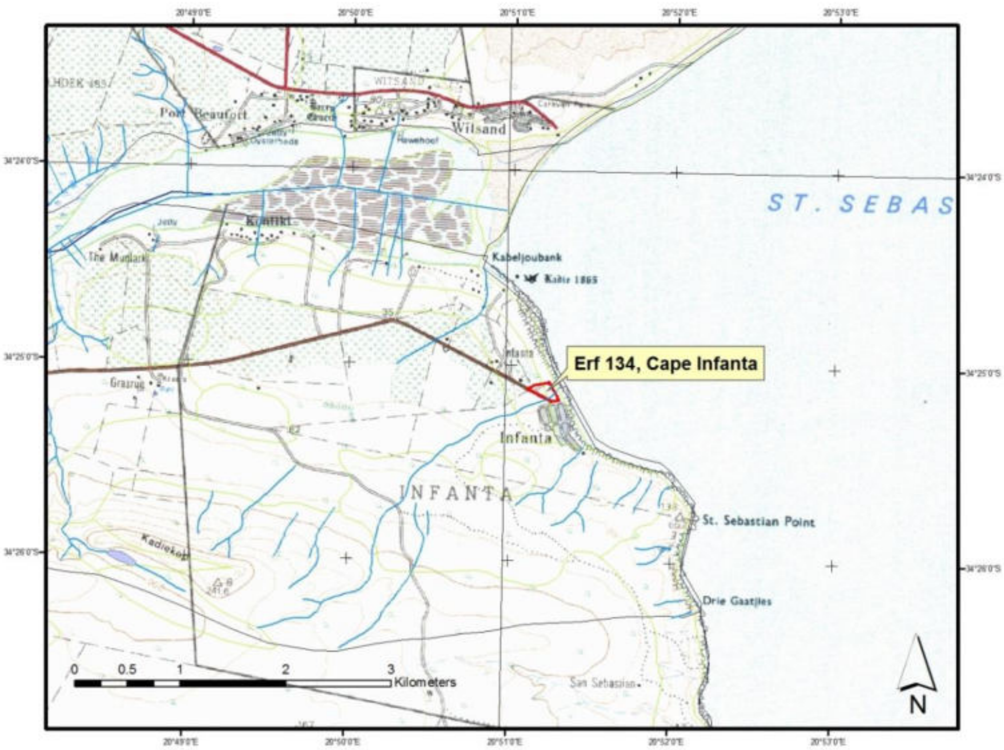


Figure 2.1 Location of erf 134 near the mouth of the Breede River, with rivers and streams shown as blue lines. The site is in the Overberg District Municipality.

2.2 Watercourse delineation

The stream as it flows over erf 134 does not have a clear riparian area around the edges of the channel. The channel itself is not visible, as flow along the channel is insufficient to create a defined channel. The riparian area around the watercourse has been heavily invaded by *Acacia cyclops*, and the soils in the riparian area are sandy soils, with no visible alluvial indicators. In the absence of soil and vegetation indicators (as per the national delineation guidelines (DWAF, 2005), delineation of the riparian area was not possible. Nonetheless, the centreline of the watercourse was surveyed, and is shown in Figure 2.2.

Figure 2.2 Aerial photograph of Cape Infanta, showing the watercourse (blue line) and its recommended ecological buffer (purple outline). The 1:100 year floodline falls within the buffer.

3 SITE SENSITIVITY VERIFICATION

The Environmental Impact Assessment Screening Tool of the Department of Forestry, Fisheries and the Environment (DFFE) shows that the site is within an area of very high aquatic biodiversity sensitivity. This is based on the fact that the site lies within a national Freshwater Ecosystem Priority Area (FEPA) sub-quaternary catchment. The status of the sub-catchment is such due to the known locations of populations of the fish species *Sandelia capensis* (Cape kurper) and *Pseudobarbus burchelli* cf. Breede (Breede River Redfin). As such the rivers in this catchment (in particular the mainstem of the lower Breede River) are considered "fish sanctuaries", requiring protection from negative impacts. It is, however, unlikely that these species occur in the short watercourses flowing off east-facing slopes of Potberg.

The presence of a watercourse on site does mean that this portion of the site is of very high sensitivity with regards to aquatic biodiversity, hence the need for an Aquatic Biodiversity Specialist Assessment (this report).

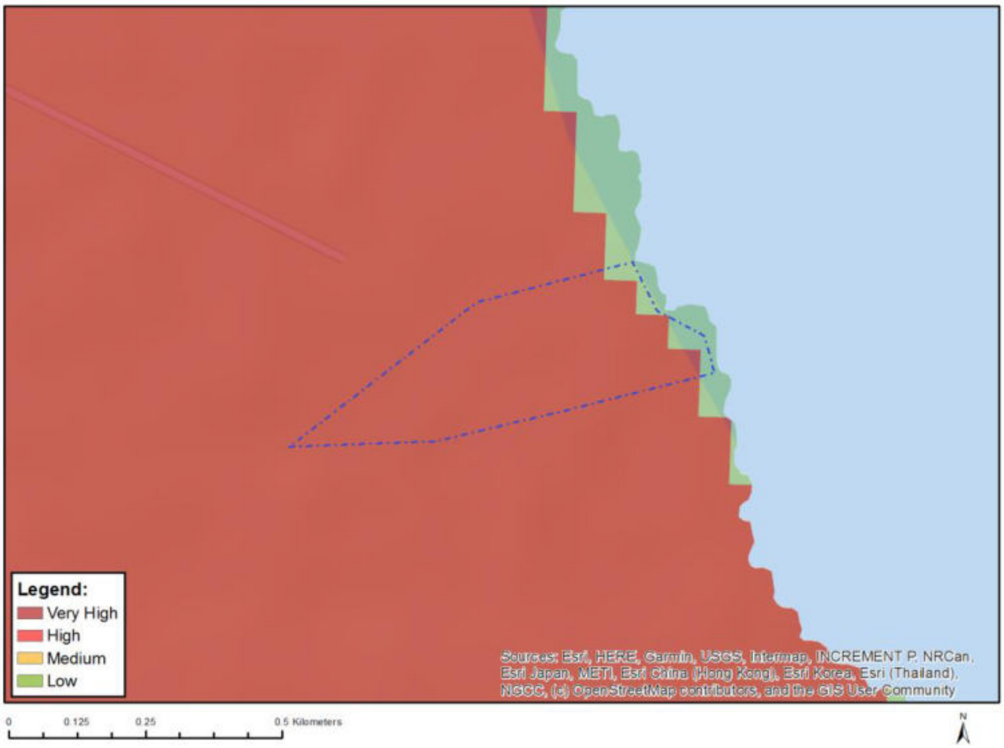


Figure 3.1 Sensitivity rating for erf 134, Cape Infanta (blue outline), according the DFFE's EIA Screening Tool.

4 ASSESSMENT OF THE CONDITION AND SENSITIVITY OF THE STREAM

4.1 Introduction

An assessment of the conservation importance or status of an inland aquatic ecosystem should combine assessments of both the current ecological integrity of the ecosystem and its perceived ecological importance and sensitivity. The *ecological integrity* of an ecosystem is defined as its ability to support and maintain a balanced, integrated composition of physico-chemical and habitat characteristics, as well as biotic components on temporal and spatial scales that are comparable to the natural characteristics of ecosystems of the region. The integrity of a system is directly influenced by its current state, and how much the system has been altered from the reference or unimpacted condition. The *ecological importance* of a river or stream is an expression of its importance to the maintenance of ecological diversity (i.e. both species and habitat diversity) and functioning on local and wider scales. *Ecological sensitivity* (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al.,* 1988; Milner, 1994). Both abiotic and biotic components of the system are taken into consideration in an assessment of ecological importance and sensitivity. It is strongly biased towards the potential importance and sensitivity of a particular section of a stream or river, as it would be expected under *unimpaired* conditions.

DWA's Resource Directed Measures (RDM) approach provides methods for the assessment of ecological integrity and of ecological importance and sensitivity, in the context of the determination of the ecological management class for riverine ecosystems as part of the Reserve Determination procedure (DWAF, 1999). This procedure can be followed at different levels of detail – desktop, rapid, intermediate and comprehensive. The rapid approach was followed for this study. Determination of the appropriate ecological management class for a river reach is useful in the context of an EIA, as this class, in conjunction with the attainable (or desired) ecological management class, provides an indication of the extent to which a river reach can be further modified (or not) by human activities that impact on that river reach. This will have a direct bearing on the significance of proposed impacts, and will guide the mitigation (if possible and relevant) of such impacts.

4.2 Methods

In 2005, DWS revised the methods for the determination of the PES of watercourses, through the development of the EcoClassification approach (Kleynhans *et al.*, 2005b). EcoClassification refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative the natural or close to the natural reference condition. This approach also allows for different levels of assessment, depending on time and budget, and the requirements of the assessment.

The rapid approach was followed for this study. Essentially this approach was based on assessment of existing impacts on two components of the stream - the **riparian** zone and the **instream** habitat, using visual information.

Assessments were made separately for both components, but data for the riparian zone were interpreted primarily in terms of their potential impact on the instream component. Criteria within each component are pre-weighted according to the importance of each, and each criterion is scored between 0 and 25, with six descriptive categories ranging from 0 (no impact), 1 to 5 (small impact), 6 to 10 (moderate impact), 11 to 15 (large impact), 16 to 20 (serious impact) and 21 to 25 (critical impact). The criteria are provided in Table 4.1.

The total scores for the instream and riparian zone components were used to place the stream in a habitat integrity or Present Ecological State (PES) category (A – F) for both components.

Table 4.1 Criteria used in the assessment of Present Ecological Status of watercourses (from Kleynhans, 1996).

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Water quality modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Flow modification – floods and low flows	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic fauna	Invasion by exotic fauna will influence indigenous biodiversity, with possible knock-on effects for habitat quality and availability.
Solid waste disposal	This refers to litter and any other solid waste, i.e. a direct anthropogenic impact which may alter habitat structurally, obstruct flow, or have a direct impact on biota. Also a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the vegetated buffer will reduce its ability to protect the river from sediment and polluted runoff from the surrounding catchment. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Riparian area habitat diversity is reduced, and timing and quality of food source (leaves, wood, etc) for aquatic biota altered.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

The DWS-recommended method for the determination of the **Ecological Importance and Sensitivity** for watercourses of a particular ecosystem considers the following ecological aspects of watercourses (DWAF, 1999):

- Rare and endangered instream and riparian biota;
- Unique instream and riparian biota;
- Intolerant instream and riparian biota;
- Species richness, both riparian and instream;
- Diversity of habitat types or features;
- Refuge value of habitat types;
- Sensitivity of habitat to flow changes;
- Sensitivity to water quality changes;
- Migration route/corridor for instream and riparian biota, and
- Presence of Protected Areas and conservation areas.

Each criterion is scored between 1 and 5, and the medians of these scores are calculated to derive the EIS category (Table 4.3).

Table 4.2 PES categories for watercourses (from Kleynhans, 1996).

Category	Description	Score (%)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

4.3 Results of assessment

In terms of both riparian and instream integrity, the stream is considered to be a **Category A (natural)** stream, as there is no significant abstraction of water from the stream, little modification to the channel and stream bed, and the surrounding vegetation is largely intact, with the exception of the section of stream flowing through erf 134 (Table 3.4).

In terms of ecological importance and sensitivity, only the abiotic component could be assessed, placing the stream in the '**high**' EIS category (Table 3.4). Due to its ephemeral nature, the stream is highly sensitive to changes in water quantity and quality, as any change will alter the characteristics of the stream. The stream is not highly important in terms of the provision of aquatic or semi-aquatic habitat, or as refuge for aquatic and semi-aquatic fauna and flora, due to the fact that the stream corridor is primarily a terrestrial feature, except during the days when there is flow in the stream. The stream flows off mountains that lie within the De Hoop Nature Reserve, which elevates its ecological importance.

Table 4.3 Ecological importance and sensitivity categories for watercourses.

Ecological Importance and Sensitivity Categories	General Description
Very high (score >3 and ≤4)	Reaches or rivers that are considered to be unique on a national or even international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to channel / bed modifications and have no or only a small capacity for use.
High (score >2 and ≤3)	Reaches or rivers that are considered to be unique on a national scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to channel / bed modifications but in some cases, may have a substantial capacity for use.
Moderate (score >1 and ≤2)	Reaches or rivers that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually not very sensitive to channel / bed modifications and often have a substantial capacity for use.
Low/marginal (score >0 and ≤1)	Reaches or rivers that are not unique at any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to channel / bed modifications and usually have a substantial capacity for use.

According to the DWA (1999), for a rapid determination of the ecological management class of a river, the "high" category equates to the default ecological management class of B – these are sensitive systems, where only a small risk of modifying the natural abiotic characteristics of the river should be allowed.

In summary, the **PES of the stream is Category A**, while the ecological management class for the stream is Class B. Future development in the stream's catchment and management of the stream must ensure that the stream remains in its current state, with no deterioration in management class. Overall, the stream can be considered to be of **very high conservation importance**. Due to the largely terrestrial nature of the stream corridor, it is important to also consider the conservation importance of the surrounding dunes and vegetation, and the requirements of any fauna that may use the stream corridor for dispersal, refuge, etc.

Table 4.4 Summary of the results of the assessments of HI and EIS for the stream entering erf 134, Cape Infanta.

Ecosystem	Habitat Integrity		Ecological Importance and Sensitivity
	Instream	*Riparian*	
Stream entering erf 134	94 CATEGORY A	91 CATEGORY A	2.5 HIGH

5 DESCRIPTION OF THE PROPOSED DEVELOPMENT

5.1 General description of the development

Three alternative development layouts are proposed. **Alternative 1** (13th April 2012) comprises 23 erven, 16 of which would be single storey and 7 double storey (Figure 5.1), **Alternative 2** (26th August 2013) comprises 21 erven, 15 of which are single storey and 5 double storey (Figure 5.2) and lastly, **Alternative 3** (19th May 2021, updated November 2024) also with 21 erven (Figure 5.3). The main material differences between Alternatives 2 and 3 are the location of the entrance roads and a shift in the configuration of the erven. All three development alternatives incorporate a conservation area in the north-western corner of the property. The location of the conservation area on Alternatives 2 and 3 takes account of the limestone sensitive area, as delineated in the botanist specialist report, and in both layouts the conservation area is just over 6 000 m^2.

The total cover of developable erven for all three alternatives is roughly 50%. All alternatives allow for the existing Main House and stoep, braai area and graveyard to remain as is, incorporated into the development as a separate erf. The existing garage and store will remain for all alternatives.

The final alternative is the **no development option**. This represents the status quo in terms of zoning – Agriculture 1 – and in terms of current permissible uses - primary use is for cultivation of land for crops and plants or the breeding of animals, or the operation of a game farm on an extensive basis on natural veld or land. The latter use includes activities and buildings that are reasonably connected with the main farming activities of the farm. Consent uses include additional dwelling units (a maximum of an additional five units), farm store, farm stall, intensive feed farming, riding school, nursery, service trade, and/or tourist facilities.

Figure 5.1 Alternative 1 layout for erf 134 Cape Infanta, comprising 23 erven and a conservation area in the north-western corner.

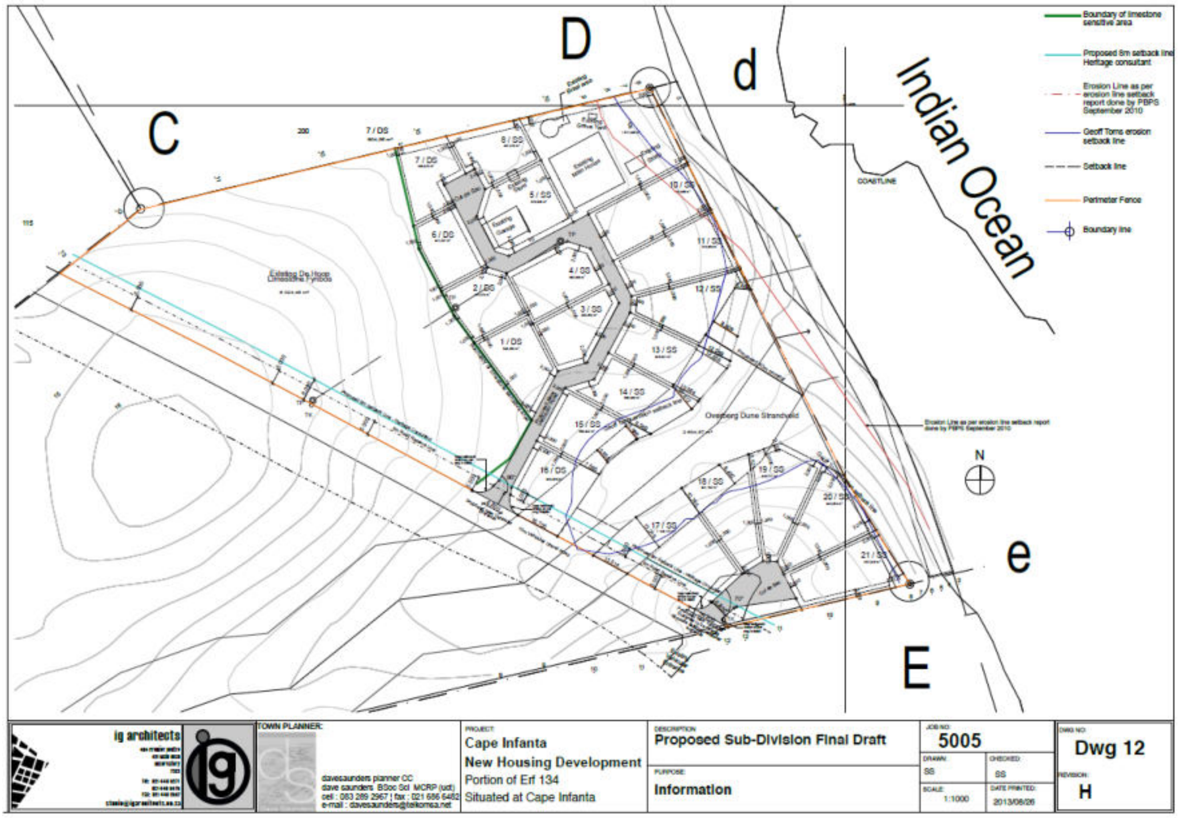


Figure 5.2 Alternative 2 layout for erf 134 Cape Infanta, comprising 21 erven and a conservation area in the north-western corner.

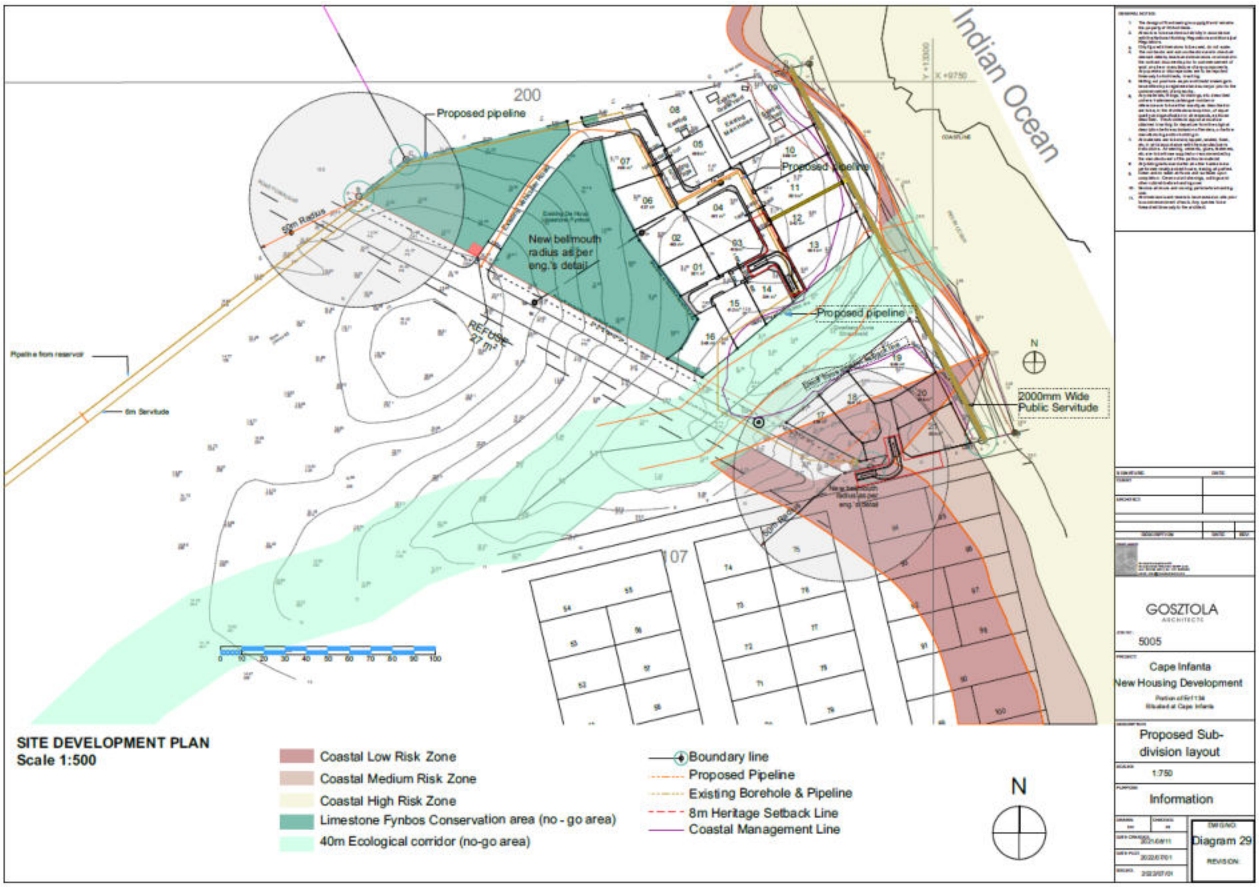


Figure 5.3 Alternative 3 layout proposed for erf 134 Cape Infanta, comprising 21 erven and a conservation area in the north-western corner. The main differences between Alternatives 2 and 3 are the location of the entrance roads, and the configuration of the erven.

Alternatives 1, 2 and 3 were developed through an iterative process, whereby the concerns of all specialists involved in the assessment phase were addressed and accommodated. The following specific concerns were raised from a freshwater ecological perspective:

- More open space within the development for the infiltration of runoff and precipitation;
- Smaller hardened footprint, and so less stormwater generated, and
- A sufficiently wide (40m) corridor around the watercourse is accommodated by the development layouts. The establishment of such a corridor will protect the watercourse/stream and the surrounding dunes that contribute runoff to the stream during rainfall.

5.2 Internal Roads

There will be two access roads onto the property for all Alternatives. For Alternative 3, the northern entrance road will run along the existing vehicular track. All internal roads are proposed to be 3m wide, with a 5m-wide road reserve (Fraser, 2014, 2020). This will accommodate mixed vehicular and pedestrian use. The roads will be surfaced with pavers, tar or 700mm wide concrete strips and the 1m-wide road reserve on either side will be grassed swales with some landscaping with indigenous vegetation to intercept runoff and allow infiltration.

5.3 Water supply

Water will be supplied from rainwater harvesting and storage structures, and boreholes. Water demand is expected to be in the order of 21 000 litres per day (Fraser, 2023). Rainwater storage tanks (most likely to be located underground in order to minimise the visual impact) of 5 kl capacity have been recommended for the houses, as it is expected that none of the houses will be occupied for more than 4 months of the year. Rainwater will be collected via roofs and guttering, and stored in tanks.

Parsons (2006) reported that there would be sufficient borehole water for 80 housing units, and that the water is of sufficient quality for drinking purposes, although it has been reported as being brackish. A Water User Licence would not be necessary, as a total of 1 m^3/day can be abstracted from each borehole before a Licence becomes necessary, and this quantity is more than sufficient to augment the rainwater supply. All boreholes are located to the west of the gravel road adjacent to the property, and it has been recommended (Fraser, 2023) that a reservoir be built close to one of the boreholes, and water transferred to the development via an existing pipeline (Figure 5.4). A new water pipeline would need to be constructed to take water into the development, and this pipe would be placed within the ecological buffer recommended for the watercourse (see Section 7.2) and will cross the watercourse within the roadway embankment, at 1m depth in a steel sleeve. The pipe will be located between the road edge and the culvert headwall at the crossing over the watercourse.

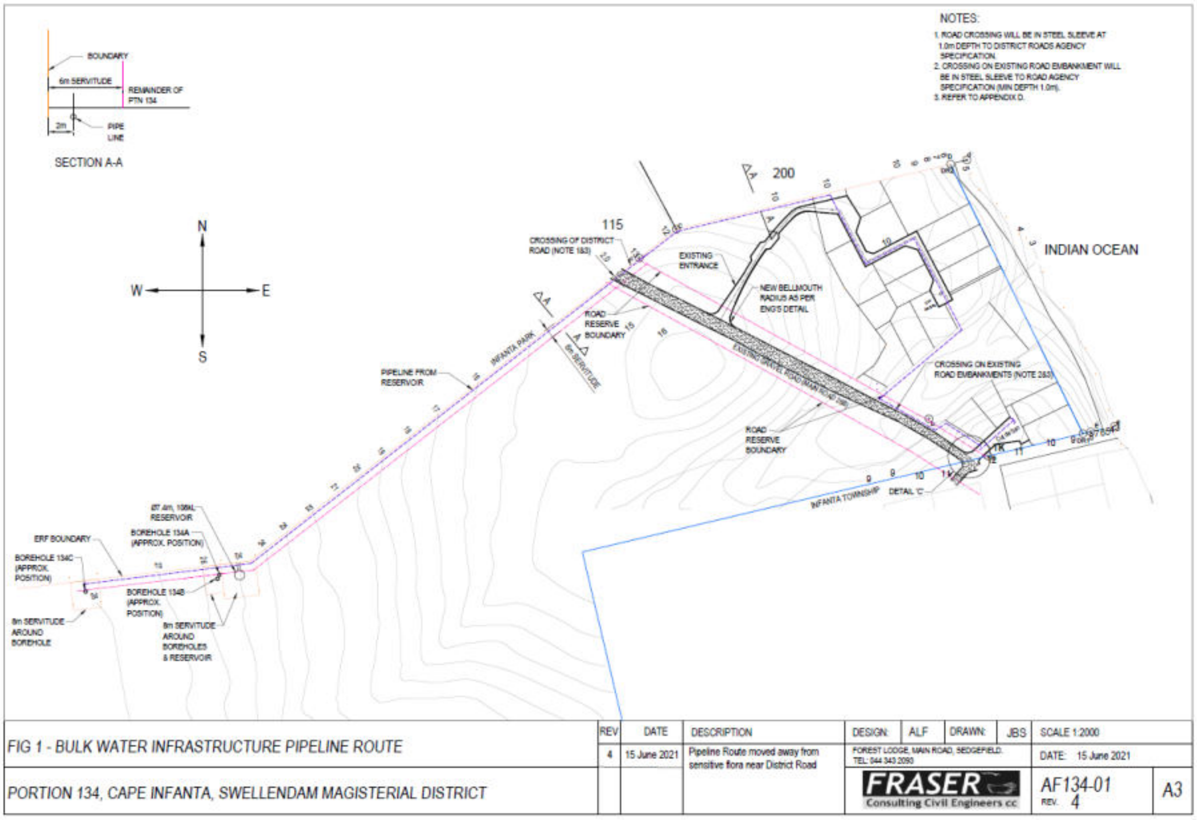


Figure 5.4 **Location of the borehole, water supply pipeline and proposed 108 kl reservoir to the west of the site.**

5.4 Stormwater Management

The stormwater management system has been designed using the principles of Sustainable Urban Drainage Systems (SUDS), which aim to mimic the natural (pre-development) system as far as possible. The natural state of runoff on the property is that 80% of natural runoff would flow towards the watercourse, and 20% towards the ocean (Fraser, 2014), and that the vegetated and rough characteristics of the surrounding catchment imply that most precipitation will be held on the land rather than flow overland into the watercourse or ocean.

The construction of hardened surfaces on the property would change this situation. In order to avoid this unnatural change, it is proposed that all roof runoff be directed into rainwater tanks, and that overflow from the tanks, and water running off all other hardened surfaces (e.g. roads) would be conveyed towards areas where water will be retained and allowed to filter into the ground, e.g. localised water sinks and soakaways (sand pits), rain gardens (essentially landscaped (i.e. not hardened) areas that lie immediately adjacent to the hard surfaces, such as roads, parking areas), grass swales and other permeable surfaces.

5.5 Sewage Management

The development is likely to produce roughly 17 kl sewage per day, at full occupancy (Fraser, 2023). The **primary option** for the treatment of sewage is a household package treatment plant, as supplied by Maskam Water™. The recommended option is the Fusion Series Treatment System. The treated effluent from such a plant complies with DWS's General Limits. The system requires a 6 monthly service, and it is recommended that each household takes care of its own effluent, instead of one or two plants for the whole development.

The process includes:

- A sedimentation chamber;
- An anaerobic chamber;
- A aerator filter media chamber; and
- A treated water storage chamber.

The water can be recycled for non-potable use such as flushing toilets, with the remaining effluent being used for irrigation or being discharged underground to a soak-away. Alternatively, all the effluent can be discharged to a soak-away as the surrounding soil is sand and is very porous.

An **alternative option** is the use of septic tanks and soak aways, a method that has been successful for many decades in Cape Infanta and which carries a low risk for groundwater and surface water pollution in the area (Parsons, 2020; Ross, 2020). The water will typically be conveyed to a 2500 litre tank, and will use either a single or two-tank system. There is the option of splitting grey water from black water. Only clean water is allowed to leave the final tank, leaving solids, oil and grease behind, where bacteria break down the matter. Recommendations for septic tank operation are made by Fraser (2023), thus ensuring that this sewage manage system will operate at the highest standards of hygiene and at the same time reduce the likelihood of negative impacts, such as overflow and pollution. Treatment is to also to DWS General Limits (Fraser, 2020).

6 LEGISLATION GOVERNING THE CONSERVATION AND MANAGEMENT OF WETLANDS AND RIVERS IN SOUTH AFRICA

The following sections briefly summarise those sections of the South African legislation and guidelines documents that pertain to the conservation and management of rivers and wetlands.

6.1 National Environmental Management Act (Act 107 of 1998, as amended by Act 62 of 2008)

The National Environmental Management Act of 2008 (NEMA), outlines measures that….”prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”

Of particular relevance to this assessment is Chapter 1(4r), which states that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

The Environmental Impact Assessment Regulations are stipulated in Government Notice R. 543 of 18th June 2010.

6.2 Conservation of Agricultural Resources Act (Act 43 of 1983)

Key aspects include legislation that allows for:

<u>Section 6:</u> Prescription of control measures relating to the utilisation and protection of vleis, marshes, water sponges and water courses. These measures are described in regulations promulgated in terms of the Act, as follows:

Regulation 7(1): Subject to the Water Act of 1956 (since amended to the Water Act 36 of 1998), no land user shall utilise the vegetation of a vlei, marsh or water sponge or within the flood area of a water course or within 10 m horizontally outside such flood area in a manner that causes or may cause the deterioration or damage to the natural agricultural resources.

Regulation 7(3) and (4): Unless written permission is obtained, no land user may drain or cultivate any vlei, marsh or water sponge or cultivate any land within the flood area or 10 m outside this area (unless already under cultivation).

6.3 Cape Nature Conservation Ordinance (Ordinance 19 of 1974; amended in 2000)

This ordinance provides measures to protect the natural flora and fauna, as well as listing nature reserves in the Western Cape that are managed by the Western Cape Nature Conservation Board (WCNCB). This ordinance, with the Western Cape Nature Conservation Board Act of 1998 was amended in 2000 to become the Nature Conservation Laws Amendment Act. Lists of endangered flora and fauna can be found in this act.

6.4 National Water Act (1998)

The following non-consumptive water uses relate to activities that may impact on the integrity and function of water resources and the overall quality of the resource:

a. Taking water from a water resource;

b. Storing water;

c. Impeding or diverting the flow of water in a watercourse;

d. Engaging in a stream flow reduction activity;

e. Engaging in a controlled activity identified and declared as such in terms of the Act;

f. Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

g. Disposing of waste in a manner which may detrimentally impact on a water resource;

h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

i. Altering the bed, banks, course or characteristics of a watercourse;

j. Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

k. Using water for recreational purposes.

DWA have issued a number of **General Authorisations (GA)** in terms of Section 39 of the National Water Act.

6.5 Western Cape Provincial Spatial Development Framework (March, 2014)

Policies regarding the protection of biodiversity and ecosystem services in the Western Cape are:

- The Western Cape's Critical Biodiversity Area (CBA) mapping, which CapeNature have updated and refined as the Western Cape Biodiversity Spatial Plan (see Section 6.6), together with the draft priority climate change adaption corridors, comprise the spatial extent of the Western Cape's biodiversity network. This must inform spatial planning and land use management decisions throughout the province.
- Using the latest available CBA mapping as a primary informant, regional, district and municipal SDFs must delineate Spatial Planning Categories (SPCs) that reflect suitable land use activities in the different CBA categories.
- To complement CapeNature's protected area expansion strategy and their Stewardship programme, SDFs should highlight priority areas outside the protected area network that are critical for the achievement of the province's conservation targets.

Policies regarding the management, repair and optimisation of inland water resources are:

- Given current water deficits, which will be accentuated by climate change, a 'water wise' planning and design approach in the Western Cape's built environment is to be mainstreamed.
- Rehabilitation of degraded water systems is a complex inter-disciplinary intervention requiring built environment upgrading (i.e. infrastructure and the built fabric), improved farming practises, as well as the involvement of diverse stakeholders.
- Introduce and retrofit appropriate levels of water and sanitation systems technologies in informal settlements and formal neighbourhoods with backyard shacks as a priority.

- An overarching approach to water demand management is to be adopted – firstly efficiencies must be maximised, storage capacity sustainably optimised and ground water extraction sustainably optimised, with the last resort option of desalination being explored, if necessary.
- Protection and rehabilitation of river systems and high yielding groundwater recharge areas, particularly in areas of intensive land use (i.e. agricultural use, industry, mining and settlement interactions) should be prioritised.
- Regional Plans to be developed for Water Management Areas to ensure clear linkages and interdependencies between the natural resource base (including water resources) and the socio-economic development of the region are understood and addressed.
- Agricultural water demand management programmes to be developed with an emphasis on the Breede Valley and Oliphants / Doorn agricultural areas. Industrial water demand management programmes to be developed with an emphasis on Saldanha, Southern Cape and Cape Town. Settlement water demand management programmes to be developed with an emphasis on the Cape Town functional region.
- Government facilities (inclusive of education, health and public works facilities) to lead in implementing effective and efficient water demand management programmes.
- Continue with programmes (such as Working for Water) which reduce the presence of alien vegetation along river systems.

6.6 Western Cape Biodiversity Spatial Plan (2017)

The Western Cape Biodiversity Spatial Plan (WCBSP) is the product of a systematic biodiversity planning assessment that delineates Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and freshwater realms. These spatial priorities are used to inform sustainable development in the Western Cape Province. This product replaces all previous systematic biodiversity planning products and sector plans with updated layers and features.

6.7 Swellendam Spatial Development Framework (2020)

The Swellendam Municipality SDF is informed by the Provincial Spatial Development Framework Plan and the Western Cape Spatial Plan. One of the key objectives under the goal "Promote inter-municipal co-ordination to support sustainable use of natural resources and infrastructure" is to manage and protect water resources, catchments and dams. The promotion of conservation of biodiversity and sustainable environmental management based on bioregional planning objectives is identified as a critical issue.

With regard to Infanta, the local spatial development principles are to:

- Promote conservation of the surrounding natural environment and setting;
- Restrict inappropriate residential development;
- Maintain the pristine natural environment and rural coastal character, and
- Contain the urban footprint of Infanta within a clearly demarcated urban edge (see Figure 6.1).

Specifically, the following is included in the Framework:

Conservation of Sensitive Biophysical Environment: Sensitive areas of the biophysical environment should be managed with conservation objectives in mind, and should be protected from urban development. In this regard, the following areas are of particular importance:

- The urban edge areas immediately adjacent to areas of natural vegetation.

- The coastline, natural drainage system and areas immediately adjacent thereto.
- Any dune systems, particularly any frontal dunes along, the coastline.

Corridors of Linear Open Spaces:

- The functioning of the drainage line (see Figure 6.1) which effectively separates Infanta from Infanta Park should be protected and managed with conservation objectives in mind to ensure that both its ecological and hydraulic functionality is optimised and maintained.
- The existing coastal setback line, which is, in effect, the demarcated urban edge, should be maintained. No development should be permitted in this setback area, thereby ensuring that a continuous coastal corridor is maintained.

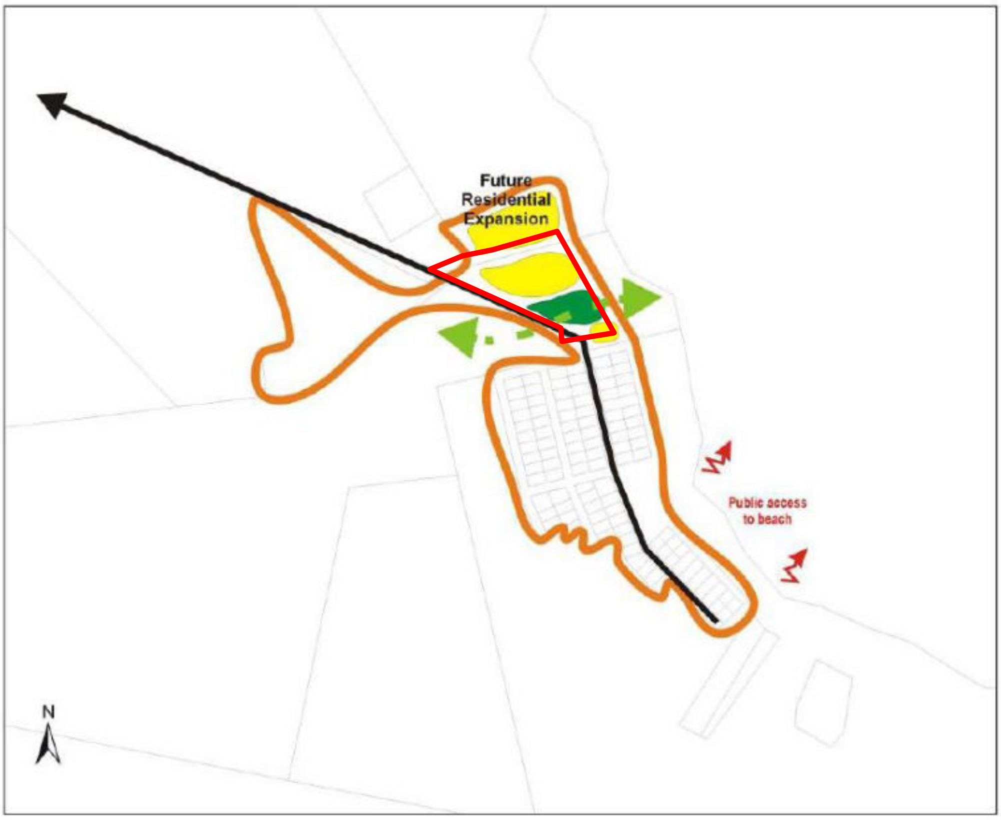


Figure 6.1 Spatial management model for Infanta (Swellendam SDF). The red boundary is erf 134 and the green dashed line is the watercourse corridor.

6.8 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The Act aims to:

- Provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act of 1998;
- Protect the species and ecosystems that warrant national protection;
- Ensure the sustainable use of indigenous biological resources;
- Ensure the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; and
- Describe the establishment and functions of a South African National Biodiversity Institute.

7 DESCRIPTION AND ASSESSMENT OF EXPECTED IMPACTS

The impacts that are expected to be associated with the proposed development (Alternatives 1, 2 and 3 – see Section 5.1) can be divided into those associated with the proposed layout, the construction phase (including pre-construction) and the operational phase.

7.1 Description of impacts and mitigation measures

7.1.1 Development Phase (design and construction)

A detailed construction environmental management programme (CEMPr) must be completed before the construction phase commences. The CEMPr must have input from all relevant specialists, and must contain detailed guidance on the minimization of disturbance during construction.

Trenching within the ecological corridor for laying of bulkwater pipeline – this may lead to mobilisation of sediment into the watercourse, or ocean, especially during high rainfall events, and may lead to the short-term loss of natural vegetation within the working area.

Mitigation:

- Ideally, the pipeline should be located outside of the ecological corridor.
- The width of the construction footprint must be kept to a minimum.
- Trenches must be excavated by hand, and not using machinery.
- Excavation of the pipeline trench must be done during the dry season.
- Opened trenches must be filled as quickly as possible after trenching is initiated. This is to keep the disturbed areas open and unstabilised for the shortest period possible. No trenches must be opened within three days of predicted heavy rainfall.
- The disturbed pipeline area must be rehabilitated, with input from a botanist, in order to snrue that the area recovers from the impacts of construction.

Storage or dumping of building materials (sand, soil, bricks etc.) or temporary lay-down of equipment close to the watercourse and its corridor – such dumping would damage the soil structure, and would destroy or shade out plants growing in and around the stream. Building materials, particularly fine material such as sand, dumped near the stream may gradually flow down the slope and enter the stream corridor.

Mitigation:

- Ensure that all building materials and equipment are stored at least 50m away from the watercourse corridor, as demarcated prior to construction.
- Materials should be stored in piles that do not exceed 1.5m in height and should be protected from the wind, to prevent spread of fine materials across the site.

Pollution of the stream corridor through leakage of fuels, oils, etc. from construction machinery, from washing of instruments or flushing of concrete mixers and other vehicles as well as sediments from de-watering of excavations. The ephemeral nature of the stream means that such pollutants would accumulate, and would flush into the sea only after heavy rains, which may lead to significant pollution of the coastal zone.

Mitigation:

- Any construction activities close to the stream cease during periods of heavy rain, to reduce the risks of contamination of the stream and ocean through rainfall and runoff.
- Machinery prone to oil or fuel leakage must be located at least 50 m away from any sensitive ecosystem, and the area bunded in order to contain leakages.
- Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly.
- Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities.

<u>Destruction or deterioration of freshwater habitat as a result of foot and vehicular traffic</u> – access across and around the stream corridor onto the building site is likely to lead to damage of soils and vegetation.

Mitigation:

- The watercourse corridor must be well marked during the pre-construction phase.
- Pathways and access roads must be routed away from the stream corridor and coastline.

<u>Disturbance of freshwater fauna and flora</u> – the presence of construction teams and their machinery will lead to noise and light pollution in the area, which will disturb the local fauna and flora.

Mitigation:

- The construction site and access pathways should avoid sensitive areas, which must be demarcated during the pre-construction phase. If lights are used, these should be directed away from the stream corridor and coastline.
- Any animals found during site preparation or construction must be recorded and handed to the ECO.
- An education programme for all employees must be run at the start of construction, and when new contractor teams start on site.

<u>Introduction and spread of alien invasives</u> – top material brought onto the site, for filling and landscaping can lead to the introduction of alien or invasive seedbanks.

Mitigation:

- All soils and top material must be bought from a reliable source, and must be free of alien seeds or alien grass runners.

<u>Cumulative impacts associated with construction:</u>

All of the impacts described above will have a cumulative effect on the local environment, even if these are mitigated against. This activity would happen in the context of an urban environment close to the ocean and Breede River mouth, and thus all construction impacts would have an additive effect, i.e. each construction impact has the potential to harm the environment, to a lesser or greater extent, depending on the likelihood and effectiveness of mitigation. The impacts of greatest significance are those that are likely to create a disturbance or lead to the pollution of natural areas, or those that may persist for some time.

7.1.2 Operational Phase

A detailed environmental management programme (EMPr) must be compiled for the ongoing management of the development, and especially of its natural open spaces and conservation areas. The EMP must have input from all relevant specialists, and must contain detailed guidance on the minimization of disturbance and maximisation of conservation efforts.

The main points of the EMPr should be published as notices within every home so that all residents and visitors are aware of the sensitive environment in which the development is placed.

All development Alternatives will result in the hardening of the property and loss of terrestrial open space. This would impact on the movement of flora and fauna both in and out of the stream corridor, and across the erf to the coast or up the slopes. The whole of erf 134 to the east of the gravel road lies within a "coastal protection zone", as defined in the Integrated Coastal Management Act (2009). The purpose of this type of protection zone is to ensure protection of ecosystems associated with the coastline, which would include the mouths of rivers and streams meeting the sea. While development is allowed in coastal protection zones, this should be done in such a way as to avoid negative impacts on the ecosystems affected.

Mitigation:

While the open spaces within the development – in the north-western corner and around the watercourse – will mitigate to some extent against the impacts associated with the loss of open space and hardening of the property, there is limited connectivity between these two areas. These spaces are connected by a fairly narrow corridor along the western edge of the property adjacent to the gravel road. The movement of fauna and flora across the site would be improved through not constructing fences between the houses, thus allowing fauna to move between the houses. If fences must be constructed, these must be designed to allow the free movement of small mammals. A further mitigation would be through ensuring that all gardens are planted with locally indigenous plant species.

The open spaces provided for in all Alternatives, and the proposed SUDS infrastructure should allow for sufficient area for the infiltration of runoff across the site. No further mitigation measures are recommended in this regard.

All three Alternatives will result in the setting aside of a considerable portion of the site as conservation area. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development alternative, due to the uncertainties associated with this option.

Cumulative impacts associated with the layout:

The activity will happen within a context of existing and possible future coastal development and hardening of the urban area of Cape Infanta (roads and houses). Thus, there is a cumulative effect of the loss of open space, which can be mitigated, but which is assumed to be of the same significance as the impacts of this development assessed on its own. This impact would have an additive effect over the long-term, i.e. each development will add to the effect to a lesser or greater extent, depending on mitigation, but always with a negative impact on the environment.

One of the main concerns about the operational phase of the residential development (Alternatives 1, 2 and 3) is the generation and management of stormwater. The stream is ephemeral and any change in hydrology will change the nature of the system, and lead to a deterioration in the quality of habitat provided within the corridor.

Mitigation:

- The proposed stormwater management system, if implemented in full, would adequately mitigate against the negative impacts associated with the generation, storage and discharge of stormwater on the site. It is understood that all stormwater generated by the development will be minimised at the point of accumulation, with only high discharge volumes and natural runoff being directed towards the watercourse and coastline.
- The pipe carrying water under the road must be cleaned out, so that this does not pose a flood risk for the proposed development. In addition, stormwater runoff from the dirt road into Cape Infanta must be formalised.

There will be <u>on-site treatment of waste water</u>, through the use of small package plants or septic tanks and soak-aways. Neither of these options for treatment of waste water will discharge treated effluent water directly into the watercourse, however, over time, these systems do release water which may contain nutrients into the soil. Due to the sandy nature of the soil, these will filter into the ground and may contaminate the groundwater, and ultimately may enter the river corridor. The risk of this occurring is low, however.

Mitigation:

- Treated waste water should not be used for irrigation, but can be used for flushing of toilets.
- All septic tanks and package plants are to be placed outside the 40m ecological corridor.
- Package plants, septic tanks and soak-aways must be checked to ensure that they are working, at least annually.
- Residents of the development must be educated in the use of household chemicals, detergents and solvents. It is inappropriate to use substances that could affect the efficiency of the septic tanks. Certain chemicals, such as bleaches, can destroy the bacterial communities in the septic tank.

The development will need to <u>abstract water from groundwater resources</u> in the area. This may lead to local drawdown of groundwater resources.

Mitigation:

- Both permanent residents and occasional visitors must be encouraged to use water sparingly, as groundwater is a precious resource, and the impacts of increased abstraction relatively unknown.
- Use of rainwater must be facilitated through construction of rainwater tanks, and use of rainwater encouraged.
- Only locally indigenous plants shall be allowed in gardens and landscaped areas. Grassed lawns must be of indigenous species, such as *Cynodon dactylon* (kweekgras).

<u>Disturbance of fauna and flora</u> - the proximity of the residential units and roads to the stream corridor and coastal zone will lead to an increase in disturbance in the form of noise, light, and physical disturbance from trampling by people and pets. The proposed buffer zone around the watercourse will provide some protection for the fauna and flora.

Mitigation:

- Residential and road lights should be directed away from the stream corridor and coastline.

- Residents, visitors and their pets should be discouraged from walking into and through the stream corridor. Boardwalks can be used to allow pedestrian access into the corridor, while protecting the fauna and flora.

Spread of alien invasives - landscaped areas may introduce exotic species that easily invade into natural areas, thus outcompeting indigenous species, and leading to a loss of diversity.

Mitigation:

- The stream corridor should be planted with appropriate indigenous vegetation, where necessary, and a barrier provided between landscaped areas (gardens or roadsides) and the corridor (e.g. a pathway).
- Kikuyu grass should not be allowed on the site.
- Road reserves can be grassed with indigenous species such as *Cynodon dactylon* (kweekgras).
- The spread of alien plant species into the natural areas must be prevented and monitored.

Removal of alien vegetation - this is an opportunity to remove all alien and invasive plant species that inhabit the site, and so increase the local biodiversity of flora as well as the depending on the vegetation.

All three alternatives will result in the management of a considerable portion of the site as a conservation area. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development alternative, due to the uncertainties associated with this option.

Cumulative impacts associated with operation:

All of the above operational impacts will have an additive cumulative effect on the natural environment, either negative or positive (in the case of alien vegetation removal). The impacts of most concern would be the loss of open space, generation of stormwater, on-site treatment of waste water, and the use of groundwater resources. There may currently be the capacity for this particular development, but should there be further development in the area, the additive effect may exceed the capacity.

7.2 Recommended ecological buffer for the watercourse

In determining a development footprint that will have the least impact on an inland aquatic ecosystem, it is essential to establish the recommended development setback, or ecological buffer for each ecosystem. It is important to note that in order to protect a water resource, the development setback or buffer should be used instead of the blanket 32m, 500m or 100m setback requirements of the NEMA/National Water Act. For watercourses, the 1:100 year floodline should preferably be within the recommended buffer.

The buffer for the watercourse was determined using the site-based protocol for buffer determination of MacFarlane and Bredin (2017). The assessment is based on the PES and EIS of the watercourse (see Section 4), and the assumed quality of the buffer during both phases of the project. In this case, it was assumed that the current vegetation (i.e. fairly sparse, shrubby vegetation) will remain within the buffer. The density of vegetation within a buffer plays a major role in determining its effectiveness – a well-vegetated buffer, with a high basal cover (such as grass or sedges) is the most effective, due to the ability of the plants and their roots to trap sediments, toxins and other pollutants before they reach the wetland.

The recommended buffer for the watercourse is 20m, for both the construction and operational phases. Due to the lack of a clearly defined channel, the buffer was measured from the centreline of the watercourse, as shown in Figure 2.2. In this instance, this was considered more than adequate for the protection of the watercourse, due to its intermittent nature, and thus the lack of sensitive riverine fauna and flora. The main aim of the buffer is to protect the riverine corridor, and the surrounding slopes, which supply water to the watercourse (from rainfall), in addition to supply from upstream.

7.3 Methods for the assessment of impacts

The evaluation of impacts was done using the criteria supplied in the EIA Regulations published by the Department of Environmental Affairs, in terms of the National Environmental Management Act (Act 107 of 1998), on 4th December 2014, and amended on the 7th April 2017. The criteria are listed in Table 7.1.

Table 7.1 Criteria used for the assessment of impacts associated with the proposed Cape Infanta development.

	Criterion	Description
a)	**Nature of Impact**	Define or describe the type of effect (**negative** or **positive**) that a proposed activity would have on the environment. This description includes **what is to be affected**.
b)	**Extent**	Describe whether the impact occurs on a scale limited to the **site** area, **local** area (i.e. limited to the site and within 10 km of the site), **regional** (covers an entire region or extends into another region) or **national** (national implications or crosses over national boundaries) scale.
c)	**Duration**	Predict whether the lifespan of the impact will be **short term** (0 to 5 years); **medium term** (5 to 15 years); **long term** (i.e. beyond the operational phase but not permanently), or **permanent** (i.e. mitigation through natural processes or human intervention will not occur in such a way or in such time span that the impact can be considered transient).
d)	**Consequence**	Indicate how the activity will affect the environment.
e)	**Probability**	Describe the probability of the impact actually occurring as **definite** (impact will occur regardless of mitigations), **highly probable** (most likely), **probable** (distinct possibility), or **improbable** (low likelihood).
f)	**Irreplaceable loss of resources**	Describes the degree to which resources will be irreplaceably lost due to the proposed activity. It can be **no loss of resources**, **marginal loss**, **significant loss** or **complete loss** of resources.
g)	**Reversibility**	The degree to which an impact can be reversed, from **fully reversible**, to **partly reversible** to **irreversible**.
h)	**Indirect impacts**	Indirect impacts are secondary impacts and usually occur at a different place or time. Specialists will need to elaborate on any indirect or secondary impacts of proposed activities. If there are no indirect impacts specialist will need to briefly explain so.
i)	**Cumulative impact**	An effect which in itself may not be significant but may become significant if added to other existing or potential impacts that may result from activities associated with the proposed development. Cumulative impacts prior to and post mitigation must be assessed. The cumulative effect can be: **negligible** (the impact would result in negligible to no cumulative effect), **low** (the impact would result in insignificant cumulative effects), **medium** (the impact would result in minor cumulative effects) or **high** (the impact would result in significant cumulative effects).
j)	**Degree to which the impact can be avoided**	This indicates the degree to which an impact can be avoided. The degree of avoidance can either be **high** (impact is completely avoidable), **moderate** (impact is avoidable with moderate mitigation), **low** (the impact is difficult to avoid and will require significant mitigation measures) or **unavoidable** (the impact is cannot be avoided even with significant mitigation measures).
k)	**Degree to which impact can be managed**	This indicates the degree to which an impact can be managed. The degree of management can either be **high** (impact is completely manageable), **moderate** (impact is manageable with moderate mitigation), **low** (the impact is difficult to manage and will require significant mitigation measures) or **unmanageable** (the impact is cannot be managed even with significant mitigation measures).

	Criterion	Description
l)	**Residual impacts**	Residual impacts are those impacts that remain following the implementation of mitigation measures. Residual impacts must be identified and discussed. If there are no residual impacts, the specialist will need to briefly explain that the activity will have no residual impacts.
m)	**Degree to which an impact can be mitigated**	The impact can be **high** (fully mitigated), **moderate** (partly mitigated) or **not mitigated**.
n)	**Significance**	The significance of impacts shall be assessed with and without mitigations. The significance of identified impacts on components of the affected environment shall be described as: • **Very high negative or positive**: A negative impact will have highly significant effects which are unlikely to be mitigated adequately. A positive impact will have a highly significant positive effect on the environment. • **High negative or positive**: A negative impact will have significant effects and will require significant mitigation measures to achieve an accepted level of impact. A positive impact will have significant positive effects. • **Medium positive or negative**: The impact would have a moderate effect on the environment, requiring moderate mitigation (if negative). • **Low negative or positive**: The impact will have negligible effect on the environment and will require little or no mitigation (if negative). • **No impact**: Where the impact will not have an influence on the environment.

7.4 Results of Assessment

7.4.1 Development phase (design and construction)

	Alternatives 1, 2 and 3	**No-Go**
Freshwater Impacts		
Potential impact and risk:	**Trenching within the ecological corridor for laying of bulkwater pipeline, leading to mobilisation of sediment into the watercourse, or ocean, especially during high rainfall events, and may lead to the short-term loss of natural vegetation within the working area**	
Nature of impact:	Negative impact on the condition of the ecological corridor and stream habitat	N/A
Extent and duration of impact:	Local and short term	N/A
Consequence of impact or risk	Deterioration in stream Present Ecological State	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Fully reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	Sedimentation in the tidal zone, and smothering of vegetation in the watercourse	N/A
Cumulative impact prior to mitigation:	Low to medium negative	N/A
Significance rating of impact prior to mitigation	Low to medium negative	N/A

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium (assuming the pipeline cannot be moved out of the ecological corridor)	N/A
Proposed mitigation:	Assuming that the pipeline cannot be moved out of the ecological corridor, the following mitigation measures apply: • The width of the construction footprint must be kept to a minimum. • Trenches must be excavated by hand, and not using machinery. • Excavation of the pipeline trench must be done during the dry season. • Opened trenches must be filled as quickly as possible after trenching is initiated. This is to keep the disturbed areas open and destabilised for the shortest period possible. No trenches must be opened within three days of predicted heavy rainfall. • The disturbed pipeline area must be rehabilitated, with input from a botanist, in order to ensure that the area recovers from the impacts of construction.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Low	N/A
Significance rating of impact after mitigation	Low	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Damage the soil structure, and destroy or shade out plants growing in and around the stream**	
Nature of impact:	Negative impact on the condition of the stream habitat	N/A
Extent and duration of impact:	Local and short term	N/A
Consequence of impact or risk	Deterioration in stream Present Ecological State	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Fully reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	No indirect impacts due to low intensity and local scale of the impact	N/A
Cumulative impact prior to mitigation:	Low to medium negative	N/A
Significance rating of impact prior to mitigation	Low to medium negative	N/A

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact can be avoided:	High	N/A
Degree to which the impact can be mitigated:	High	N/A
Proposed mitigation:	• Ensure that all building materials and equipment are stored at least 50m away from the watercourse corridor, as demarcated prior to construction. • Materials must be stored in piles that do not exceed 1.5m in height and must be protected from the wind, to prevent spread of fine materials across the site.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Negligible	N/A
Significance rating of impact after mitigation	Negligible	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Pollution of the stream corridor through leakage of fuels, oils, etc. from construction machinery**	
Nature of impact:	Negative impact on the water quality within the stream and coastline	N/A
Extent and duration of impact:	Regional and Long term	N/A
Consequence of impact or risk	Deterioration in water quality in the stream	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Partially reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	N/A
Indirect Impacts:	This may impact negatively on water quality on the coastline (intertidal and tidal zone), which may manifest during or after construction.	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Low to medium negative	N/A
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium	N/A
Proposed mitigation:	• Any construction activities close to the stream cease during periods of heavy rain, to reduce the risks of contamination of the stream and ocean through rainfall and runoff. • Machinery prone to oil or fuel leakage must be located at least 50 m away from any sensitive ecosystem, and the area bunded in order to contain leakages.	N/A

	Alternatives 1, 2 and 3	No-Go
	• Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly. • Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities.	
Residual Impacts:	Even with mitigation, there may be some soil contamination around the construction site, which will slowly wash into the stream and the sea. The intensity is likely to be low.	N/A
Cumulative impact post mitigation:	Low to medium negative	N/A
Significance rating of impact after mitigation	Low negative	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Destruction or deterioration of freshwater habitat as a result of foot and vehicular traffic**	
Nature of impact:	Negative impact on stream habitat	N/A
Extent and duration of impact:	Local and Short term	N/A
Consequence of impact or risk	Deterioration in condition of stream habitat	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Fully reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	Unlikely to be any indirect impacts due to the low intensity and local scale of the impact	N/A
Cumulative impact prior to mitigation:	Low negative	N/A
Significance rating of impact prior to mitigation	Low negative	N/A
Degree to which the impact can be avoided:	High	N/A
Degree to which the impact can be mitigated:	High	N/A
Proposed mitigation:	• The watercourse corridor must be well marked during the pre-construction phase. • Pathways and access roads must be routed away from the stream corridor and coastline.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Negligible	N/A
Significance rating of impact after mitigation	Negligible	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Disturbance of freshwater fauna and flora due to light and noise pollution**	
Nature of impact:	Negative impact on biodiversity - stream fauna and flora	N/A
Extent and duration of impact:	Local and Short term	N/A
Consequence of impact or risk	Movement of fauna off site, and deterioration in condition of plant communities leading to loss of biodiversity on the site	N/A
Probability of occurrence:	Definite	N/A
Degree to which the impact can be reversed:	Partially reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A
Indirect Impacts:	Fauna may move off the site and onto other properties, increasing inter-species interactions elsewhere. This is likely to be of low intensity, as the neighbouring areas to the north and west of the site can probably accommodate the number of individuals that may be impacted in this manner.	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Low to Medium negative	N/A
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium	N/A
Proposed mitigation:	• The construction site and access pathways should avoid sensitive areas, which must be demarcated during the pre-construction phase. If lights are used, these should be directed away from the stream corridor and coastline. • Any animals found during site preparation or construction must be recorded and handed to the ECO. • An education programme for all employees must be run at the start of construction, and when new contractor teams start on site.	N/A
Residual Impacts:	This impact is difficult to mitigate completely, so there is likely to be a residual impact, although of low intensity.	N/A
Cumulative impact post mitigation:	Low to Medium negative	N/A
Significance rating of impact after mitigation	Low negative	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Introduction and spread of alien invasives – top material brought onto the site, for filling and landscaping can lead to the introduction of alien or invasive seed banks.**	
Nature of impact:	Negative impact on biodiversity, condition of the stream habitat, and hydrology (uptake of water by IAPs)	N/A
Extent and duration of impact:	Regional and Long term	N/A

	Alternatives 1, 2 and 3	No-Go
Consequence of impact or risk	Deterioration in condition of the stream habitat, and altered hydrology.	N/A
Probability of occurrence:	Highly Probable	N/A
Degree to which the impact can be reversed:	Partially reversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	N/A
Indirect Impacts:	Altered hydrology over the long-term may be considered an indirect impact, but has been included here as a direct impact.	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Medium negative	N/A
Degree to which the impact can be avoided:	Medium	N/A
Degree to which the impact can be mitigated:	Medium	N/A
Proposed mitigation:	• All soils and top material must be bought from a reliable source, and must be free of alien seeds or grass runners.	N/A
Residual Impacts:	It is virtually impossible to rid soils of all IAP seed, so it is likely that there will be some residual impact after implementation of all mitigation measures recommended here.	N/A
Cumulative impact post mitigation:	Low to Medium negative	N/A
Significance rating of impact after mitigation	Low to Medium negative	N/A

7.4.2 Operational Phase

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Development of open space**	
Nature of impact:	Negative impact on **movement and health of local fauna and flora**	N/A
Extent and duration of impact:	Local and permanent	N/A
Consequence of impact or risk	Fragmentation of landscape connectivity could lead to deterioration in habitat condition within the watercourse corridor, and loss of biodiversity as fauna move off the site.	N/A
Probability of occurrence:	Probable	N/A
Degree to which the impact can be reversed:	Irreversible	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	N/A

	Alternatives 1, 2 and 3	No-Go
Indirect Impacts:	Flora and fauna may move off the site and search for habitat elsewhere, which may place pressure on habitat, communities and populations elsewhere	N/A
Cumulative impact prior to mitigation:	Medium negative	N/A
Significance rating of impact prior to mitigation	Medium negative	N/A
Degree to which the impact can be avoided:	Low	N/A
Degree to which the impact can be mitigated:	High	N/A
Proposed mitigation:	• While the open spaces within the development – in the north-western corner and around the watercourse – will mitigate to some extent against the impacts associated with the loss of open space and hardening of the property, there is limited connectivity between these two areas. These spaces are connected by a fairly narrow corridor along the western edge of the property adjacent to the gravel road. The movement of fauna and flora across the site would be improved through not constructing fences between the houses, thus allowing fauna to move between the houses. A further mitigation would be through ensuring that all gardens are planted with locally indigenous plant species. • The open spaces provided for in Alternatives 1, 2 and 3, and the proposed SUDS infrastructure should allow for sufficient area for the infiltration of runoff across the site. No further mitigation measures are recommended in this regard. • Alternatives 1, 2 and 3 will result in the setting aside of a considerable portion of the site as conservation area. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development alternative, due to the uncertainties associated with this option.	N/A
Residual Impacts:	There will be a residual impact on the flora and fauna around the watercourse, due to the change in the local landscape, despite mitigation. This will be low of low intensity, due to the available open space surrounding the property.	N/A
Cumulative impact post mitigation:	Low to medium negative	N/A
Significance rating of impact after mitigation	Low negative	N/A

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Pollution of the watercourse and coastline from stormwater**	
Nature of impact:	Negative impact on water quality in the stream and coastline	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent

	Alternatives 1, 2 and 3	No-Go
Consequence of impact or risk	Deterioration in water quality in the stream and the sea along the coastline	
Probability of occurrence:	Probable	Unlikely
Degree to which the impact can be reversed:	Partly reversible	Partly reversible
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Low to medium negative	Low negative
Significance rating of impact prior to mitigation	Low to medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• The proposed stormwater management system, if implemented in full, would adequately mitigate against the negative impacts associated with the generation, storage and discharge of stormwater on the site. It is understood that all stormwater generated by the development will be minimised at the point of accumulation, with only high discharge volumes and natural runoff being directed towards the watercourse and coastline. • The stormwater pipe carrying water under the road must be cleaned out, so that this does not pose a flood risk for the proposed development. In addition, stormwater runoff from the dirt road into Cape Infanta must be formalised.	N/A
Residual Impacts:	None	N/A
Cumulative impact post mitigation:	Low to medium negative	Negligible
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Pollution of the watercourse, groundwater and coastline through on-site treatment of waste water**	
Nature of impact:	Negative impact on water quality in the stream, groundwater and coastline	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent
Consequence of impact or risk	Deterioration in water quality in the stream, groundwater and the sea along the coastline	
Probability of occurrence:	Probable	Unlikely
Degree to which the impact can be reversed:	Partly reversible	Partly reversible

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Low to medium negative	Low negative
Significance rating of impact prior to mitigation	Low to medium negative	Low negative
Degree to which the impact can be avoided:	Moderate	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• Treated waste water should **not** be used for irrigation, but can be used for flushing of toilets. • All septic tanks and package plants are to be placed outside the 40m ecological corridor. • Package plants, septic tanks and soak-aways must be checked to ensure that they are working, at least annually. • Residents of the development must be educated in the use of household chemicals, detergents and solvents. It is inappropriate to use substances that could affect the efficiency of the septic tanks. Certain chemicals, such as bleaches, can destroy the bacterial communities in the septic tank.	N/A
Residual Impacts:	It is likely that there will be low intensity negative residual impacts associated with the treatment of waste water, as there is always slow leakage of organic pollutants from these systems over time.	Although there may also be some pollution from the existing septic tank, this is likely to have a negligible effect on the local environment.
Cumulative impact post mitigation:	Low to medium negative	Negligible
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Increased volumes of stormwater runoff**	
Nature of impact:	Negative impact on hydrology of the coastline	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent
Consequence of impact or risk	Deterioration in condition of the stream due to altered hydrology	
Probability of occurrence:	Probable	Probable
Degree to which the impact can be reversed:	Fully reversible	Fully reversible

	Alternatives 1, 2 and 3	No-Go
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Medium negative	Low to medium negative
Significance rating of impact prior to mitigation	Low to medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	See above	N/A
Residual Impacts:	There is likely to be some residual amount of stormwater flowing into the watercourse as a result of the development, even with the proposed mitigation. This will be of low intensity and so of low significance.	N/A
Cumulative impact post mitigation:	Low to medium negative	Low
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Abstraction of water from groundwater resources with risk of drawdown of local water table**	
Nature of impact:	Negative impact on local ecosystems dependent on groundwater, due to drawdown of local water table	
Extent and duration of impact:	Regional and Permanent	Regional and Permanent
Consequence of impact or risk	Deterioration in condition of ecosystems dependent on groundwater, leading to loss of biodiversity and altered hydrology.	
Probability of occurrence:	Probable	Unlikely
Degree to which the impact can be reversed:	Fully reversible	Fully reversible
Degree to which the impact may cause irreplaceable loss of resources:	Irreplaceable	Irreplaceable
Indirect Impacts:	No indirect impacts likely	No indirect impacts likely
Cumulative impact prior to mitigation:	Medium negative	Low negative
Significance rating of impact prior to mitigation	Low negative	Low negative
Degree to which the impact can be avoided:	Medium	Medium
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated

	Alternatives 1, 2 and 3	No-Go
Proposed mitigation:	• Both permanent residents and occasional visitors must be encouraged to use water sparingly, as groundwater is a precious resource, and the impacts of increased abstraction relatively unknown. • Use of rainwater must be facilitated through construction of rainwater tanks, and use of rainwater encouraged. • Only locally indigenous plants shall be allowed in gardens and landscaped areas. Grassed lawns must be of indigenous species, such as *Cynodon dactylon* (kweekgras).	N/A
Residual Impacts:	Water will be consumed and this cannot be avoided. Mitigation should reduce the likelihood of there being a negative consequence of water use down to low.	None
Cumulative impact post mitigation:	Low to medium negative	Negligible
Significance rating of impact after mitigation	Low negative	Low negative

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Disturbance of fauna and flora through noise light and trampling**	
Nature of impact:	Negative impact on biodiversity - stream fauna and flora	
Extent and duration of impact:	Local and Permanent	Local and Permanent
Consequence of impact or risk	Movement of fauna off site, and deterioration in condition of plant communities leading to loss of biodiversity on the site	
Probability of occurrence:	Probable	Improbable
Degree to which the impact can be reversed:	Fully reversible	Fully reversible
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	Partly replaceable
Indirect Impacts:	Fauna may move off the site and onto other properties, increasing inter-species interactions elsewhere. This is likely to be of low intensity, as the neighbouring areas to the north and west of the site can probably accommodate the number of individuals that may be impacted in this manner.	
Cumulative impact prior to mitigation:	Medium negative	Low negative
Significance rating of impact prior to mitigation	Medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• Residential and road lights must be directed away from the stream corridor and coastline. • Residents, visitors and their pets must be discouraged from walking into and through the stream corridor.	N/A

	Alternatives 1, 2 and 3	No-Go
	• Boardwalks can be used to allow pedestrian access into the corridor, while protecting the fauna and flora.	
Residual Impacts:	This impact is difficult to mitigate completely, so there is likely to be a residual impact, although of low intensity.	N/A
Cumulative impact post mitigation:	Low to medium negative	Low negative
Significance rating of impact after mitigation	Low negative	Negligible

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Introduction and spread of alien invasives through landscaping activities and gardening**	
Nature of impact:	Negative impact on biodiversity, condition of the stream habitat, and hydrology (uptake of water by IAPs)	
Extent and duration of impact:	Regional and Long-term	Regional and Long-term
Consequence of impact or risk	Deterioration in habitat condition, and reduced water availability.	
Probability of occurrence:	Highly Probable	Probable
Degree to which the impact can be reversed:	Partly reversible	Partly reversible
Degree to which the impact may cause irreplaceable loss of resources:	Partly replaceable	Partly replaceable
Indirect Impacts:	No indirect impacts are likely. All impacts are direct.	
Cumulative impact prior to mitigation:	Medium negative	Low negative
Significance rating of impact prior to mitigation	Medium negative	Low negative
Degree to which the impact can be avoided:	High	High
Degree to which the impact can be mitigated:	Partly mitigated	Partly mitigated
Proposed mitigation:	• The stream corridor must be planted with appropriate indigenous vegetation, where necessary, and a barrier provided between landscaped areas (gardens or roadsides) and the corridor (e.g. a pathway). • Kikuyu grass must not be allowed on the site. • The spread of alien plant species into the natural areas must be prevented and monitored.	N/A
Residual Impacts:	It is virtually impossible to rid soils of all IAP seed, so it is likely that there will be some residual impact after implementation of all mitigation measures recommended here.	
Cumulative impact post mitigation:	Low to medium negative	Low negative
Significance rating of impact after mitigation	Low negative	Low negative

	Alternatives 1, 2 and 3	No-Go
Freshwater Impacts		
Potential impact and risk:	**Clearing alien vegetation from the site**	
Nature of impact:	Positive impact on biodiversity and ecosystem functioning	
Extent and duration of impact:	Regional and Long-term	Regional and Long-term
Consequence of impact or risk		
Probability of occurrence:	Definite	Improbable
Degree to which the impact can be reversed:	Fully reversible	Fully reversible
Degree to which the impact may cause irreplaceable loss of resources:	N/A	N/A
Indirect Impacts:	None	
Cumulative impact prior to mitigation:	Medium positive	Low to medium positive
Significance rating of impact prior to mitigation	Medium positive	Low to medium positive
Degree to which the impact can be avoided:	Low	Low
Degree to which the impact can be mitigated:	N/A	N/A
Proposed mitigation:	N/A	N/A
Residual Impacts:	N/A	N/A
Cumulative impact post mitigation:	N/A	N/A
Significance rating of impact after mitigation	N/A	N/A

8 SUMMARY AND CONCLUSIONS

- Three feasible development layouts have been proposed for erf 134, Cape Infanta. **Alternative 1** (13th April 2012) comprises 23 erven, 16 of which would be single storey and 7 double storey, **Alternative 2** (26th August 2013) comprises 21 erven, 15 of which are single storey and 5 double storey and lastly, **Alternative 3** (9th May 2023) also with 21 erven. The main material differences between Alternatives 2 and 3 are the location of the entrance roads and a shift in the configuration of the 21 erven. All three development alternatives incorporate a conservation area in the north-western corner of the property and a 40m-wide corridor following the watercourse, which incorporates the 1:100 year floodline for the ephemeral stream. The total cover of developable erven for all alternatives is approximately 50%.
- Alternatives 1, 2 and 3 address the following specific concerns from a freshwater ecological perspective:
    - More open space within the development for the infiltration of runoff and precipitation;
    - A smaller hardened footprint, and so less stormwater generated, and
    - A sufficiently wide (40 m) corridor around the watercourse is accommodated by the layout. The establishment of such a corridor will protect the stream and the surrounding dunes that contribute runoff to the stream during rainfall. The erven in Alternative 3 are all outside of the proposed watercourse corridor. There may be a low negative impact associated with the construction of the bulkwater supply pipeline within the ecological corridor. Mitigation measures to ensure that this impact is contained within a small footprint are provided in this report.
- The width of the watercourse corridor was determined, as is best practice, according to the width of the channel, its flow patterns (ephemeral, in this case), condition of the watercourse (good condition) and the vegetation adjacent to the watercourse, and the nature of the proposed activity surrounding the river (the nature of the impact influences the width of the buffer required to protect the system from the impact). The ecological buffer recommended for the protection of the ephemeral watercourse on the site is 20m, which should be measured from the edge of the channel (MacFarlane and Bredin, 2017), and it must include the 1:100 year floodline. In this case, the edge of the channel was difficult to identify due to the very ephemeral nature of surface flow within the system, but the recommended ecological buffer of 20m measured from the centreline is considered to be adequate for protection of the watercourse. The boundary of the recommended buffer is outside of the 1:100 year floodline, creating an adequate ecological corridor through the development.
- The 40m-wide watercourse corridor is of an adequate width to allow for sufficient terrestrial habitat on either side of the stream to create a buffer against the proposed activity, as required by the Swellendam SDF. This will protect an adequate zone of dune habitat adjacent to the stream, off which rainfall runs into the stream. The corridor will also allow for the movement of fauna and flora through the site.
- The location of the conservation area on Alternatives 2 and 3 takes account of a limestone fynbos sensitive area, as delineated in the botanist specialist report, and in both layouts the conservation area is just over 6 000 m^2.
- Alternatives 2 and 3 comprise fewer erven and less road surface than Alternative 1. However, this difference does not translate into a difference in the significance of the impacts associated with the three alternatives, at least from a freshwater ecological perspective.
- The impacts of Alternatives 1, 2 and 3 were assessed against the no development alternative.

- The no development alternative represents the status quo in terms of zoning – Agriculture 1 – and in terms of current permissible uses - primary use is for cultivation of land for crops and plants or the breeding of animals, or the operation of a game farm on an extensive basis on natural veld or land. The latter use includes activities and buildings that are reasonably connected with the main farming activities of the farm. Consent uses include additional dwelling units (a maximum of an additional five units), farm store, farm stall, intensive feed farming, riding school, nursery, service trade, and/or tourist facilities.
- There are several negative impacts associated with the construction of Alternatives 1, 2 and 3, the most significant of which is the introduction of alien plant species through the use of topsoil for filling and landscaping on the site. Topsoil must be obtained from a reliable source, and local topsoil made use of wherever possible. All of the construction impacts can be minimised through the implementation of several mitigation measures, which must be detailed in an environmental management plan for the site, prior to the commencement of construction.
- There are no construction impacts associated with the no development option, however the current zoning of the property does allow for the construction of a further 5 units.
- Alternatives 1, 2 and 3 will result in the hardening of the property and the loss of terrestrial open space. This would impact on the movement of flora and fauna both in and out of the stream corridor, and across the erf to the coast or up the slopes. While the open spaces within the development – in the north-western corner and around the watercourse – will mitigate to some extent against the impacts associated with the loss of open space and hardening of the property, there is limited connectivity between these two areas. These spaces are connected by a fairly narrow corridor along the western edge of the property adjacent to the gravel road. The movement of fauna and flora across the site would be improved through the absence of any fences between the houses, thus allowing fauna to move between the houses. A further mitigation would be through ensuring that all gardens are planted with locally indigenous plant species. With mitigation, this impact was assessed as being of medium negative significance for both development alternatives.
- This negative impact is balanced by the positive impact of the creation of a conservation area in the north-western portion of the site. While there is no detail on how this area will be managed, this represents a positive impact that it is unlikely would apply to the no development option, due to the uncertainties associated with this option.
- Other concerns about the operational phase of the residential development (all three Alternatives) are the generation and management of stormwater and water from the package treatment units and / or septic tanks and soak-aways. The stream is ephemeral and any change in hydrology or pollution of the watercourse due to the introduction of residential stormwater runoff, the seepage from septic tanks and soak-aways, or the use of treated effluent for irrigation will change the nature of the system, and lead to a deterioration in the quality of habitat provided within the corridor. This may also lead to a cumulative effect over time, should more developments occur in the area. This impact was assessed as being of low to medium significance before mitigation, and of low significance with mitigation. Treated effluent from package plants may not be discharged directly to the watercourse or coastline, and should not be used for on-site irrigation of open areas, due to the risk of pollution. Treatment plants, septic tanks and soak-aways must be located outside of the 40m ecological corridor, and checked regularly.
- While the abstraction of groundwater may lead to the drawdown of local groundwater resources, this is likely to be of low intensity and so of low significance. However, the cumulative effect of this impact may increase in significance should further developments be proposed in the area. Rainwater tanks must be constructed and residents encouraged to use rainwater.

- These operational phase impacts may also be associated with the no development option, but this is unlikely due to the low density of units allowed.
- Detailed environmental management programmes (EMPr) must be compiled for the construction phase and ongoing management of the development, and especially of its natural open spaces and conservation areas. The EMPr's must have input from all relevant specialists, and must contain detailed guidance on the minimization of disturbance and maximisation of conservation efforts.
- The no development option is likely to lead to fewer ecological impacts of significance, and so is the preferred overall option from a freshwater ecological perspective. However, Alternatives 1, 2 and 3 do take into account the concerns raised throughout the project, specifically with regard to the watercourse on the site.
- Alternative 3 is the preferred development layout from a freshwater ecological impact, as all of the erven are located outside of the watercourse corridor.
- With sensitive management of the natural areas on the site, and the implementation of the mitigation measures recommended here, the impacts of this proposed development could be minimised.

9 REFERENCES

DWAF. 1999. Resource Directed Measures for Protection of Water Resources. Volume 3: River Ecosystems Version 1.0, Pretoria. Resource Directed Measures for Protection of Water Resources, Pretoria, South Africa.

Fraser Consulting Civil Engineers, 2014. Infanta: Erf 134. Civil Engineering Infrastructure (Report for EIA). Revision 12. Report prepared for Jarjin Investments cc, 25th August 2014, Report No. AF134-1-r12.

Fraser Consulting Civil Engineers, 2020. Infanta: Erf 134. Civil Engineering Infrastructure (Report for EIA). Revision 16. Report prepared for Westerhelling Investments, 27th September 2020, Report No. F134-1-r16.

Fraser Consulting Civil Engineers, 2023. Infanta: Erf 134. Civil Engineering Infrastructure (Report for EIA). Revision 20. Report prepared for Westerhelling Investments, 27th September 2020, Report No. F134-1-r20.

Kleynhans, CJ, Thirion, C, and Moolman, J. 2005. The Development and Refinement of a Level II Ecoregion map for South Africa together with Geomorphological zones for all major Rivers. Project No. 2002-392. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Macfarlane, D.M. and Bredin, I.P. 2017. Buffer zone guidelines for rivers, wetlands and estuaries. Part 1: Technical Manual. WRC Report TT 715/1/17, Water Research Commission, Pretoria.

MacFarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries. Water Research Commission Report, TT 610/14, 169 pp.

Milner, A.M. 1994. System recovery. In, P.Calow & G.E. Petts (eds.): The rivers handbook. Vol. 2. Blackwell Scientific Publications. London.

Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa , Lesotho and Swaziland. Strelitzia 19. South African National Botanical Institute, Pretoria.

Parsons, R. 2005. Geohydrological Assessment of the Planned Development at Erf 134, Infanta. Report No 180/INF-D1. December 2005.

Parsons R. 2020. Proposed Development of Erf 134 Infanta: Use of Septic Tanks. Letter report dated 11 September 2020 to Fraser Engineers cc. Parsons and Associates Specialist Groundwater Consultants; PO Box 151, Pringle Bay, 7196. www.pasgc.co.za.

Rebelo, A.G., Boucher, C., Helme, N., Mucina, L. and Rutherford, M.C. 2006. Fynbos Biome. In Mucina, L. And Rutherford, M.C. (eds.). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19: 52 – 219).

Resh, V.H., A.V. Brown, A.P. Covich, M.E. Gurtz, H.W. Li, G.W. Minshall, S.R. Reice, A.L. Sheldon, J.B. Wallace & R.C. Wissmar. 1988. The role of disturbance theory in stream ecology. Journal of the North American Benthological Society. 7: 433-455.

Ross W.R. 2020. Treatment and Disposal of Domestic Sewage effluent at proposed New Housing Development on Erf 134 – Infanta. Letter Report to Fraser Engineers cc. Ross Consultancy, PO Box 3483, Tygervalley, 7536, Cape Town, South Africa

Toens & Partners, 1999. Overberg District Council - Cape Infanta: Groundwater Investigation. T&P Report No. 990219, report prepared by D Visser, November 1999.

ERF 134

SERVICES REPORT FOR
CIVIL ENGINEERING SERVICES FOR THE
DEVELOPMENT OF ERF 134, CAPE INFANTA,
SWELLENDAM MUNICIPALITY

HESRIV-573

March 2025

PREPARED BY:

HESSEQUA
RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS

Mr G Pepler
22 Heidelberg Road
RIVERSDALE
6670
Tel : (028) 713 4030
Fax : (086) 617 4114
Mobile : 083 447 9297
Email : gpepler.hri@wispernet.co.za

CLIENT:

Westerhelling Investments
Mr. M. de Agrella
CAPE INFANTA
6740

TABLE OF CONTENT

1. INTRODUCTION 1

2. LOCATION 1

3. ACCESS ROADS 2

4. ENGINEERING SERVICES 3

4.1. Mass Earthworks 3

4.2. Roads 3

4.3. Stormwater 4
4.3.1. Stormwater Management Strategy 4
4.3.2. Stormwater Design 4

4.4. Water 5
4.4.1. Water Demand 5
4.4.2. Availability of sufficient Water Sources 5
4.4.3. Water Storage and Fire Fighting 5
4.4.4. Water Link Services 6

4.5. Sewerage 7
4.5.1. Sewage Management 7
4.5.2. Sewer Design Flows 7

4.6. Electrical Sleeves 8

5. SOLID WASTE 8

6. CONCLUSION 8

ANNEXURE A - DRAWINGS 9

HESRIV-573-R1 : Proposed street and stormwater layout with longitudinal sections 9

HESRIV-573-W1 : Water layout and typical sections 9

HESRIV-573-W2 : External water layout 9

ANNEXURE B 10

100-Year floodlines as calculated by AL Fraser (Pr Eng) 10

ANNEXURE C 11

Confirmation from Western Cape Road Network Management in support of the water main crossing of Main Road 268 11

ANNEXURE D 12

Maskam Water brochure and process description 12

ANNEXURE E.. 13

Swellendam Municipality acceptance letter to collect solid waste from the site transfer station. 13

....

1. INTRODUCTION

Hessequa Consulting Engineers CC has been appointed by Westerhelling Investments for the planning of civil engineering services for the proposed development of Erf 134, Cape Infanta, Swellendam Municipality.

The provision of civil engineering services will be in accordance with the guidelines and requirements of the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* as published by the CSIR and that of the Swellendam Municipality.

This report indicates, discusses and elaborates on the design criteria and specifications to be applied in the detail design of the internal and external infrastructure including roads, stormwater, water and Waste Water Treatment, Solid Waste Management, floodlines as well as requirements for the provision of electrical sleeves.

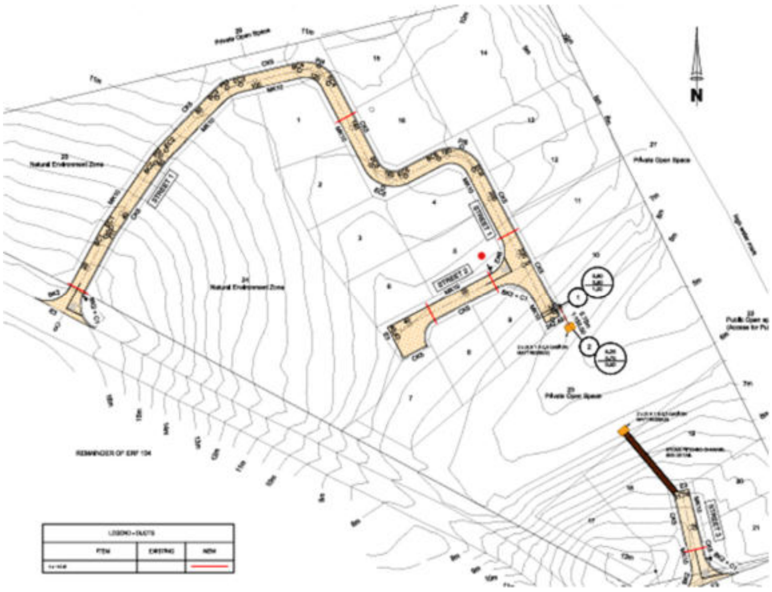
The concept design is based on a site survey completed by Pieter Houterman (Land Surveyor).

This report indicates, discusses and elaborates on the design criteria and specifications to be applied in the detail design of the internal and external infrastructure. The supply and distribution of electrical services and bulk supply will be discussed in a separate Electrical Services Report.

2. LOCATION

Infanta is situated west of the Breede River mouth and 60km south-east of Swellendam. Erf 134 Infanta is 86 ha in extent and currently has one residential unit. The project entails the development of an additional 20 units on erf 134.

The development is located north-east of Main Road 268. There is a dry watercourse that passes through the development site. Fifteen of the new units will be located north of the watercourse and the remainder 5 units to the south of the watercourse.



3. ACCESS ROADS

Access to the original dwelling and the additional 15 erven will be via an existing entrance, from main road 268, to erf 134. The five erven south of the water course will gain access from Hoek Street (gravel road).

The existing road network has sufficient spare capacity to accommodate the proposed development. The expected additional trips to and from the proposed development will have an insignificant impact on the surrounding road network. No upgrading of existing road network is envisaged.

4. ENGINEERING SERVICES

Civil engineering services will be designed in accordance with the design standards of the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* as published by the CSIR as well as the minimum requirements of Swellendam Municipality.

4.1. MASS EARTHWORKS

No mass earthworks will be required.

4.2. ROADS

The internal road reserves are 8m wide. The access road as well as the internal road network will consist of 4,5m wide road surfaces. Road finishing will consist of 60mm Interlocking segmented paving with stormwater pipework, open stone pitched channel and inlet- and outlet structures.

The design criteria will be based on the design standards of the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development.* Suitable commercial sources for the construction materials are available within Swellendam municipal area and surrounding towns.

Table 1: Road Design Criteria

Parameter	**Residential Access way (Class 5d)**
Category	UC
Traffic Class	E0
Structural Design Traffic	$< 0.2 \times 10^6$
Surface Treatment	60mm Interlocking Segmented Paving
Sub-base from commercial sources	150mm G5 (95% MAASHTO) on 150mm Upper Selected (93% MAASHTO) on 150mm Roadbed prep in-situ Material (90% MAASHTO)
Carriage Way Width	4,5m
Design Speed	30 km/h
Minimum Gradient	0.5%
Cross Fall	2%
Bell mouths	8m Radius

4.3. STORMWATER

4.3.1. Stormwater Management Strategy

It is estimated that stormwater runoff, depending on erf coverage, will increase by approximately 25% post development.

The following measures are proposed to mitigate the impact of post development stormwater runoff downstream from the proposed development:

- Installation of 5,0 kℓ water tanks on each residential erf will contribute to the attenuation of initial runoffs. The tank overflow will be directed to underground soakaways. With the expected Mean Annual Precipitation (MAP) of 430mm/year, an average roof size of 215m² and 80% efficiency rate the expected annually rainwater harvesting per unit will be around 74 kℓ/household.
- The runoff from any hardened surface, within the developed plots, will be directed towards gardens using strategic landscaping with native vegetation to intercept the runoff.
- The concentration of stormwater runoff will be minimised through the application of landscaping techniques, i.e. by creating grass lined swales, undulations and depressions. These cutoff swales will intercept any overland flow, which will discourage erf runoff to road surfaces.
- Stormwater from road surfaces will be released into the water course through energy dissipating Reno Mattresses structures.

4.3.2. Stormwater Design

Stormwater infrastructure will be constructed in accordance with the standard requirements and specifications as agreed with the Swellendam Municipality. The 100-year floodlines were determined by Mr A.L.Fraser (Pr Eng) and falls outside the development area. See outcome of the floodline study attached to Annexure B.

Design criteria adopted for the development regarding stormwater infrastructure is summarised as follows:

Runoff rates will be determined according to the Rational Method.

Flood recurrence interval	:	2 years
Pipe material	:	Concrete
Pipe class	:	75D
Pipe diameters	:	Minimum 375mm Ø up to diameter as required
Bedding	:	Class C

Inlets	:	Kerb and grid inlet structure for the northern erven.
	:	Open stone pitched channel, in stormwater servitude, for the southern erven.
Manholes	:	Point of deflections on pipes

4.4. WATER

4.4.1. Water Demand

The estimated Annual Average Daily Demand (AADD) for the development is as follows:

21 Single Residential Erven (small) - 800 ℓ/unit/day	16,8 kℓ/day
Total AADD	**16,8 kℓ/day or 0,194 ℓ/s**

4.4.2. Availability of sufficient Water Sources

With the expected Mean Annual Precipitation (MAP) of 430mm/year, an average roof size of 215m² and 80% efficiency rate the expected annually rainwater harvesting per unit will be around 74 kℓ/household. It is proposed that the harvesting of rainwater be used for potable water consumption. Each household will be required to have a 5,0 kℓ water tank for rainwater harvesting.

There are boreholes (134: 134A and 134C) located on erf 134, north of the district road. Van Biljon (2014-a) undertook a 72-hour pumping test on borehole 134C. The 72-hour pumping test established that borehole 134C can produce 25 m³/day, every day, for 100 years. For the best-case scenario, the yield goes up to 48m³/day. According to van Biljon (2014), borehole 134C's daily yield is 25 m³/day which is more than the daily demand which has been estimated as 16,8 m³/day. There is therefore sufficient borehole water for the proposed development of 21 units on erf 134. The calculations are conservative because the houses are unlikely to be occupied throughout the year.

4.4.3. Water Storage and Fire Fighting

The proposed development, with houses of floor area over 200 m², is classified, with respect to firefighting, as low risk group 1 by the Red Book (2004). To achieve the minimal low risk group 1 residual water pressure of 7m and the firefighting flow rate of 900 ℓ/minute, a 125mm Ø water supply pipeline is required from the reservoir to the development.

Borehole 134C is located to the south of Main Road 268. It is recommended that a 130 kℓ SBS Tank reservoir be constructed near (the unused) borehole 134 A (Drawing HESRIV-573-W2). The size of the reservoir is determined by the required firefighting capacity (108 kℓ) plus the daily demand of 16,8kℓ/day.

To ensure that sufficient firefighting capabilities exist, the supply pipeline from the reservoir to the development will consist of a 125mm Ø Class 9 uPVC water main complete with isolating valves, fire hydrants and erf connections. (Drawing HESRIV-573-W1). A servitude should be registered for the pipeline route.

4.4.4. Water Link Services

A new 125mm Ø, Class 9, uPVC water main will be constructed between the reservoir and development complete with isolating valves, fire hydrants and erf connections. An 200mm Ø corrosion protected steel sleeve will cross Main Road 268 between the two fence lines. An 125mm Ø HDPE fusion welded water main will be constructed through the steel sleeve. Water mains parallel to Main Road 268 will be constructed within the 5m building line. Confirmation that the District Roads Engineer support the proposal is attached under Annexure C of this report.

Erf connections will consist of HDPE PE80 PN12,5 pipes and terminated with endcaps.

The basis of the water reticulation design for the proposed development is summarised in the table below:

Table 2: Water Reticulation Design Criteria

PARAMETER	GUIDELINE
Pipe materials for erf connections	HDPE PE80 PN12,5
Pipe materials for reticulation mains	uPVC (Class 9)
Minimum diameter for reticulation mains	125mm
Minimum diameter for erf connections serving two erven	25mm branching to 2 x 20mm
Minimum diameter for erf connections serving one erf	20mm
Valves	125mm AVK (open clockwise)
Fire Hydrants	AVK London V on respective pipe Ø
Water meters	20mm Elster Kent (Water meter to be installed by Swellendam Municipality with Building Plan approvals.)

4.5. SEWERAGE

4.5.1. Sewage Management

Both the existing Infanta and the existing Infanta Park use septic tanks for sewage treatment. The septic tanks at Infanta Village are scattered amongst the potable water boreholes within the Village. A few new houses have conservancy tanks which are serviced by Swellendam Municipal tankers.

One of three alternatives are available for consideration and approval by Swellendam Municipality namely Conservancy Tanks, Septic Tanks with Soak-aways or small household WWT Package Plants. The nearest Waste Water Treatment Works is 74 km (Swellendam) from site. The use of Conservancy tanks is in our opinion not economically viable and not recommended.

It is proposed that each erf be fitted with an on-site WWTW Package Plant to handle the expected sewage flow. The factory built activated sludge sewage treatment plant will produce effluent that meets the Department of Water Affairs General Standards.

According to the Manufacturer's (Maskam Water) design criteria the system consists over the following qualities:

- Odourless and quiet.
- The installed is underground.
- Has a small footprint.
- Effluent meets the South African DWS General Standard.
- Includes nitrification and de-nitrification cycles.

The smallest available model is the ZF450 which has a capacity to treat 1,500 ℓ/day which is well above the expected 640 ℓ/day sewage flow per household. The water can be recycled for non-potable usage such as flushing toilets, with the remaining effluent being used for irrigation or being discharged underground to a soak-away. Alternatively, all the effluent can be discharged to a soak-away as the surrounding soil is sand and very porous. See Maskam Water Brochure and Process Description under Annexure D

4.5.2. Sewer Design Flows

In accordance with the *Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development* it is expected that 80% of the Average annual water daily demand will end up in the wastewater system.

The annual average dry weather flow (AADWF) equals 80% of 16,8 kℓ/d = 13,44 kℓ/d (640 ℓ/household/day) = 0,156 ℓ/s.

To determine the Peak Wet Weather Flow (PWWF) a peak factor of 2,5 were taken in consideration with an expected stormwater infiltration of 15%. The PWWF equals 0,447 ℓ/s.

4.6. ELECTRICAL SLEEVES

The position of electrical sleeves (110mm Class 34 PVC) will be determined in consultation with the Electrical Engineer.

5. SOLID WASTE

The expected volume of solid waste generated, for the specific development, will be seasonable. The highest volume of solid waste will be generated during the December-January period with other peaks around school holidays. Low volumes of waste will be generated during winter months. It is expected that between 0,15 to 0,25 m^3/household/week, solid waste, will be generated.

Homeowners will be expected to deliver household solid waste to a Waste Transfer Station that will be located at one of the two entrances to the development. Swellendam Municipality will service the transfer station on Tuesday's and transport the un-compacted solid waste to the Swellendam Municipal Solid Waste Site.

A letter from Swellendam Municipality accepting this proposal is shown as Annexure E. The final decision/position of the solid waste transfer station will be made in association with the Swellendam Municipality.

6. CONCLUSION

We trust that the information included in this report will provide insight to the level of services required for the proposed development.

G PEPLER Pr Tech Eng
HESSEQUA CONSULTING ENGINEERS

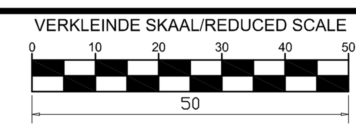
12 March 2025

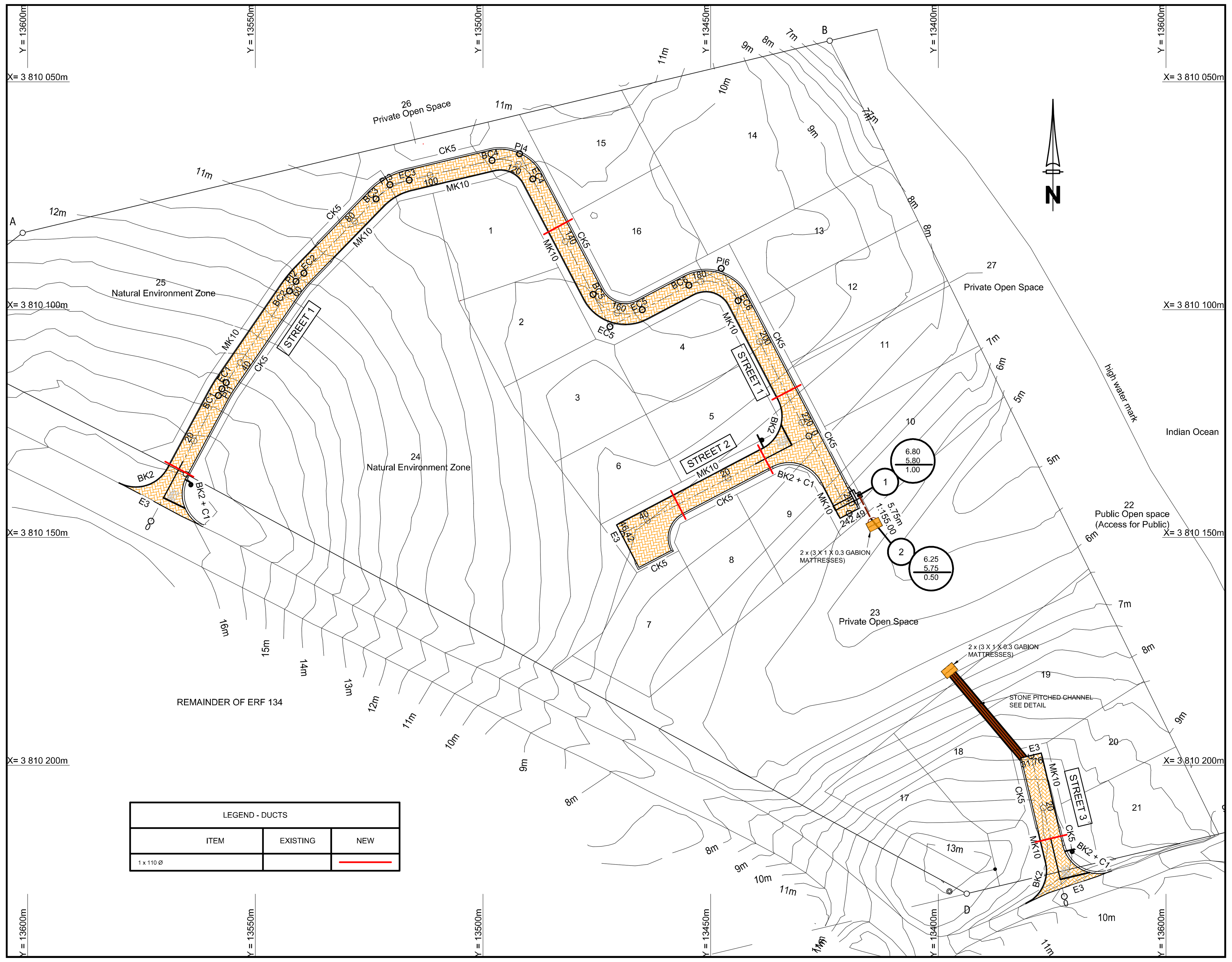
ANNEXURE A - DRAWINGS

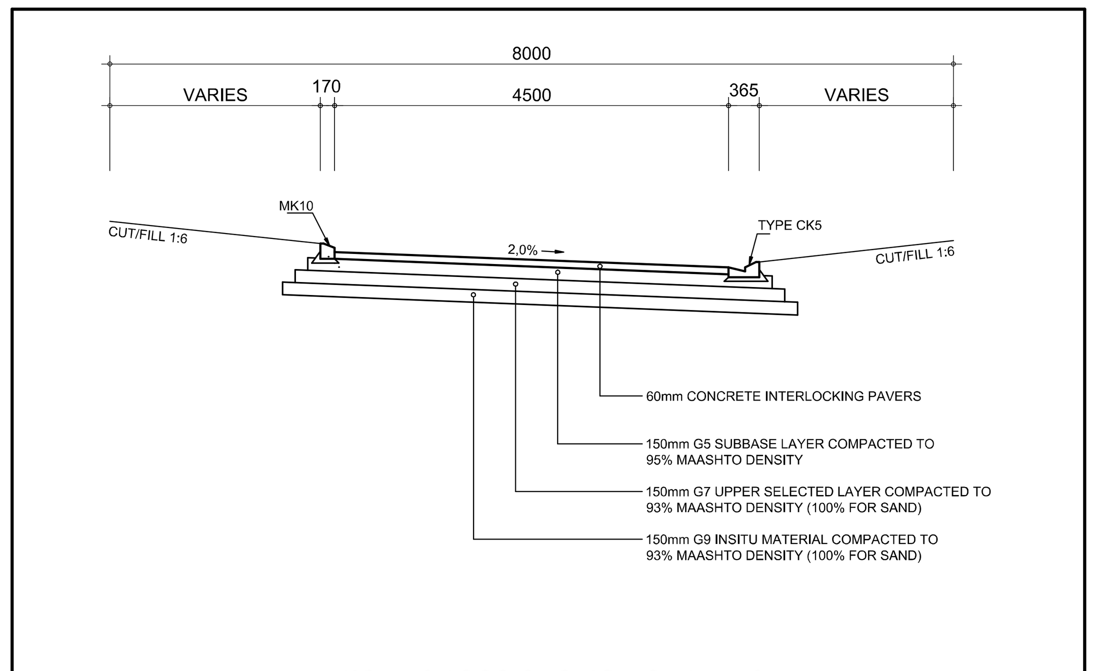
HESRIV-573-R1 : Proposed street and stormwater layout with longitudinal sections

HESRIV-573-W1 : Water layout and typical sections

HESRIV-573-W2 : External water layout







TYPICAL CROSS SECTION STREETS

SETTING OUT DATA

POINT No.	CHAINAGE DISTANCE ON ROAD	COORDINATE : Lo19°/WGS84 Y -0,000	X +0 000 000,00	RADIUS
STREET 1 (4.5m WIDE)				
START	0.00	13572.914	3810146.400	
BC1	31.27	13558.118	3810118.847	
PI1		13557.332	3810117.382	30.00
EC1	34.59	13556.389	3810116.014	
BC2	59.05	13542.510	3810095.877	
PI2		13541.077	3810093.798	30.00
EC2	64.08	13539.317	3810091.988	
BC3	86.79	13523.488	3810075.709	
PI3		13520.448	3810072.582	15.00
EC3	95.27	13516.204	3810071.573	
BC4	113.98	13498.013	3810067.247	
PI4		13491.959	3810065.807	8.00
EC4	124.56	13489.074	3810071.321	
BC5	153.13	13475.825	3810096.639	
PI5		13472.116	3810103.728	8.00
EC5	165.69	13465.028	3810100.019	
BC6	177.29	13454.768	3810094.649	
PI6		13447.679	3810090.940	8.00
EC6	189.85	13443.970	3810098.029	
END	242.49	13419.562	3810144.673	
STREET 2 (4.5m WIDE)				
START	0.00	13428.431	3810127.724	
END	46.42	13469.561	3810149.247	
STREET 3 (4.5m WIDE)				
START	0.00	13372.312	3810228.776	
END	31.76	13379.626	3810197.871	

CO-ORDINATE LIST FOR STORMWATER

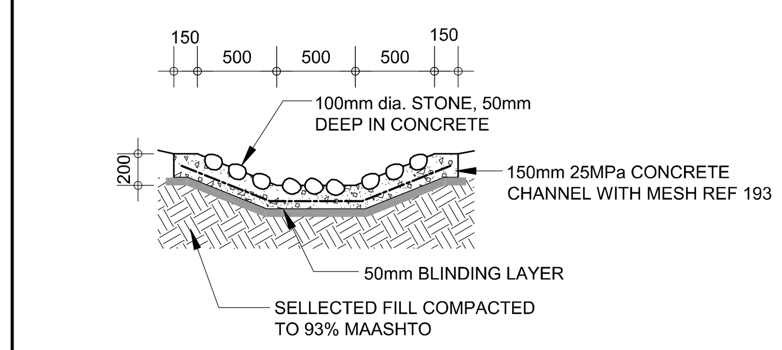
POINT No.	COORDINATE : Lo19°/WGS84 Y +0,000	X +0,000
1	13417.447	3810145.853
2	13414.778	3810150.722

KEY

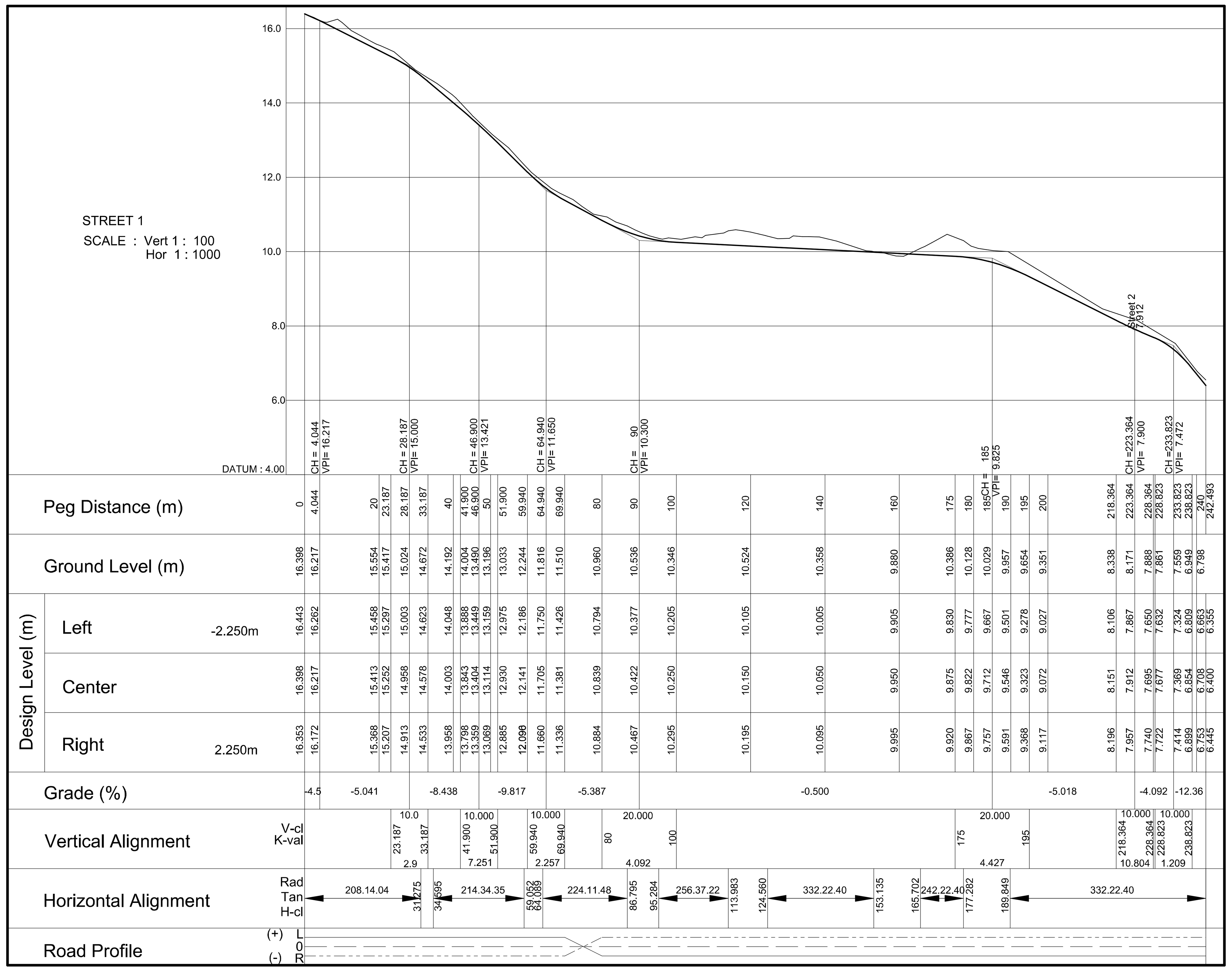
- BK2 = BARRIER KERB TYPE BK2
- BK2 + C1 = BARRIER KERB TYPE BK2 & CHANNEL TYPE C1
- CK5 = MOUNTABLE KERB TYPE CK5
- MK10 = EDGING TYPE MK10
- "R1" = STOP SIGN

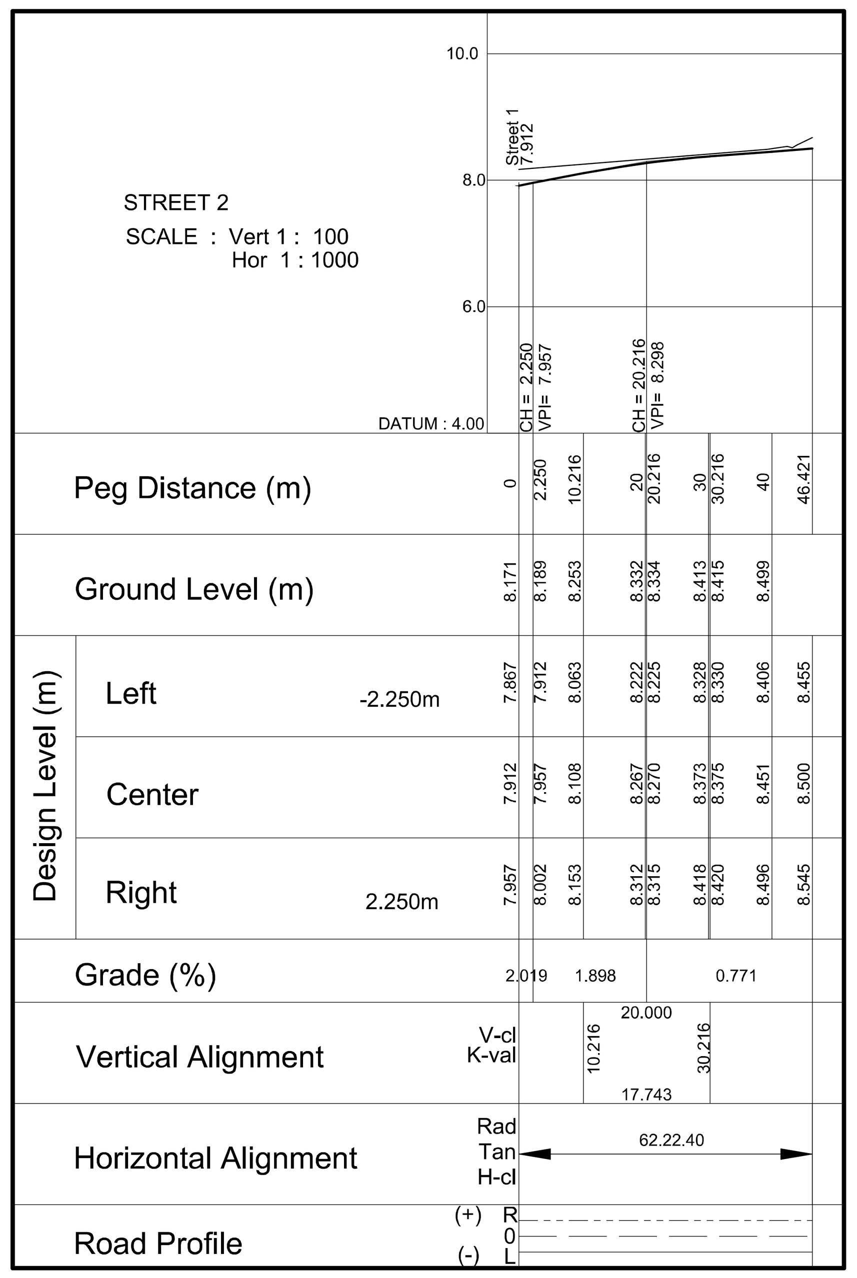
LEGEND - STORMWATER

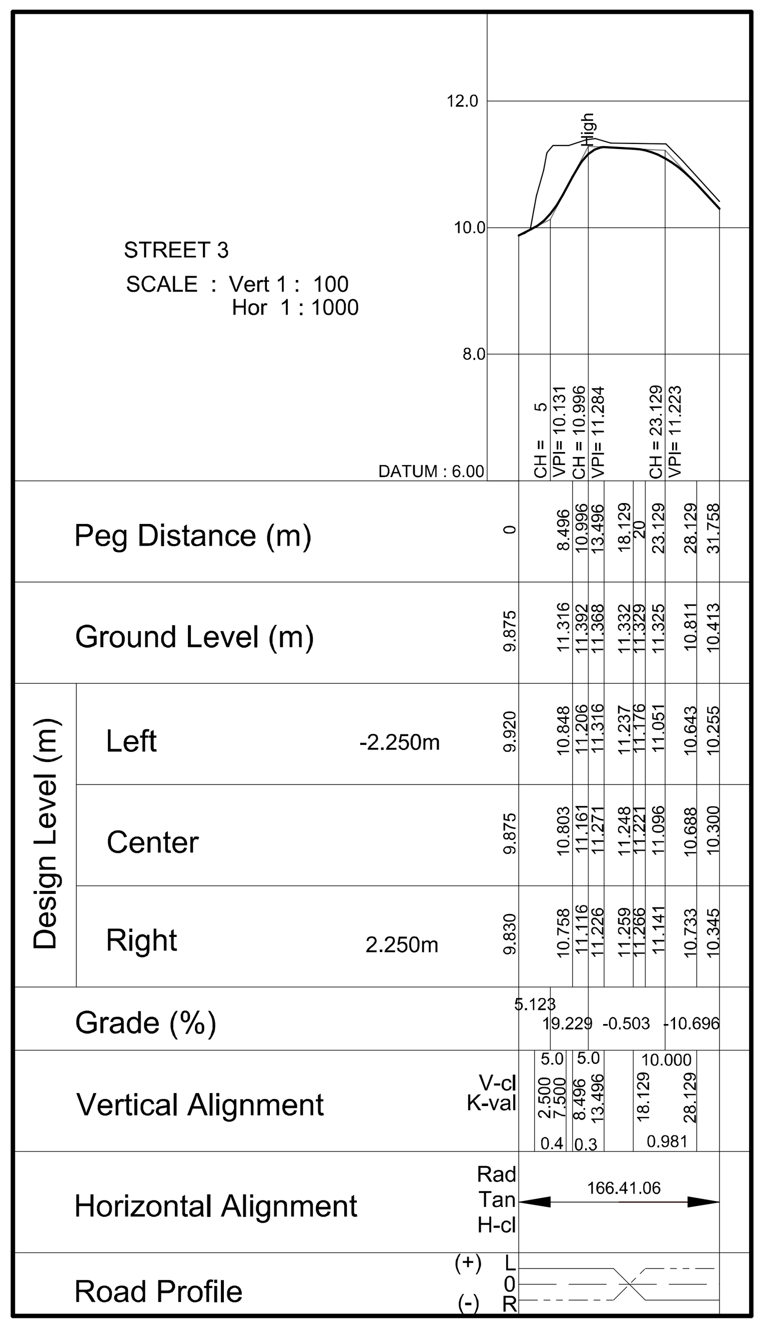
ITEM	EXISTING	NEW
Ø 375 STORMWATER PIPE (OGEE 100D)		
MANHOLE		
GRID INLET STRUCTURE SEE DRAWING HESRIV-573-R2		
OUTLET STRUCTURE SEE DRAWING HESRIV-573-R1		
DISTANCE GRADIENT		56.00m 1:102.00
MANHOLE WITH PIPE		
MANHOLE NUMBER		SW02
COVER LEVEL INVERT LEVEL DEPTH		00.00 00.00 0.00



STONE PITCHED CHANNEL CROSS SECTION







Notas/Notes

Wysiging/Amendment

Nr. No.	Datum Date	Nagesien Checked	Deur By	Beskrywing Description

HESSEQUA RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS
P.O. BOX 577
RIVERSDALE 6670
22 HEIDELBERG ROAD RIVERSDALE
CELL : 083 447 9297
TEL/FAX : 028 713 4030

Ontwerp Designed	Geteken Drawn	Nagesien Checked
AA	AA	GP

Raadgewende Ingenieur / Consulting Engineer — Pr Tech Eng — 12-03-2025 Datum/Date

Klient/Client — Datum/Date

Klient/Client

CAPE INFANTA DEVELOPMENT

Erf 134
CAPE INFANTA
6740

Projek/Project

PROPOSED DEVELOPMENT OF ERF 134 : CAPE INFANTA

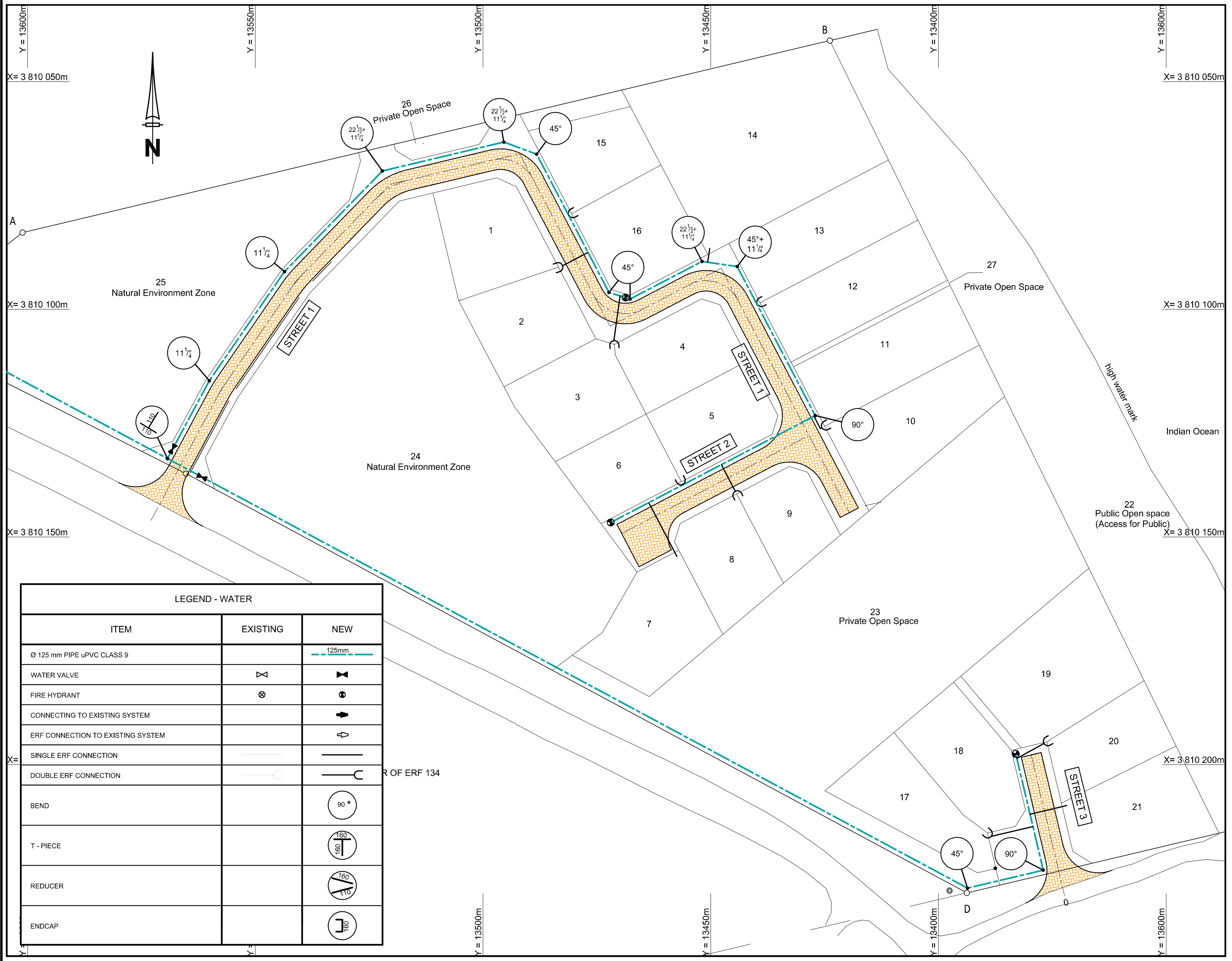
Tekening Beskrywing/Drawing description

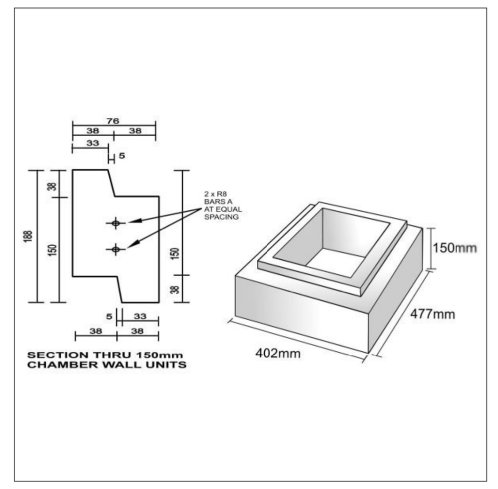
PROPOSED STREET AND STORMWATER LAYOUT WITH LONGITUDINAL SECTIONS

Skaal/Scale	Datum/Date
1:750	FEBRUARY 2025

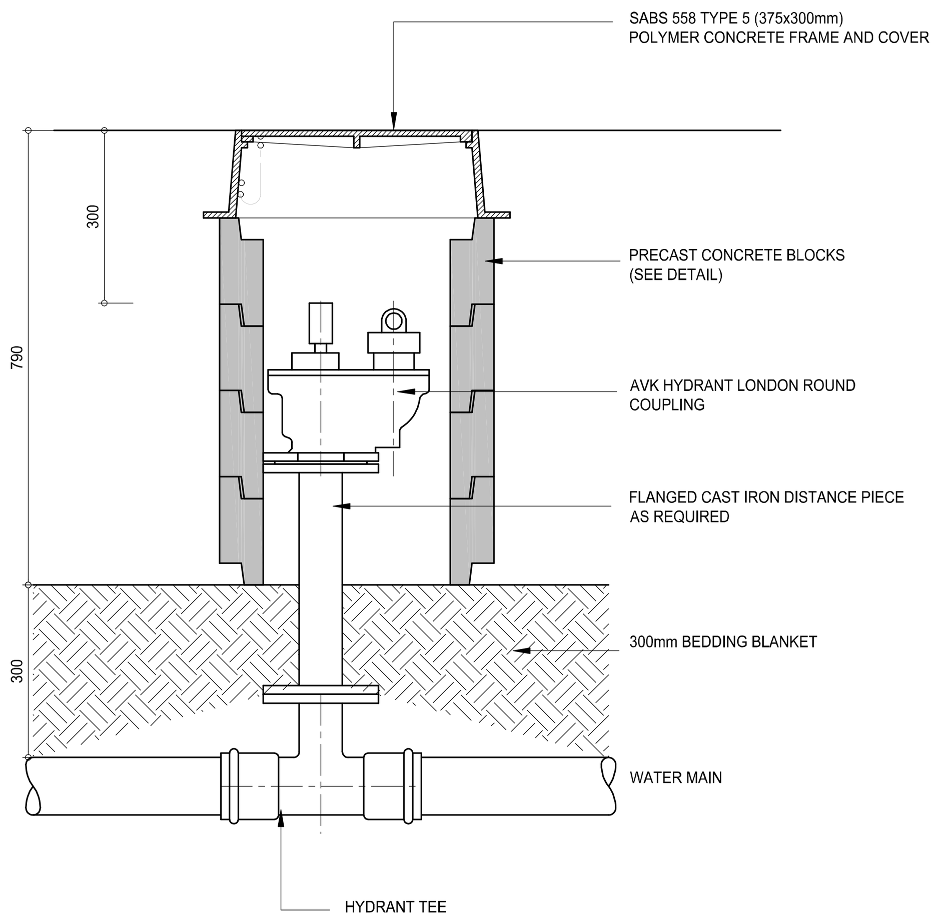
Tekening nommer/Drawing number

HESRIV-573-R1

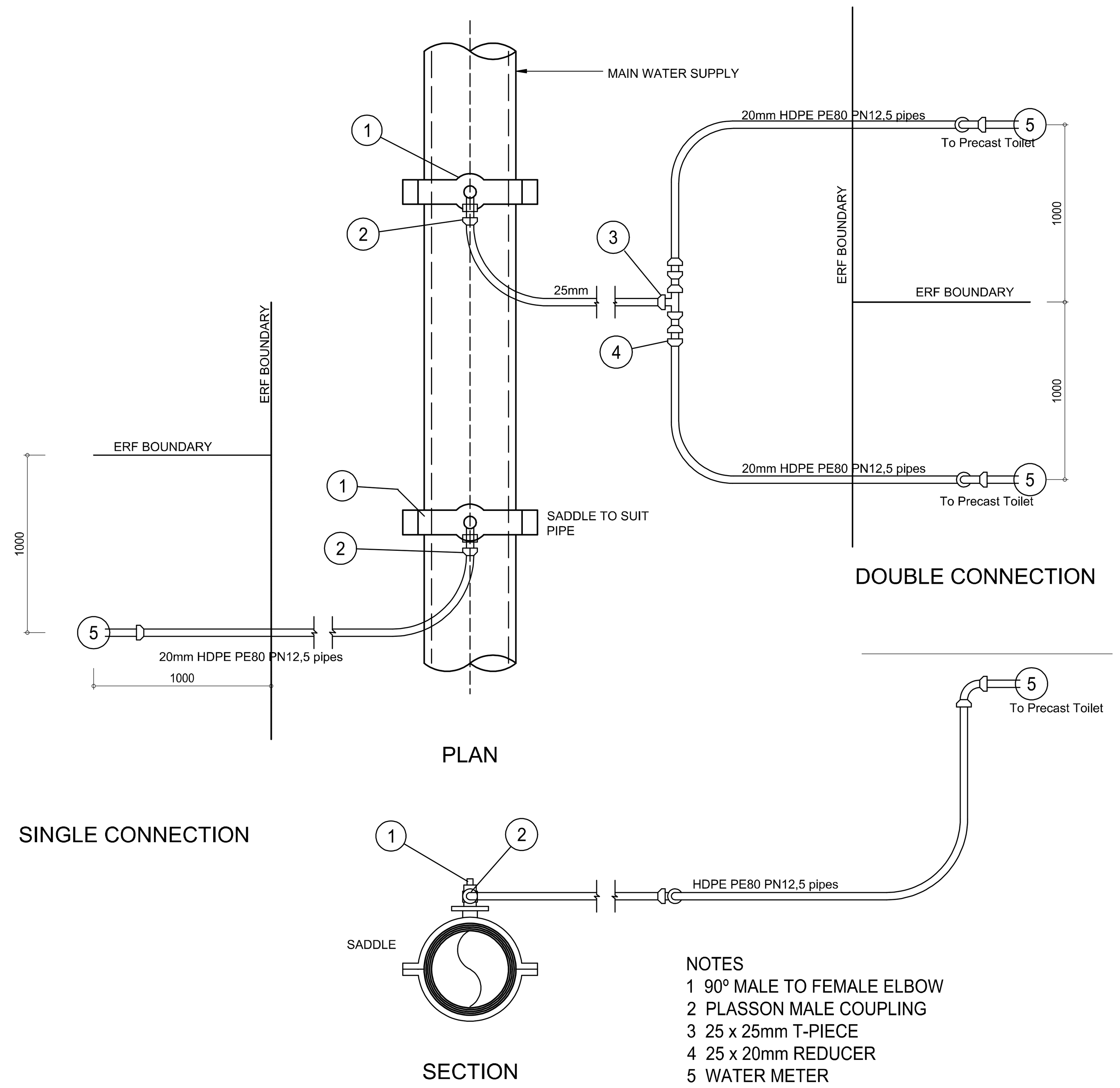




PRECAST CONCRETE BLOCK

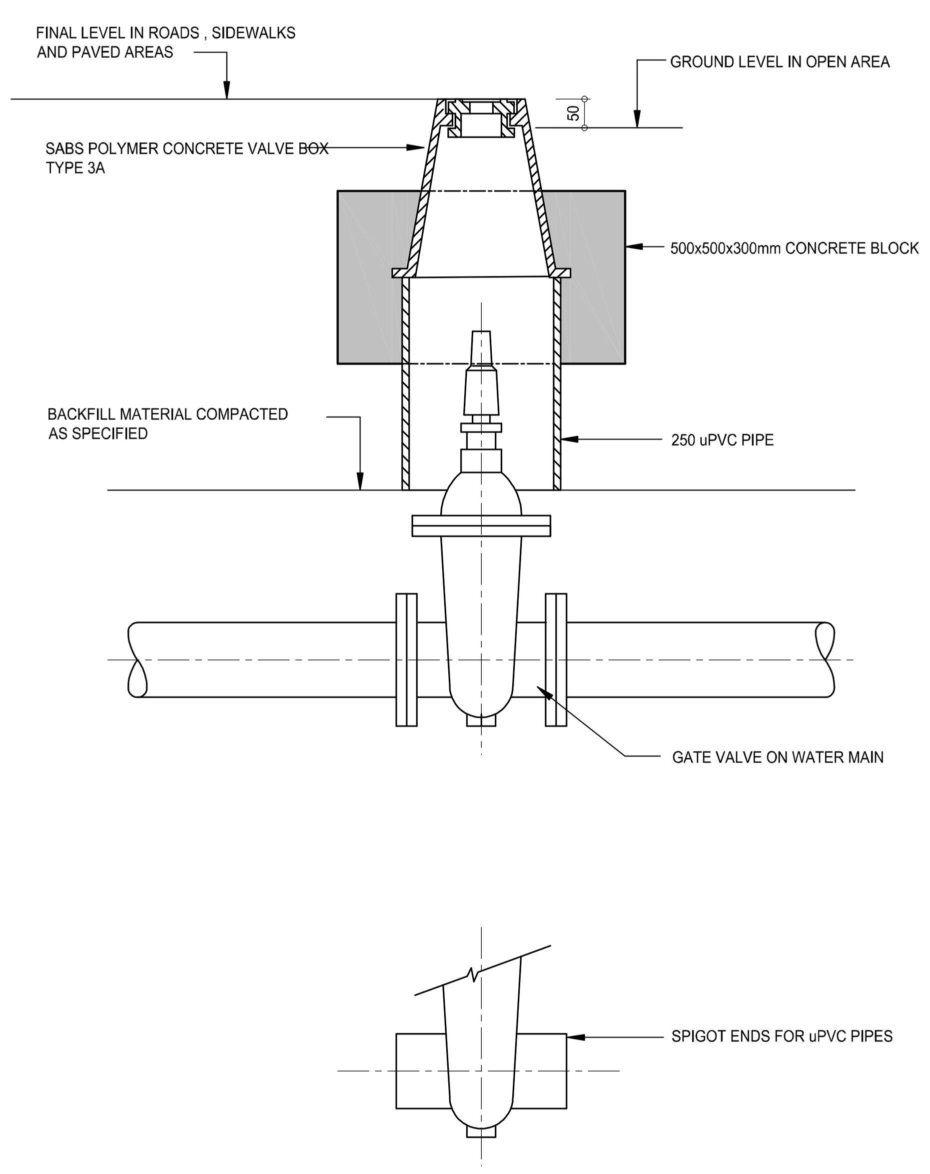


HYDRANT CHAMBER

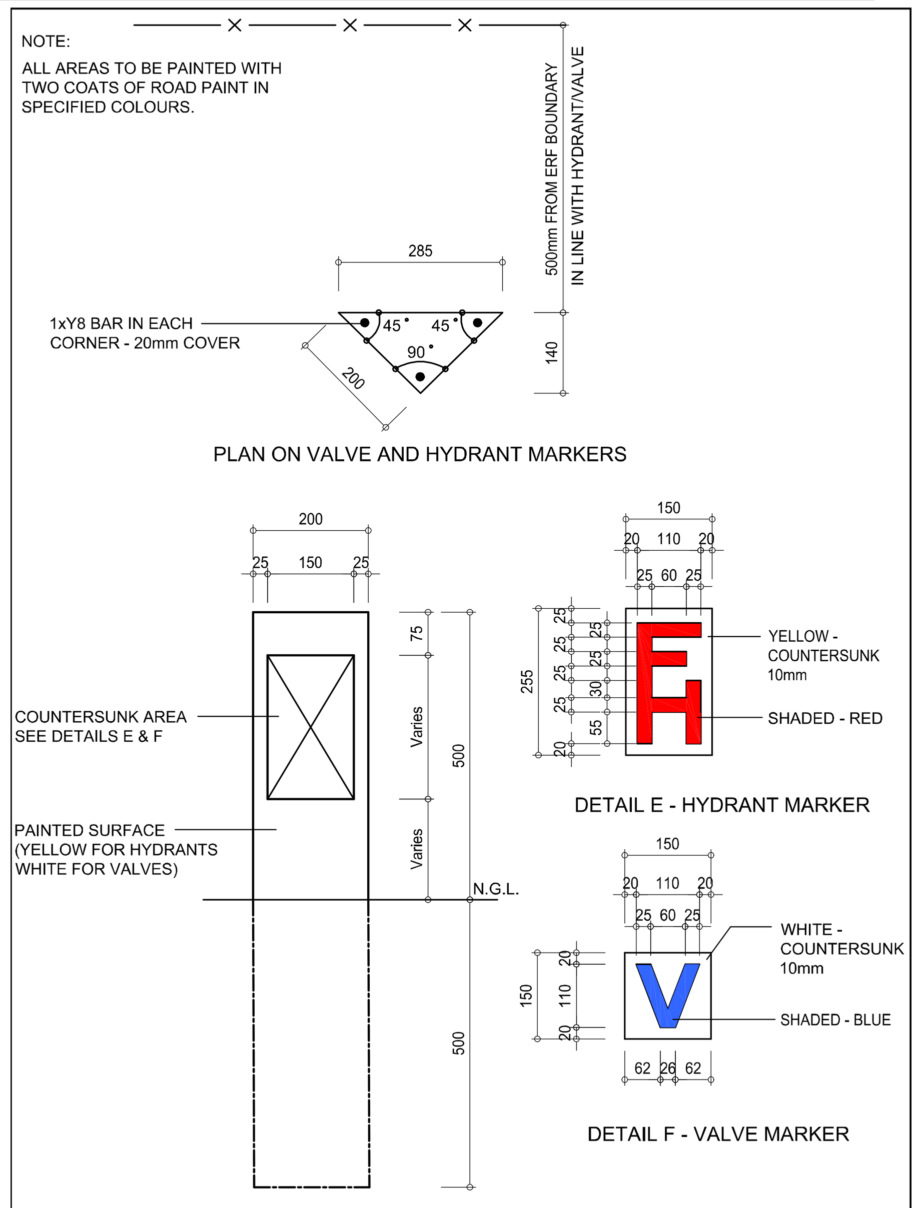


NOTES
1 90º MALE TO FEMALE ELBOW
2 PLASSON MALE COUPLING
3 25 x 25mm T-PIECE
4 25 x 20mm REDUCER
5 WATER METER

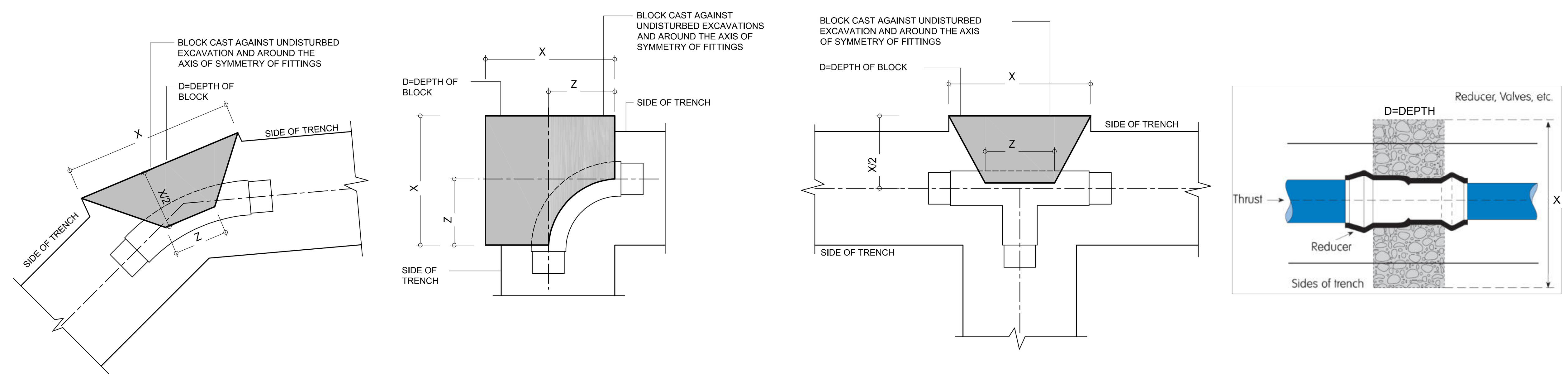
TYPICAL DETAIL OF
WATER CONNECTION ON ERVEN (25/20mm)



TYPICAL DETAIL OF VALVE CHAMBER



TYPICAL DETAIL OF
VALVE AND HYDRANT MARKERS



TYPICAL THRUST BLOCK DETAILS
SANDY SOIL
BEARING CAPACITY 200-400kPA

NOTE: COUPLINGS AND FLANGES MUST BE LEFT FREE OF CONCRETE

PIPE	11¼° BEND			22½° BEND			45° BEND			90° BEND			T-JUNCTION			END CAPS/VALVES REDUCERS	
DIAM.	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm	Zmm	Xmm	Dmm
75	200	100	100	200	150	150	250	200	150	300	220	180	300	210	150	700	300
100	200	150	100	250	200	150	350	250	200	350	300	250	350	300	200	1000	400
150	250	200	200	350	300	200	500	450	350	550	450	400	600	400	280	1050	500
200	350	250	250	500	350	250	650	500	450	750	550	480	700	600	350	1100	600
250	400	350	300	600	450	300	800	600	500	1000	650	530	900	700	450	1150	700
300	500	400	350	700	550	350	950	750	550	1200	770	580	1150	800	550	1200	800
350	600	500	400	900	700	400	1200	900	600	1480	950	630	1550	900	550	1500	800

Wysiging/Amendment

Nr No	Datum Date	Nagesien Checked	Deur By	Beskrywing/Description

VERKLEINDE SKAAL/REDUCED SCALE

Notas/Notes

HESSEQUA
RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS
P.O. BOX 577
RIVERSDALE 6670
22 HEIDELBERG ROAD, RIVERSDALE
CELL: 083 447 9297
TEL/FAX: 028 713 4030
CESA

Ontwerp Designed	AA
Geteken Drawn	AA
Nagesien Checked	GP

Pr Tech Eng
Raadgewende Ingenieur
Consulting Engineer
Datum/Date 12-03-2025

Klient/Client
Datum/Date

Klient/Client
CAPE INFANTA DEVELOPMENT
Erf 134
CAPE INFANTA
6740

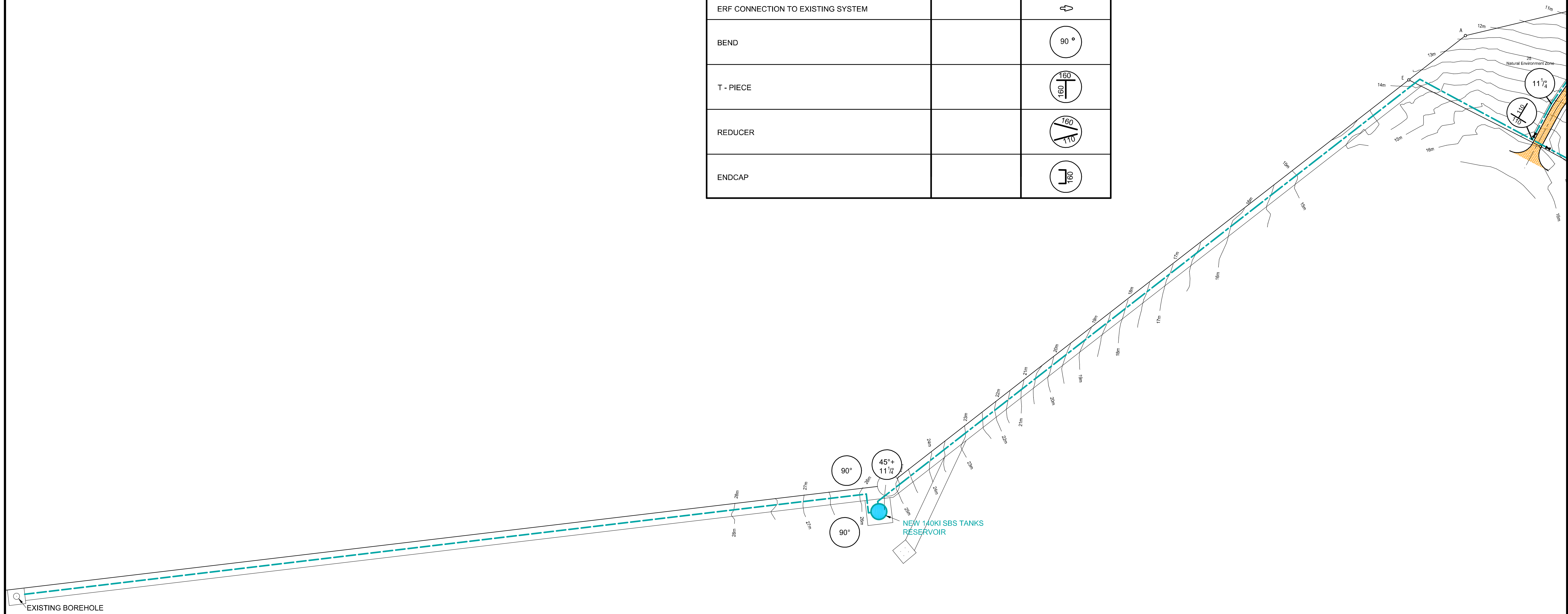
Projek/Project
PROPOSED DEVELOPMENT OF ERF 134 : CAPE INFANTA

Tekening Beskrywing/Drawing description
WATER LAYOUT AND TYPICAL DETAILS

Skaal/Scale N.T.S
Datum/Date FEBRUARY 2025
Tekening Nommer/Drawing number HESRIV-573-W1

12 Mar 2025

LEGEND - WATER		
ITEM	EXISTING	NEW
Ø 75 mm PIPE uPVC CLASS 9		75mm
Ø 125 mm PIPE uPVC CLASS 9		125mm
WATER VALVE	⋈	⧓
CONNECTING TO EXISTING SYSTEM		
ERF CONNECTION TO EXISTING SYSTEM		
BEND		90 °
T - PIECE		160 / 160
REDUCER		160 / 110
ENDCAP		160



VERKLEINDE SKAAL/REDUCED SCALE

0 10 20 30 40 50

50

Notas/Notes

Wysiging/Amendment				
Nr. No.	Datum Date	Nagesien Checked	Deur By	Beskrywing Description

ESSEQUA
RAADGEWENDE INGENIEURS • CONSULTING ENGINEERS

P.O. BOX 577
RIVERSDALE 6670
22 HEIDELBERG ROAD RIVERSDALE
CELL : 083 447 9297
TEL/FAX : 028 713 4030

CESA

Designed	Drawn	Checked
AA	AA	GP

Pr Tech Eng — 12-03-2025
Raadgewende Ingenieur / Consulting Engineer — Datum/Date

Klient/Client — Datum/Date

Klient/Client

CAPE INFANTA DEVELOPMENT

Erf 134
CAPE INFANTA
6740

Projek/Project

PROPOSED DEVELOPMENT OF ERF 134 : CAPE INFANTA

Tekening Beskrywing/Drawing description

EXTERNAL WATER LAYOUT

Skaal/Scale	Datum/Date
1:1500	MARCH 2025

Tekening nommer/Drawing number

HESRIV-573-W2

ANNEXURE B

100-Year floodlines as calculated by AL Fraser (Pr Eng)

LEGEND:

RS 20	- RIVER STATION 20
(blue dashed line)	- 100 YEAR RI FLOODLINE
47m	- CONTOUR LEVEL

-10 -5 0 5 10 15

SCALE BAR:

GENERAL NOTES:

1. Floor levels should be located 300mm above indicated flood levels as additional safety.
2. Table of Key Information:
   - Catchment Area 291ha
   - 100 Year rainfall 130mm/day
   - Time of Concentration 3h
   - 100year Peak flow $5m^3/s$

REV	DATE	DESCRIPTION
3	15 June 2021	Note 1 removed, Drawing Number changed

Table of Floodline Information for

100 yr RI floods

RS	WSL	EGL
70	6.59	6.69
60	6.19	6.21
50	5.98	6.03
40	5.64	5.69
30	5.07	5.14
20	4.32	4.43
10	3.40	3.44

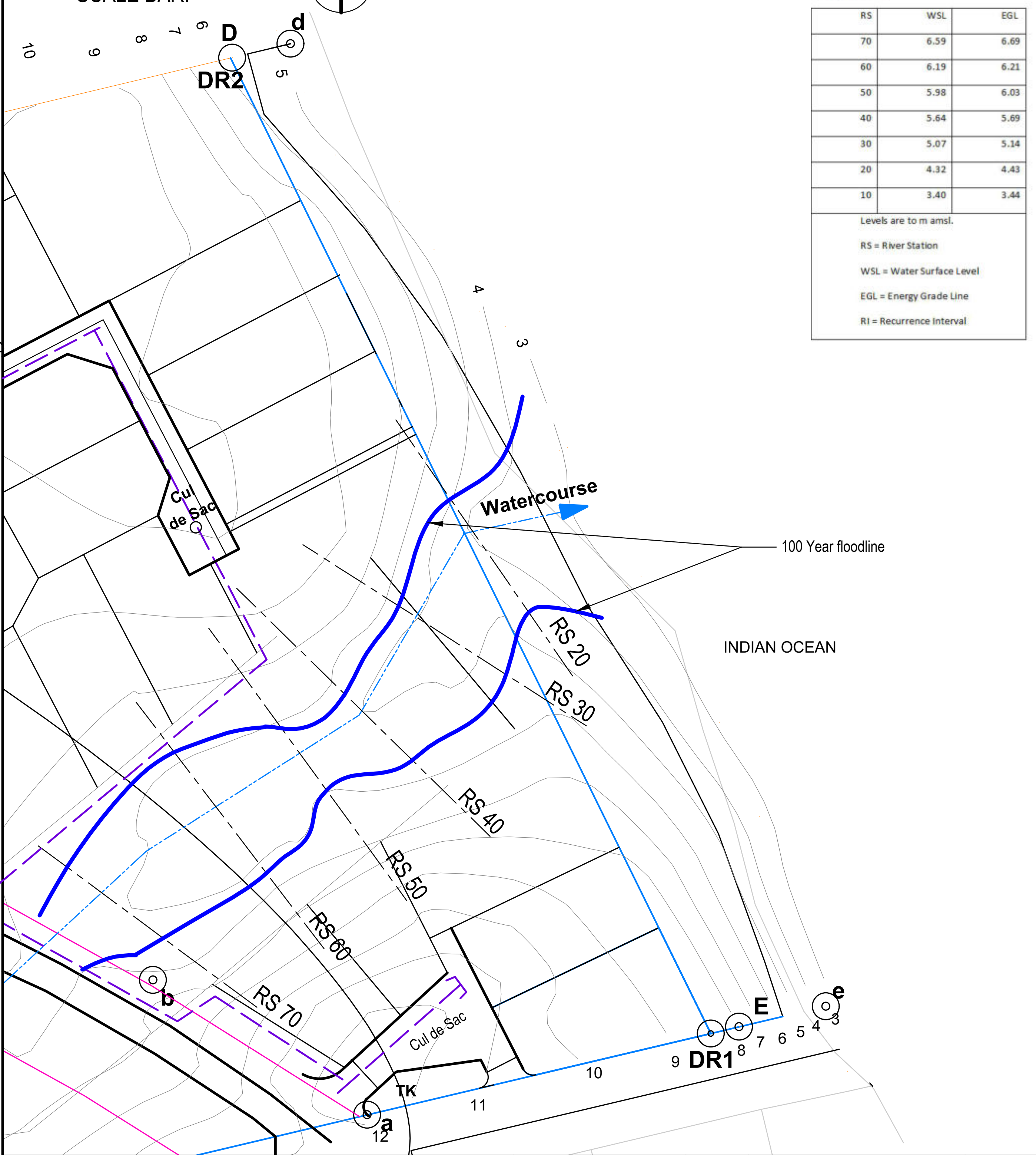
Levels are to m amsl.

RS = River Station

WSL = Water Surface Level

EGL = Energy Grade Line

RI = Recurrence Interval



PORTION 134, CAPE INFANTA, SWELLENDAM MAGISTERIAL DISTRICT - FLOODLINES

DESIGN:	ALF	DRAWN:	JBS	SCALE 1:1000
FOREST LODGE, MAIN ROAD, SEDGEFIELD. TEL: 044 343 2093				DATE: 12 Dec. 2020
FRASER Consulting Civil Engineers cc				AF134-04 REV. 3

A4

ANNEXURE C

Confirmation from Western Cape Road Network Management in support of the water main crossing of Main Road 268

Western Cape Government

Transport and Public Works

ROAD NETWORK MANAGEMENT
Email: Grace.Swanepoel@westerncape.gov.za
tel: +27 21 483 4669
Rm 335, 9 Dorp Street, Cape Town, 8001
PO Box 2603, Cape Town, 8000

REFERENCE : 16/9/6/1-27/24 (Job 23035)
ENQUIRIES : Ms GD Swanepoel
DATE : 10 August 2017

Fraser Consulting Civil Engineers
PO Box 178
SEDGEFIELD
6573

Attention: Mr A Fraser

Dear Sir

REQUEST FOR INFORMATION: CROSSING MAIN ROAD 268

1. Your e-mail of 24 May 2017 to Mr Van Eeden at Overberg District Municipality refers.

2. Your application for information affects Main Road 268, of which this Branch is the Road Authority, as follows:

2.1 With a crossing at ±km68.58.

2.2 Parallel to that road and outside of the road reserve, but within the adjacent 5m Building Line (Roads Ordinance 19 of 1976), between ±km68.58 LHS and km68.82 (end of Proclaimed Main Road).

3. This Branch will support your proposal, provided that the steel sleeve pipe, which must be installed from fence line to fence line, is sufficiently protected against corrosion and provided that the sleeve pipe is at least 1000mm below the lowest point across the cross-section (side drains; which should be allowed to be at least 800mm in depth).

4. Upon receipt of such a detail design this Branch will act accordingly.

Yours faithfully

ML WATTERS
For CHIEF DIRECTOR: ROAD NETWORK MANAGEMENT

ANNEXURE D

Maskam Water brochure and process description

Applications:

- Households and grouped housing
- Schools
- Hotels
- Office blocks
- Lodges & guest houses
- Farms
- Factories
- Informal settlements
- Commercial wastewater secondary treatment
  Waste strength reduction:
  <75 mg/l COD
  <25 mg/l TSS
- Commercial wastewater pre-treatment before discharging to municipal sewer network (COD reduction)

Material:

- All materials are noncorrosive in the septic environment.

Easy to install or retrofit:

Save water - Treat your waste water on-site and re-use for:

- Toilet flushing
- Irrigation
- Cleaning of hard landscaping
- Water features
- Other non-potable uses (potable use is possible through further treatment)

Maintenance:

- System will be provided with maintenance contract.
- Maintenance provider is dependent upon geographical location.
- 6 Monthly service required.
- No check-ups needed between service intervals.

Disinfection:

- Chlorine / UV / Ozone

Electrical Panel

- Monitors the system 24/7
- Warning light and siren will notify user if a problem occurs
- IP65 enclosure
- Power supply to Blower and UV (disinfection)
- Indicator lights on front of panel for each alarm condition
- Optional: GSM module

Air Pump

- Feeds oxygen to aeration chamber and powers recirculation/sludge return

Available models

Clarus Model	Daily Treatment Capacity * (litres per day)	Length (mm)	Width (mm)	Height (mm)	Power consumption (Watts) Excluding disinfection
ZF 450	1500	2160	1120	1580	58
ZF 800	3000	2500	1450	1880	58
ZF 1120	4000	3020	1750	2000	95
ZF 1440	5000	3380	1840	12150	115
ZF 2000	7500	3960	1990	2270	125
ZF 2400	9000	4670	1990	2270	210
ZF 3200	12000	4560	2260	2420	340
ZF 4000	15000	4660	2440	2540	340

* Daily treatment capacity is based on influent values equal to or less than domestic sewage (grey and black water combined). The influent values below is the maximum organic loading for the above treatment capacities. For influent with heavier loadings, please contact our office or your nearest Maskam Water Dealer to assist with sizing the correct plant for your application.

COD	400	BOD	250	Ammonia	20

CLARUS ENVIRONMENTAL
Zoeller Family of Water Solutions

Financing available

The saving in your water bill can cover the instalment

www.maskamwater.com

CLARUS ENVIRONMENTAL
Zoeller Family of Water Solutions™

3649 Cane Run Road • Louisville, KY 40211-1961, USA
1-800-928-7867 • 1-502-778-2731 • Fax: 1-502-774-3624
www.clarusenvironmental.com

SECTION: C3.10.150
CL0053
1215
Supersedes
0214

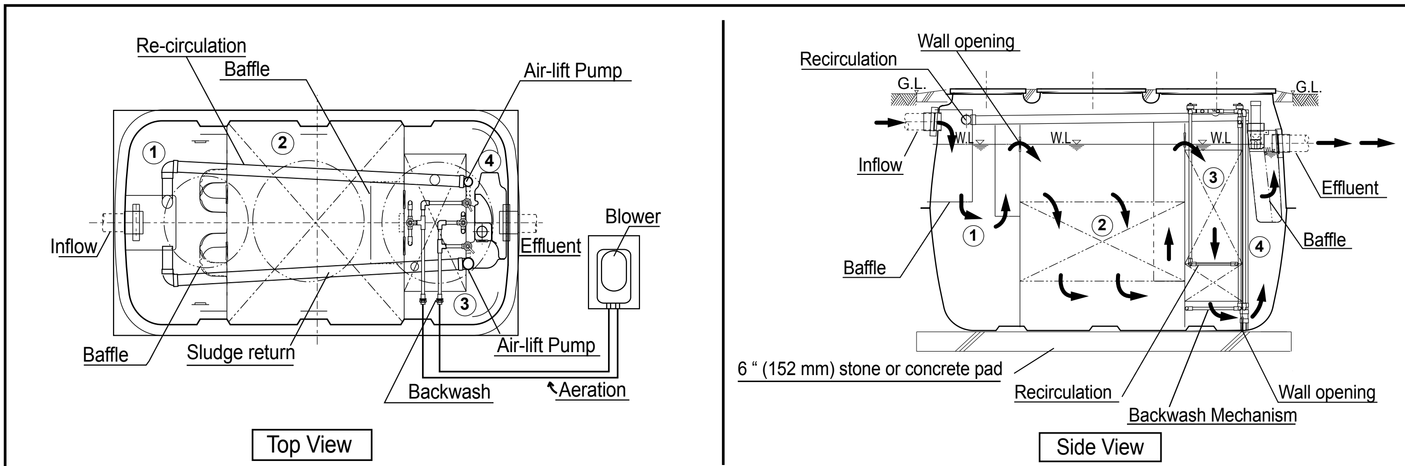
Fusion® Series Treatment Systems

PROCESS DESCRIPTION

NSF®

Certified to NSF/ANSI Standard 40 Class 1 Performance Designation

How the Fusion® system works



Numbers correspond to the explanations below.

1. **Sedimentation Chamber**
This chamber is designed to physically separate solids (sludge) and fat/grease (scum) from the incoming water.

2. **Anaerobic Chamber**
This chamber contains a spherical-skeleton type of filter media (4.3 inch diameter). Through fixed film processes on the surface of the filter media, biological anaerobic treatment thrives while suspended solids are captured. Furthermore, the microorganisms in this chamber convert nitrates in the recirculated water returning from the aerobic chamber to gaseous nitrogen. The nitrogen then escapes to the atmosphere.

3. **Aerobic Filter Media Chamber**
The aerobic floating and circulating filter media chamber consists of an aeration upper section and a filter media lower section. The chamber is filled with hollow, cylindrical filter media (0.6 inch diameter and 0.55 inches long). Biological treatment takes place with the help of the fixed film growth on the filter media surface. Aeration is continuous. Residual suspended solids are captured by the filter media circulating in this section.

The filter media in the Aeration chamber are backwashed regularly (5 or 10 minute cycle, twice a day) by the backwash system located at the bottom of the chamber. The backwashed water is transferred by an air lift pump back into the sedimentation chamber for further digestion.

4. **Treated Water Storage Chamber**
During normal operation, a recirculation line transfers a portion of the treated water back into the sedimentation chamber by way of an air lift pump. This chamber is designed to temporarily store treated water coming out of the aerobic filter media chamber. The treated water in the storage chamber is ready for discharge.

ANNEXURE E

Swellendam Municipality acceptance letter to collect solid waste from the site transfer station.

SWELLENDAM
MUNICIPALITY/MUNISIPALITEIT/MASIPALA

+27 28 514 8500
info@swellenmun.co.za
swellenmun
www.swellenmun.co.za
+27 28 514 2694

49 Voortrek Street, Swellendam | P.O Box 20, Swellendam 6740

Date:	28 September 2020
Enquiries:	B. Burger
Attention:	A. Fraser
Reference Number:	16/5/2/2
Per e-mail:	fraser@fcce.co.za

Sir,

DEVELOPMENT OF ERF 134, INFANTA: SOLID WASTE REMOVAL

Your request regarding the update on our previous letter concerning solid waste collection in Infanta, has reference.

The solid waste facility was indeed upgraded during 2019, as mentioned in Dr. Clayton's letter, dated 20 February 2012. The facility, which only excepts demolition and garden waste, is also equipped with a household (wet waste) and recyclables container unit. These containers are serviced weekly by an external service provider – all of the household refuse is then hauled to the Bontebok solid waste facility in Swellendam.

Should the abovementioned development go forth, a transfer station, which must be able to accommodate the volume of refuse generated internally, should be established at the entrance gate of the proposed development. This station shall then be serviced by either the contractor collecting the waste in Infanta, or the contractor hauling the waste to Swellendam. Details of such a station shall be considered during the civil services or the building plan application process.

I hope this will clarify the status quo of the current solid waste disposal function.

Please do not hesitate to contact us for any additional information.

Best regards

F. ERASMUS Pr. (Tech.) Eng.

DIRECTOR: INFRASTRUCTURE SERVICES

MOTIVATION IN TERMS OF SECTION 27 OF THE NWA

PROPOSED INFANTA DEVLOPMENT'S WATER USE ACTIVITIES ON ERF 134, INFANTA

Section 27 of the NWA, 1998 (Act No. 36 of 1998) sets out factors that should be considered by the DWS before issuing water use licenses. This section of the report will describe in detail the relevancy of the above-mentioned factors in relation to the water uses that are applied for and how Westerhelling Investments CC complies with them.

BACKGROUND

Westerhelling Investments CC proposes to rezone a 3.04-hectare portion of Erf 134, Infanta, from *Agricultural Zone (AZ)* to *Subdivisional Area* in terms of Section 15(2)(a) of the Swellendam Municipal Planning By-law (November 2020). This rezoning will enable the establishment of 20 additional single-dwelling units, resulting in a total of 21 units on the property.

1. Water Demand and Supply

The estimated **Annual Average Daily Demand (AADD)** for the development is:

- **21 single residential erven (small):** 800 ℓ/unit/day = 16.8 m³/day

With a Mean Annual Precipitation (MAP) of 430 mm/year, an average roof size of 215 m², and an 80% efficiency rate, each unit is expected to harvest approximately **74 m³ of rainwater annually.** Each household will be required to install a **5.0 m³rainwater harvesting tank** for additional potable use.

Two boreholes (134A and 134C) are located on Erf 134 north of the district road. A 72-hour pumping test on borehole 134C (Van Biljon, 2014) confirmed a sustainable yield of **25 m³/day** (up to **48 m³/day** in the best case). This yield exceeds the development's potable demand of **16.8 m³/day** (≈ **6,312 m³/a**). The development's total annual water demand, including provision for fire-fighting, is estimated at **7,665 m³/a.**

The property falls within the **H70K catchment**, where the General Authorisation allows abstraction of **150 m³/ha/a.** For Erf 134 (≈ 87 ha), this equates to a maximum abstraction of **13,050 m³/a,** well above the development's requirement. This confirms that sufficient groundwater resources are available, particularly as the dwellings are unlikely to be occupied year-round.

2. Wastewater Management

A total of **21 wastewater package treatment plants (WWTPs)**, one per unit, is proposed instead of conservancy tanks. These units will treat domestic sewage generated by the development. Of the 16.8 m³/day water demand, approximately **13.44 m³/day of sewage** (≈ **4,905.6 m³/a**) will be produced collectively.

Each residential unit will operate its own WWTP, but all units will be registered collectively under a **single Section 21(g) water use activity** to be managed by the **Homeowners' Association (HOA)** in terms of its constitution.

Treated effluent will be:

- Recycled for non-potable uses (e.g. toilet flushing); and/or
- Used for irrigation or discharged underground via soak-aways.

3. Water Infrastructure

A new **125 mm Ø Class 9 uPVC water main** will be constructed between the reservoir and the development, fitted with isolating valves, fire hydrants, and erf connections. A **200 mm Ø corrosion-**

protected steel sleeve will cross Main Road 268, carrying a **125 mm Ø HDPE fusion-welded water main.**. This water main will cross a watercourse and will be placed within the existing road reserve.

4. SECTION 27(A) - EXISTING LAWFUL WATER USE

No existing lawfull water use.

5. SECTION 27(B) - REDRESSING PAST DISCRIMINATION

The proposed water use activities will contribute to job creation and skills development, particularly for historically disadvantaged individuals. The maintenance of wastewater management infrastructure, and pipeline crossings, will provide employment opportunities during both construction and operational phases.

6. SECTION 27(C) - EFFICIENT AND BENEFICIAL USE OF WATER IN THE PUBLIC INTEREST

The proposed development promotes efficient and beneficial water use by incorporating rainwater harvesting, on-site wastewater treatment, and the reuse of treated effluent for non-potable purposes. Groundwater abstraction will remain within authorised limits, ensuring sustainability and availability for other users. These measures reduce pressure on freshwater resources and support responsible, equitable use of water in the public interest.

7. SECTION 27(D) - SOCIO-ECONOMIC IMPACT OF THE PROPOSED WATER USE

The proposed water use will support the development by providing a reliable supply for domestic needs while ensuring that water resources are managed sustainably. Efficient use, rainwater harvesting, and reuse of treated effluent will limit environmental impact and secure long-term availability. This contributes to local economic activity, property value, and community wellbeing without compromising the water needs of other users.

8. SECTION 27(E) - APPLICABLE CATCHMENT MANAGEMENT STRATEGY

The proposed water use falls within the jurisdiction of the Berg-Olifants Catchment Management Agency (BOCMA). The development's approach aligns with regional water management objectives by ensuring sustainable abstraction, responsible use, and compliance with water quality standards. Measures such as rainwater harvesting, on-site wastewater treatment, and effluent reuse further support catchment-level water sustainability.

9. SECTION 27(F) - IMPACT ON THE WATER RESOURCE AND OTHER WATER USERS

The proposed water use has minimal impact on the water resource and other users. Groundwater abstraction will remain within sustainable limits, and wastewater will be treated and reused for irrigation or non-potable purposes.

10. SECTION 27(G) - CLASS AND RESOURCE QUALITY OBJECTIVES OF THE WATER RESOURCE

The proposed development will comply with the applicable resource quality objectives for the Berg-Olifants catchment. Groundwater abstraction and wastewater management have been planned to ensure that water quality is maintained, and treated effluent will be reused or disposed of in a manner that prevents contamination, supporting the long-term ecological and domestic use of the water resource.

11. SECTION 27(H) - INVESTMENT ALREADY MADE

Investment to date includes the development and assessment of boreholes, including pump tests, as well as planning and technical assessments to ensure sustainable water supply. These steps demonstrate proactive measures to manage water resources responsibly and support the proposed development.

---

12. SECTION 27(I) - STRATEGIC IMPORTANCE OF THE WATER USE

The proposed water use is strategically important as it provides a reliable supply of water for domestic purposes, supporting the residential development. By ensuring sustainable abstraction from boreholes, integrating rainwater harvesting, and planning for responsible wastewater management, the development safeguards water resources while meeting household needs efficiently and in the public interest.

SECTION 27(J) - WATER RESOURCE QUALITY REQUIREMENTS FOR THE RESERVE

The proposed water uses will be managed in a manner that does not compromise the ecological reserve. Monitoring measures will ensure that groundwater and wastewater meets environmental quality standards.

---

13. SECTION 27(K) - PROBABLE DURATION OF THE WATER USE AUTHORISATION

Given the long-term nature of the development, it is recommended that the WUL be issued for the maximum allowable period under the National Water Act.

Application Status

Water User
Westerhelling Investments CC

Application
WU42464 - Cape Infanta - Groundwater abstraction on Erf 137, Infanta

Duration: Day 0 of 90
Current Status: Site Inspection Determinations

#	Date	Applicant	Department	Duration in Days
1	Oct 27 2025 9:29AM		Site Inspection Determinations	12 Day(s) (Current)
2	Oct 7 2025 2:37PM	Site Inspection Determinations		15 Day(s)
3	Oct 7 2025 10:57AM		Pre Application Enquiry	1 Day(s)
4	Oct 3 2025 11:36AM		Site Inspection Determinations	3 Day(s)
5	Oct 3 2025 10:51AM		Site Inspection Determinations	1 Day(s)
6	Sep 9 2025 10:52AM	Applicant : Prepares WUL Application for submission		18 Day(s)
7	Sep 3 2025 11:57AM		Pre Application Enquiry	5 Day(s)
8	Mar 14 2025 9:35AM		Pre Application Enquiry	118 Day(s)
9	Mar 13 2025 2:23PM	Applicant : Prepares Pre-application for submission		2 Day(s)