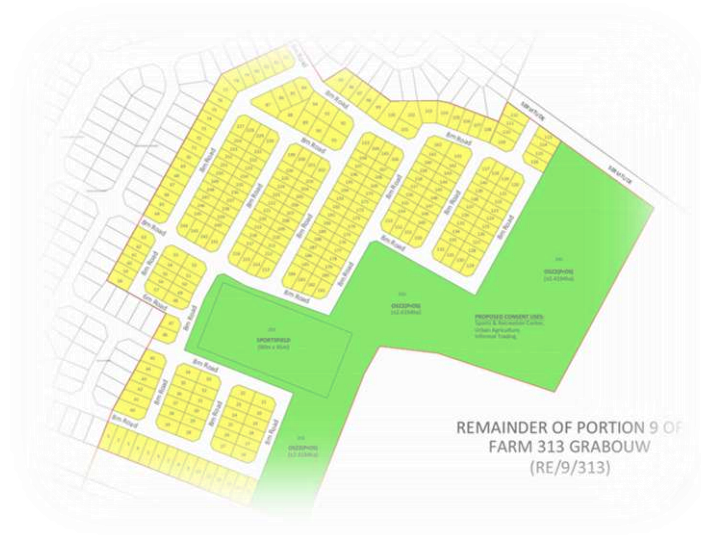


TECH 01/2022/23 – GRABOUW: GREATER GRABOUW HOUSING PROJECT

ERF 313, GRABOUW



CIVIL ENGINEERING SERVICES: PRELIMINARY DESIGN REPORT

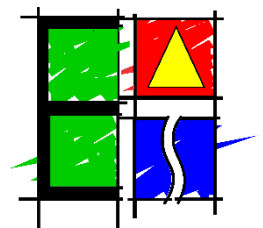
PREPARED FOR



PREPARED BY:

Engineering Advice & Services Western Cape
8 St James Street, Audas Estate
Somerset West
Cape Town, 7130

Tel: (+27) 21 879 4992 | admin@easwc.co.za



DOCUMENT CONTROL

REVISION NUMBER	ACTION	DATE
0	Submitted to the client for approval.	09 December 2024

COMMENTS	NAME	DATE
Report Compiled by	C. van der Merwe Btech	03 December 2024
Report Reviewed by	J. Makhetha Pr Tech	04 December 2024
Amendments made by		

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1 INTRODUCTION

1.1 TERMS OF REFERENCE

Engineering Advice and Services Western Cape (EASWC) were appointed by the **Theewaterskloof Municipality (TWK)** in July 2023, for the provision of Professional Services in relation to the **Provision of Professional Consulting Services for Grabouw: Greater Grabouw 7000 Housing Project** (Greater Grabouw Housing Project).

The **Greater Grabouw Housing Project** involves the planning and implementation for approximately 7000 households in the Grabouw area. As part of the appointment, and in summary, EASWC is required to plan and implement the accommodation of the approximately 7000 households by allocating them into the following housing project categories as applicable to the identified land parcels:

- Integrated Residential Development Programme (IRDP) Housing
- Temporary Relocation Area (TRA) Housing
- In-Situ Upgrading of Informal Settlement (UIS)
- Interim Services

Based on the scope as set out in the appointment of EASWC, the **Greater Grabouw Housing Project** is planned for implementation through the following identified land parcels:

- Erf 8078, Grabouw Vacant Land
- Erf 313, Grabouw Vacant Land
- Farm 295, Grabouw Invaded Land
- Farm 292 and 301, Grabouw Invaded Land
- Erf 1314, Grabouw Vacant Land
- Erf 505 and 793, Grabouw Invaded Land

In accordance with the project's planning, **Erf 313** has been identified as the next priority housing development area in the implementation of the **Greater Grabouw Housing Project**.

1.2 PURPOSE OF THE REPORT

This report aims to present a clear description of the anticipated scope for the implementation of housing on **Erf 313**. By assessing and determining the applicability, relevance, and shortfalls of the available base information, this report will present the design concept for **Erf 313** and its related applicable principles and impacts with a target to advance the Client towards an informed decision-making process regarding its progression for implementation as one of the priority projects.

The report will provide a coordinated output that incorporates considerations from currently available information and Professionals.

2 PROJECT DETAILS

2.1 LOCALITY

Erf 313 is situated within the town of Grabouw, in the Western Cape and can be located as shown in Figure 2-1, below:



Figure 2-1: Erf 313, Grabouw - Locality

2.2 PROJECT BACKGROUND

Based on meetings with the Client and all previous information availed to EASWC by the Client, it is evident that Erf 313 (and the Greater Grabouw Housing Project as a whole) has been ongoing prior to the appointment of EASWC. It was established that, during this period, the **TWK Municipality** initially commenced with the feasibility of **Erf 313** through a previously appointed Professional Team. During 2022 and 2023, this previously appointed Professional Team produced the following as part of their on-going preliminary feasibility investigations:

- | | |
|-----------------------------|----------------------------------|
| ▪ Pre-feasibility Report | Element Consulting |
| ▪ Environmental Assessments | FEN Consultants |
| | Mark Berry Botanical Consultants |
| ▪ Bulk Services Assessment | GLS Consulting |

The Pre-feasibility and Bulk Services Report, as noted above, concluded that there is no existing sewer infrastructure for erf 313. Bulk sewer upgrades must be completed to create capacity in the network. Bulk water upgrades are not required and proposed water connections will be from the adjacent residential area of Snake Park and Dennekruin. Due to the Bulk sewer upgrades needed to develop erf 313, the project remained suspended as allowance had not been made at the time, for the identified upgrades.

By July 2023, the TWK Municipality had made enough progress in planning for the required capacity that they were ready to progress with implementation of **Erf 313**. However, at this point, the main Consultant from the previous Professional Team (Element Consulting) was unable to remain within the project hence the appointment of EASWC through the applicable procurement procedures.

2.2.1 ENVIRONMENTAL ASSESSMENTS

The previously conducted, freshwater verification and Botanical assessments, were finalised in September 2022 and August 2022 based on previous report dates. These reports were also availed to EASWC by the Client as part of the targeted continuity. EASWC re-engaged the service providers who conducted the studies and established terms of continuity in order to reaffirm that the studies they conducted in 2022 (as mentioned above) are still valid. Subsequently, it was confirmed that these reports remain valid, and have been incorporated it into the current planning stages. This is covered in later sections of the report.

2.2.2 BULK SERVICES ASSESSMENTS

Bulk Services Assessment Reports were conducted in September 2019 and September 2022 as part of the previous Professional Team. These reports were also availed to EASWC by the Client as part of the targeted continuity. EASWC has confirmed with the Client that these reports remain valid, and they have been incorporated into the current planning stages. Further detail is covered in later sections of the report.

3 CURRENT LAND USE AND LAND OCCUPATIONS

At issue of this report, **Erf 313** remains mainly uninvaded and largely vacant with only a small portion of the land being used as an informal sports field. The position of the informal sports field is indicated in Figure 3-1, below:



Figure 3-1: Erf 313, Grabouw, Current Land Use

4 TOPOGRAPHY AND GROUND CONDITIONS

EASWC have assessed Topographical Surveys and Preliminary Geotechnical Studies in order to accurately assess the physical and technical properties of the anticipated **Erf 313** Development area.

4.1 TOPOGRAPHY

In **March 2024**, EASWC conducted an updated Contour/Topographical Survey and Aerial Imagery to facilitate upcoming detailed planning stages. All updated Topographical Surveys and Aerial Imagery have been submitted to the Client. Contour and topographical data have incorporated in the preliminary design assessments.

4.2 GROUND CONDITIONS AND GEOTECHNICAL

A Preliminary Geotechnical Investigation was finalised in **November 2024** and has been issued to the Client as *annexure A* of this report. The Preliminary Geotechnical Investigation is a desktop study, which aims to ensure that the potential geotechnical risks are identified, to assess the requirements for specialist geotechnical processes and investigations during the latter stages of the project.

In summary, the Preliminary Geotechnical Investigation provided the following extracted conclusions:

4.2.1 GEOLOGY AND SUBSOILS

"The site is primarily underlain by quartzitic sandstone (with minor shale layers) of the Nardouw Subgroup – Table Mountain Group. Sandstone bedrock is anticipated to occur at depths generally less than 1.5 metres below existing ground level (EGL) across most of study area with areas of rock outcrop present to the west. The sandstone bedrock weathers to form fine to coarse gritty sand with much of the overburden consisting of transported colluvium/hillwash."

The excavations from 0.0 to 1.5 metres depth are anticipated to be soft in terms of SANS 1200DA criteria.

The excavations from 1.5 - 2.5 metres depth are anticipated to be intermediate in terms of SANS 1200DA criteria.

Excavations deeper than 2.5 meters (or where bedrock is at or near the surface) are anticipated to be hard and will necessitate the use of pneumatic tools, and potentially blasting.

Further detail can be found in the Preliminary Geotechnical Investigation, which is attached as *Annexure A* of this report.

4.2.2 GROUND WATER TABLE

Shallow groundwater seepage is expected in the low-lying areas, drainage lines, and valley heads. A perched groundwater table may occur at shallow depths (typically less than 1.5 meters below the existing ground level, resting on shallow bedrock), both during and after rainfall periods, as well as during the peak rainfall season.

Further detail on the above can be found the Preliminary Geotechnical Investigation, which is attached as *Annexure A* of this report.

4.2.3 IN-SITU MATERIAL QUALITY

Based on the Preliminary Geotechnical Investigation, as attached in *Annexure A* of this report, the tested samples indicate the following material types:

- *"The gravelly/sandy residual subsoils and sandstone bedrock are anticipated to classify between a G7 to G9 quality material in terms of TRH14, 1985 (generally good to fair subgrade materials)."*
- *"The sandy colluvium/hillwash (transported soils) subsoils on site are anticipated to not satisfy the criteria for a G9 quality material."*

The majority of the in-situ material would be overall suitable for general fill operations with exceptions of areas where the sandy colluvium/hillwash is encountered.

4.2.4 DRAINAGE

Based on the Preliminary Geotechnical Investigation, as attached in *Annexure A* of this report:

"Shallow groundwater seepage can be anticipated along the low-lying areas and along drainage lines and valley head areas. A perched groundwater table can be anticipated at shallow depths (generally less than 1.5 metres below EGL, perched on the shallow bedrock) both during and after periods of rainfall and/or during the high rainfall season."

Due to the shallow perched water table subsoils are highly recommended as part of the stormwater design.

Further detail on the extract can be found in section 8 of the Preliminary Geotechnical Investigation.

4.2.5 SPECIAL PRECAUTIONS

To re-iterate the assertions of the Preliminary Geotechnical Investigation:

"It must be appreciated that the above recommendations have been based solely on the desktop study of the site. In order to provide more accurate recommendations for design purposes, the following additional geotechnical work is required for this site:

- I. Machine excavated test pits for the logging/profiling and sampling of soil and bedrock horizons. This will provide a visual assessment of the soil and bedrock strata, variation in depths to bedrock and an assessment of the excavation requirements, which is essential for budgeting and construction costs;*
- II. CBR Dynamic Cone Penetrometer (DCP) tests to gauge the in-situ relative densities of the subsoils with depth; and*
- III. Laboratory tests on soil and bedrock samples to allow for more accurate material classification and recommendations for use in earthworks, foundations, roads etc."*

5 ENVIROMENTAL INVESTIGATION

In August 2022, a botanical survey was concluded by **Mark Berry Botanical Consulting** in order to determine the constraints in the development area. Subsequently, in September 2022, the Freshwater Verification study was concluded by **FEN Consulting** in order to identify all freshwater ecosystems that may potentially be impacted by the proposed housing development within the study area.

5.1 BOTANICAL SURVEY

The Botanical study identified several attributes as indicated in Figure 5-1, below. A key item is the Kogelberg Sandstone fynbos which is mainly present in the undevelopable portion of the erf. Kogelberg Sandstone fynbos is regarded as highly endangered and the conservation must remain a priority. This fynbos area was accommodated as a "no-go" zone in the proposed development layout.

Other attributes were also identified, but did not affect the proposed development. The drainage lines identified within figure 5-1 below, are discussed further in section 5.2. The report was issued to the client in a separate submission.



Figure 5-1: Botanical attributes.

5.2 FRESHWATER VERIFICATION STUDY

The freshwater verification study indicates two ephemeral drainage lines located on Erf 313. This drainage line has a 32m "No-Go" boundary zone, where no development is allowed. The "No-Go" zones and ephemeral drainage lines have been accommodated within the proposed development layout. The report was issued to the client in a separate submission.

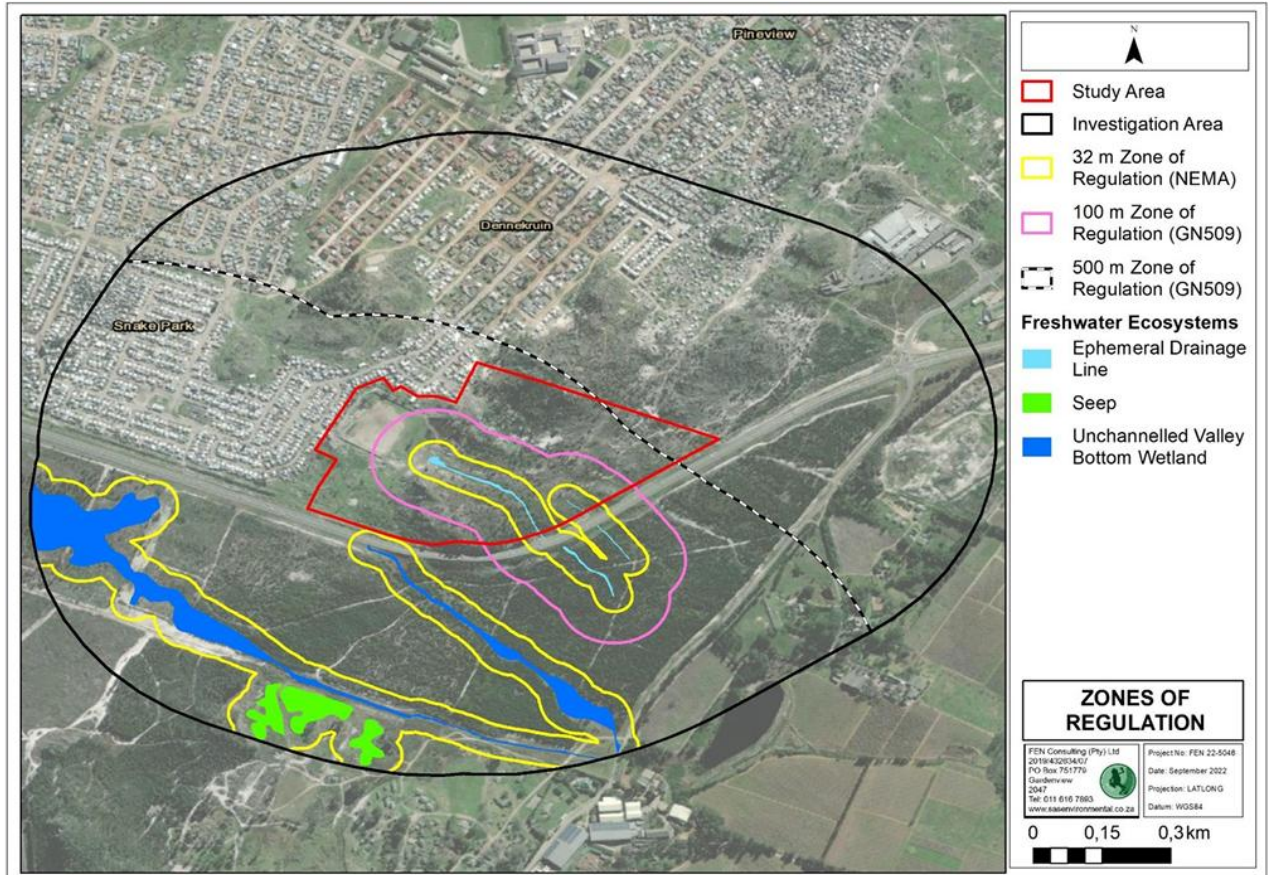


Figure 5-2: Overall delineated extent of the ephemeral drainage lines, seep and unchanneled valley bottom wetlands.

6 TOWN PLANNING LAYOUT

The Town Planning requirements for **Erf 313** project are addressed by Plan4SA.

The layout has been aligned with the Theewaterskloof Municipality's plans and indicates the currently anticipated bounds of the development area, while considering all relevant Town Planning key details as related to the anticipated housing typologies and as far as possible anticipating the physical and environmental site constraints as covered.

The first Concept Town Planning Layout has been attached to this report as *Annexure B*.

6.1 CONCEPT TOWN PLANNING LAYOUT

The Concept Town Planning Layout for **Erf 313** was completed by **Plan4SA** in **October 2024**. The current plan sub-divides erf 313 into 2 parts, Portion A (6.4 hectares) will be used as the development area and the remainder of the erf (45.7 Hectares) remains undevelopable due to unsuitable conditions and "no-go" zones.

In total, the developable portion of erf 313 is anticipated to provide 254 housing opportunities as well as open spaces.

It is important to note that the Concept Town Planning Layout remains subject to the town Planning approval processes and therefore, may be due for various amendments based on review and feedback.

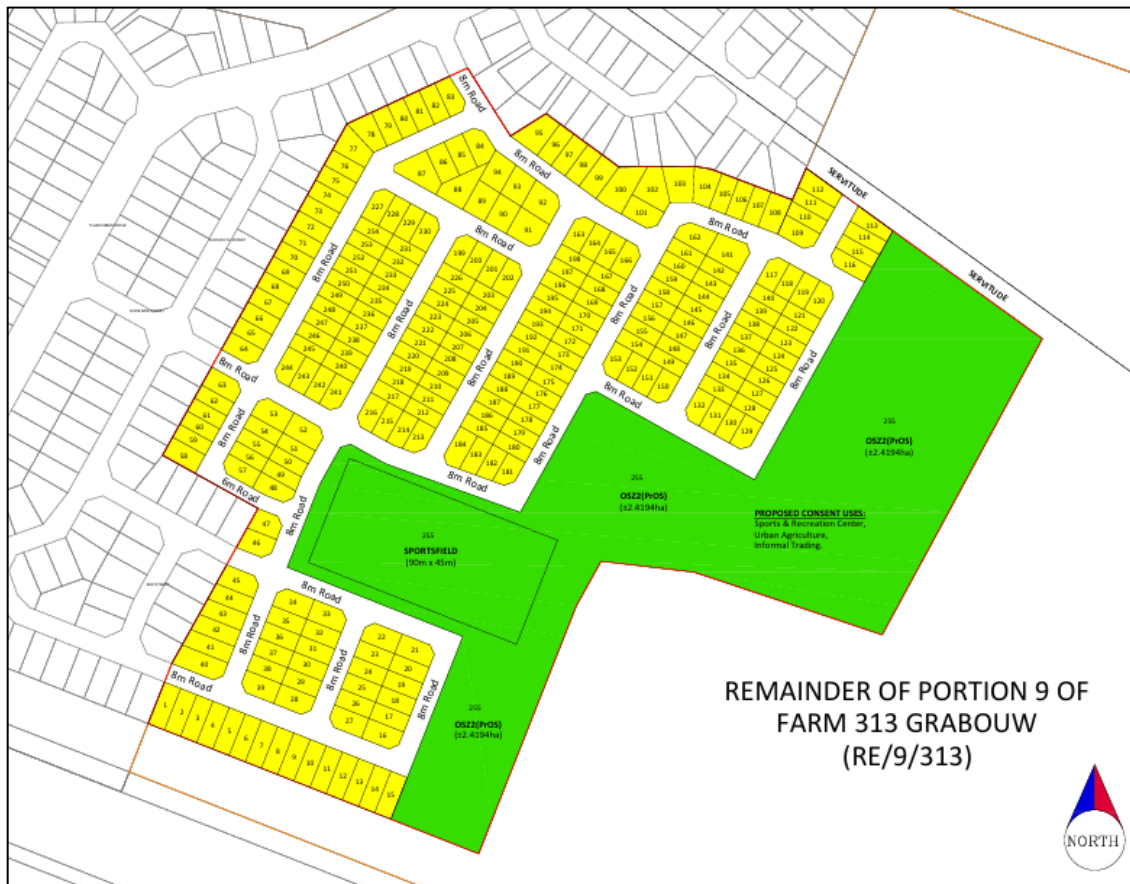


Figure 6-1: Erf 313 – Zoning plan

7 EXISTING SERVICES

Erf 313 is, in majority, a “green fields” development. Therefore, no formal existing internal services and infrastructure (that exists on the site) requires incorporation or consideration. All services and infrastructure will be installed as new.

8 PROPOSED INTERNAL CIVIL ENGINEERING SERVICES

The proposed Civil Engineering Services discussed in this section are based on coordinated outcomes of the internal **Erf 313** development footprint and include the following:

- Internal Roads Network.
- Stormwater Reticulation.
- Water Reticulation
- Sewerage Reticulation

8.1 INTERNAL ROADS NETWORK

The proposed Internal Roads Network is comprised of the following throughout the **Erf 313** development footprint:

1. 5m wide urban residential roads within 8m road reserves.
2. 4.5m wide urban residential roads within 6m road reserves.
3. Asphalt surfacing and related layer works throughout the development.
4. Mountable (drive-over) kerbing on either side of the roadway where access is anticipated.
5. Barrier kerbing in areas where vehicular access is not anticipated.
6. 1.2m sidewalk on both sides of the roadway in 8m road reserves.
7. 1.2m sidewalk on the one side of the roadway in 6m road reserves.

Beyond the facilitation of access and mobility, the internal road network will be integral to the management and conveyance of surface stormwater runoff and at appropriate positions, the road network will convey to the underground stormwater reticulation network.

The proposed Roads Layout is attached to this report as *Annexure C*.

8.2 STORMWATER RETICULATION

The proposed Stormwater Reticulation network will be linked to the road network through a system of appropriately positioned catchpits (Grid and Kerb inlets) which will then convey the stormwater to the underground reticulation as follows:

1. Minimum 300mm diameter kerb inlet pipe connections to manholes.

2. Minimum 110mm diameter Sub-soil drainage pipe network for the management of risk imposed by ground water effects.
3. Minimum of 1m diameter Stormwater Manholes (depending on pipe size connection)
4. Minimum 375mm diameter manhole-to-manhole pipe connections.
5. Stormwater pond for the detention and regulation of stormwater outflow from the development footprint

The proposed Stormwater Reticulation Layout is attached to this report as *Annexure D*.

8.3 WATER RETICULATION

The Water Reticulation Network is comprised of the following throughout the internal **Erf 313** internal development footprint:

1. 110mm Diameter connections to the existing pipe network on the northern side of the development. [Indicated]
2. 110mm Diameter water pipes throughout the development footprint.
3. Minimum 25mm individual erf connection pipes.
4. A system of appropriately positioned shut-off valves and hydrant valves.

The proposed Water Reticulation Layout is attached to this report as *Annexure E*.

8.4 SEWERAGE RETICULATION

The Sewer Reticulation Network is comprised of the following throughout the internal **Erf 313** internal development footprint:

1. Minimum 160mm diameter sewer reticulation pipe.
2. Minimum 110mm diameter individual erf connection pipe.
3. 1m diameter Sewer manholes

The proposed Sewer Reticulation Layout is attached to this report as *Annexure F*.

8.5 ANTICIPATED BULK EARTHWORKS OVERVIEW

The average slope of the developable areas ranges between **0.2% to 7%** which falls within acceptable limits of developable land for the anticipated housing typologies. However, based on site inspections and the Preliminary Geotechnical Investigations, a series of rock outcrops and the prevalence of shallow underlying

bed rock is bound to complicate the implementation of all shaping earthworks and excavation work within the development footprint of **Erf 313**.

Full details can be found within the complete Preliminary Geotechnical Investigation Report as attached in this report as *Annexure A*.

With close reference to the Preliminary Geotechnical Investigation, it is reasonable to conclude that, in order to implement bulk earthworks, shaping and excavations within the **Erf 313** Development footprint, allowance should be made for:

Non-Restricted Excavations [As classified in SANS 1200D]:

1. Within soft material
2. Within intermediate material
3. Within Hard rock
4. Boulders

Restrict Excavations [As classified in SANS 1200D]:

1. Within soft material
2. Within intermediate material
3. Within hard rock: Which, consequently, also indicates that allowances must be made for approved methods of wedging, splitting or blasting as anticipated.

Further allowances will have to be made as part of the fill operations for the replacement of boulder volumes with suitable in-situ material or, in cases where the in-situ is unsuitable or depleted, imported commercial material.

The above considerations have had to be incorporated in detail during the concept design analysis in order to facilitate an informed decision-making process for the Client. The resultant cost estimates in the later sections of this report are therefore reflective of the above considerations.

9 BULK INFRASTRUCTURE UPGRADES

As part of developing **Erf 313** in accordance with the detail covered in earlier sections of this report, the proposed services (and overall, the **Erf 313** development) will need to be integrated into the existing surrounding Grabouw bulk infrastructure. The integration of **Erf 313** into the surrounding infrastructure is assessed for implementation through a series of Bulk Infrastructure Link Upgrades for the following services:

- Roads Network
- Stormwater Reticulation
- Sewer Reticulation
- Water Reticulation

9.1 ROADS NETWORK

Based on the current assessment, no bulk collector Roads infrastructure upgrades are required for the implementation of **Erf 313** development. It is, however, important to note that access to the **Erf 313** development is anticipated to be from the existing Makenzie Street and Makhanya Street.

9.2 BULK STORMWATER RETICULATION

Based on the current assessment and the available information, no bulk Stormwater infrastructure upgrades are anticipated for the implementation of **Erf 313**. However, it should be noted that portions from erf 313 naturally drains towards the N2 national road, therefore, engagements with the National Roads Authority (SANRAL) must be finalised before detailed designs of the stormwater reticulation.

9.3 BULK WATER RETICULATION

Based on current assessment and available information, no bulk Water infrastructure upgrades are required for the implementation of erf 313.

9.4 BULK SEWERAGE RETICULATION

Based on current assessment and available information, the availability of capacity for the reticulation of Sewerage for **Erf 313** depends on the implementation of Bulk Sewer Upgrades as identified by **GLS Consulting** in the Bulk Services Assessment Reports conducted in September 2019 and September 2022. The GLS reports have been included in this report as *Annexure H*.

With basis on the GLS reports, the Client has confirmed the Bulk Sewer Upgrade process is in progress and on schedule to be completed before the completion of Erf 313 development.

10 INTERNAL SERVICES COST ESTIMATE

The estimated internal services construction cost is provided in Table 10-1 below.

Table 10-1: Erf 313 Internal Services Cost Estimate

COST ESTIMATE: CIVIL ENGINEERING SERVICES FOR ERF 313		
Item	DESCRIPTION	AMOUNT
1	SCHEDULE A - PRELIMINARY AND GENERAL	R 2 812 950.00
2	SCHEDULE B - SITE PREPARATION, BULK EARTHWORKS AND GENERAL	R 5 070 000.00
3	SCHEDULE C - ROADWORKS	R 8 567 384.00
4	SCHEDULE D - STORMWATER RETICULATION	R 4 229 382.00
5	SCHEDULE E - SEWER RETICULATION	R 3 244 463.00
6	SCHEDULE F - WATER RETICULATION	R 1 768 425.00
7	SCHEDULE G - CABLE DUCTS	R 561 600.00
	TOTAL ESTIMATED CIVIL ENGINEERING COST	R 26 254 204.00
	Add 15% VAT	R 3 938 130.60
	ESTIMATED GRAND TOTAL	R 30 192 334.60

11 INVESTIGATIONS AND STUDIES

This section of the report aims to present a summative overview of the studies/investigations that are recommended to facilitate the current progressions of the **Erf 313** development.

11.1 RECOMMENDED STUDIES AND INVESTIGATIONS

The studies/investigations listed below are recommended by EAS WC and should be considered for the progression of the current implementation of **Erf 313**:

1. Phase 1 Geotechnical Site Investigation:

For implementation upon preliminary design approval. This will allow specific focus on the anticipated problem areas and provide specific Engineering Geotechnical input linked to the current **Erf 313** concept, as included in this report.

12 CONCLUSION

Based on findings and presentations of this report, there is sufficient information to conclude that the proposed Civil Engineering services are feasible and possible to implement.

As confirmed by the TWK Municipality, the implementation of Bulk Services Upgrades required for the feasibility of **Erf 313** is on track for implementation and coordinated in line with the planning of the **Erf 313** internal services covered in this report. Through continuous coordination, the TWK Municipality has confirmed that the capacity within the Bulk Services will be created in time before or at the completion of the implementation of **Erf 313's** internal services.

The estimated costs are indicative of current rates (at issue of this report) and account for the reasonably anticipated conditions at **Erf 313**. In the case that the findings of this report are not aligned with the Client's expectations and planning, it is recommended that the findings be discussed, and alternatives explored where possible. Should the report, as submitted, be aligned with the Client's expectations and planning, it is recommended that approval be confirmed as soon as possible to allow for the progression of the implementation of **Erf 313** to the next stage of design development (Detailed Design).

13 ANNEXURES

ANNEXURE A – PRELIMINARY GEOTECHNICAL SITE INVESTIGATION

ANNEXURE B – CONCEPT TOWN PLANNING LAYOUT

ANNEXURE C – PROPOSED ROADS LAYOUT

ANNEXURE D – PROPOSED STORMWATER LAYOUT

ANNEXURE E – PROPOSED WATER LAYOUT

ANNEXURE F – PROPOSED SANITATION LAYOUT

ANNEXURE G – PROPOSED GENERAL SERVICES LAYOUT

ANNEXURE H – GLS BULK SEWER ASSESSMENT

ANNEXURE A: PRELIMINARY GEOTECHNICAL SITE INVESTIGATION

**PRELIMINARY GEOTECHNICAL INVESTIGATION FOR
THE GREATER GRABOUW HOUSING PROJECT - ERF 313**

Report No MD1483-2/1

NOVEMBER 2024

*REPORT PREPARED BY MELIS & DU PLESSIS
ON INSTRUCTION FROM ENGINEERING ADVICE & SERVICES WESTERN CAPE (PTY) LTD*

Engineering Advice & Services Western Cape (Pty) Ltd
8 St James St,
Audas Estate
SOMERSET WEST
7130

Tel No : (021) 879-4992
E-mail : wadeb@easwc.co.za

MELIS & DU PLESSIS
Consulting Engineers (Pty) Ltd
106 Wentworth, Somerset Links Office Park
De Beers Ave, SOMERSET WEST
7130

Tel No : (021) 851-2010
E-mail : info@melisdup.com

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FIGURES

PRELIMINARY GEOTECHNICAL INVESTIGATION FOR
THE GREATER GRABOUW HOUSING PROJECT - ERF 313

**PRELIMINARY GEOTECHNICAL INVESTIGATION FOR
THE GREATER GRABOUW HOUSING PROJECT – ERF 313**

NOVEMBER 2024

1. INTRODUCTION

Melis & Du Plessis Consulting Engineers (Pty) Ltd (hereafter referred to as MDP) were appointed by Engineering Advice and Services to conduct the Preliminary Geotechnical Investigation for the Greater Grabouw Housing Project - Erf 313, Theewaterskloof Municipality.

2. SCOPE OF WORKS

The Preliminary Geotechnical Investigation is a desktop study following the requirements as set out in The National Housing Code in Chapter 3 of Part 3 as stipulated in the GFSH-2 manual – Generic Specification (September 2002).

The Preliminary Geotechnical Investigation aims to ensure that potential geotechnical risks are identified, to assess the requirements for specialist geotechnical processes and investigations during the latter stages of the project. As such, the expected subsoil conditions beneath the site are described and comment is made on slope stability, earthworks, foundations, excavatability etc. in accordance with the requirements of the Theewaterskloof Local Municipality, South African National Standards (SANS 10400) and the National Home Builders Registration Council (NHBC).

The recommendations provided in this report are preliminary, and subject to change based on a Detailed Geotechnical Investigation which needs to be carried out prior to design and development/construction.

3. INFORMATION SUPPLIED

The following information was provided by Engineering Advice and Services, for use as part of this study:

- SRK Consulting Report titled, “Gypsy Queen Erf 563 Grabouw Phase 1 Geotechnical Investigation (November 2022)”, (Report No. 587360/1).
- Mark Berry Environmental Consultants Botanical Status Quo Report titled, “Portion 9 of Farm Oude Brug 313, Erf 4233 & Erf 8078, Grabouw (August 2022)”.
- Google Earth files (kmz/kml) demarcating site boundaries and Global Positioning System (GPS) coordinates of the study area, and
- Photographs across the study area.

The 1:250 000 Geological Map titled “3319 Worcester” as published by the Geological Survey, was also used by MDP.

4. SITE DESCRIPTION

The study area is located in the Grabouw area, situated approximately 70km southeast of Cape Town CBD, within the Theewaterskloof Municipality, at latitude S34° 09' 53" and longitude E18° 59' 53". The locality of the site is indicated in **FIGURE 1**.

The site which spans across Erf 313, is approximately 19.2ha in extent and is accessed via the N2 Freeway in the south. The study area is mainly characterised by densely populated informal and some formal dwellings with a network of gravel access roads. Topographically, the study area generally slopes gently to moderately from Northwest to Southeast, with localised areas in which surface outcrop is exposed (particularly in the southern portion).

General views across the study area as shown in Plate 1 and Plate 2 below.



Plate 1



Plate 2

5. GEOLOGY AND SUBSOILS

According to published geological maps and literature, the site is primarily underlain by quartzitic sandstone (with minor shale layers) of the Nardouw Subgroup – Table Mountain Group. Sandstone bedrock is anticipated to occur at depths generally less than 1.5 metres below existing ground level (EGL) across most of study area with areas of rock outcrop present to the west. The sandstone bedrock weathers to form fine to coarse gritty sand with much of the overburden consisting of transported colluvium/hillwash.

The soil profile encountered is expected to comprise a light grey to greyish brown, fine grained, silty SAND (colluvium/hillwash transported soils) which overlies a yellowish brown/light brown to khaki brown fine to coarse grained gravelly SAND to sandy GRAVEL (residuum), in turn overlying weathered fine to coarse grained gritty sandstone bedrock.

The inferred boundaries of the lithological units are indicated in **FIGURE 2**.

6. GROUNDWATER OCCURRENCE

Shallow groundwater seepage can be anticipated along the low-lying areas and along drainage lines and valley head areas. A perched groundwater table can be anticipated at shallow depths (generally less

than 1.5 metres below EGL- perched on the shallow bedrock) both during and after periods of rainfall and/or during the high rainfall season.

7. DISCUSSION

7.1. Proposed Development

It is envisaged that single storey free standing housing units are proposed to be constructed across the study area, with each unit being approximately 40m² in extent. Foundation loads for each unit are anticipated to be less than 50kPa.

7.2. General Stability

The study area is considered to be for the most part stable; however, good stormwater management is essential to ensure long term stability. Thus, it is recommended developmental practice, to maintain stability includes:

- i. Careful planning of the development in order to obviate large cuts and fills and ensure good site drainage.
- ii. Provision of stormwater control facilities such as retention structures, interceptors and similar such measures to reduce concentrated overland flows.
- iii. It is recommended that the development be focussed along gently to moderately sloping landform (generally less than 15° gradient). It is anticipated that higher housing densities can generally be achieved across most of the site.
- iv. It is recommended that the development is not planned along any steep/very steep slopes (generally greater than 15° gradient) and in/close proximity to natural drainage areas where groundwater seepage is shallow and/or surface water activity is imminent, particularly after periods of heavy rain.
- v. It is recommended that all necessary floodline studies (1 in 50 and 1 in 100 year), environmental and wetland delineation studies be carried out by a registered professional to determine the limits of development in the study area.

7.3. Earthworks

All earthworks should be carried out in a manner to promote stable development of the site. It is recommended that earthworks be carried out along the guidelines given in SANS 1200 (current version).

In terms of cuttings and natural slopes:

- i. Cut slopes in soils should be formed to batters of 1 vertical to 1.5 horizontal (34 degrees) and to a height not greater than 1.5m where retaining walls are not provided or where slope stability assessments have been undertaken on the proposed slope. Cuts in weathered bedrock should not exceed gradients of 1 vertical to 1 horizontal (45 degrees).

- ii. Inspection of cuts by a competent Engineering Geologist or Geotechnical Engineer may indicate that the angle of cut batter slopes need to be varied locally to ensure stability of the site.

In terms of embankment slopes and platforms:

- i. Where natural ground slopes are steeper than 1 vertical to 6 horizontal (6 degrees), the fill must be benched into the slope. Benches should be 0.5m deep and 2.0m wide.
- ii. Placement of fill should be undertaken in layers not exceeding 200mm thick when placed loose and compacted using suitable compaction plant to achieve minimum 93% Modified AASHTO maximum dry density.
- iii. Terraces should be graded to direct water away from the fill edges, and small earth bunds should be constructed along the crests of fills, to prevent overtopping and erosion of fill embankment slopes. These bunds should be a minimum 450mm wide and 300mm high.
- iv. Quality assurance, namely density control of any placed fill material should be undertaken at regular intervals during fill construction.
- v. Boulders larger than 200mm diameter or $\frac{1}{3}$ of the layer thickness when loose should be removed from the fill material as these could complicate the compaction works, and also cause piping within fills. Furthermore, large boulders in fills could cause later problems during construction of foundations.
- vi. Engineered fill slopes should be formed to batters of 1 vertical to 1.5 horizontal provided that the edge of fills are over constructed and thereafter trimmed back to the required position.

7.4. Excavatability and Rippability

It is anticipated that the subsoils from 0.0 to 1.5 metres depth will be easily excavatable. These materials classify as soft in terms of SANS 1200DA criteria which can easily be removed by hand tools or a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width.

It is anticipated that excavations from 1.5 - 2.5 metres in the soil to upper weathered rock layers will classify as intermediate, which can be efficiently ripped by a bulldozer of mass approximately 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW. In addition, consideration can also be given to use of a tracked excavator of flywheel power exceeding 0.10kW per millimetre of tined bucket width.

Excavations below 2.5 metres (and where bedrock is present at or near surface level) classify as hard and will require the use of pneumatic tools and possibly blasting.

7.5. Material Classification and Usage for Subgrade Treatment for Roads, Parking Areas and Surface Beds

The following comments for the study area have relevance in this regard:

- i. The gravelly/sandy residual subsoils and sandstone bedrock are anticipated to classify between a G7 to G9 quality material in terms of TRH14, 1985 (generally good to fair subgrade

materials). Where gravelly/sandy soils of G9 quality (or better) are encountered, the materials should be ripped to the depths specified by the Engineer and re-compacted to 95% Modified AASHTO maximum dry density. A design CBR of 8 - 10 can be used in this instance.

- ii. The sandy colluvium/hillwash (transported soils) subsoils on site are anticipated to not satisfy the criteria for a G9 quality material.

The above information is inferred and is subject to a Detailed Geotechnical Investigation which will include Laboratory testing for final confirmation.

7.6. Suitability of Insitu Materials for Use as Trench Backfill

Materials classifying as Selected Granular Materials i.e. "Bedding Sands" and Select Backfill in terms of SANS 1200LB definitions are anticipated to not be present on site. Accordingly, allowances for importing suitable sands for support and covering of pipes in service trenches should be made.

However, the materials on site can be used as general trench backfill above pipes.

The above information is inferred and is subject to a Detailed Geotechnical Investigation which will include Laboratory testing and pipe details for final confirmation.

7.7. NHBRC Classification of the Study Area

According to the guidelines provided by the NHBRC, it is anticipated that the site classifies as **C/C1-R** – Study area underlain by compressible and potentially collapsible sandy/gravelly soils with areas of shallow bedrock occurring generally less than 1.5 metre below EGL.

The inferred NHBRC classification boundaries are indicated in **FIGURE 2**.

The specifications following the NHBRC guidelines, together with the foundation recommendations, are listed below in **Tables 1 and 2**.

Table 1: Residential site class designations (from NHBRC)

TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSIBLE SOILS	<5 5.0 – 10	75% 75%	C C1
Rock (excluding mudrocks which may exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R

Table 2: Foundation design, building procedures and precautionary measures for single storey residential structures founded on collapsible soil horizons (from NHBRC Part 1)

SITE CLASS	ESTIMATED TOTAL SETTLEMENT (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
C	< 5	Normal	- Normal construction (strip footing or slab on the ground foundations) - Good site drainage
C1	5 – 10	Modified Normal	- Reinforced strip footings. - Articulation joints at all internal / external doors and openings. - Light reinforcement in masonry. - Site drainage and plumbing / service precautions.
		Compaction of in situ soils below individual footings	- Remove in situ material below foundation to a depth of 1.5m times the foundation width or to a competent horizon and replace with material compacted to 93 % MOD ASSHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip foundation and light reinforcement in masonry.
		Deep strip foundations	- Normal construction with drainage requirements - Founding on a competent horizon below the problem horizon
		Soil Raft	- Remove all necessary parts of expansive horizon to 1,0 m beyond the perimeter of the building and replace with inert backfill compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7,5 mm, or construction type appropriate to residual movements. - Site drainage and plumbing / service precautions.

7.8. Foundation Recommendations

Considering the topography of the site and the soils encountered, several founding systems may be adopted. The type of foundation system selected will depend on the structure type, the soil type and the thickness of the soil cover over a competent founding layer. Various foundation options are discussed below.

7.8.1. Raft Foundation

In adopting the raft founding solution on this project the following recommendations have relevance.

- i. The stiffened raft foundation should comprise a grillage of reinforced concrete beams cast integrally with the floor slab. The stiffness of the raft should be sufficient to reduce the differential movements in the supporting soil to a level than can be tolerated by the structure. In practice, it is often uneconomical to provide a raft stiff enough to allow the use of solid brickwork without movement joints, and articulated brickwork is therefore, recommended.
- ii. Additionally, the employment of pads keyed into competent bedrock would further enable the raft design to be optimised to counteract against differential settlements. This is particularly important where the structure straddles the cut/fill line on any given platform.
- iii. In the construction of the structures an allowable ground bearing pressure of 75kPa can be adopted for founding purposes for structures located at a depth of 0.5m and placed on at least medium dense residual gravelly/sandy soils. A maximum allowable ground bearing pressure of 150kPa can be considered for structures located in weathered bedrock; structures located on fill need to be supported off pads founded onto the intact bedrock.

7.8.2. Reinforced Concrete (R.C.) Strip Footings

Alternatively reinforced concrete (R.C.) strip footings and ground beams on mass concrete pads can be considered. The economic use of a founding solution comprising strip footing and R.C. ground beam on pad bases is also likely to prove feasible over the site where approved founding materials (rock) occur within 1.5 metres of finished platform level.

An allowable ground bearing pressure of 75kPa can be adopted for founding purposes for structures located at a depth of 0.5m medium dense residual gravelly/sandy soils. A maximum allowable ground bearing pressure of 150kPa can be considered for structures located in weathered bedrock

Furthermore, by virtue of its relative simplicity, this founding solution lends itself to adoption by emerging subcontractors under the guidance of a main housing contractor as part of a labour-based contract.

The site will be classified during the Detailed Geotechnical Investigation in accordance with the guidelines provided by the National Home Builders Registration Council (NHBRC).

8. STORMWATER MANAGEMENT

The use of soakpits to dispose of stormwater runoff is not recommended due to the likely occurrence of a perched water table over the majority portion of the study area (note, the presence of shallow depth to bedrock is a clear indication of a perched water table during rainy periods).

It is important that the design of the stormwater management system allow for the drainage of accumulated surface water. It is recommended that all surface water be suitably directed by use of surface drains and controlled release to low points (drainage lines or streams).

Both during and after construction, the site should be well graded to permit water to readily drain away and to prevent ponding of water anywhere on the surface of the ground. All terraces and earthworks in general should be sloped to a gradient to prevent ponding and ingress of water into the subsurface soils.

9. RECOMMENDED ADDITIONAL WORK

It must be appreciated that the above recommendations have been based solely on the desktop study of the site. In order to provide more accurate recommendations for design purposes, the following additional geotechnical work is required for this site:

- i. Machine excavated test pits for the logging/profiling and sampling of soil and bedrock horizons. This will provide a visual assessment of the soil and bedrock strata, variation in depths to bedrock and an assessment of the excavation requirements, which is essential for budgeting and construction costs;
- ii. CBR Dynamic Cone Penetrometer (DCP) tests to gauge the in-situ relative densities of the subsoils with depth; and
- iii. Laboratory tests on soil and bedrock samples to allow for more accurate material classification and recommendations for use in earthworks, foundations, roads etc.

10. CONCLUSION

This report details the results of a Preliminary Geotechnical Investigation for the “Greater Grabouw Housing Development - Rooidakke (on Erf 313), Theewaterskloof Municipality”.

The soil profile encountered is expected to comprise a light grey to greyish brown, fine grained, silty SAND (colluvium/hillwash transported soils) which overlies a yellowish brown/light brown to khaki brown fine to coarse grained gravelly SAND to sandy GRAVEL (residuum), in turn overlying weathered fine to coarse grained gritty sandstone bedrock.

The most important factor in the stable development of the site is the control and removal of both surface and groundwater from the site.

Shallow groundwater seepage can be anticipated along the low-lying areas and along drainage lines and valley head areas. A perched groundwater table can be anticipated at shallow depths (generally less than 1.5 metres below EGL, perched on the shallow bedrock) both during and after periods of rainfall and/or during the high rainfall season.

A detailed geotechnical investigation will be required to determine the limits of slope stability across the site. Development is not recommended in seepage areas where shallow groundwater seepage and/or surface water activity is imminent, particularly after periods of heavy rain.

The gravelly/sandy subsoils and sandstone bedrock are anticipated to classify between a G7 to G9 quality material in terms of TRH14, 1985 (generally good to fair subgrade materials). The sandy colluvium/hillwash (transported soils) subsoils on site are anticipated to not satisfy the criteria for a G9 quality material.

Materials classifying as Selected Granular Materials i.e. “Bedding Sands” and Select Backfill in terms of SANS 1200LB definitions are anticipated to not be present on site. However, the materials on site can be used as general trench backfill above pipes.

According to the guidelines provided by the NHBRC, it is anticipated that the site classifies as **C/C1-R** – Study area underlain by compressible and potentially collapsible sandy/gravelly soils with areas of shallow

bedrock occurring generally less than 1.5 metre below EGL.

The use of soakpits to dispose of stormwater runoff is not recommended due to the likely occurrence of a perched water table over the majority portion of the study area (note, the presence of shallow depth to bedrock is a clear indication of a perched water table during rainy periods).

A raft foundation can be selected across most of the area/s to support the proposed structures. Cognisance of the requirement of pad supports to the raft beneath the fill portion of the layout with pads keyed into bedrock should be made.

The economic use of comprising strip footing and R.C. ground beam on pad bases is also likely to prove feasible over the site where approved founding materials occur within 1.5m of finished platform levels.

Taking all the factors into account it is considered that the site is suitable for the proposed development, subject to the findings of a detailed geotechnical investigation.

This report has been based solely on a desktop study. To provide more accurate recommendations, it is recommended that a Detailed Phase 1 Geotechnical Investigation be carried out across the study area (comprising inspection pits, CBR Dynamic Cone Penetrometer tests, laboratory sampling etc.) prior to engineering design and construction. As such, MDP would be able to assist in this regard.

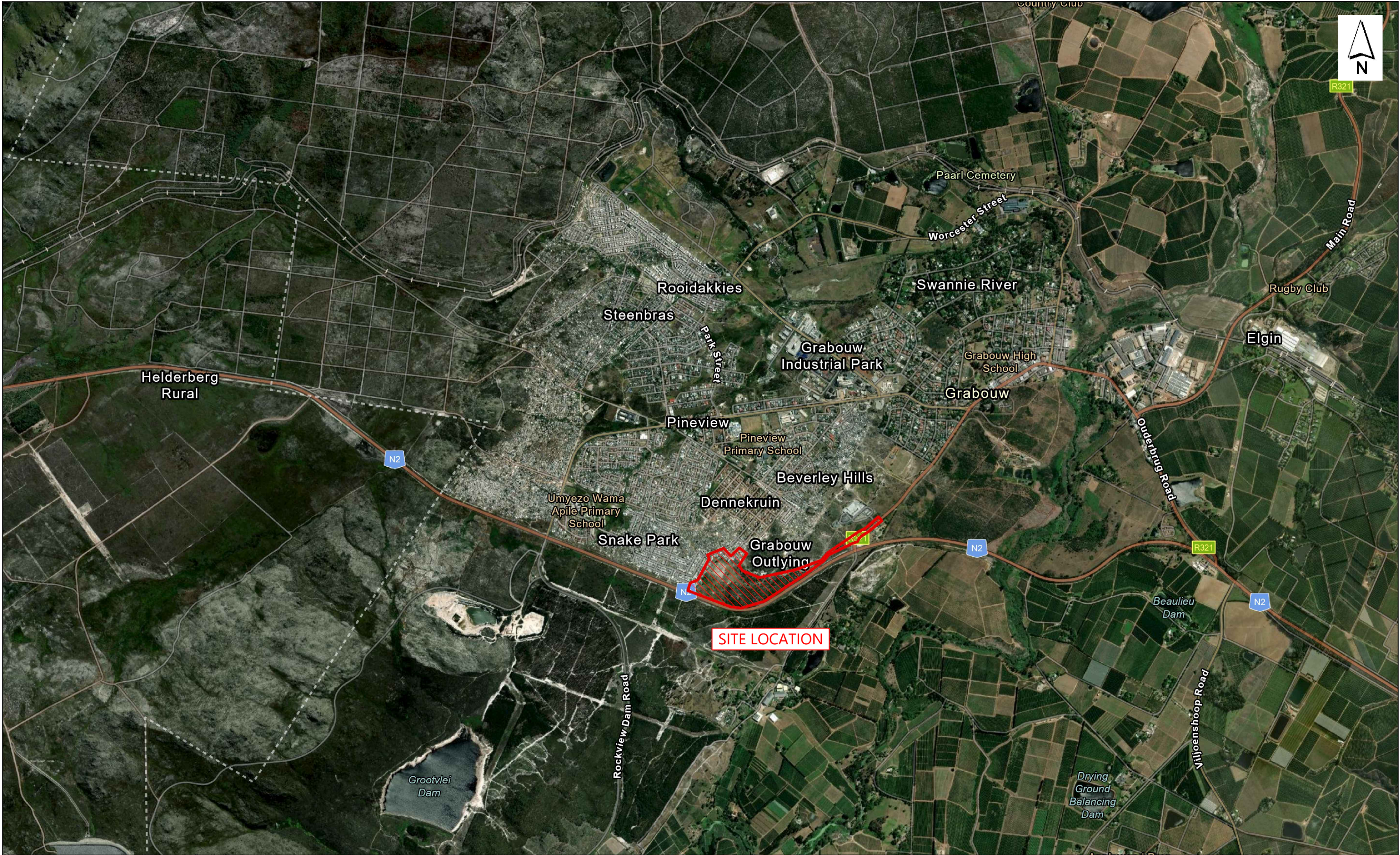


Y. Hansa

for MELIS & DU PLESSIS CONSULTING ENGINEERS (Pty) Ltd

FIGURE 1

Locality Plan



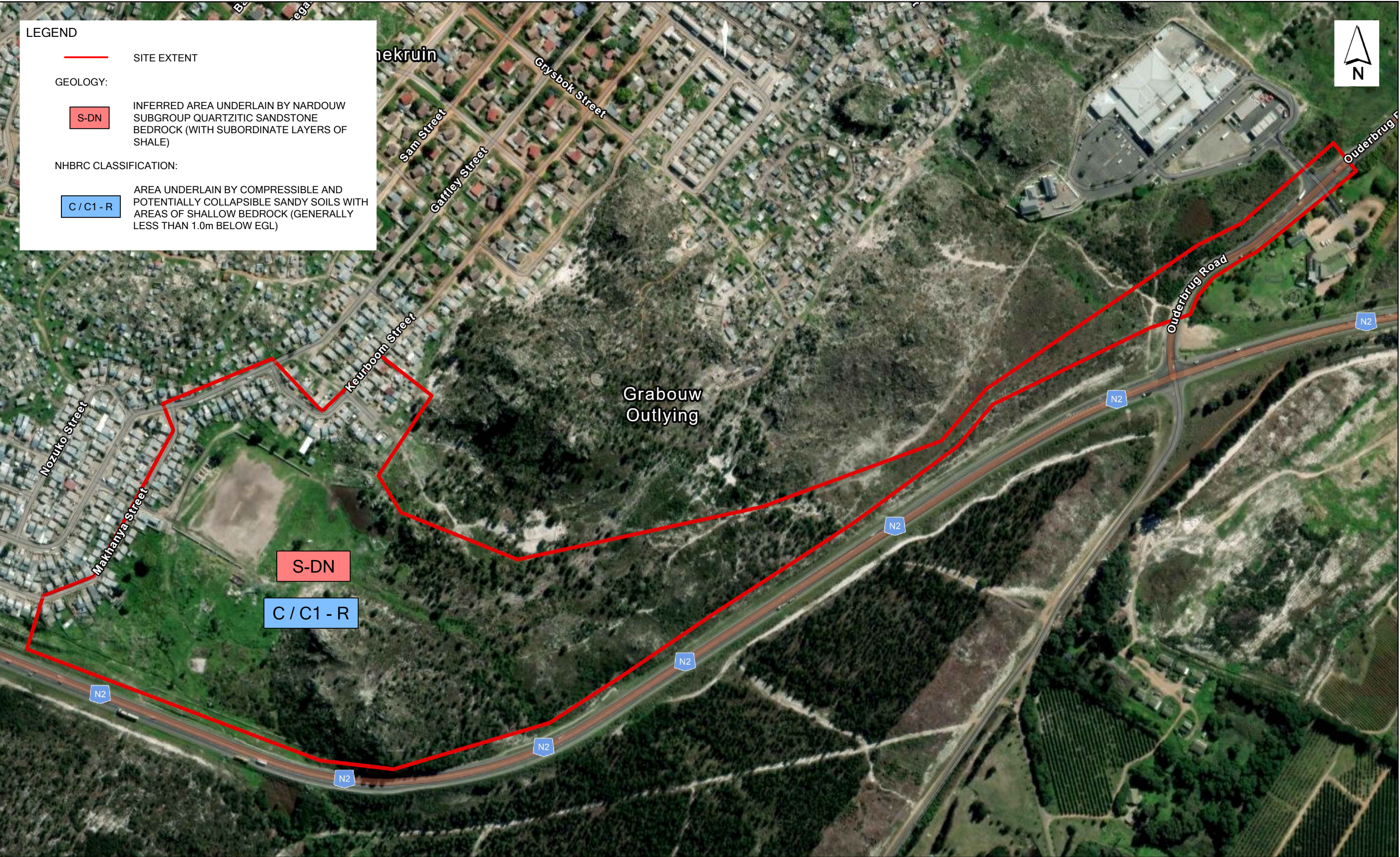
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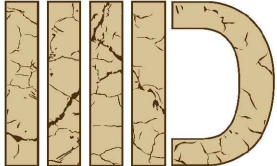
FIGURE 1: LOCALITY PLAN

DRAWING No.		MD1483-24/11-3	
PROJECT No.		MD1483-2	REVISION No.
			0
DATE		26-11-2024	SCALE
			1:25 000

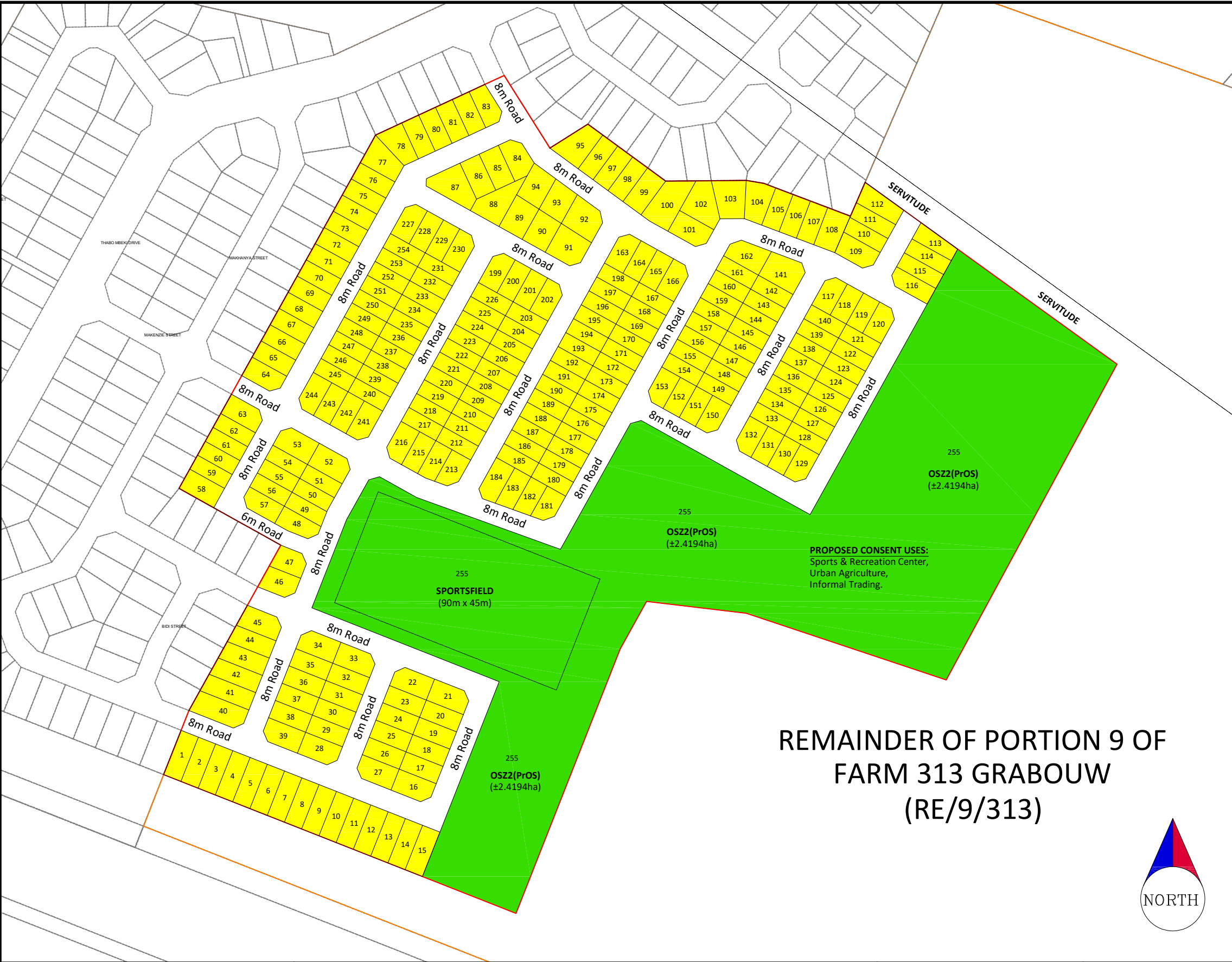
FIGURE 2

Geology & NHBRC Classification



 MELIS & DU PLESSIS CONSULTING ENGINEERS (PTY) LTD	GREATER GRABOUW HOUSING PROJECT - ERF 313 : GEOTECHNICAL DESKTOP STUDY		DRAWING No. MD1483-24/11-4	
	FIGURE 2: GEOLOGY & NHBRC CLASSIFICATION		PROJECT No. MD1483-2	REVISION No. 0
			DATE 26-11-2024	SCALE 1:3000

ANNEXURE B: CONCEPT TOWN PLANNING LAYOUT



REMAINDER OF PORTION 9 OF
FARM 313 GRABOUW
(RE/9/313)

GRABOUW HOUSING PROJECT
Remainder of Portion 9 of the Farm
Oude Brug 313, Grabouw

	PROPERTY	TITLE DEED	SG DIAGRAM	AREA
	Remainder of Portion 9 of the Farm 313	T98690/1999 T10304/2005	SG180/1999	45.6977 ha
	Proposed Portion A (a portion of RE/9/313)			6.3655 ha

PROPOSED SUBDIVISION & ZONING:

	LAND USE	ZONING	ERF NRS	NR ERVEN
	Subsidy Housing	Single Residential Zone 2 (SRZ2)	1 - 254	254
	Private Open Space	Open Space Zone 2 (OSZ2)	255	1
	Streets / Public Roads	Transport Zone 2 (TUZ2)	Remainder	1
	SUB-TOTAL			256

ZONING & LAND USE NOTES:

- RESIDENTIAL LAND USES:
 - The proposed layout makes provision for SUBSIDY Housing on Single Residential Zone 2 (SRZ2) erven.
 - Proposed Consent Uses on SRZ2 erven: House Shop rights on all corner erven.
 - Erven can accommodate Freestanding dwelling units, Semi-detached dwelling units and 2-Unit Duplexes.
- OPEN SPACE LAND USES
 - Proposed Erf 255: to be zoned as Open Space Zone 2 (OSZ2)(Private Open Space) and used as a park.
 - Consent uses proposed on Erf 255: Sport & Recreation Centre, Urban Agriculture and Informal Trading.
- OTHER NON-RESIDENTIAL LAND USES
 - All internal roads to be zoned Transport Zone 2 (TUZ) and used as Public Roads / Streets.

GENERAL NOTES:

- All measurements, areas and distances are indicative and must be confirmed by a Professional Land Surveyor.
- The property is owned by the Theewaterskloof Municipality.
- There are no known servitudes on the proposed subdivided Portion A (a Portion of the Remainder of Portion 9 of Farm 313).

CLIENT / OWNER INFORMATION

THEEWATERSKLOOF MUNICIPALITY

Contact: Mr Landile Litholi
Position: Head: Project Implementation
Tel: 028-214-3300 / 028-214-3427
Cell: 076-183-7752
Email: landileli@twk.gov.za
Web: www.twk.gov.za

DRAWING TITLE

ZONING PLAN

PLAN NUMBER

4

SCALE

NTS

SHEET SIZE

A3

SHEET NUMBER

1 of 1

PROJECT NAME

GREATER GRABOUW HOUSING: RE/9/313

DRAWING TITLE CODES

CP: Consolidation Plan
DF: Development Framework
LP: Locality Plan
LUP: Land Use Plan
SDP: Site Development Plan
SLP: Site Layout Plan
SUB: Subdivision Plan
ZP: Zoning Plan

DRAWING DISCIPLINE CODES

TRP: Town & Regional Planning
TP: Transportation Planning

DRAWING STATUS CODES

D: Draft
F: Final

DRAWING NUMBER

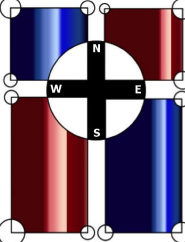
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20241017 - D01

PROFESSIONAL PLANNERS
& PROJECT MANAGERS

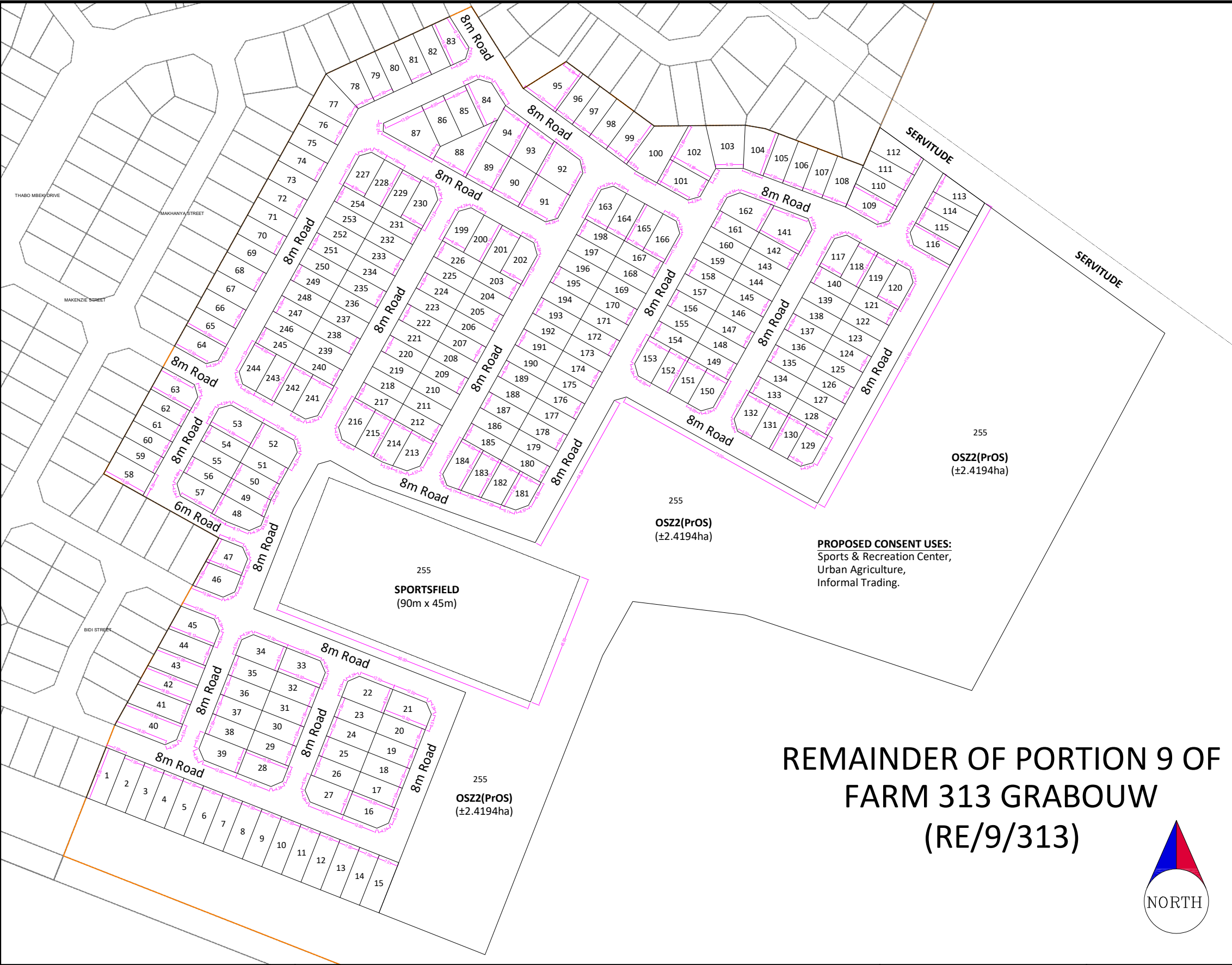
MARTIN JONKER
Tel: 084-410-6132
Fax: 086-524-8738
Email: martinj@plan4sa.co.za
Web: www.plan4sa.co.za

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PLAN 4 SA



Established 2015



REMAINDER OF PORTION 9 OF
FARM 313 GRABOUW
(RE/9/313)



GRABOUW HOUSING PROJECT
Remainder of Portion 9 of the Farm
Oude Brug 313, Grabouw

	PROPERTY	TITLE DEED	SG DIAGRAM	AREA
	Remainder of Portion 9 of the Farm 313	T98690/1999 T10304/2005	SG180/1999	45.6977 ha
	Proposed Portion A (a portion of RE/9/313)			6.3655 ha

PROPOSED SUBDIVISION & ZONING:

	LAND USE	ZONING	NR ERVEN	AREA (m²)	AREA (ha)	AREA (%)
	Subsidy Housing	SRZ2	254	26,638	2.6638	41.85%
	Private Open Space	OSZ2	1	24,194	2.4194	38.01%
	Public Streets / Roads	TUZ2	1	12,822	1.2822	20.14%
	TOTAL		256	63,655	6.3655	100%

SITE DEVELOPMENT PLAN NOTES:

- All measurements, areas and distances are indicative and must be confirmed by a Professional Land Surveyor.
- ROADS
 - Except for 1 x 6m wide road, all other internal roads have an 8m road reserve.
 - Access to the site is obtained from 4 access points on its western boundary which links up with the existing neighbourhood to the west of the site.
- RESIDENTIAL BLOCKS / ERVEN
 - The proposed layout makes provision for 254 x residential erven to be used for Subsidy Housing purposes. Proposed zoning is Single Residential Zone 2 (SRZ2).
 - Proposed consent uses on residential erven: House Shop rights for all corner erven in the development.
 - Block widths are 30m except for blocks on the boundaries of the site.
- DENSITY
 - Gross density: ± 40 du/ha
 - Nett density: ± 95 du/ha
- NON-RESIDENTIAL ERVEN
 - 1 x Private Open Space (OSZ2) zoned site which will accommodate a soccerfield. Proposed consent uses on this site includes Sports & Recreation Center, Urban Agriculture and Informal Trading.
 - Existing community uses (Place of Instruction, Place of Worship, etc.) in the neighbouring areas will be used.

CLIENT / OWNER INFORMATION

THEEWATERSKLOOF MUNICIPALITY

Contact: Mr Landile Litholi
Position: Head: Project Implementation
Tel: 028-214-3300 / 028-214-3427
Cell: 076-183-7752
Email: landileli@twk.gov.za
Web: www.twk.gov.za

DRAWING TITLE

DRAFT SITE DEVELOPMENT PLAN

PLAN NUMBER

3

SCALE

NTS

SHEET SIZE

A3

SHEET NUMBER

1 of 1

PROJECT NAME

GREATER GRABOUW HOUSING: RE/9/313

DRAWING TITLE CODES

CP: Consolidation Plan
DF: Development Framework
LP: Locality Plan
LUP: Land Use Plan
SDP: Site Development Plan
SLP: Site Layout Plan
SUB: Subdivision Plan
ZP: Zoning Plan

DRAWING DISCIPLINE CODES

TRP: Town & Regional Planning
TP: Transportation Planning

DRAWING STATUS CODES

D: Draft
F: Final

DRAWING NUMBER

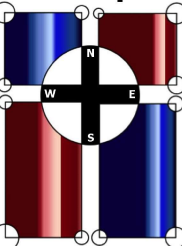
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PROFESSIONAL PLANNERS
& PROJECT MANAGERS

MARTIN JONKER
Tel: 084-410-6132
Fax: 086-524-8738
Email: martinj@plan4sa.co.za
Web: www.plan4sa.co.za

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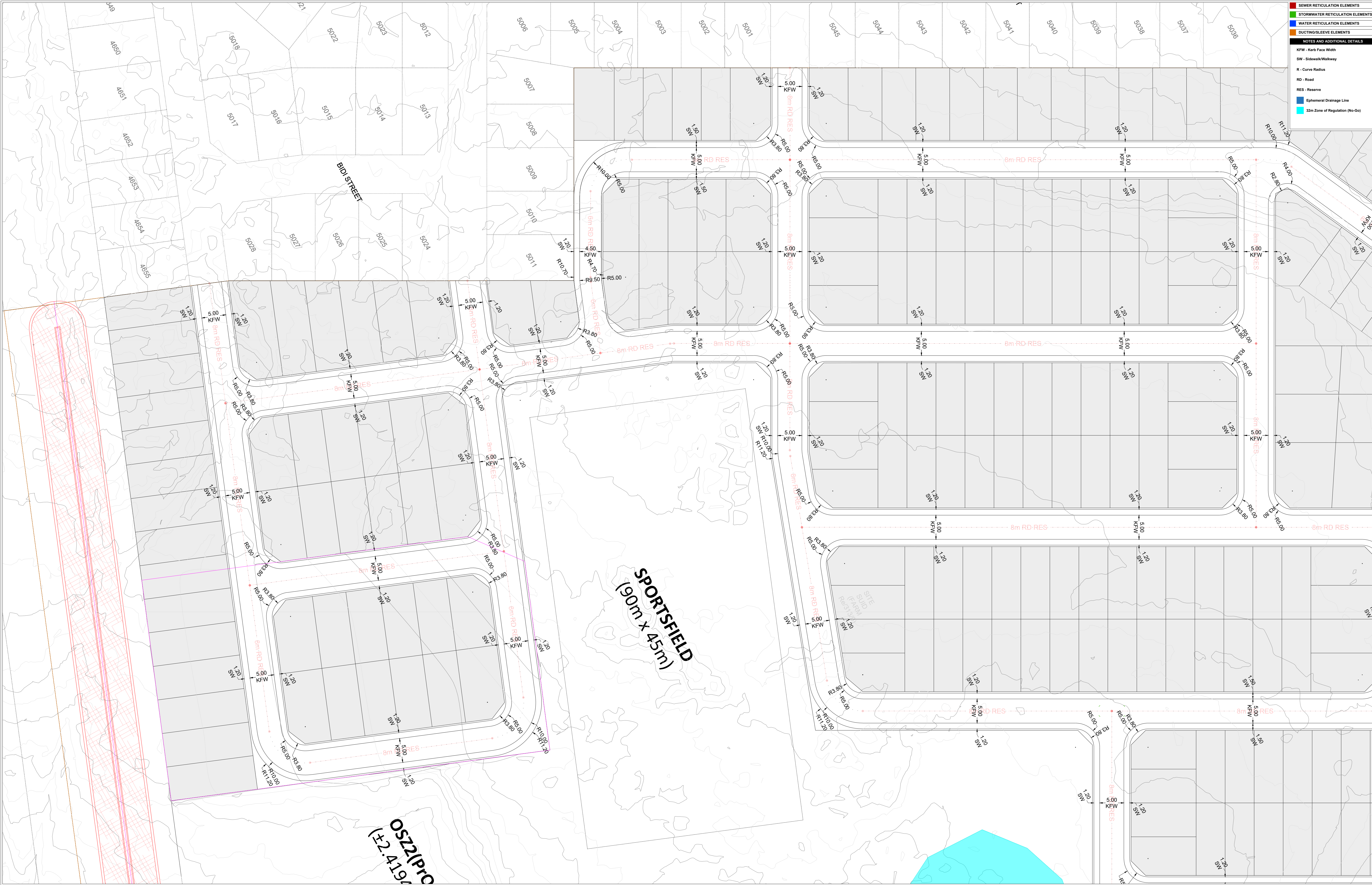


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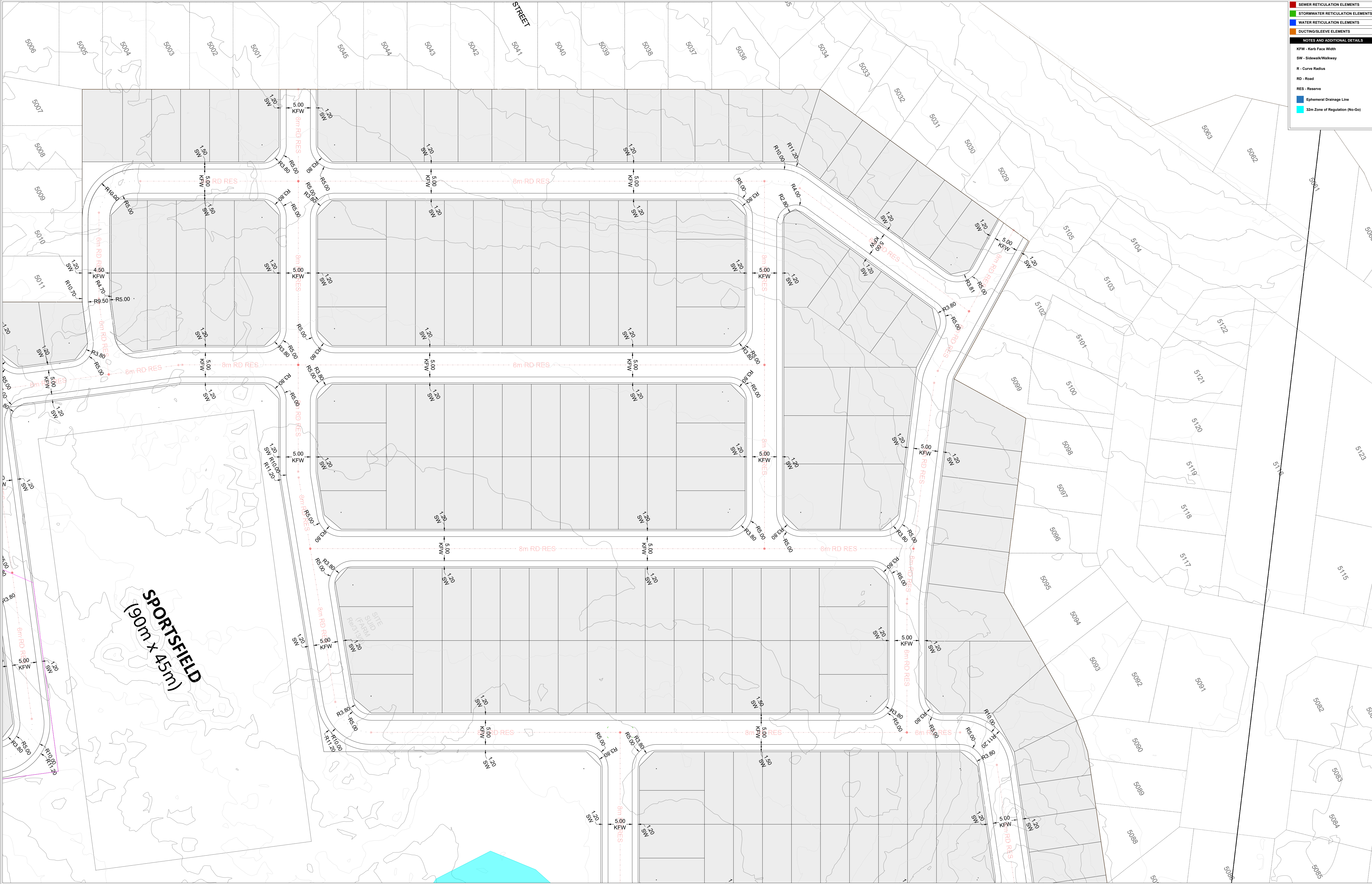
ANNEXURE C: PROPOSED ROADS LAYOUT



FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS		ENGINEERING ADVICE AND SERVICES WESTERN CAPE 8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992		CLIENT DETAILS		PROJECT	EAS JOB / CONTRACT NO.
	NO.	DATE	DESCRIPTION	APPROVED		DRAWN BY	DESIGNED BY	ERF 313, GRABOUW			EAS-2191			
						C. VAN DER MERWE	C. VAN DER MERWE				TECH 01/2022/23			
						APPROVED BY	DATE							
						G. DU PLESSIS	04/12/2024				DRAWING DESCRIPTION	EAS JOB / CONTRACT NO.		
											PROPOSED ROADS RESERVE LAYOUT	2191/0412/RDS/01		
				A1	1:600		ECSA REG. NUMBER: 2080039							



FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS	ENGINEERING ADVICE AND SERVICES		CLIENTDETAILS	PROJECT	EAS JOB / CONTRACT NO.			
	NO.	DATE	DESCRIPTION	APPROVED	A1	1:350		DRAWN BY		DESIGNED BY		ERF 313, GRABOUW - GYPSEY QUEEN	EAS-2191		
								C. VAN DER MERWE		C. VAN DER MERWE			TECH 01/2022/23		
								APPROVED BY		DATE			8 St James Street, Audas Estate, Somerset West Cape Town 7130	04/12/2024	EAS JOB / CONTRACT NO.
								G. DU PLESSIS							2191/0412/RDS/02A



SEWER RETICULATION ELEMENTS

STORMWATER RETICULATION ELEMENTS

WATER RETICULATION ELEMENTS

DUCTING-SLEEVE ELEMENTS

NOTES AND ADDITIONAL DETAILS

KFW - Kerb Face Width

SW - Sidewalk/Walkway

R - Curve Radius

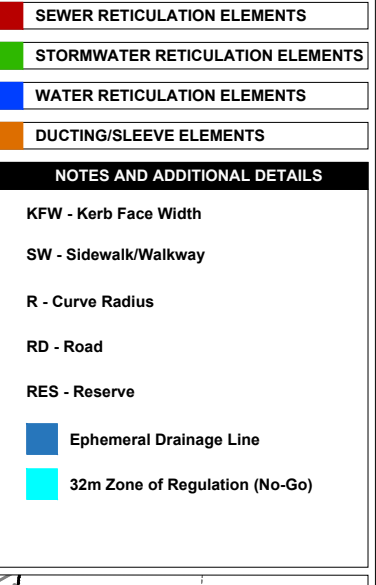
RD - Road

RES - Reserve

Ephemeral Drainage Line

32m Zone of Regulation (No-Go)

FOR REPORT	AMMENDMENTS				ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS		ENGINEERING ADVICE AND SERVICES WESTERN CAPE 8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992	CLIENTDETAILS Theewaterskloof Municipality	PROJECT		EAS JOB / CONTRACT NO.
	NO.	DATE	DESCRIPTION	APPROVED		DRAWN BY	DESIGNED BY	ERF 313, GRABOUW - GYPSEY QUEEN						
						C. VAN DER MERWE	C. VAN DER MERWE	EAS-2191						
						APPROVED BY	DATE	TECH 01/2022/23						
						G. DU PLESSIS	04/12/2024	EAS JOB / CONTRACT NO.						
						ECSA REG. NUMBER: 2080239								
								DRAWING DESCRIPTION						
								PROPOSED ROADS LAYOUT - PART B						
										2191/0412/RDS/02B				



AMMENDMENTS			
NO.	DATE	DESCRIPTION	APPROVED

SCALE ON ORIGINAL
PAPER SIZE

1:350



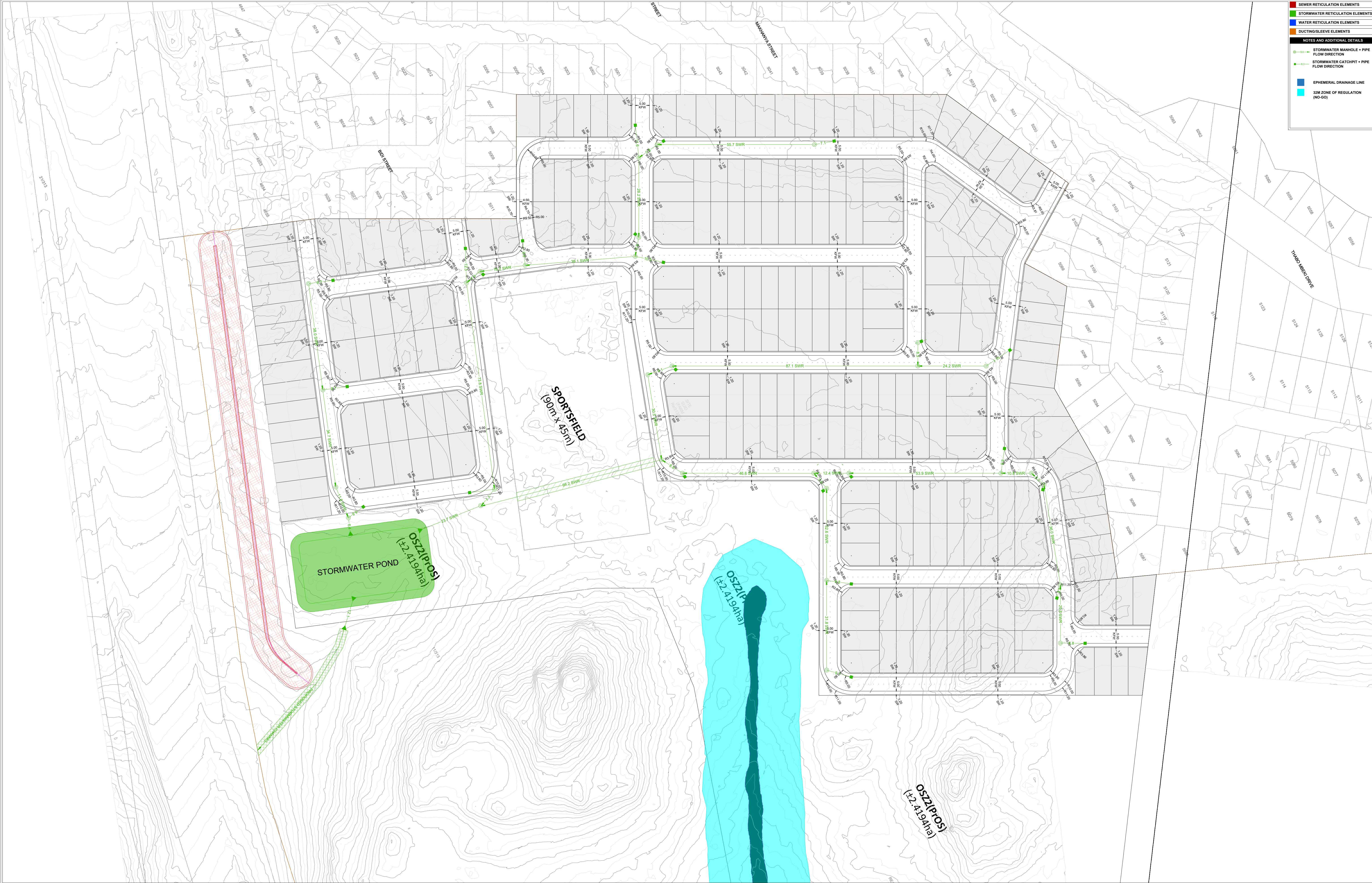
ECBA REG. NUMBER: 20090229



Theewaterskloof
Municipality

2191/0412/RDS/02C

ANNEXURE D: PROPOSED STORMWATER LAYOUT



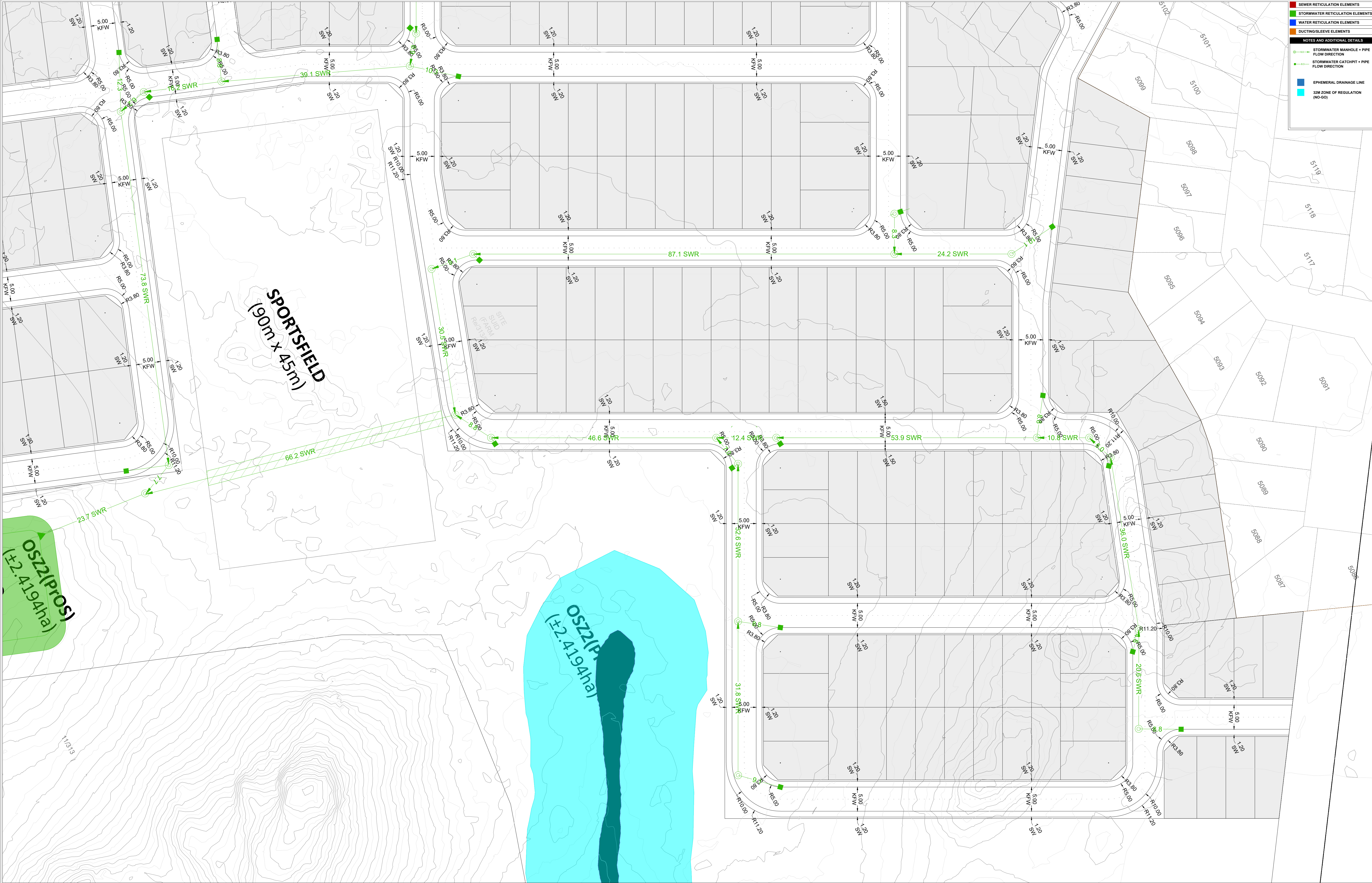
FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS	ENGINEERING ADVICE AND SERVICES			CLIENTDETAILS	PROJECT	EAS JOB / CONTRACT NO.			
	NO.	DATE	DESCRIPTION	APPROVED	A1	1:600	DRAWN BY	DESIGNED BY			8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992		ERF 313, GRABOUW	EAS-2191		
							C. VAN DER MERWE	C. VAN DER MERWE						TECH 01/2022/23		
							APPROVED BY	DATE						PROPOSED STORMWATER CONCEPT LAYOUT	EAS JOB / CONTRACT NO.	
							G. DU PLESSIS	04/12/2024								2191/0412/STW/01
							ECSA REG. NUMBER: 2080039									



FOR REPORT	AMMENDMENTS				ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS		ENGINEERING ADVICE AND SERVICES WESTERN CAPE 8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992		CLIENT DETAILS		PROJECT		EAS JOB / CONTRACT NO.
	NO.	DATE	DESCRIPTION	APPROVED					ERF 313, GRABOUW			EAS-2191				
												TECH 01/2022/23				
												EAS JOB / CONTRACT NO.				
												2191/0412/STW/02A				
					A1	1:350		DRAWN BY C. VAN DER MERWE		DESIGNED BY C. VAN DER MERWE	APPROVED BY G. DU PLESSIS		DATE 04/12/2024	ECSA REG. NUMBER: 2080039		



FOR REPORT				AMMENDMENTS		ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS		ENGINEERING ADVICE AND SERVICES		CLIENT DETAILS		PROJECT	EAS JOB / CONTRACT NO.	
				NO.	DATE	DESCRIPTION	APPROVED		DRAWN BY	DESIGNED BY	WESTERN CAPE		Theewaterskloof Municipality		ERF 313, GRABOUW	EAS-2191	
									C. VAN DER MERWE	C. VAN DER MERWE	8 St James Street, Audas Estate, Somerset West Cape Town 7130					TECH 01/2022/23	
									APPROVED BY	DATE	Tel/Fax: +27 (0)21 879 4992				DRAWING DESCRIPTION	EAS JOB / CONTRACT NO.	
									G. DU PLESSIS	04/12/2024					PROPOSED STORMWATER CONCEPT LAYOUT - PART B	2191/0412/STW/02B	
									ECSA REG. NUMBER: 2080039								



SEWER RETICULATION ELEMENTS

STORMWATER RETICULATION ELEMENTS

WATER RETICULATION ELEMENTS

DUCTING-SLEEVE ELEMENTS

NOTES AND ADDITIONAL DETAILS

STORMWATER MANHOLE + PIPE
FLOW DIRECTION

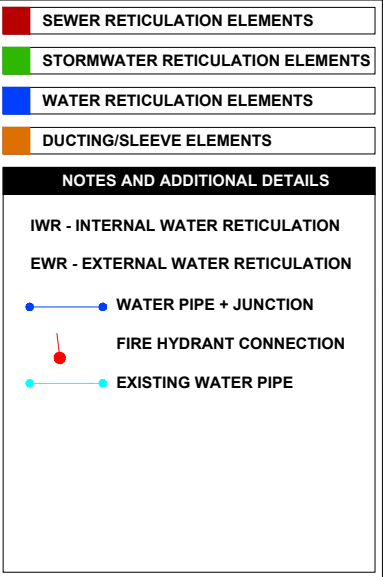
STORMWATER CATCHPIT + PIPE
FLOW DIRECTION

EPHEMERAL DRAINAGE LINE

32M ZONE OF REGULATION
(NO-GO)

FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS		ENGINEERING ADVICE AND SERVICES WESTERN CAPE 8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992		CLIENT DETAILS		PROJECT		EAS JOB / CONTRACT NO.	
	NO.	DATE	DESCRIPTION	APPROVED		DRAWN BY	DESIGNED BY	ERF 313, GRABOUW			EAS-2191					
						C. VAN DER MERWE	C. VAN DER MERWE	TECH 01/2022/23								
						APPROVED BY		DATE			DRAWING DESCRIPTION		EAS JOB / CONTRACT NO.			
						G. DU PLESSIS		04/12/2024			PROPOSED STORMWATER CONCEPT LAYOUT - PART C		2191/0412/STW/02C			
					A1	1:350		ECSA REG. NUMBER: 2080239								

ANNEXURE E: PROPOSED WATER LAYOUT



FOR REPORT

AMMENDMENTS			
NO.	DATE	DESCRIPTION	APPROVED

**ORIGINAL
PAPER
SIZE**

A1

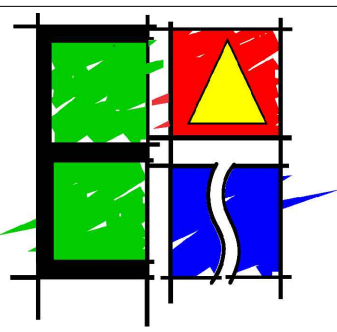
SCALE ON ORIGINAL
PAPER SIZE

1:600



APPROVALS	
DRAWN BY	DESIGNED BY
C. VAN DER MERWE	C. VAN DER MERWE
APPROVED BY	DATE
G. DU PLESSIS	04/12/2024

**ENGINEERING ADVICE
AND SERVICES**
WESTERN CAPE
8 St James Street, Audas
Estate, Somerset West
Cape Town
7130
Tel/Fax: +27 (0)21 879 4992

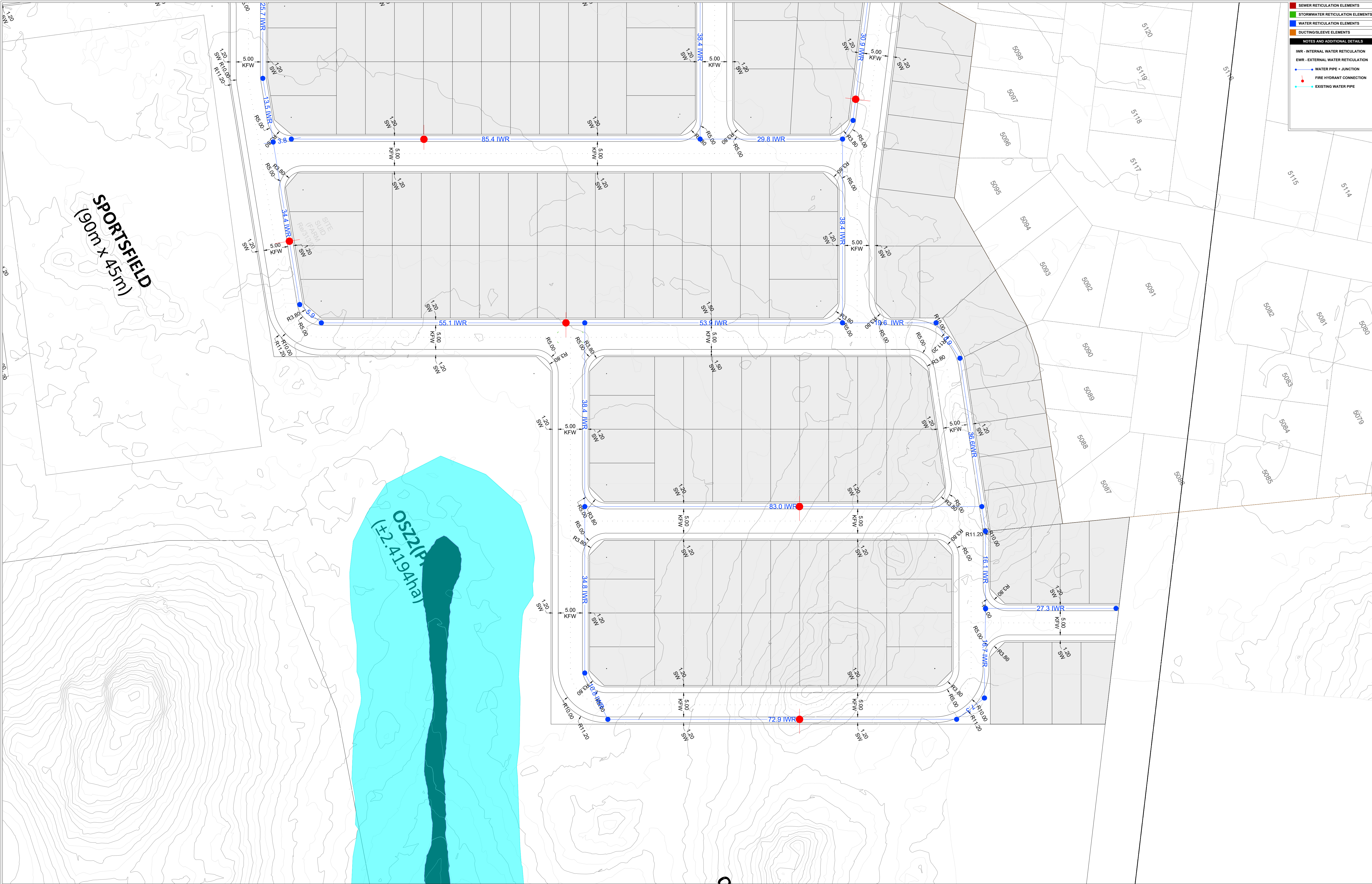


CLIENTDETAILS

Theewaterskloof
Municipality

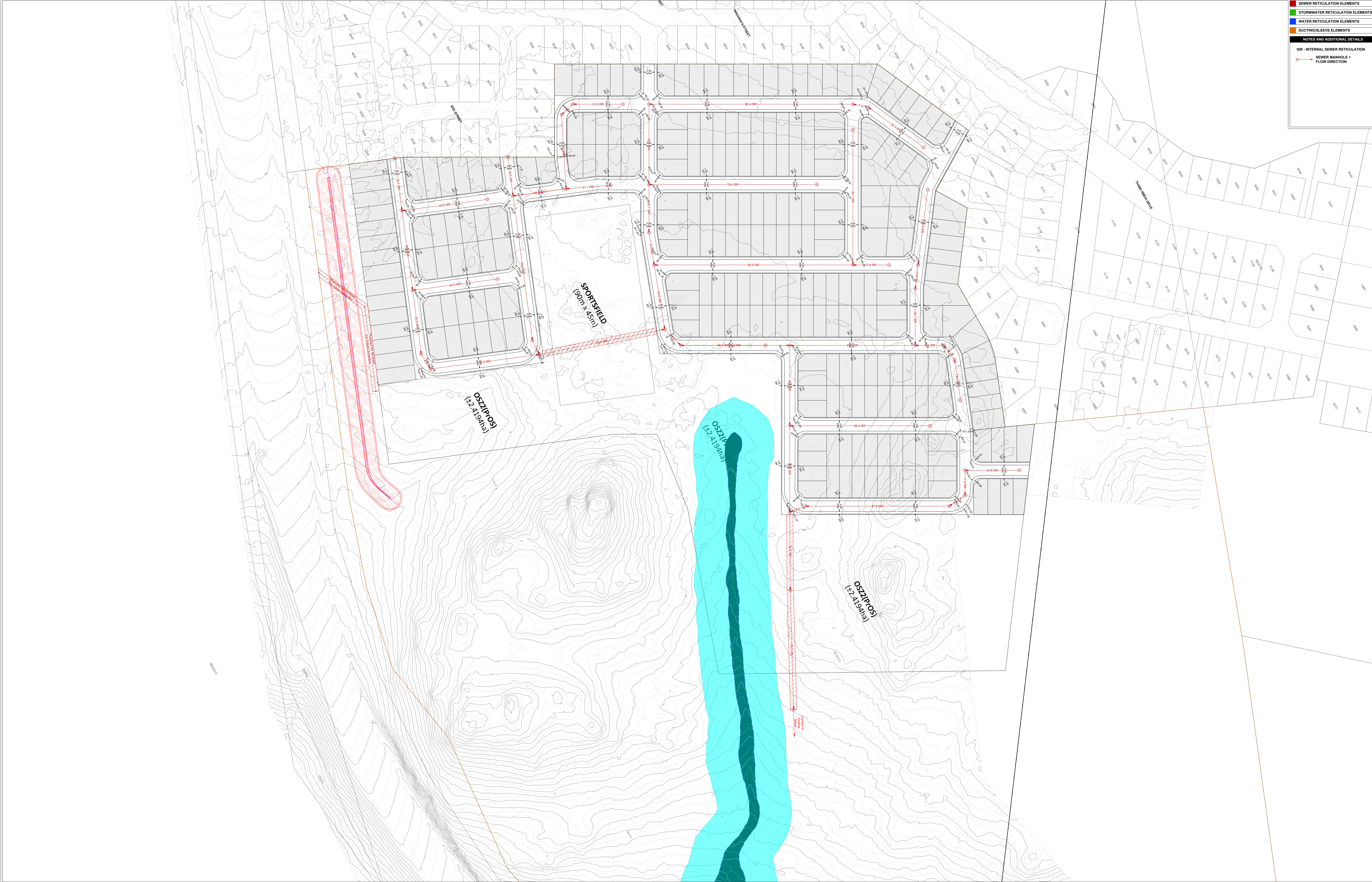
PROJECT
ERF 313, GRABOUW
DRAWING DESCRIPTION
PROPOSED WATER CONCEPT LAYOUT

EAS JOB / CONTRACT NO.
EAS-2191
TECH 01/2022/23
EAS JOB / CONTRACT NO.
2191/0412/WAT/01



FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS		ENGINEERING ADVICE AND SERVICES WESTERN CAPE 8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992		CLIENT DETAILS		PROJECT	EAS JOB / CONTRACT NO.
	NO.	DATE	DESCRIPTION	APPROVED		DRAWN BY	DESIGNED BY	ERF 313, GRABOUW			EAS-2191			
						C. VAN DER MERWE	C. VAN DER MERWE				TECH 01/2022/23			
						APPROVED BY	DATE				EAS JOB / CONTRACT NO.			
						G. DU PLESSIS	04/12/2024				2191/0412/WAT/02C			
								ECSA REG. NUMBER: 2080239						

ANNEXURE F: PROPOSED SANITATION LAYOUT



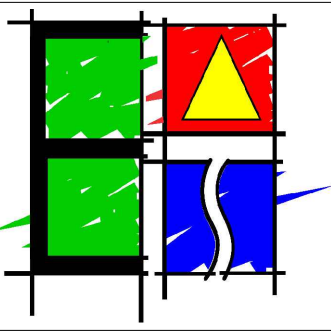
FOR REPORT

AMMENDMENTS			
NO.	DATE	DESCRIPTION	APPROVED

ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH
A1	1:800	

APPROVALS	
DRAWN BY C. VAN DER MERWE	DESIGNED BY C. VAN DER MERWE
APPROVED BY G. DU PLESSIS	DATE 04/12/2024
ECOA REG. NUMBER: 2080239	

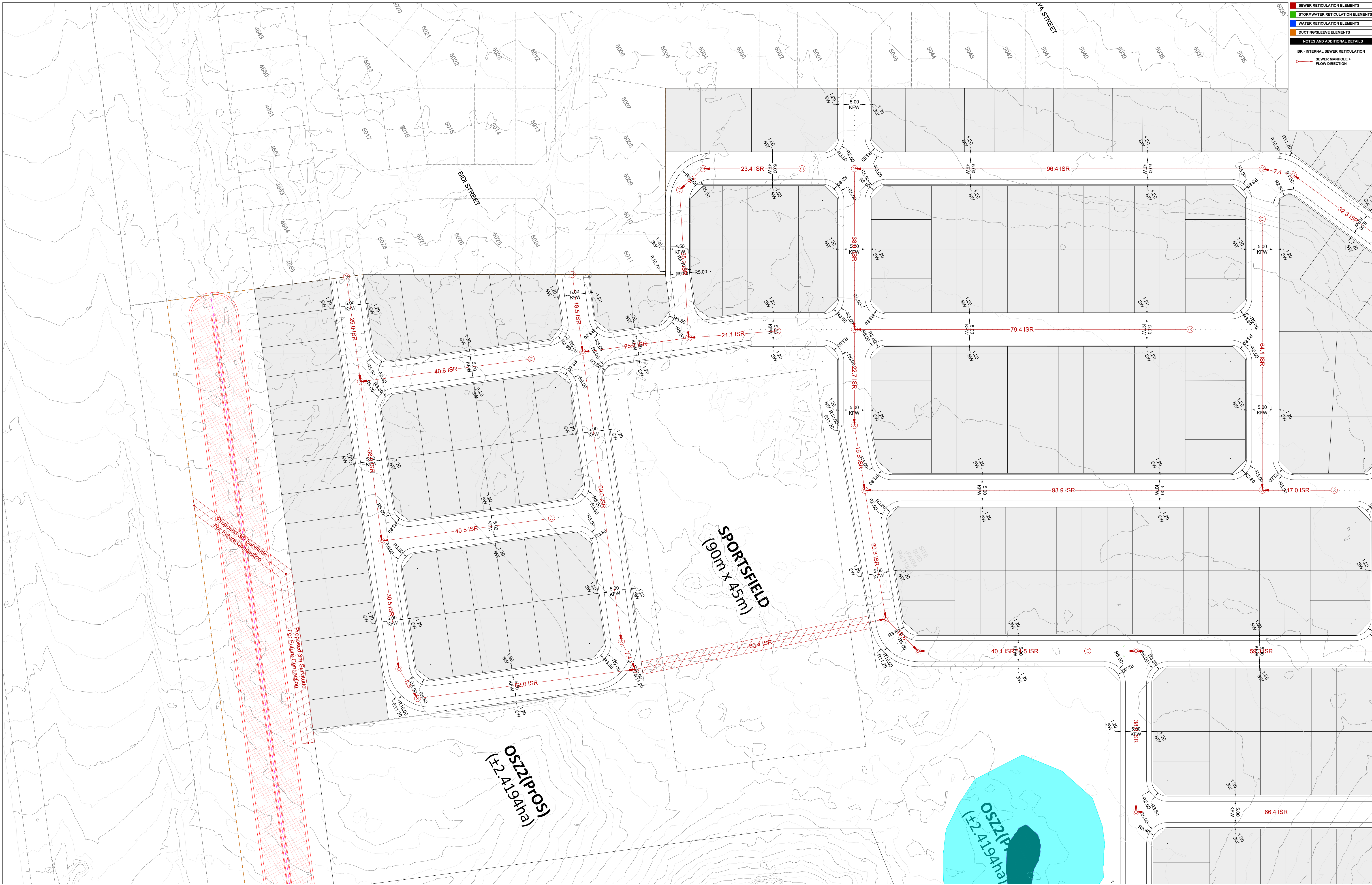
ENGINEERING ADVICE
AND SERVICES
WESTERN CAPE
8 St James Street, Audas
Estate, Somerset West
Cape Town
7130
Tel/Fax: +27 (0)21 879 4992



CLIENT DETAILS
Theewaterskloof
Municipality

PROJECT
ERF 313, GRABOUW
DRAWING DESCRIPTION
PROPOSED SEWER CONCEPT LAYOUT

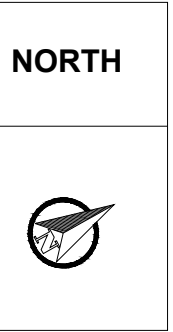
EAS JOB / CONTRACT NO.
EAS-2191
TECH 01/2022/23
EAS JOB / CONTRACT NO.
2191/0412/SEW/01



FOR REPORT

AMMENDMENTS			
NO.	DATE	DESCRIPTION	APPROVED

ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE
A1	1:400



APPROVALS	
DRAWN BY C. VAN DER MERWE	DESIGNED BY C. VAN DER MERWE
APPROVED BY G. DU PLESSIS	DATE 04/12/2024

ENGINEERING ADVICE AND SERVICES

WESTERN CAPE

8 St James Street, Audas Estate, Somerset West Cape Town 7130

Tel/Fax: +27 (0)21 879 4992

CLIENT DETAILS

PROJECT	ERF 313, GRABOUW
DRAWING DESCRIPTION	PROPOSED SEWER CONCEPT LAYOUT - PART A

EAS JOB / CONTRACT NO.	EAS-2191
TECH	01/2022/23
EAS JOB / CONTRACT NO.	2191/0412/SEW/02A



FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS	ENGINEERING ADVICE AND SERVICES		CLIENTDETAILS	PROJECT	EAS JOB / CONTRACT NO.	
	NO.	DATE	DESCRIPTION	APPROVED	A1	1:400		DRAWN BY		DESIGNED BY		ERF 313, GRABOUW	EAS-2191
								C. VAN DER MERWE		C. VAN DER MERWE		TECH 01/2022/23	
								APPROVED BY		DATE		PROPOSED SEWER CONCEPT LAYOUT - PART B	2191/0412/SEW/02B
								G. DU PLESSIS		04/12/2024			
								ECSA REG. NUMBER: 20800339					



FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS	ENGINEERING ADVICE AND SERVICES		CLIENTDETAILS	PROJECT	EAS JOB / CONTRACT NO.
	NO.	DATE	DESCRIPTION	APPROVED			DRAWN BY	DESIGNED BY		WESTERN CAPE	ERF 313, GRABOUW	EAS-2191
							C. VAN DER MERWE	C. VAN DER MERWE		8 St James Street, Audas Estate, Somerset West Cape Town 7130	TECH 01/2022/23	
							APPROVED BY	DATE				EAS JOB / CONTRACT NO.
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ANNEXURE G: PROPOSED GENERAL SERVICES LAYOUT



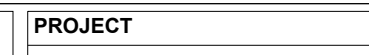
SEWER RETICULATION ELEMENTS

STORMWATER RETICULATION ELEMENTS

WATER RETICULATION ELEMENTS

DUCTING-SLEEVE ELEMENTS

NOTES AND ADDITIONAL DETAILS

FOR REPORT	AMMENDMENTS			ORIGINAL PAPER SIZE	SCALE ON ORIGINAL PAPER SIZE	NORTH	APPROVALS	ENGINEERING ADVICE AND SERVICES		CLIENTDETAILS	PROJECT	EAS JOB / CONTRACT NO.			
	NO.	DATE	DESCRIPTION	APPROVED	A1	1:800		DRAWN BY		DESIGNED BY		ERF 313, GRABOUW	EAS-2191		
								C. VAN DER MERWE		C. VAN DER MERWE			TECH 01/2022/23		
								APPROVED BY		DATE			8 St James Street, Audas Estate, Somerset West Cape Town 7130 Tel/Fax: +27 (0)21 879 4992	DRAWING DESCRIPTION	EAS JOB / CONTRACT NO.
								G. DU PLESSIS		04/12/2024				COMBINED PROPOSED SERVICES CONCEPT OVERVIEW LAYOUT	2191/0412/GEN/01
ECSA REG. NUMBER: 2080039															

ANNEXURE H: GLS BULK SEWER ASSESSMENT

LEGEND

Pipe diameters	
<= 110	
> 110 <= 160	
> 160 <= 225	
> 225 <= 315	
> 315 <= 400	
> 400	
Existing rising main	
Existing pumping station	
Existing Wastewater Treatment Plant (WWTP)	
Existing diversion structure	
Master plan item	
Future sewer system for existing stands	
Future sewer system (schematic)	
Future rising mains	
Future pumping station	
Future Wastewater Treatment Plant (WWTP)	
Future diversion structure	
Abandon rising mains	
Abandon pumping station	
Urban edge	
Cadastral boundaries	
Railway line	
River	
Future Development Areas	
Affordable housing	
Business/Commercial	
Densification (BCI)	
Resort	
Industrial	
Informal relocated	
Informal upgraded	
Mixed	
Other	
Parks and sportfields	
Public facilities	
Res 500	
Res 1000	
Res 1500	
Res 2000	

FUTURE DEVELOPMENT AREAS

Future Development Name	Anticipated Landuse	Area (ha)	Density (Units/ha)	No. of Units	Coverage (m ² /ha)	Time Related Phasing (years)	AADD (inc. UAW) (kUd)	PDDWF (kUd)
Grabouw								
G1	Informal upgraded	25.9	40	1037		3	414	323
G2	Informal upgraded	42.5	40	1700		3	608	605
G3	Informal upgraded	44.5	40	1782		2	713	656
G4	Public facilities	5.0			19 200	2	16	26
G5	Business/Commercial	8.7	40	348		5	157	127
G6	Informal upgraded	9.5	40	381		1	156	119
G7	Single residential 500	39.3	25	982		1	288	422
G8	Public facilities	2.4			9 500	5	38	27
G9	Business/Commercial	0.4			1 900	10	7	6
G10	Public facilities	0.7			3 000	10	12	8
G11	Business/Commercial	0.4			1 900	10	7	6
G12	Mixed	1.6	25	40		15	30	20
G13	Affordable housing	41.5	40	1659		20	747	534
G15	Public facilities	3.3			15 800	10	63	45
G16	Affordable housing	1.3	40	52		10	23	17
G17	Affordable housing	1.1	40	44		10	19	14
G18	Affordable housing	3.9	40	157		10	70	50
G19	Single residential 500	2.8	25	70		15	32	20
G20	Industrial	34.5	25	70	173 000	35	692	490
G21	Affordable housing	3.3	40	134		10	66	48
G22.1	Business/Commercial	2.7			13 100	5	48	39
G22.2	Business/Commercial	9.6			40 500	15	162	131
G23	Single residential 500	13.0	12	156		2	108	77
G24	Affordable housing	14.7	40	588		10	265	190
G25	Industrial	2.6			12 800	5	51	34
G26	Industrial	0.8			2 300	10	12	8
G27	Industrial	6.7			3 400	15	13	9
G28	Single residential 1000	26.1	13	338		15	335	255
G29	Public facilities	3.0			12 100	15	48	34
G30	Single residential 1000	49.3	8	373		30	337	
G31	Single residential 1500	8.4	8	64		30	95	64
G32	Densification (BCI)	20.9			83 700	15	64	45
G33	Densification (BCI)	1.5			7 000	15	4	
G34	Single residential 1000	50.7	13	634		20	634	490
G35	Single residential 1000	19.8	8	158		35	118	123
G36	Single residential 1000	13.5	8	102		25	102	86
Existing unreserved areas Grabouw				0				0
Additional information due to Master Plan items				0				0
Sub-Total Grabouw		510		10 372	438 600		7 320	5 123

* Existing development areas not in the treasury data
* Private development with its own bulk infrastructure

COST ESTIMATES AND PHASING OF THE REQUIRED WORKS

Item No.	MP Item Type	Description	Estimated cost * (R/y 2019/20 value)	Time Related Phasing	Comments	Project no.
Grabouw						
Distribution System Items						
TGS1.5	FM	885 m x 250 mm ¹ New Gravity	1 086 000	2020	When future areas G1 & G2 develop	TGS-PRJ-003
TGS1.6	FM	648 m x 315 mm ¹ New Gravity	1 968 000	2020	When future areas G1 & G2 develop	TGS-PRJ-003
TGS1.7	MP	285 m x 200 mm ¹ Upgrade existing Gravity (Investigate first)	1 372 000	2020	When existing outfall sewer reaches capacity	TGS-PRJ-006
TGS1.8	MP	189 m x 415 mm ¹ Upgrade existing Gravity	676 000	2040	When existing outfall sewer reaches capacity	TGS-PRJ-008
TGS1.9	FM	441 m x 400 mm ¹ New Gravity	2 667 000	2021	When existing outfall sewer reaches capacity	TGS-PRJ-005
TGS1.13	MP	514 m x 300 mm ¹ Upgrade existing Gravity (Investigate first)	2 397 000	2020	When existing outfall sewer reaches capacity	TGS-PRJ-004
TGS1.17	MP	267 m x 250 mm ¹ Upgrade existing Gravity	633 000	2022	When future areas G3 & G13 develop	TGS-PRJ-004
TGS1.18	FM	681 m x 250 mm ¹ New Gravity	1 530 000	2022	When future areas G3 & G13 develop	TGS-PRJ-004
TGS1.19	FM	131 m x 200 mm ¹ New Gravity	230 000	2022	Required to service unreserved informal areas in Grabouw	TGS-PRJ-004
TGS1.2	FM	287 m x 150 mm ¹ New Gravity	1 085 000	2021	When future area G2 develop	TGS-PRJ-006
TGS1.4	FM	502 m x 250 mm ¹ New Gravity	1 286 000	2023	New bulk sewer to service Gypsy Queen area	TGS-PRJ-006
TGS1.6	FM	580 m x 100 mm ¹ New Gravity	1 118 000	2025	Gypsy Queen internal sewer infrastructure (to be verified)	TGS-PRJ-006
TGS1.7	FM	290 m x 315 mm ¹ New Gravity	1 413 000	2023	New bulk sewer to service Gypsy Queen area	TGS-PRJ-006
TGS1.8	MP	Upgrade existing Flow Diversion (Investigate first)	329 200	2023	When existing outfall sewer reaches capacity (Investigate existing diversion structures on bulk sewer)	TGS-PRJ-006
TGS1.9	MP	11 m x 315 mm ¹ Upgrade existing Gravity	164 400	2023	With implementation of item TGS1.8	TGS-PRJ-006
TGS1.10	MP	402 m x 315 mm ¹ Upgrade existing Gravity	1 304 000	2023	When existing outfall sewer reaches capacity	TGS-PRJ-006
TGS1.11	MP	30 m x 385 mm ¹ Upgrade existing Gravity (Investigate first)	760 000	2040	When existing outfall sewer reaches capacity	TGS-PRJ-008
TGS1.12	MP	133 m x 160 mm ¹ Upgrade existing Gravity (Investigate first)	364 000	2020	Investigate slope of existing sewer	TGS-PRJ-009
TGS1.13	MP	88 m x 160 mm ¹ Upgrade existing Gravity (Investigate first)	274 000	2040	Investigate slope of existing sewer	TGS-PRJ-009
TGS1.14	FM	1059 m x 200 mm ¹ New Gravity	2 307 000	2040	When future areas G19 & G20 develop (including N2 crossing)	TGS-PRJ-017
TGS1.5	FM	137 m x 200 mm ¹ New Gravity	305 000	2020	When future areas G25 & G34 develop	TGS-PRJ-010
TGS1.6	FM	1047 m x 200 mm ¹ New Gravity	2 273 000	2035	When future areas G28 & G30 develop	TGS-PRJ-010
TGS1.7	FM	270 m x 200 mm ¹ New Gravity	624 000	2035	When future area G28 develops	TGS-PRJ-010
TGS1.13	FM	1656 m x 200 mm ¹ New Gravity	3 684 100	2040	When future areas G25 & G34 develop (including river crossing)	TGS-PRJ-011
TGS1.2	FM	New Flow Diversion	588 000	2030	Re-direct flow to the new bulk sewer when Pineview PS is decommissioned	TGS-PRJ-002
TGS1.2	FM	New Flow Diversion	282 000	2028	When the Molteno PS is decommissioned	TGS-PRJ-001
TGS1.5	FM	84 m x 160 mm ¹ New Gravity	207 000	2025	When Molteno PS is decommissioned	TGS-PRJ-001
Pumping stations & rising mains						
TGS1.1	MPA	Abandon existing Pump Station	201 600	2020	Abandon existing pump station and rising main when new bulk sewer is constructed	TGS-PRJ-002
TGS1.3	MPA	Abandon existing Rising		2030	Abandon existing pump station and rising main when new bulk sewer is constructed	TGS-PRJ-002
TGS1.1	MPA	Abandon existing Pump Station	201 600	2025	Abandon existing pump station and rising main when new bulk sewer is constructed	TGS-PRJ-001
TGS1.4	MPA	Abandon existing Rising		2025	Abandon existing pump station and rising main when new bulk sewer is constructed	TGS-PRJ-001
TGS1.1	MPH	Upgrade existing Pump Station (Investigate first)	226 500	2025	Upgrade PS capacity to 40 l/s	TGS-PRJ-001
TGS1.1	MPH	New Pump Station	631 300	2040	New PS when future area G34 develops	TGS-PRJ-007
TGS1.2	FM	821 m x 90 mm ¹ New Rising	507 500	2040	When future PS G31 is constructed	TGS-PRJ-001
Bulk sewer system						
TGS1.1	FM	827 m x 675 mm ¹ New Gravity	5 620 000	2030	Required when Pineview PS reaches capacity	TGS-PRJ-002
TGS1.3	FM	816 m x 975 mm ¹ New Gravity	9 203 000	2035	New bulk sewer for Grabouw (requires to decommission the existing Molteno PS)	TGS-PRJ-001
TGS1.8	FM	1835 m x 875 mm ¹ New Gravity	11 011 700	2035	New bulk sewer for Grabouw	TGS-PRJ-001
TGS1.2	FM	New Pump Station	2 076 200	2030	New bulk PS when flow from the Pineview PS is redirected to Palmiet PS (40 l/s)	TGS-PRJ-002
TGS1.3	MP	678 m x 450 mm ¹ New Rising	3 186 100	2030	When new bulk Palmiet PS is constructed	TGS-PRJ-002
TOTALS			57 677 800			

* Costs include P&O's, Contingencies & Fees, but exclude EIA studies, registration of servitudes and/or land acquisition and VAT.

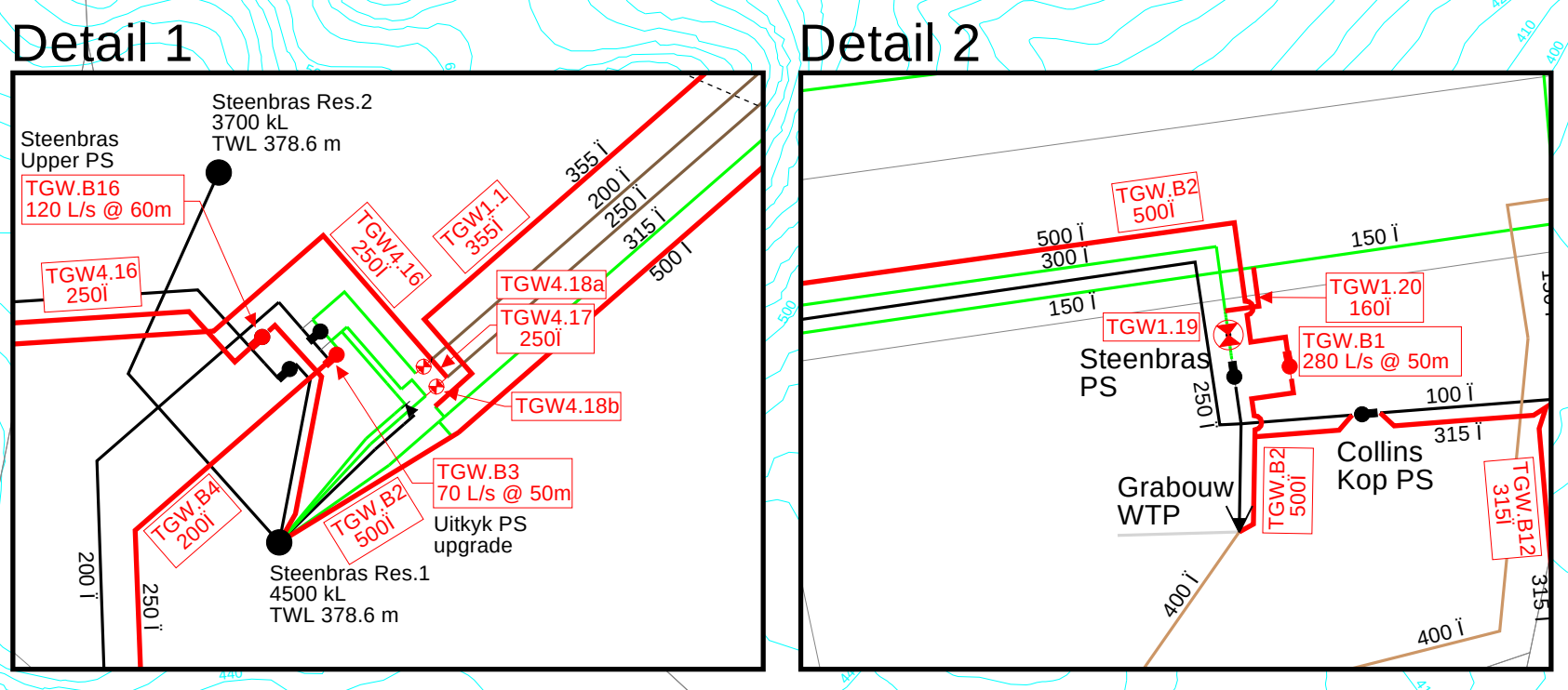
Note: FM = Future main - New gravity outfall sewer, rising main, pump station, diversion structure or WWTP
MP = Master Plan items which reinforce the existing system
MPA = Master Plan items which are eliminated
MPH = Master Plan Investigator - Upgrades for existing facilities, where there is uncertainty over e.g. actual diameters, actual slopes or actual pump capacities. The existing facilities must be investigated
MPB = Master Plan items of which the existing full flow velocity < 0.8 m/s investigate

LEGEND

Existing network pipes
Overberg Water pipes
Bulk pipeline
Bulk supply pipeline (Raw water)
Existing reservoir
Existing pumping station
Existing zone valve
Existing non-return valve
Existing pressure reducing valve
Existing borehole
Existing WTP
Master plan item
Future network pipes (schematically)
Future reservoir
Future pumping station
Future PRV
Future zone valve
Future non return valve
Future flow control valve
Urban edge
Cadastral boundaries
Railway line
River
Coastline

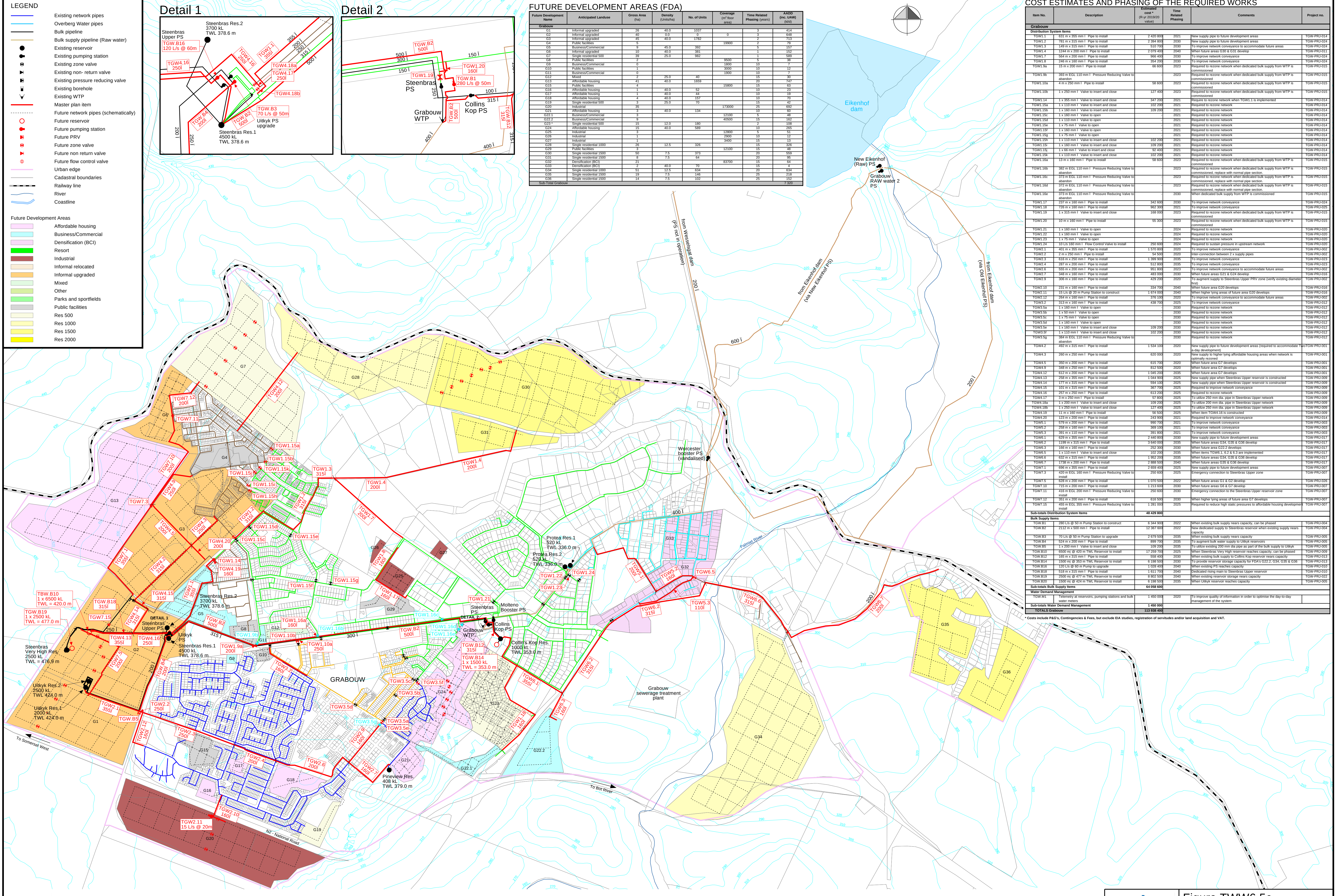
Future Development Areas

Affordable housing
Business/Commercial
Densification (BCI)
Resort
Industrial
Informal relocated
Informal upgraded
Mixed
Other
Parks and sportfields
Public facilities
Res 500
Res 1000
Res 1500
Res 2000



FUTURE DEVELOPMENT AREAS (FDA)

Future Development Name	Anticipated Landuse	Gross Area (ha)	Density (Units/ha)	No. of Units	Coverage (m² Roof area)	Time Related Phasing (years)	AADD (inc. UAW) (kL/d)
Grabouw							
G1	Informal upgraded	26	40.0	1037	0	3	414
G2	Informal upgraded	40	0.0	0	0	3	648
G3	Informal upgraded	29	40.0	1,162	19,900	2	713
G4	Public facilities	5		367		2	78
G5	Business/Commercial	10	45.0	391		5	157
G6	Informal upgraded	10	40.0	391		1	132
G7	Single residential 500	39	25.0	962	9,500	1	589
G8	Public facilities	2		100		5	38
G9	Business/Commercial	0			1800	10	7
G10	Public facilities	2		100	2000	10	12
G11	Business/Commercial	0			1500	10	7
G12	Mixed	0	25.0	40		10	12
G13	Alteable housing	41	40.0	1,659		10	747
G15	Public facilities	1	40.0	52	15,900	15	83
G16	Alteable housing	1	40.0	41		10	19
G17	Alteable housing	4	40.0	161		5	15
G18	Alteable housing	3	25.0	70		10	42
G19	Individual	39	40.0	1,34	17,500	25	692
G20	Individual	1		60		10	10
G21	Business/Commercial	3			12,100	5	48
G22	Business/Commercial	9			40,500	15	192
G23	Single residential 500	15	12.0	180		2	108
G24	Alteable housing	15	40.0	589	12,800	10	285
G25	Individual	1			2,900	10	12
G27	Individual	1			3,000	15	13
G28	Single residential 1000	26	12.5	326		15	326
G29	Individual	5			12,100	10	48
G30	Single residential 1500	50	7.5	373		20	559
G31	Single residential 1500	8	7.5	61		20	85
G32	Densification (BCI)	21			83,700	15	64
G33	Densification (BCI)	2	40.0	70		15	4
G34	Single residential 1000	11	12.5	144		20	624
G35	Single residential 1500	19	7.5	146		25	218
G36	Single residential 1500	14	7.5	102		25	132
Sub-totals Grabouw							1,250



COST ESTIMATES AND PHASING OF THE REQUIRED WORKS

Item No.	Description	Estimated cost (R-yr 2018/19 value)	Time Related Phasing	Comments	Project no.
Grabouw					
Distribution System Items					
TGW1.1	831 m x 355 mm I Pipe to install	2 420 800	2021	New supply pipe to future development areas	TGW-PRJ-004
TGW1.2	781 m x 315 mm I Pipe to install	2 384 800	2030	New supply pipe to future development areas	TGW-PRJ-024
TGW1.3	1 451 m x 315 mm I Pipe to install	3 010 700	2030	To improve network conveyance to accommodate future areas	TGW-PRJ-024
TGW1.4	1 244 m x 200 mm I Pipe to install	2 079 400	2040	When future areas G30 & G31 develop	TGW-PRJ-011
TGW1.7	564 m x 200 mm I Pipe to install	960 400	2030	To improve network conveyance	TGW-PRJ-024
TGW1.8	246 m x 150 mm I Pipe to install	254 200	2030	To improve network conveyance	TGW-PRJ-024
TGW1.9a	15 m x 200 mm I Pipe to install	86 600	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.9b	393 m ECL 110 mm I Pressure Reducing Valve to abandon	-	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.10a	4 m x 250 mm I Valve to install	58 600	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.10b	1 x 250 mm I Valve to insert and close	127 400	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.14	1 x 355 mm I Valve to insert and close	347 200	2021	Required to rezone network when TGW1.1 is implemented	TGW-PRJ-014
TGW1.16a	1 x 110 mm I Valve to insert and close	102 200	2024	Required to rezone network	TGW-PRJ-025
TGW1.16b	1 x 150 mm I Valve to insert and close	109 200	2021	Required to rezone network	TGW-PRJ-014
TGW1.15c	1 x 150 mm I Valve to open	-	2021	Required to rezone network	TGW-PRJ-014
TGW1.16c	1 x 110 mm I Valve to open	-	2021	Required to rezone network	TGW-PRJ-014
TGW1.15e	1 x 75 mm I Valve to open	-	2021	Required to rezone network	TGW-PRJ-014
TGW1.15f	1 x 150 mm I Valve to open	-	2021	Required to rezone network	TGW-PRJ-014
TGW1.15g	1 x 75 mm I Valve to open	-	2021	Required to rezone network	TGW-PRJ-014
TGW1.15h	1 x 110 mm I Valve to insert and close	102 200	2021	Required to rezone network	TGW-PRJ-014
TGW1.15i	1 x 150 mm I Valve to insert and close	109 200	2021	Required to rezone network	TGW-PRJ-014
TGW1.15j	1 x 110 mm I Valve to insert and close	102 200	2021	Required to rezone network	TGW-PRJ-014
TGW1.15k	1 x 110 mm I Valve to insert and close	102 200	2021	Required to rezone network	TGW-PRJ-014
TGW1.16a	13 m x 150 mm I Valve to install	38 600	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.16b	382 m ECL 110 mm I Pressure Reducing Valve to abandon	-	2030	Required to rezone network when dedicated bulk supply from WTP is commissioned, replace with normal pipe section	TGW-PRJ-015
TGW1.16c	371 m ECL 110 mm I Pressure Reducing Valve to abandon	-	2030	Required to rezone network when dedicated bulk supply from WTP is commissioned, replace with normal pipe section	TGW-PRJ-015
TGW1.16d	372 m ECL 110 mm I Pressure Reducing Valve to abandon	-	2030	Required to rezone network when dedicated bulk supply from WTP is commissioned, replace with normal pipe section	TGW-PRJ-015
TGW1.16e	373 m ECL 110 mm I Pressure Reducing Valve to abandon	-	2030	When dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.17	237 m x 150 mm I Pipe to install	342 600	2030	To improve network conveyance	TGW-PRJ-024
TGW1.18	738 m x 150 mm I Pipe to install	942 300	2021	To improve network conveyance	TGW-PRJ-025
TGW1.19	1 x 315 mm I Valve to insert and close	168 500	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.20	10 m x 150 mm I Pipe to install	95 500	2023	Required to rezone network when dedicated bulk supply from WTP is commissioned	TGW-PRJ-015
TGW1.21	1 x 150 mm I Valve to open	-	2024	Required to rezone network	TGW-PRJ-026
TGW1.22	1 x 150 mm I Valve to open	-	2024	Required to rezone network	TGW-PRJ-026
TGW1.23	1 x 75 mm I Valve to open	-	2024	Required to rezone network	TGW-PRJ-026
TGW1.24	10 x 150 mm I Pressure Control Valve to install	250 000	2024	Required to install pressure in upstream network	TGW-PRJ-026
TGW2.1	401 m x 355 mm I Pipe to install	1 570 800	2020	To improve network conveyance	TGW-PRJ-002
TGW2.2	2 m x 250 mm I Pipe to install	54 500	2020	Inter-connection between 2 x supply pipes	TGW-PRJ-002
TGW2.3	616 m x 250 mm I Pipe to install	1 399 800	2035	To improve network conveyance	TGW-PRJ-023
TGW2.4	281 m x 200 mm I Pipe to install	412 800	2025	To improve network conveyance	TGW-PRJ-023
TGW2.6	555 m x 200 mm I Pipe to install	951 800	2023	To improve network conveyance to accommodate future areas	TGW-PRJ-002
TGW2.7	348 m x 150 mm I Pipe to install	483 000	2020	When future areas G21 & G24 develop	TGW-PRJ-016
TGW2.8	366 m x 150 mm I Pipe to install	492 500	2020	To augment supply to Steenbras Upper PRV zone (empty existing dam/pond)	TGW-PRJ-016
TGW2.10	231 m x 150 mm I Pipe to install	324 200	2040	When future areas G20 develop	TGW-PRJ-015
TGW2.11	15 L/s @ 20 m Pump Station to construct	1 674 000	2040	When higher lying areas of future area G20 develop	TGW-PRJ-015
TGW2.12	264 m x 150 mm I Pipe to install	376 100	2020	To improve network conveyance to accommodate future areas	TGW-PRJ-002
TGW2.13	313 m x 150 mm I Pipe to install	438 100	2020	To improve network conveyance to accommodate future areas	TGW-PRJ-002
TGW3.5a	1 x 150 mm I Valve to open	-	2030	Required to rezone network	TGW-PRJ-012
TGW3.5b	1 x 50 mm I Valve to open	-	2030	Required to rezone network	TGW-PRJ-012
TGW3.5c	1 x 75 mm I Valve to open	-	2030	Required to rezone network	TGW-PRJ-012
TGW3.5d	1 x 150 mm I Valve to open	-	2030	Required to rezone network	TGW-PRJ-012
TGW3.5e	1 x 150 mm I Valve to insert and close	109 200	2030	Required to rezone network	TGW-PRJ-012
TGW3.5f	1 x 110 mm I Valve to insert and close	102 200	2030	Required to rezone network	TGW-PRJ-012
TGW3.5g	381 m ECL 110 mm I Pressure Reducing Valve to abandon	-	2030	Required to rezone network	TGW-PRJ-012
TGW4.2	492 m x 315 mm I Pipe to install	1 634 100	2020	New supply pipe to future development areas (required to accommodate a-day development)	TGW-PRJ-001
TGW4.3	260 m x 250 mm I Pipe to install	620 000	2020	New supply to higher lying affordable housing areas when network is initially re-zoned	TGW-PRJ-001
TGW4.5	350 m x 200 mm I Pipe to install	615 700	2020	When future area G7 develops	TGW-PRJ-001
TGW4.9	348 m x 250 mm I Pipe to install	612 500	2020	When future area G7 develops	TGW-PRJ-001
TGW4.12	612 m x 200 mm I Pipe to install	1 045 200	2035	When future area G7 develops	TGW-PRJ-001
TGW4.13	256 m x 355 mm I Pipe to install	1 044 900	2025	New supply pipe when Steenbras Upper reservoir is constructed	TGW-PRJ-009
TGW4.14	171 m x 315 mm I Pipe to install	541 100	2025	New supply pipe when Steenbras Upper reservoir is constructed	TGW-PRJ-009
TGW4.15	101 m x 315 mm I Pipe to install	367 700	2025	Required to improve network conveyance	TGW-PRJ-009
TGW4.16	257 m x 250 mm I Pipe to install	613 200	2025	Required to rezone network	TGW-PRJ-009
TGW4.17	3 m x 250 mm I Pipe to install	57 800	2025	To utilize 250 mm dia. pipe in Steenbras Upper network	TGW-PRJ-009
TGW4.18a	1 x 200 mm I Valve to insert and close	109 200	2025	To utilize 200 mm dia. pipe in Steenbras Upper network	TGW-PRJ-009
TGW4.18b	1 x 250 mm I Valve to insert and close	127 400	2025	To utilize 250 mm dia. pipe in Steenbras Upper network	TGW-PRJ-009
TGW4.19	11 m x 150 mm I Pipe to install	56 500	2025	When item TGW4.16 is constructed	TGW-PRJ-009
TGW4.20	123 m x 200 mm I Pipe to install	243 800	2021	Required to improve network conveyance	TGW-PRJ-014
TGW5.1	579 m x 200 mm I Pipe to install	990 700	2021	To improve network conveyance	TGW-PRJ-003
TGW5.2	258 m x 150 mm I Pipe to install	369 100	2021	To improve network conveyance	TGW-PRJ-003
TGW5.3	391 m x 110 mm I Pipe to install	391 800	2021	To improve network conveyance	TGW-PRJ-003
TGW5.4	629 m x 355 mm I Pipe to install	2 440 800	2020	New supply pipe to future development areas	TGW-PRJ-017
TGW5.2	1199 m x 315 mm I Pipe to install	3 640 000	2035	When future areas G34, G35 & G36 develop	TGW-PRJ-017
TGW5.3	166 m x 150 mm I Pipe to install	252 300	2030	When future area G22.2 develops	TGW-PRJ-017
TGW5.5	1 x 110 mm I Valve to insert and close	102 200	2035	When items TGW6.1, 6.2 & 6.3 are implemented	TGW-PRJ-017
TGW5.6	835 m x 315 mm I Pipe to install	1 982 200	2035	When future areas G34, G35 & G36 develop	TGW-PRJ-017
TGW5.7	1748 m x 200 mm I Pipe to install	2 985 500	2040	When future areas G35 & G36 develop	TGW-PRJ-017
TGW7.1	686 m x 355 mm I Pipe to install	2 093 400	2025	New supply pipe to future development areas	TGW-PRJ-007
TGW7.3	420 m ECL 150 mm I Pressure Reducing Valve to install	250 000	2025	Emergency connection to Steenbras Upper zone	TGW-PRJ-007
TGW7.5	628 m x 200 mm I Pipe to install	1 070 500	2022	When future areas G1 & G2 develop	TGW-PRJ-028
TGW7.10	715 m x 200 mm I Pipe to install	1 213 600	2030	When future areas G5 & G7 develop	TGW-PRJ-007
TGW7.11	416 m ECL 300 mm I Pressure Reducing Valve to install	270 000	2030	Emergency connection to Steenbras Upper reservoir zone	TGW-PRJ-007
TGW7.12	351 m x 200 mm I Pipe to install	616 500	2035	When higher lying areas of future area G7 develop	TGW-PRJ-007
TGW7.15	455 m ECL 355 mm I Pressure Reducing Valve to install	1 281 000	2035	Required to reduce high static pressures to affordable housing developments	TGW-PRJ-007
Sub-totals Distribution System Items		48 429 800			
Bulk Supply Items					
TGW8.1	280 L/s @ 50 m Pump Station to construct	6 344 900	2022	When existing bulk supply nears capacity, can be phased	TGW-PRJ-004
TGW8.2	2112 m x 300 mm I Pipe to install	12 307 000	2022	New dedicated supply to Steenbras reservoir when existing supply nears capacity	TGW-PRJ-004
TGW8.3	70 L/s @ 50 m Pump Station to upgrade	2 619 500	2035	When existing bulk supply nears capacity	TGW-PRJ-005
TGW8.4	54 m x 200 mm I Pipe to install	69 100	2035	To augment bulk water supply to Uitenhage reservoirs	TGW-PRJ-005
TGW8.5	1 x 200 mm I Valve to insert and close	109 200	2035	To utilize existing 200 mm dia pipe as part of the bulk supply to Uitenhage	TGW-PRJ-005
TGW8.10	6500 m³ @ 420 m T.W.L. Reservoir to install	17 259 700	2025	When Steenbras Very High Reservoir reaches capacity, can be phased	TGW-PRJ-005
TGW8.12	150 m³ @ 315 mm I Pipe to install	68 400	2030	When existing bulk supply to Collins Kop reservoir nears capacity	TGW-PRJ-013
TGW8.14	1500 m³ @ 35 m T.W.L. Reservoir to install	6 188 500	2030	To provide reservoir storage capacity for PDA's G22.2, G34, G35 & G36	TGW-PRJ-013
TGW8.16	120 L/s @ 60 m Pump to upgrade	1 039 400	2040	When existing PS reaches capacity	TGW-PRJ-010
TGW8.18	518 m x 315 mm I Pipe to install	1 011 700	2040	Dedicated rising main to Steenbras Upper reservoir	TGW-PRJ-010
TGW8.19	2500 m³ @ 47 m T.W.L. Reservoir to install	8 892 500	2040	When existing reservoir storage nears capacity	TGW-PRJ-022
TGW8.20	1500 m³ @ 42 m T.W.L. Reservoir to install	6 139 500	2035	When Uitenhage reservoir reaches capacity	TGW-PRJ-005
Sub-totals Bulk Supply Items		64 056 600			
Water Demand Management					
TGW.M1	Telemetry at reservoirs, pumping stations and bulk water intakes	1 450 000	2020	To improve quality of information in order to optimise the day-to-day management of the system	
Sub-totals Water Demand Management		1 450 000			
TOTALS Grabouw		113 936 400			
* Costs include P&G's, Contingencies & Fees, but exclude EIA studies, registration of servitudes and/or land acquisition and VAT.					