



GAUTENG PROVINCE HUMAN SETTLEMENTS CIVIL ENGINEERING OUTLINE SCHEME REPORT

RAPID LAND RELEASE PROGRAMME PACKAGE B STAGE 2 – ENNERDALE EXTENSION 9 Task Order No. RLRP – 2019/07-06

DATE: 5 DECEMBER 2019



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Title **CIVIL ENGINEERING OUTLINE SCHEME REPORT: RAPID LAND
RELEASE PROGRAMME**

PACKAGE B STAGE 2 – ENNERDALE EXTENSION 9

(Task Order No. RLRP – 2019/07-06)

Project Team : GladAfrica Consulting Engineers (Pty) Ltd

Employer : Gauteng Province Human Settlements

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Director Initials & Surname Signature Date

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1. INTRODUCTION

1.1 Project Background

GladAfrica Consulting Engineers (Pty) Ltd was appointed by Gauteng Province Human Settlements to provide professional services for the Rapid Land Release Programme (RLRP), Package B Stage 2. The proposed site is within the residential area of Ennerdale, Johannesburg. The site is currently zoned as Special and is currently used as a Medical clinic.

1.2 Purpose of Report

This report focuses on the engineering services requirements for the outline scheme report. The outline scheme report will be combined and included in the Township Establishment application and lodged with the City of Johannesburg (CoJ).

1.3 Site Location

The property is located in Ennerdale, Johannesburg and is owned by the City of Johannesburg. The site is bordered by existing residential roads and dwellings. The property location is listed below:

| <u>PROPERTY</u> | <u>LOCATION</u> | <u>EXTENT (m²)</u> |
|-------------------|-------------------------------------|-------------------------------|
| Erf 5445 and 5446 | 26° 24' 21.67'' S 27° 49' 39.44'' E | 352 163 |

The site layout plan is shown in **Figure 1**.

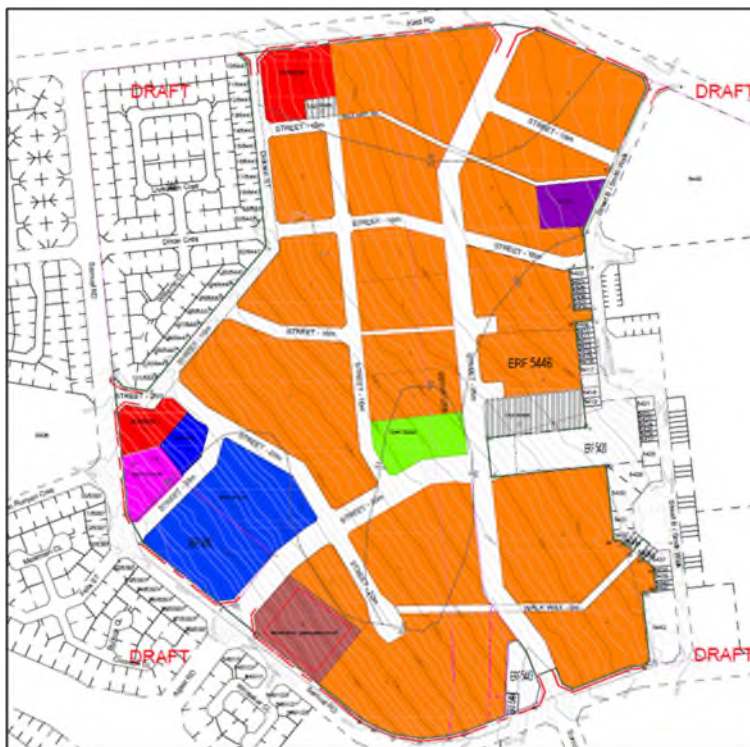


Figure 1: Site Layout

2. THE DEVELOPER

The Gauteng Province Human Settlements is the developer of the site and the contact details are as follows:

Mr. S Mpinyuri

Department of Housing

Project Director: Rapid Land Release, Planning and Property Management

Tel: +27 (0) 11 630 5175

Email: shingai.mpinyuri@gauteng.gov.za

3. TOWN PLANNING

3.1 Existing Zoning

The existing zoning of Erf 5445 and 5446 is Special and the extent is 35,2 ha.

3.2 Planned & Proposed Zoning

The proposed zoning for the site is RDP and Social Housing, High Density with mixed use, and 3 334 units will be developed. The proposed zoning is shown in **Table 1** with proposed 28 erven, 21 of which are Residential 3 stands, 2 of which are Business 1 stands, 1 Institutional erf, 1 Education (primary school) stand, 1 clinic, 1 creche and one longitudinal electrical servitude. The 21 Residential 3 erven comprise 3 334 dwelling units. The education stand is earmarked for a primary school with 1000 learners, the creche could have 100 children.

Table 1: Zoning Breakdown

| Zoning | Erf No. | Housing Type | No of Erven | Number of units | Area (ha) | du/ha |
|---------------|---------|--------------|-------------|-----------------|-------------|-------|
| Residential 3 | 1 | RDP | 1 | 121 | 0,8 | 152 |
| Zoning | 2 | RDP | 1 | 178 | 1,2 | 152 |
| Zoning | 3 | RDP | 1 | 90 | 0,6 | 152 |
| Zoning | 4 | RDP | 1 | 96 | 0,6 | 152 |
| Zoning | 5 | RDP | 1 | 73 | 0,5 | 152 |
| Zoning | 6 | RDP | 1 | 87 | 0,6 | 152 |
| Open Space | 7 | | 1 | | 0,6 | |
| Zoning | 8 | RDP | 1 | 398 | 2,6 | 152 |
| Zoning | 9 | RDP | 1 | 151 | 1,0 | 152 |
| Zoning | 10 | RDP | 1 | 105 | 0,7 | 152 |
| Zoning | 11 | RDP | 1 | 65 | 0,4 | 152 |
| Zoning | 12 | RDP | 1 | 371 | 2,4 | 152 |
| Zoning | 13 | RDP | 1 | 252 | 1,7 | 152 |
| Zoning | 14 | RDP | 1 | 181 | 1,2 | 152 |
| Zoning | 15 | RDP | 1 | 301 | 2,0 | 152 |
| Zoning | 16 | RDP | 1 | 123 | 0,8 | 152 |
| Zoning | 17 | RDP | 1 | 147 | 1,0 | 152 |
| Zoning | 18 | RDP | 1 | 132 | 0,9 | 152 |
| Zoning | 19 | RDP | 1 | 104 | 0,7 | 152 |
| Zoning | 20 | RDP | 1 | 219 | 1,4 | 152 |
| Zoning | 21 | RDP | 1 | 143 | 0,9 | 152 |
| Business 1 | 22 | | 1 | | 0,3 | |
| Creche | 23 | | 1 | | 0,2 | |
| Education | 24 | | 1 | | 2,0 | |
| Institution | 25 | | 1 | | 0,4 | |
| Business 1 | 26 | | 1 | | 0,6 | |
| Clinic | 27 | | 1 | | 0,3 | |
| Taxi Rank | 28 | | 1 | | 0,1 | |
| Taxi Rank | 29 | | 1 | | 0,5 | |
| Municipal | 30 | | 1 | | 0,83 | |
| Servitude | | | | | 0,0 | |
| Walkway | | | | | 0,5 | |
| Street | | | | | 6,9 | |
| Total | | | 30 | 3 334 | 35,2 | |

4. TRAFFIC IMPACT ASSESSMENT

4.1 Site layout and access arrangements

The proposed site layout with possible transport access points is shown in **Figure 2** below.

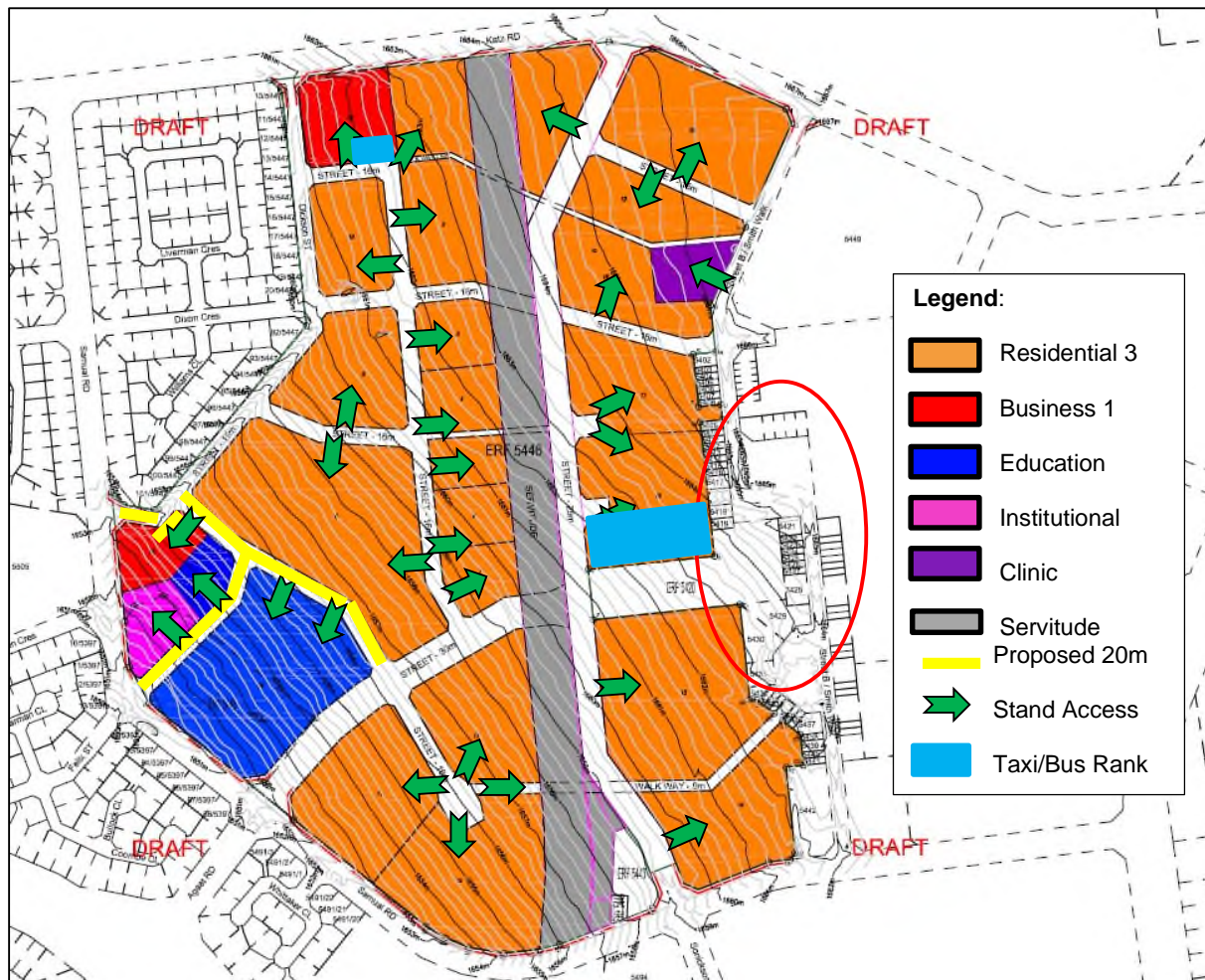


Figure 2: Draft Proposed Township Layout of Ennerdale Ext 9

The road reserve widths have been estimated as will be required. Lines of no access are shown as dashed red lines. The 30m road reserve is a continuation of Agaat Road into the Activity Node of Ennerdale across the wide servitude. It is expected that this servitude will be relaxed. A 25m road reserve is earmarked for the north-south spine of Sonickson Road Extension all the way to Katz Road. The balance of the roads are local streets and each land parcel will have only one access. Since the education, institutional and small business erf will require drop-off /pickup laybys on both sides of the road, it is recommended that the local street indicated in yellow be provided with a 20 m wide road reserve. The proposed access points to the stands are shown with the green arrows.

4.2 Surrounding Road Hierarchy

As indicated in **Figure 3** the R558 passes to the south of the site and comes from the Grasmere interchange in the east ending in a T-junction. It then continues on the northern leg of the T-junction northward.

Class 3 streets include Agaat Road and its extension through the Ennerdale Ext 9 Township, Sonickson Street between the R558 and the development and Wellington Road running north-south and which crosses the R558 and forms the eastern boundary of the proposed Ennerdale Activity Node.

Katz Road, Samuel Road and Street B/Smith Street are existing Class 4 local collectors to which the north-south extension of Sonickson Street through to Katz Street is added in the new township. The balance of Class 5 local streets are shown as bright pink in **Figure 3** above.



Figure 3: Road Hierarchy - Current surrounding and proposed

4.3 Traffic Impact and Public Transport

The trip generation for this development during the morning and afternoon peak hour is 0,374 trips per dwelling unit, accounting for very low car ownership and a Transit Node. The total traffic for the Residential 3 dwelling units amounts to about 1500 car trips. Since the car ownership is very low, all of the township streets should accommodate public transport in the form of mini-bus taxi services. Due to the current distribution of taxi ranks as shown in **Figure 4**, it is proposed that at least 2 new taxi ranks be created to serve Ennerdale Ext 9 as depicted in **Figure 2**.

As the closest Strategic Public Transport Network (BRT trunk services) runs east-west along the R558 from the Golden Highway (R553), a feeder route is proposed along the Agaat Road extension running from the trunk route (R558) to the Street B/Smith Street Activity Node, northwards to Katz Road and along Katz Road back to the R558.

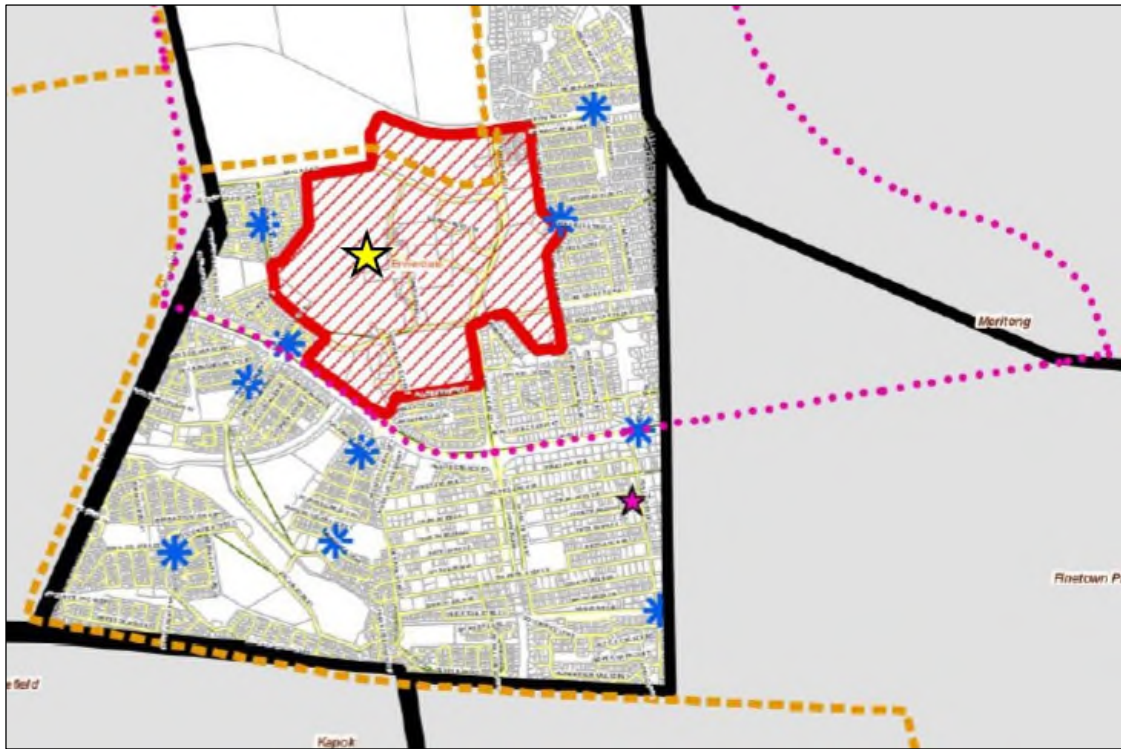


Figure 4: Current location of taxi ranks

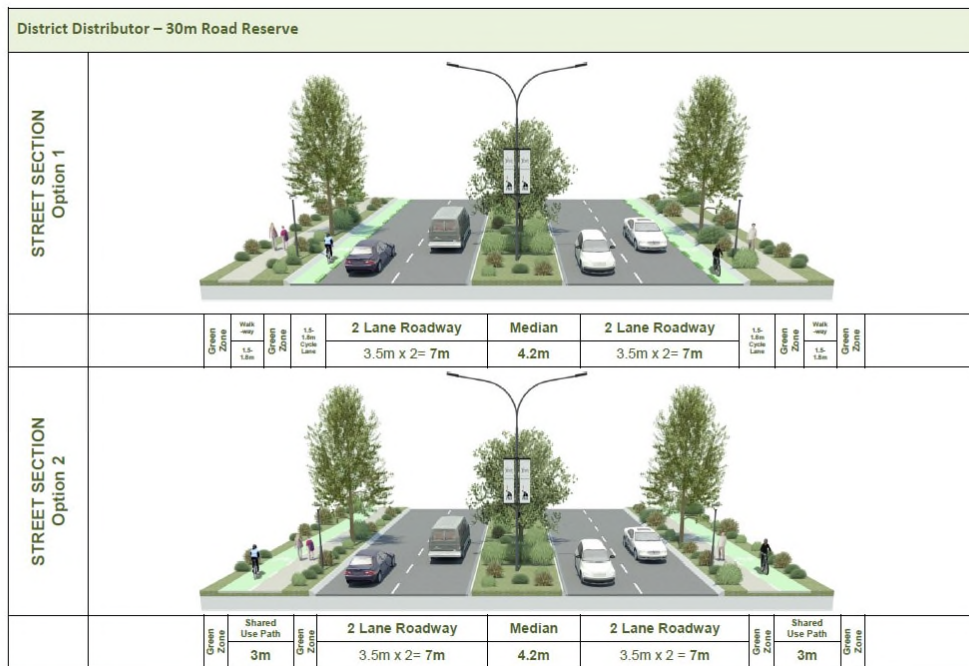
4.4 Infrastructure Upgrades Required

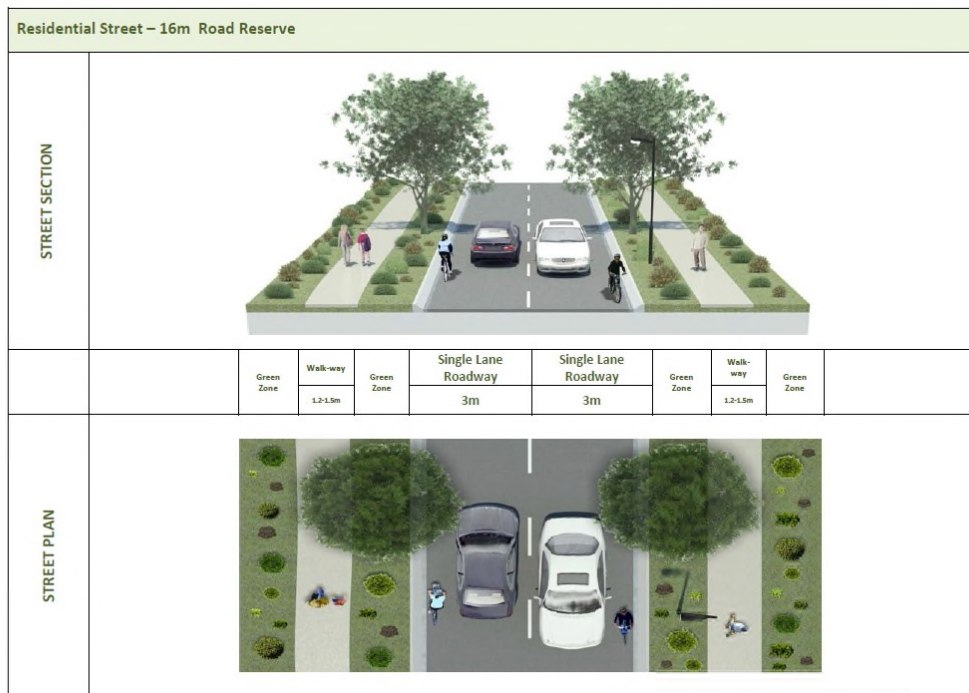
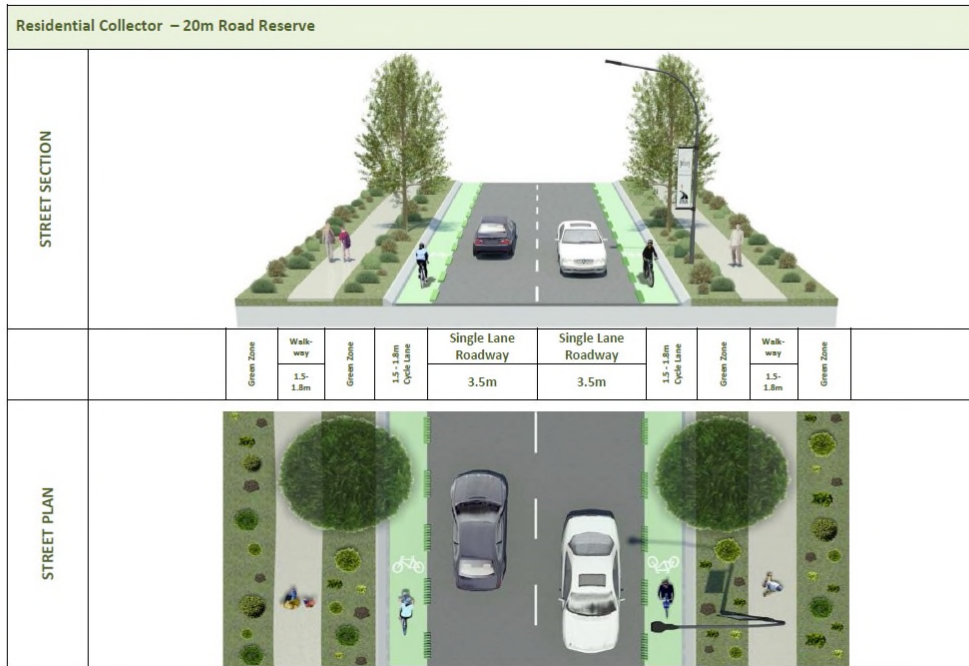
It is proposed that four (4) lanes be constructed along Agaat Road extension from Samuel Road to the Street B/Smith Street. Traffic signals are proposed at the Agaat/Samuel, Agaat/Sonickson and at the Smith Street intersections. Local widening to accommodate right lanes will be required at the following intersections:

- Katz and Sonickson
- Samuel and Dixon Crescent (x2)
- Samuel and Felix
- Class 5 Street and Street B/Smith
- Samuel and Sonickson

The road infrastructure will comply with the City of Johannesburg Complete Streets cross-sections in order to provide NMT facilities. Furthermore, as depicted **Figure 1**, there is a reserved walkway servitude from the northern Taxi rank to the Clinic as well as from the southernmost cul-de-sac to the Activity node.

The various Complete Streets Cross-sections are shown below for each of the various road reserve widths.





5. ROAD INFRASTRUCTURE

5.1 Introduction

With reference to the desktop traffic impact study findings, the following will be required for the new proposed development:

New Road

- Continuation of Agaat Street
- Continuation of Sickonson Street

Intersection Improvements

- Katz Road and Sonickson Street
- Samuel Road and Dixon Crescent
- Samuel Road and Felix Street
- Street B/Smith and New Class 5 Street
- Samuel Road and Sonickson Street

Intersections that will require traffic signals

- Agaat Road and Samuel Street
- Aggat Road and Sonickson Street
- Street B/Smith Walk and Samuel Road
- Street B/Smith Walk and Katz Road

5.2 Road Class & Category

The proposed criteria for the upgrades are follows:

Agaat Road

Road Category – **B**

Road Class – **3**

Road Width – **3.5 m lane width**

Sonickson Street

Road Category – **B**

Road Class – **3**

Road Width – **3.0 m lane width**

Remaining Streets

Road Category – **C**

Road Class – **5**

Road Width – **3.0 m lane width**

New “Fig. 7” kerbs will be installed along road edges, circles and around bell mouths. The horizontal alignment of all new roads shall be such that the appropriate vehicles can navigate turns and radii of 12m – 15m will apply to all of them. All new road components and additional lanes will be assessed on site with respect to crossfall directions and will match the existing respective cross falls as required. The vertical alignment of all the new road components shall generally follow the existing road vertical alignments, unless problematic areas are identified which require adjustments to be made to the vertical alignments of the new road components. Pedestrian walkways will be constructed adjacent to the green zone along all of the new upgraded roads.

6. STORMWATER DRAINAGE

6.1 Stormwater Overview

The existing Agaat Road, Samuel Road, Katz Road and Street B / Smith Walk all have existing stormwater infrastructure as per the JRA Stormwater Reticulation layout. Existing kerb inlets and manholes are shown on the JRA layout. The intention is for the proposed new developments to connect into these existing stormwater reticulation networks, wherever possible. Those unable to connect into the existing system, will be connected into a new suitably sized underground system. Kerb inlets will be used to intercept surface runoff and discharged into the new stormwater lines. Manholes will be provided all change of direction and connecting points. The proposed bulk stormwater requirements are shown in **Figure 5**.

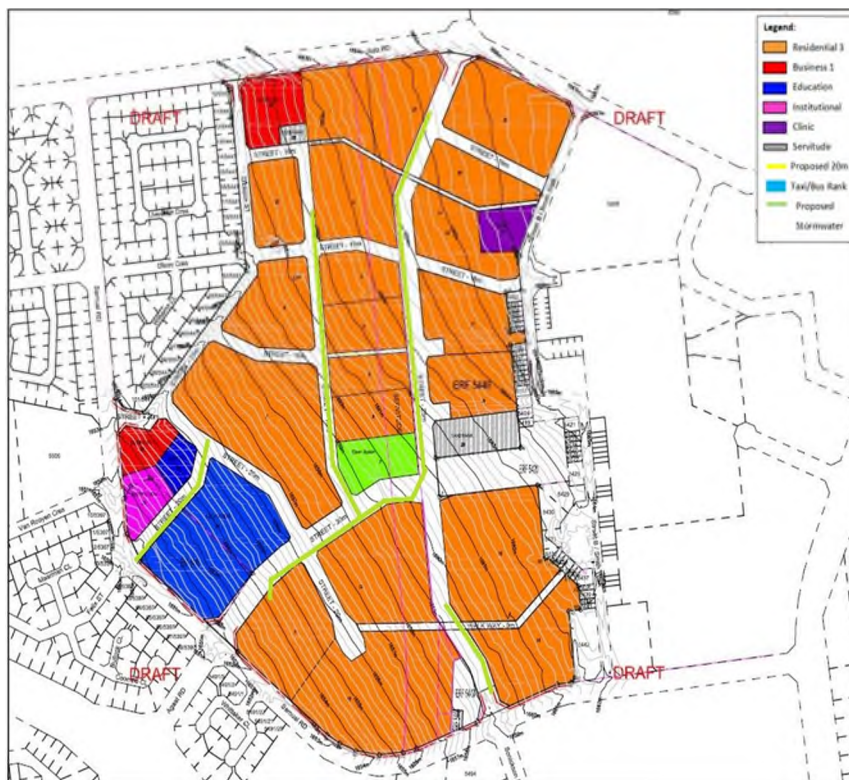


Figure 5: External Bulk Requirements

The existing stormwater infrastructure pipe diameters have not yet been confirmed and some additional upgrades may be required. The detailed analysis of the required upgrades will follow in the detail design stage.

It is noted that the servitude indicated in **Figure 5** is expected to be relaxed.

6.1.1 Minor Storm Criterion

All new stormwater will be designed to drain surface runoff within the kerblines and discharged into a network of new underground pipes. The infrastructure will be sized to accommodate a 1:5 year return storm and a 1:20 year return storm in mid-blocks.

6.1.2 Major Storm Criterion

It is the intention to contain any major storm occurrence with 1:25-year and 1:50-year return periods, within the road boundaries and between the kerb lines. Provisions will be made at the respective low points of the roads, by lowering the kerb line suitably to allow stormwater to discharge off the road surface and overland where possible.

The site is not affected by a 1: 50 or the 1: 100-year floodline of any natural river system.

6.2 Cost Estimate for Road Infrastructure and Stormwater Drainage

| Description | Amount |
|---|--------------------------|
| External Roads | |
| Roads – 18 960m ² | = R <u>18 960 000.00</u> |
| Sub Total | = R 18 960 000.00 |
| External Stormwater | |
| Stormwater –2320m | = R <u>6 960 000.00</u> |
| Sub Total | = R 6 960 000.00 |
| Total Estimated Construction Value | = R 25 920 000.00 |
| Preliminary & General @ 20% | = R 5 184 000.00 |
| Combined Costs | |
| Total Estimated Construction Costs | = R 31 104 000.00 |
| Contingencies @ 10% | = R <u>3 110 400.00</u> |
| Sub Total | = R 34 214 400.00 |
| VAT @ 15% | = R 5 132 160.00 |
| Total Estimated Construction Value | = R 39 346 560.00 |

The above preliminary costs are to be used as a guideline for budgetary purposes only and should be updated in further phases of the project. The costs do not include escalation and professional fees.

7. WATER

7.1 Municipal Authority

| | | |
|------------------------------|---|--------------------------------------|
| Johannesburg Water (Pty) Ltd | : | Development Control (Water) |
| Postal Address | : | P O Box 3112 JOHANNESBURG 2000 |
| Contact Person | : | Mr. Duncan Hulley |
| Telephone | : | (011) 688 1631 |
| Fax | : | (011) 688 1521 |

7.2 Design Standards for Water

| | | |
|---------------------------|---|---|
| Minimum Servitude Widths | : | Minimum width of 2.0 m |
| Minimum Diameter | : | 110 mm Ø |
| Minimum Pipe Class | : | Class 12 uPVC / HDPE / Steel |
| Pipe Location | : | 1.0 m in stand boundary 2.0 m in roads reserve |
| Minimum Cover | : | 0.8 m crossing roads 0.6 m in other areas |
| Maximum Cover | : | 1.5 m for all conditions |
| Class Bedding | : | Class "B" bedding or suitable |
| Average Water Demand | : | 600 litre per day per unit |
| Seasonal Peak Factor | : | 1.5 (Not used for this site) |
| Instantaneous Peak Factor | : | 4.0 |
| Water Pressure | : | 2.5 – 9.0 bar static pressure 1.5 bar as absolute minimum pressure |
| Minimum Head | : | 0.8 bar at any connection during fire |
| Fire Risk | : | Moderate risk zone; 100 l/s for Residential 4 at 1.5 bar; 180 m maximum spacing underground fire hydrants |

7.3 Water Demand

The daily water demand for erven 5445 and 5446 is 200 kl/d and 15 l/s for fire flow. The proposed water average daily demand for RDP and Social Housing of 3 334 units, including mix use, is 11 450 kl/d. The fire flow classification is 25 l/s with minimum 15 m pressure. The demand and fire flow requirements will be further addressed during the preliminary design stage.

8. SEWAGE

8.1 Municipal Authority

| | | |
|------------------------------|---|--------------------------------------|
| Johannesburg Water (Pty) Ltd | : | Development Control (Wastewater) |
| Postal Address | : | P O Box 3112 JOHANNESBURG 2000 |
| Contact Person | : | Mr. Duncan Hulley |
| Telephone | : | (011) 688 1631 |
| Fax | : | (011) 688 1521 |

8.2 Design Standards for Sewage

| | | |
|---------------------------|---|--|
| Minimum Diameter | : | 160 mm Ø for residential and commercial developments, both with 100 mm Ø erf connections |
| Pipe Location | : | 1.0 m in stand boundary 2.0 m in road reserve |
| Minimum Cover | : | 1.4 m in traffic areas 1.0 m in other areas |
| Manhole Spacing | : | 80 m |
| Class Bedding | : | Class "B" bedding |
| Average Sewerage Outflow | : | 600 litre per day per unit |
| Infiltration | : | 0.012 l/s per 100m (150mm diameter) 0.016 l/s per 100m (200mm diameter) |
| Peak Factor | : | 2.5 for Residential 4 |
| Maximum Flow Depth | : | 67% of pipe diameter |
| Manhole Diameters | : | 1. minimum (nominal) precast concrete |
| All Connections | : | Minimum 110mm Ø uPVC |
| Minimum gradient to sewer | : | 1:200 minimum gradient |

8.3 Sewage Outflow

The sewer outflow for Erf 5445 and 5446 is 120 kl/d. The proposed average daily sewage outflow for RDP & Social Housing, 3 334 units including mix use is 6 905 kl/d.

9. PROPOSED BULK WATER AND COST ESTIMATE

9.1 Water capacity report

GladAfrica Consulting Engineers (Pty) Ltd appointed GLS Consulting Engineers to investigate the capacity of the water supply system to supply the proposed development. Refer to the water capacity study report in **Annexure A**.

9.2 New internal water reticulation and connection to existing system

The existing system analysis indicates the reticulation system requires upgrading with added demands of the proposed developments. The following upgrades are required immediately to accommodate the development as shown in **Figure 6**.



Figure 6: Proposed Schematic Internal Reticulation System

9.3 Cost estimate

The internal water reticulation will be designed in accordance with the design guidelines and standards of Johannesburg Water. The proposed new internal water reticulation will be a ring main and the following is proposed along with then cost estimate.

The preliminary cost estimate excluding contingencies, professional fees and VAT is as follows:

| | |
|---------------------------------|-----------------------|
| • 110 mm x 2 265 m x R 1 100.00 | R 2 491 500.00. |
| • 160 mm x 530 m x R 1 250.00 | R 662 500.00 |
| • 200 mm x 775 m x R 1 450.00 | R 1 123 750.00 |
| • 250 mm x 110 m x R 1 785.00 | R 196 350.00 |
| • 315 mm x 350 m x R 2 325.00 | <u>R 813 750.00</u> |
| TOTAL | R 5 287 850.00 |

9.4 Bulk Water

The Ennerdale Ext. 9 development will be accommodated in the Ennerdale Reservoir zone. The existing zonal demand is 14 920kL/d. This will increase to 17 783 kL/d (incl. UAW) once the development is established.

The existing system analysis indicates the distribution system requires extensive upgrading due to the added demands of the proposed developments. The upgrades as shown in **Figure 7** are required immediately to accommodate the development.

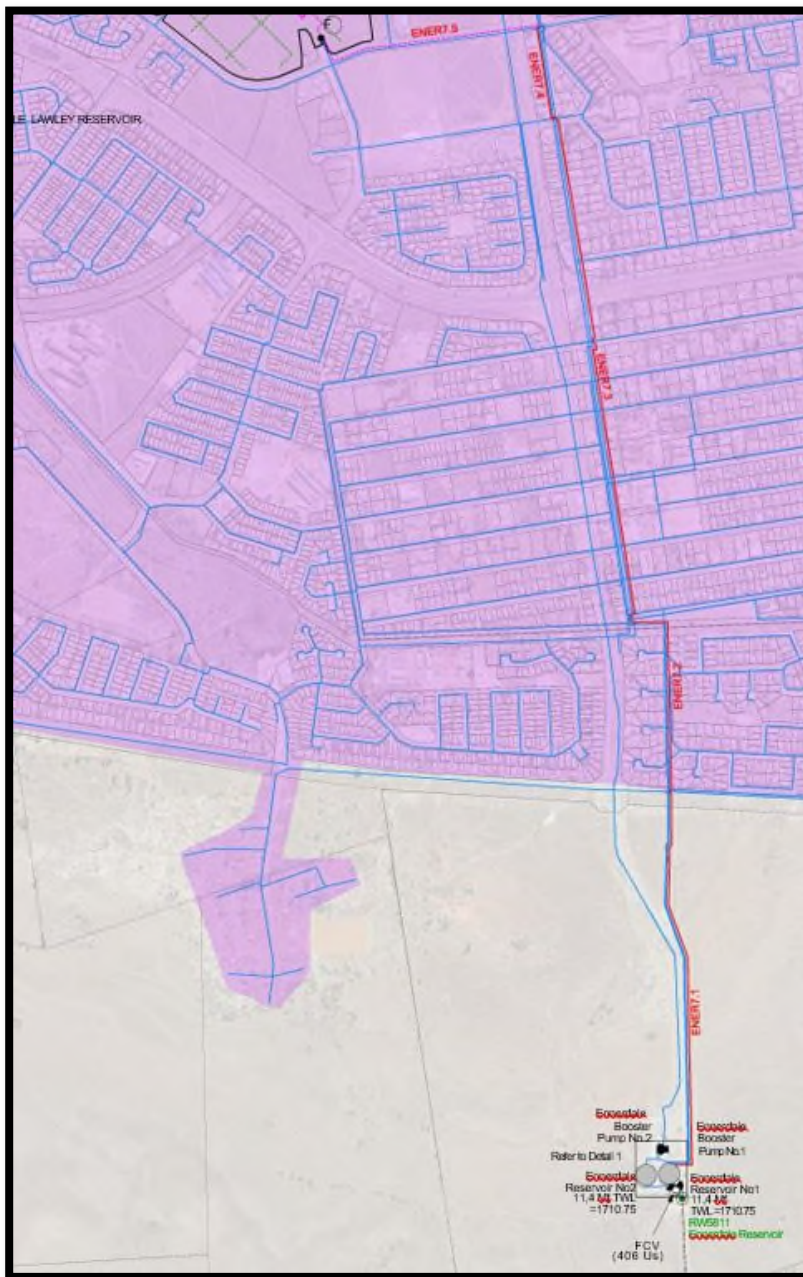


Figure 7: Proposed Schematic Bulk Distribution System

9.5 Cost Estimate bulk distribution system

The cost estimate for the proposed new bulk distribution excluding contingencies, professional fees and VAT is as follows:

| | |
|--------------------------------|------------------------|
| • ENER7.1 – 926 m x 650 mm Ø | R 8 365 100.00 |
| • ENER7.2 – 498 m x 400 mm Ø | R 2 394 000.00 |
| • ENER7.3 – 1 167 m x 355 mm Ø | R 4 396 400.00 |
| • ENER7.4 – 224 m x 315 mm Ø | R 736 300.00 |
| • ENER7.5 – 547 m x 315 mm Ø | <u>R 1 696 400.00</u> |
| TOTAL | R 17 588 200.00 |

10. PROPOSED BULK SEWAGE AND COST ESTIMATE

10.1 Sewer capacity report

GladAfrica Consulting Engineers (Pty) Ltd appointed GLS Consulting Engineers to investigate the capacity of the sewer system to drain the proposed development. Refer to the sewer capacity report in **Annexure B**.

10.2 New internal sewer reticulation and connection to existing system

The existing system analysis plus the additional sewage contribution from the proposed development indicates that the existing infrastructure has sufficient capacity. The proposed development can be connected to the existing 160 mm Ø sewers routed alongside and through the property, as indicated in **Figure 8**.

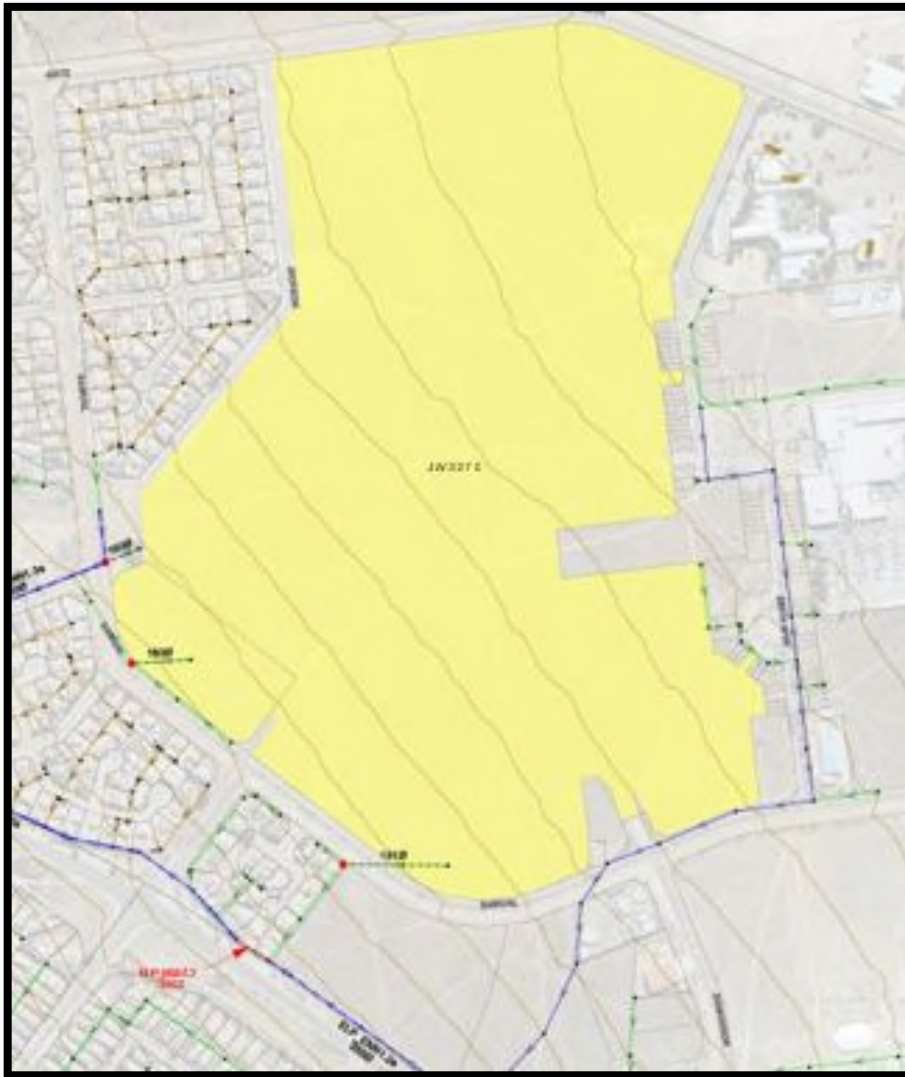


Figure 8: Proposed Sewer Connections

10.3 Cost estimate

The proposed new internal sewer reticulation will connect to the existing 250 mm and proposed new 355 mm collector sewer pipes on both the southern and western sides of the development and will tie into the downstream bulk collector sewers.

The preliminary cost estimate excluding contingencies, professional fees and VAT is as follows:

| | |
|---------------------------------|-----------------------|
| • 160 mm x 1 660 m x R 1 560.00 | R 2 589 600.00 |
| • 200 mm x 440 m x R 1 725.00 | R 759 000.00 |
| • 250 mm x 186 m x R 1 970.00 | R 366 420.00 |
| • 315 mm x 440 m x R 2 510.00 | <u>R 1 104 400.00</u> |
| TOTAL | R 4 819 420.00 |

10.4 Bulk Sewage

Sewage from the proposed development drains via a 300 - 1050 mm \emptyset pipeline in a westerly direction until it reaches Ennerdale WWTW.

The ultimate scenario analysis plus the additional sewage contribution from the proposed development indicates that the collector pipes downstream of the development will need to be upgraded. There is no as-built information available for this reticulation and therefore the reticulation downstream of the development will need to be surveyed to determine the extent of the work required. It is proposed that all the collectors downstream of the development be surveyed but only a few sections of pipe are critical. The bulk pipes downstream of the proposed development have a relative spare capacity greater than 15% (i.e. pipes larger than 450 mm diameter) for the existing and ultimate scenarios. The proposed collector upgrades are shown in **Figure 9**.

The cost estimate, excluding contingencies, professional fees and VAT, for the following sewage collector upgrades is shown below but will need to be confirmed by completing the surveys as highlighted above:

| | |
|---|-----------------------|
| • ELP_ENN1.1 – 69 m x 450 mm \emptyset | R 459 000.00 |
| • ELP_ENN1.1a – 164 m x 450 mm \emptyset | R 868 000.00 |
| • ELP_ENN1.2 – 189 m x 355 mm \emptyset | R 792 000.00 |
| • ELP_ENN1.2a – 1224 m x 355 mm \emptyset | R 4 398 000.00 |
| • ELP_ENN1.3 – 15 m x 250 mm \emptyset | R 154 000.00 |
| • ELP_ENN1.3a – 399 m x 250 mm \emptyset | <u>R 1 156 000.00</u> |
| TOTAL | R 7 827 000.00 |



Figure 9: Proposed Collector Upgrades

ANNEXURE A
WATER CAPACITY REPORT



FINAL REPORT

November 2019

GladAfrica Consulting Engineer (Pty) LTD

GladAfrica House
Hertford Office Park
90 Bekker Road
HALFWAY HOUSE
1686

Attention: Andre du Plessis

Dear Sir

SI_038 - WATER IMPACT STUDY FOR PROPOSED ENNERDALE X9 & RIET FONTEIN DEVELOPMENTS

The City of Johannesburg (CoJ) is facing a significant housing crisis, with an estimated housing backlog of 300 000 units. In steps to remedy this situation the Rapid Land Release Program (RLRP) was launched in August 2018 aimed at prioritising the release of land and identifying vacant land parcels for the development of housing.

GladAfrica Consulting Engineers (Pty) Ltd was appointed by Gauteng Province Human Settlements to provide professional services for the proposed developments of the RLRP Package B Stage 2.

As requested by GladAfrica, GLS Consulting has investigated the capacity of the existing water and sewer systems to serve the proposed developments, and comment as follows.

GLS Consulting (Pty) Ltd

T +27 21 880 0388 | F +27 21 880 0389

13 Elektron Street, Techno Park, Stellenbosch, 7600 | PO Box 814, Stellenbosch, 7599

Reg no: 2007/003039/07

www.gls.co.za

Directors: MS Mokgosi, JJ Streicher, HA Baartman, DJ Kotze

1. EXTENT OF DEVELOPMENT

Two (2) housing developments are to be established and will comprise of single dwelling and multiple dwelling unit buildings (social housing, RDP housing/flats) and will include various additional facilities associated with high-density residential developments e.g. Business/Commercial, Educational, Institutional and Recreational facilities. The proposed developments will comprise of approximately 10 000 units and have a combined footprint of almost 119 ha.

Table SI038_W4 gives a full breakdown of these developments including the anticipated land use, the provided development parameters (received from *GladAfrica and Plan Associates* – see Annexure A), the selected Unit Water Demands (UWD), the estimated Annual Average Daily Demand (AADD) and the peak demand for each development/erven.

As requested by GladAfrica, the number of residential units for the proposed Rietfontein development has been inflated from 3600 units (as specified in the provided development parameters) to 7000 units. Consequently, all associated facilities (Business/Commercial, Educational, Institutional and Recreational) for this development have also been inflated to match the new population requirement (determined from provided parameters).

The location of these developments and layout of existing water and sewer services in the vicinity of the sites are indicated on Figures SI038_W3, SI038_W4, SI038_S2 & SI038_S3 (water and sewer drawings respectively ie. – “_W” & “_S”).

We confirm that these proposed development are located within the current CoJ urban development boundary.

Table S1038_W4: Anticipated Landuse and Water Demands

| Township | Erven | Future Dev. (JW Ref.) | Gross Area (m ²) | Anticipated Landuse | Floors | Coverage (%) | FAR | Req./Avail. Stand Area (m ²) | Floor Area (m ²) | Grounds Area (m ²) | No. Units | Unit Size (m ²) | Nett Density (u/Ha) | Table 2: JW Design Guidelines | | | Table J2 to J6: Red Book (2019) | | | | | | | | | | | |
|---------------------------|---------------|-----------------------|------------------------------|--|--------|--------------|------------------|--|------------------------------|--------------------------------|-----------|-----------------------------|---------------------|-------------------------------|----------------------------|-------------------------|---------------------------------|----------------------------|----------------------------|----------------------------|-----------------|--------------------------|---------------------------------------|-------------------------------|----------------------------|----|----|---|
| | | | | | | | | | | | | | | UWD Type | UWD (excl. UAW) | AADD (excl. UAW) (kℓ/d) | UWD Type | UWD (excl. UAW) | Operation | UWD Type | UWD (excl. UAW) | AADD (excl. UAW) (kℓ/d) | AADD* ₁ (incl. UAW) (kℓ/d) | Peak Flow* ₁ (ℓ/s) | | | | |
| Ennerdale X9 | 5445, 5446 | JW3270 | 341 207 | Flats (Social Housing) | 3 | 30.0 | 0.9 | 66 790 | 60 111 | 46 753 | 1 200 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 325 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 777 | 972 | 38 | | | | |
| | | | | Flats (RDP Housing) | 3 | 30.0 | 0.9 | 99 935 | 89 942 | 69 955 | 1 800 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 486 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 1 163 | 1 454 | 57 | | | | |
| | | | | Business* ₂ | 1 | 60.0 | 0.4 | 17 000 | 6 800 | 10 200 | | | | | | 500m ² Floor | 1.65 kℓ/unit* ₆ | 22 | gross area | 21.00 kℓ/Ha | or | 100m ² Floor | 0.65 kℓ/unit* ₆ | 44 | 55 | 2 | | |
| | | | | Creche/ECD Centre* ₂ | 1 | 60.0 | 0.4 | 4 000 | 1 600 | 2 400 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 10 | 12 | 0 | | |
| | | | | Primary School* ₂ | 1 | 60.0 | 0.4 | 24 900 | 9 960 | 14 940 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 60 | 75 | 3 | | |
| | | | | Secondary School* ₂ | 1 | 60.0 | 0.4 | 20 611 | 8 244 | 12 367 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 49 | 62 | 2 | | |
| | | | | Clinic* ₂ | 1 | 60.0 | 0.4 | 2 000 | 800 | 1 200 | | | | | | | | | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 11 | 14 | 1 | | |
| | | | | Church* ₂ | 1 | 60.0 | 0.4 | 4 014 | 1 606 | 2 408 | | | | | | | | | 100m ² Floor | 0.30 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 8 | 10 | 0 | | |
| | | | | Post Office/ICT Access Point* ₂ | 1 | 60.0 | 0.4 | 818 | 327 | 491 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/Ha | 2 | 2 | 0 | | |
| | | | | Recreation (Sports & Parks) | 1 | | | 55 000 | | 55 000 | | | | | | | | | gross area | 12.00 kℓ/Ha | | | | 66 | 83 | 3 | | |
| | | | | Streets | 1 | | | 46 138 | | 46 138 | | | | | | | | | | | | | | | | | | |
| Subtotal | | | 341 207 | | | | 341 207 | 179 390 | 261 852 | 3 000 | | | | | 833 | | | | | | | 2 190 | 2 738 | 82 | | | | |
| Rietfontein* ₅ | RE/129/301-IQ | JW3271 | 837 886 | Residential (Single Dwelling) | 1 | 50.0 | | 174 960 | | 174 960 | 972 | 90 | 60 | unit | 0.60 kℓ/d | 583 | gross area | 21.00 kℓ/Ha | or | unit | 0.45 kℓ/d | 437 | 729 | 29 | | | | |
| | | | | Flats (Social Housing) | 3 | 30.0 | 0.9 | 167 755 | 150 980 | 117 429 | 3 014 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 815 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 1 953 | 2 441 | 96 | | | | |
| | | | | Flats (RDP Housing) | 3 | 30.0 | 0.9 | 167 336 | 150 603 | 117 135 | 3 014 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 813 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 1 948 | 2 435 | 96 | | | | |
| | | | | Business* ₂ | 1 | 60.0 | 0.4 | 21 389 | 8 556 | 12 833 | | | | | | | | 500m ² Floor | 1.65 kℓ/unit* ₆ | 28 | gross area | 21.00 kℓ/Ha | or | 100m ² Floor | 0.65 kℓ/unit* ₆ | 56 | 70 | 3 |
| | | | | Creche/ECD Centre* ₂ | 1 | 60.0 | 0.4 | 9 695 | 3 878 | 5 817 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 23 | 29 | 1 | | |
| | | | | Primary School* ₂ | 1 | 60.0 | 0.4 | 60 352 | 24 141 | 36 211 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 145 | 181 | 7 | | |
| | | | | Secondary School* ₂ | 1 | 60.0 | 0.4 | 50 659 | 20 263 | 30 395 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 122 | 152 | 6 | | |
| | | | | Church* ₂ | 1 | 60.0 | 0.4 | 9 695 | 3 878 | 5 817 | | | | | | | | | 100m ² Floor | 0.30 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 19 | 23 | 1 | | |
| | | | | Post Office/ICT Access Point* ₂ | 1 | 60.0 | 0.4 | 1 961 | 784 | 1 177 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 5 | 6 | 0 | | |
| | | | | Recreation (Sports & Parks) | 1 | | | 62 222 | | 62 222 | | | | | | | | | gross area | 12.00 kℓ/Ha | | | | 75 | 93 | 4 | | |
| | | | | Streets | 1 | | | 111 861 | | 111 861 | | | | | | | | | | | | | | | | | | |
| Subtotal | | | 837 886 | | | | 837 886 | 363 083 | 675 858 | 7 000 | | | | | 2 240 | | | | | | | 4 781 | 6 159 | 185 | | | | |
| Total | | | 1 206 194 | | | | 1 206 194 | 566 578 | 956 776 | 10 489 | | | | | 3 203 | | | | | | | 7 284 | 9 287 | 365 | | | | |

*₁ = Grounds water requirement
 *₂ = Assumed FAR (Red Book)
 *₃ = Includes 20% UAW
 *₄ = Includes PHF of 3
 *₅ = Parameters inflated by (x) 1.94
 *₆ = Unit as specified in the UWD Type field

2. BACKGROUND

The two (2) proposed developments each fall within a separate water district study area:

- Rietfontein – Lenasia & Lehae Water District for which GLS compiled the master plan report for JW in August 2015 (JWAT-C-1206-01-12-0715).
- Ennerdale X9 – Lawley & Ennerdale Water District for which GLS compiled the master plan report for JW in March 2016 (JWAT-C-1206-01-07-0215).

The two (2) proposed developments each fall within a separate sewage drainage basin:

- Rietfontein – Olifantsvlei Drainage Basin for which GLS compiled the master plan report for JW in June 2016 (JWAT-C-1206-03-32-0716).
- Ennerdale X9 – Ennerdale, Lenasia & Poortjie Drainage Basin for which GLS compiled the master plan report for JW in March 2016 (JWAT-C-1206-03-31-0416).

These reports and the latest hydraulic models (2019-08) formed the basis of the water/sewage impact study undertaken for the proposed developments. The existing JW master plans do make provision for the proposed developments however, with substantially lower densities investigated here-in. Therefore, the demands were updated in the models to investigate what effect the proposed developments will have on the current JW master plans and thereafter provide feedback with regards to the required master plan items to be implemented and their phasing.

3. WATER SYSTEM

3.1 Water Demand

The AADD for the proposed developments and peak demands (PHF=3) are indicated in Table SI038_W4. The water demand was calculated as per the JW Design Guidelines and/or the so-called “Red Book” (Guidelines for Human Settlement Planning and Design, 2019) as discussed below. A new version of the “Red Book” (2019) has recently been released and therefore, the UWDs specified in the previous version of the “Red Book” (2003) are no longer applicable.

The resultant demands using UWDs provided in all tables, in both sources, were compared and thereafter, the most conservative demands applied (*=applied UWD). All UWDs, as provided below, exclude UAW.

For Business/Commercial, Educational and Institutional facilities a FAR = 0.4 is recommended in the “Red Book” (2019, Table J.2) if the anticipated FAR is unknown, as in this case.

3.1.1 Residential

The following UWDs are specified for Residential Type I & III developments which refer to single dwelling and multiple dwelling unit buildings (≤ 3 storeys) respectively.

JW Design Guidelines – “Table 2: Average Water Demand”:

- *Residential I = 0.6 kL/unit/d
- Residential III = 0.8 – 2.7 kL/500m² floor area/d

JW Design Guidelines – “Table 3.2: Detailed Consumption rates for various users”:

- Residential I (60 units/Ha) = 30 kL/Ha/d

The “Red Book” – “Table J.2: Recommended unit AADDs”:

- Residential I (Group Housing, 60 to 40 units/Ha) = 21 kL/Ha/d or
= 0.45 kL/unit/d

The “Red Book” – “Table J.4: Typical AADD unit demands for special land use categories”:

- *Residential III (Living units, 20m² to 40m²)
 - Building = 1.2 kL/100m² floor area/d
 - Grounds = 12 kL/Ha/d

The applied residential UWDs (when converted to a per-unit demand) are also in line with those specified in the previous version of the “Red Book” (2003).

3.1.2 Business and Commercial

JW Design Guidelines – “Table 2: Average Water Demand”:

- Business & Commercial = 1.65 kL/500m² floor area/d

JW Design Guidelines – “Table 3.2: Detailed Consumption rates for various users” specifies:

- Commercial Development (FAR up to 0.5) = 0.3 kL/100m² floor area/d

The “Red Book” – “Table J.2: Recommended unit AADDs”:

- Business/Commercial = 21 kL/Ha/d or
= *0.65 kL/100m² floor area/d

3.1.3 Educational

The “Red Book” – “Table J.2: Recommended unit AADDs”:

- Educational = 20 kL/Ha/d or
= *0.6 kL/100m² floor area/d

The UWDs provided in the JW Design Guidelines for could not be applied/compared as these are only specified per pupil. At this stage, the capacity (no. of pupils) of the educational facilities is unknown.

3.1.4 Institutional

The “Red Book” – “Table J.2: Recommended unit AADDs”:

- Institutional (Post-Office) = 20 kL/Ha/d or
= *0.6 kL/100m² floor area/d

The “Red Book” – “Table J.4: Typical AADD unit demands for special land use categories”:

- *Church
 - Building = 0.3 kL/100m² floor area/d
 - Grounds = 12 kL/Ha/d
- *Hospital (Clinic)
 - Building = 1.2 kL/100m² floor area/d
 - Grounds = 12 kL/Ha/d

3.1.5 Recreational

The “Red Book” – “Table J.4: Typical AADD unit demands for special land use categories”:

- Sports Ground (Parks/Playgrounds)
 - *Low Intensity = 12 kL/Ha/d

It was assumed from aerial photographs of the Rietfontein and Ennerdale X9 development surrounds that all sports grounds, parks and playgrounds would be low intensity in terms of upkeep.

3.1.6 Total Water Demand

The total estimated water demand of the proposed developments is 8 897 kL/d (including UAW), which translates to approximately 75 kL/ha (gross site area).

The total peak demand, calculated assuming a peak factor of 3 (based on logging results on previous master plan studies in Ennerdale), for all proposed developments, is approximately 268 L/s.

It is important to note that the recommendations of this report are based on the provided/inflated development parameters. Any amendments to these will require the recommendations of this impact analysis to be reviewed.

3.2 Water System Analysis

The existing and future system impact analysis per reservoir zone/water district is discussed herein and highlights the existing bulk (backlog) issues as well as the master plan items to be implemented immediately in order to accommodate the developments. These items are included in Figure SI038_W5 & SI038_W6 and Table SI038_W5 & SI038_W6 including cost estimates and phasing, for Rietfontein & Ennerdale X9 respectively.

Table SI038_W5 & SI038_W6 also indicates whether the proposed works form part of the original master plan (existing), is a new item required as a result of the proposed developments (new) or lastly, if the original master plan has been revised as a result of the proposed development.

3.2.1 Lenasia Low Level (Cosmos) Reservoir (Rietfontein)

3.2.1.1 Zonal Demand

The Rietfontein development (6 159kL/d) is located within the Cosmos Reservoir zone. The existing zonal demand is 23 175kL/d. This will increase to 29 334 kL/d (incl. UAW) once the development is established. The ultimate demand of the zone will increase to approximately 49 247kL/d when further development & expansion of the zone occurs.

3.2.1.2 Bulk Supply

The Lenasia & Lehae water district is supplied from RW1984 connection via a 675mm Ø feeder main. Currently, the Lenasia Low Level (Cosmos) Reservoir zone is supplied in combination from the 675mm Ø feeder main (direct from RW1984) and Cosmos Reservoir. Cosmos Reservoir thereafter on-supplies to

Hospital Hill Reservoir via the Cosmos PS. Additionally, Hospital Hill Reservoir on-supplies to Lenasia High Level Reservoir via the Hospital Hill PS.

The bulk system analysis at existing and potential future demands is discussed below:

- The 43.6ML Cosmos Reservoir currently possesses 45h x AADD storage. This will drop to 36h x AADD when the Rietfontein development materialises and starts using water. This is greater than the minimum required reservoir storage of 24h x AADD for existing reservoirs, in accordance with JW's modelling, and is therefore sufficient.
- The required existing supply rate to Cosmos Reservoir is 1 108L/s (1.5 x AADD). This includes the required supply rate for on-supply to Hospital Hill Reservoir & Lenasia High Level Reservoir (706L/s). This will increase to 1 215L/s once the developments materialise and start using water, and if operation remains as is. The model suggests the existing 675mm Ø bulk supply pipe does not have sufficient capacity to supply even the existing rate, given the previously logged peak pressures at the connection (170m).
- The existing master plan proposes a new dedicated bulk supply for both Cosmos Reservoir and Hospital Hill Reservoir, primarily through the installation of a new 1300mm Ø bulk supply pipeline from the RW1984 connection. The 1300mm Ø would then branch into an 850mm Ø (revision) and 1000mm Ø to supply Cosmos Reservoir and Hospital Hill Reservoirs respectively. This proposal has the following benefits:
 - Eliminate direct supply from the existing 675 mm Ø bulk supply pipeline. In future, this pipeline will form part of the bulk distribution for the Cosmos Reservoir zone.
 - Eliminate on-supply of Hospital Hill Reservoir through Cosmos Reservoir, reducing the required supply rate to Cosmos Reservoir and additionally, alleviating the need for Cosmos PS (although the existing master plan gives an option to upgrade this for back-up/emergency use).
- In the above operating configuration, the required supply rate to Cosmos Reservoir would only be 509L/s after the Rietfontein development materialises. Ultimately, the required supply rate to Cosmos Reservoir and Hospital Reservoir becomes 855L/s and 1168L/s respectively. The proposed feeder mains have been sized for these supply rates.

The following bulk upgrades (backlog) are recommended to accommodate the development:

- Project LNS3 (3.1 – 3.7) – Includes the new dedicated bulk supply - 1300mm Ø which branches into a 1000mm Ø and 850mm Ø (increased size from previous master plan due to higher demands/densities) to supply Hospital Hill and Cosmos Reservoir respectively. Additionally, all the valve work required to implement operational changes, as discussed in the paragraphs above.

3.2.1.3 Distribution & Reticulation

The existing system analysis indicates the robust distribution system upstream is sufficient with added demand of the proposed developments. No upgrades are required immediately however, will be required in future when demand of the zone increases further (refer to Section 3.2.1.4).

Only the internal development distribution/reticulation is required. The schematic future mains (FM) are provided below:

- LNS30 (30.1 – 30.6) – 450/400/315/200/160mm Ø FM pipes

3.2.1.4 Additional Information

Additional revisions (excluding those listed prior) to the master plan are required as a result of Rietfontein development, however, implementation of these is not necessary to accommodate the development now. These are only required at a later stage when demands of the zone increase further (future development and/or expansion of the reservoir zone). The following additional revisions were made:

- Project LNS29 (29.1) – A new 30.5 ML Cosmos Reservoir (previously 24ML) will now be required in future.
- Project LNS25 (25.2) – An 800mm Ø parallel reinforcement (previously 500mm Ø) to the existing 675mm Ø distribution main which runs next to the R558/M10.

It should be noted that the condition of the 40 year old existing 675 mm Ø bulk pipeline, which runs along a railway line, for the most part, is suspect. The Ennerdale Depot has reported a number of bursts along this pipeline. This again highlights the immediate need for Project LNS3 as discussed above. A condition assessment of this pipeline is proposed to verify its Remaining Useful Life. Slip-lining of this pipeline (if possible) or a complete replacement may be required, depending on the assessment results.

On a more general planning note, the extensive existing bulk supply for this water district will require significant upgrading along its entirety to accommodate future development and densification in the region. This coupled with the fact that Midvaal Local Municipality is located directly east of the district, has previously drawn attention to a regional consideration of the future bulk supply to this area. This regional bulk supply would consist of a new strategically positioned RW reservoir on the boundary of both municipalities, supplied by the RW Spioenkop Reservoir, to serve the Lenasia and Lehae water district as well as potential future Midvaal developments (as per latest Midvaal SDF). An initial review of this option (as discussed in *SP_447 – Southern Farms Impact Investigation Report*) indicates it will likely present a much shorter route of supply thus more optimal supply option from both RW's and JW's perspective. Further investigation of this bulk supply option in consultation with Rand Water, Midvaal and Johannesburg Water, is

recommended, prompted again by further revisions to upgrade requirements to the existing bulk supply system discussed here-in.

3.2.2 Ennerdale Reservoir (Ennerdale X9)

3.2.2.1 Zonal Demand

The Ennerdale X9 development (2 738kL/d) will be accommodated in the Ennerdale Reservoir zone. The existing zonal demand is 14 920kL/d. This will increase to 17 659 kL/d (incl. UAW) once the development is established. The ultimate demand of the zone will increase to approximately 40 393 kL/d when further development, densification and expansion of the zone occurs. An Ennerdale Tower zone (supplied from Ennerdale Reservoir) will also be created in future, with an ultimate demand of 2 233kL/d.

3.2.2.2 Bulk Supply

The bulk water supply to the existing Lawley & Ennerdale Water District is provided by RW through their Daleside Booster Pump scheme via their T5/T4 (800/600mm Ø) pipelines, which reduces to 500mm Ø (T4) after take-offs. to Orange Farm (T5), terminating at the Ennerdale Reservoir site. From the Ennerdale Reservoir site, the Ennerdale Booster PS pumps water to Lawley Reservoir via a 500mm Ø pipeline.

Recently, RW commissioned a new connection (RW5811) near the Ennerdale Reservoir site to measure supply to the Lawley & Ennerdale Water District. Prior to this, the RW bulk meter at Ironside (RW4263 Orange Farm) located approximately 10km to the south-east was used to measure supply to numerous water districts (including Lawley/Ennerdale) – the RW system between these points still forms part of the model extent (external bulk) as is therefore also discussed/analysed below.

The bulk system analysis at existing and potential future demands is discussed below:

- The 2 x 11.4 ML Ennerdale Reservoirs currently possess 37h x AADD storage. This will drop to 31h x AADD when the Ennerdale X9 development materialises and starts using water. This is greater than the minimum required reservoir storage of 24h x AADD for existing reservoirs, in accordance with JW's modelling, and is therefore sufficient.
- JW Operations have previously reported that supply to Ennerdale Reservoirs is insufficient at times and the reservoirs struggle to fill as a result.
- The required existing supply rate to Ennerdale Reservoirs is 359L/s (1.5 x AADD). This includes the required supply rate for on-supply to Lawley Reservoir (100L/s). This will increase to 406L/s once the development materialises and start using water. The model indicates the RW bulk supply (T5/T4) does not have sufficient capacity to supply even the existing rate, which concurs with current problems experienced with supply, as reported by JW Operations.
- The bulk supply pipes therefore require upgrading however, this must be implemented by RW (and is therefore not included as requirements here-in).

- Ultimately, the required supply rate to Ennerdale Reservoir will be 1201L/s. This includes the required supply rate for on-supply to existing/future Lawley Reservoirs (376L/s), Poortjie Reservoirs (86L/s) and Ennerdale Tower (39L/s). The RW bulk supply upgrade should be sized for this ultimate supply rate.

3.2.2.3 Distribution & Reticulation

The existing system analysis indicates the distribution and reticulation system requires extensive upgrading with added demands of the proposed developments. The following upgrades are required immediately to accommodate the development:

- ENER7 (7.1-7.9) – 650/400/355/315mm Ø reinforcements to the existing distribution system from the reservoir site along Alabaster, Skelton, Charles, Hercules, Minerva & Samuel Roads and the 315/250/200/160mm Ø schematic internal development FM pipes.

3.2.2.4 Additional Information

Additional revisions (excluding those listed prior) to the master plan are required as a result of Ennerdale X9 development, however, implementation of these is not necessary to accommodate the development now. These are only required at a later stage when demands of the zone increase further (future development and/or expansion of the reservoir zone). The following additional revisions were made:

- Project EN5 (5.1) – A new 41.5 ML Cosmos Reservoir (previously 40ML) will now be required in future.
- Project ENER3 (3.9) – A new 900mm Ø (previously 500mm) northern supply branch off the future reservoir outlet

3.2.3 Fire Flow Conditions

Fire flow conditions were simulated at the hydrants/points E&F (outside the developments), as indicated in Figure SI038_W5, SI038_W6 (Rietfontein & Ennerdale X9 respectively) and Table SI038_W7.

The fire flow analysis indicates that the total required fire flow can be supplied through the existing/proposed distribution and reticulation systems at the required pressures (as prescribed in the “Red Book” – see Table SI038_W7). This could not be simulated on the internal reticulation for the development, as the internal layout is not available at this point. All internal distribution/reticulation pipes included in this study are thus purely schematic.

Table SI038_W5: Bulk and Reticulation MP items (Rietfontein)

| Item Type | Item No. | Extent | Size | Rev./Exist./New Item | Task/Comment | Cost |
|---|----------|----------|-----------|----------------------|-----------------------------------|----------------------|
| Backlog Works - Bulk | | | | | | |
| MP | LNS3.1 | 9898 m x | 1300 mm Ø | Existing | Pipe to install | R 235 218 700 |
| MP | LNS3.2 | 1 x | 675 mm Ø | Existing | Valve to close/Pipe to disconnect | R 0 |
| MP | LNS3.3 | 1 m x | 675 mm Ø | Existing | Pipe to install | R 955 800 |
| MP | LNS3.4 | 1 x | 675 mm Ø | Existing | Valve to close/Pipe to disconnect | R 0 |
| MP | LNS3.5 | 1 x | 500 mm Ø | Existing | Valve to close/Pipe to disconnect | R 0 |
| MP | LNS3.6 | 58 m x | 1000 mm Ø | Existing | Pipe to install | R 2 325 100 |
| MP | LNS3.7 | 164 m x | 850 mm Ø | Revision | Pipe to install | R 3 220 200 |
| Sub-Total | | | | | | R 241 719 800 |
| Required Works - Proposed Developments | | | | | | |
| FM | LNS30.1 | 226 m x | 450 mm Ø | New | Pipe to install | R 1 294 100 |
| FM | LNS30.2 | 100 m x | 400 mm Ø | New | Pipe to install | R 555 100 |
| FM | LNS30.3 | 200 m x | 315 mm Ø | New | Pipe to install | R 663 600 |
| FM | LNS30.4 | 200 m x | 250 mm Ø | New | Pipe to install | R 488 600 |
| FM | LNS30.5 | 600 m x | 200 mm Ø | New | Pipe to install | R 1 024 200 |
| FM | LNS30.6 | 601 m x | 160 mm Ø | New | Pipe to install | R 803 300 |
| Sub-Total | | | | | | R 4 828 900 |
| Total | | | | | | R 246 548 700 |

Table S1038_W6: Bulk and Reticulation MP items (Ennerdale X9)

| Item Type | Item No. | Extent | Size | Rev./Exist./New Item | Task/Comment | Cost |
|---|----------|----------|----------|----------------------|-----------------|---------------------|
| Required Works - Proposed Developments | | | | | | |
| MP | ENER7.1 | 926 m x | 650 mm Ø | New | Pipe to install | R 8 365 100 |
| MP | ENER7.2 | 498 m x | 400 mm Ø | New | Pipe to install | R 2 394 000 |
| MP | ENER7.3 | 1167 m x | 355 mm Ø | New | Pipe to install | R 4 396 400 |
| MP | ENER7.4 | 224 m x | 315 mm Ø | New | Pipe to install | R 736 300 |
| MP | ENER7.5 | 547 m x | 315 mm Ø | New | Pipe to install | R 1 696 400 |
| FM | ENER7.6 | 240 m x | 315 mm Ø | New | Pipe to install | R 782 700 |
| FM | ENER7.7 | 100 m x | 250 mm Ø | New | Pipe to install | R 269 500 |
| FM | ENER7.8 | 200 m x | 200 mm Ø | New | Pipe to install | R 370 200 |
| FM | ENER7.9 | 300 m x | 160 mm Ø | New | Pipe to install | R 421 800 |
| Sub-Total | | | | | | R 19 432 400 |
| Total | | | | | | R 19 432 400 |

Table SI038_W7: Fire Flow Hydrants

| Hydrant Code | Developments Tested | Min Flow [l/s] | Min Pressure [m] |
|--------------|---------------------|----------------|------------------|
| E | JW3271 | 50 | 15 |
| F | JW3270 | 50 | 15 |

5. SUMMARY

The main findings and recommendations from this investigation are:

Investigation - General

- i. The developer intends to establish two housing developments comprising of 10 000 units plus supplementary facilities.
- ii. The existing JW master plans do make provision for the proposed developments however, with substantially lower densities investigated here-in.

Water Investigation - Rietfontein

- iii. The Rietfontein development (6 159kL/d) is located within in the Lenasia Low Level (Cosmos) Reservoir zone. The existing zonal demand is 23 175kL/d. This will increase to 29 334 kL/d (incl. UAW) once the development is established. The ultimate demand will be approximately 49 247kL/d.
- iv. The 43.6ML Cosmos Reservoir currently possesses 45h x AADD storage. This will drop to 36h x AADD when the Rietfontein development materialises and starts using water, and is therefore sufficient.
- v. The model indicates the existing 675mm Ø bulk supply pipe to Cosmos Reservoir does not have sufficient capacity to supply even the existing rate, given the previously logged peak pressures at the connection (170m). The new bulk supply from RW1984 to Cosmos and Hospital Hill reservoir is required immediately, as discussed in Section 3.2.1.2.
- vi. The existing system analysis indicates the robust distribution system upstream is sufficient with added demand of the proposed developments. No upgrades besides internal distribution/reticulation of the development are required for the Rietfontein development.
- vii. Furthermore, although not required immediately, certain additions/revisions to the master plan are required as a result of the development. These are discussed in Section 3.2.1.4.
- viii. The fire flow analysis indicates the required fire flow can be supplied through the existing/proposed distribution and reticulation systems at the required pressures, outside the development site. This could not be tested internally, as the reticulation layout is not available at this point.

Water Investigation – Ennerdale X9

- ix. The Ennerdale X9 development (2 738kL/d) is located within the Ennerdale Reservoir zone. The existing zonal demand is 14 920kL/d. This will increase to 17 659 kL/d (incl. UAW) once the

development is established. The ultimate demand will be approximately 40 393 kL/d. An Ennerdale Tower zone (supplied from Ennerdale Reservoir) will also be created in future, with an ultimate demand of 2 233kL/d.

- x. The 2 x 11.4 ML Ennerdale Reservoirs currently possess 37h x AADD storage. This will drop to 31h x AADD when the Ennerdale X9 development materialises and starts using water, and are therefore sufficient.
- xi. The model indicates the RW bulk supply (T5/T4) does not have sufficient capacity to supply even the existing rate, which concurs with current problems experienced with supply, as reported by JW Operations. The bulk supply must be upgraded – to be implemented by RW themselves (details not provided here-in).
- xii. The existing system analysis indicates the distribution and reticulation system requires extensive upgrading to accommodate the proposed Ennerdale X9 development, as discussed in Section 3.2.2.3.
- xiii. Furthermore, although not required immediately, certain additions/revisions to the master plan are required as a result of the development. These are discussed in Section 3.2.2.4.
- xiv. The fire flow analysis indicates the required fire flow can be supplied through the existing/proposed distribution and reticulation systems at the required pressures, outside the development site. This could not be tested internally, as the reticulation layout is not available at this point.
- xv. **On a more general planning note, the extensive existing bulk supply for the Cosmos/Lenasia water districts that will require significant upgrading along its entirety to accommodate future development and densification in the region. This coupled with the fact that Midvaal Local Municipality is located directly east of the district, has previously drawn attention to a regional consideration of the future bulk supply to this area. This regional bulk supply would consist of a new strategically positioned RW reservoir on the boundary of both municipalities, supplied by the RW Spioenkop Reservoir, to serve the Lenasia and Lehae water district as well as potential future Midvaal developments (as per latest Midvaal SDF). An initial review of this option (as discussed in SP_447 – Southern Farms Impact Investigation Report) indicates it will likely present a much shorter route of supply thus more optimal supply option from both RW's and JW's perspective. Further investigation of this bulk supply option in consultation with Rand Water, Midvaal and Johannesburg Water, is recommended, prompted again by further revisions to upgrade requirements to the existing bulk supply system discussed here-in.**

Sewer Investigation – Ennerdale X9

- xvi. The bulk pipes which will receive sewage flow from the Ennerdale Extension 9 development will have sufficient capacity in the existing and ultimate scenarios.
- xvii. The MP items listed in Table SI038_S3 will need to be implemented in line with the proposed development.
- xviii. Ennerdale WWTW has insufficient capacity for the existing flows, therefore it will not be able to accommodate the additional sewage flow from the Ennerdale Extension 9 development. Upgrading Ennerdale WWTW has been investigated and will be implemented in 2020. Once implemented there will be sufficient treatment capacity to accommodate the additional flow.

Sewer Investigation - Rietfontein

- xix. The bulk pipes which will receive sewage flow from the Rietfontein Lenasia development will have sufficient capacity in the existing and ultimate scenarios.
- xx. The MP items listed in Table SI038_S5 will need to be implemented in line with the proposed development.
- xxi. According to the analysis the Olifantsvlei WWTW currently has sufficient treatment capacity to accommodate the proposed development.

We trust you find the above sufficient regarding your request.

Yours faithfully

GLS CONSULTING (PTY) LTD
REG. NO.: 2007/003039/07

A handwritten signature in black ink, appearing to be 'JK', is written over a faint, light-colored signature line.

Per: MR JK COMPION (Pr.Eng.)
(Senior Executive)

ANNEXURE B
SEWER CAPACITY REPORT



FINAL REPORT

November 2019

GladAfrica Consulting Engineer (Pty) LTD

GladAfrica House
Hertford Office Park
90 Bekker Road
HALFWAY HOUSE
1686

Attention: Andre du Plessis

Dear Sir

SI_038 - WATER IMPACT STUDY FOR PROPOSED ENNERDALE X9 & RIET FONTEIN DEVELOPMENTS

The City of Johannesburg (CoJ) is facing a significant housing crisis, with an estimated housing backlog of 300 000 units. In steps to remedy this situation the Rapid Land Release Program (RLRP) was launched in August 2018 aimed at prioritising the release of land and identifying vacant land parcels for the development of housing.

GladAfrica Consulting Engineers (Pty) Ltd was appointed by Gauteng Province Human Settlements to provide professional services for the proposed developments of the RLRP Package B Stage 2.

As requested by GladAfrica, GLS Consulting has investigated the capacity of the existing water and sewer systems to serve the proposed developments, and comment as follows.

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Directors: MS Mokgosi, JJ Streicher, HA Baartman, DJ Kotze

1. EXTENT OF DEVELOPMENT

Two (2) housing developments are to be established and will comprise of single dwelling and multiple dwelling unit buildings (social housing, RDP housing/flats) and will include various additional facilities associated with high-density residential developments e.g. Business/Commercial, Educational, Institutional and Recreational facilities. The proposed developments will comprise of approximately 10 000 units and have a combined footprint of almost 119 ha.

Table SI038_W4 gives a full breakdown of these developments including the anticipated land use, the provided development parameters (received from *GladAfrica and Plan Associates* – see Annexure A), the selected Unit Water Demands (UWD), the estimated Annual Average Daily Demand (AADD) and the peak demand for each development/erven.

As requested by GladAfrica, the number of residential units for the proposed Rietfontein development has been inflated from 3600 units (as specified in the provided development parameters) to 7000 units. Consequently, all associated facilities (Business/Commercial, Educational, Institutional and Recreational) for this development have also been inflated to match the new population requirement (determined from provided parameters).

The location of these developments and layout of existing water and sewer services in the vicinity of the sites are indicated on Figures SI038_W3, SI038_W4, SI038_S2 & SI038_S3 (water and sewer drawings respectively ie. – “_W” & “_S”).

We confirm that these proposed development are located within the current CoJ urban development boundary.

Table S1038_W4: Anticipated Landuse and Water Demands

| Township | Erven | Future Dev. (JW Ref.) | Gross Area (m ²) | Anticipated Landuse | Floors | Coverage (%) | FAR | Req./Avail. Stand Area (m ²) | Floor Area (m ²) | Grounds Area (m ²) | No. Units | Unit Size (m ²) | Nett Density (u/Ha) | Table 2: JW Design Guidelines | | | Table J2 to J6: Red Book (2019) | | | | | | | | | |
|---------------------------|---------------|-----------------------|------------------------------|--|--------|--------------|------------------|--|------------------------------|--------------------------------|-----------|-----------------------------|---------------------|-------------------------------|----------------------------|-------------------------|---------------------------------|----------------------------|-------------------------|----------------------------|-----------------|--------------------------|---------------------------------------|-------------------------------|-----|---|
| | | | | | | | | | | | | | | UWD Type | UWD (excl. UAW) | AADD (excl. UAW) (kℓ/d) | UWD Type | UWD (excl. UAW) | Operation | UWD Type | UWD (excl. UAW) | AADD (excl. UAW) (kℓ/d) | AADD* ₁ (incl. UAW) (kℓ/d) | Peak Flow* ₁ (ℓ/s) | | |
| Ennerdale X9 | 5445, 5446 | JW3270 | 341 207 | Flats (Social Housing) | 3 | 30.0 | 0.9 | 66 790 | 60 111 | 46 753 | 1 200 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 325 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 777 | 972 | 38 | | |
| | | | | Flats (RDP Housing) | 3 | 30.0 | 0.9 | 99 935 | 89 942 | 69 955 | 1 800 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 486 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 1 163 | 1 454 | 57 | | |
| | | | | Business* ₂ | 1 | 60.0 | 0.4 | 17 000 | 6 800 | 10 200 | | | | | | 500m ² Floor | 1.65 kℓ/unit* ₆ | 22 | gross area | 21.00 kℓ/Ha | or | 100m ² Floor | 0.65 kℓ/unit* ₆ | 44 | 55 | 2 |
| | | | | Creche/ECD Centre* ₂ | 1 | 60.0 | 0.4 | 4 000 | 1 600 | 2 400 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 10 | 12 | 0 |
| | | | | Primary School* ₂ | 1 | 60.0 | 0.4 | 24 900 | 9 960 | 14 940 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 60 | 75 | 3 |
| | | | | Secondary School* ₂ | 1 | 60.0 | 0.4 | 20 611 | 8 244 | 12 367 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 49 | 62 | 2 |
| | | | | Clinic* ₂ | 1 | 60.0 | 0.4 | 2 000 | 800 | 1 200 | | | | | | | | | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 11 | 14 | 1 |
| | | | | Church* ₂ | 1 | 60.0 | 0.4 | 4 014 | 1 606 | 2 408 | | | | | | | | | 100m ² Floor | 0.30 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 8 | 10 | 0 |
| | | | | Post Office/ICT Access Point* ₂ | 1 | 60.0 | 0.4 | 818 | 327 | 491 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/Ha | 2 | 2 | 0 |
| | | | | Recreation (Sports & Parks) | 1 | | | 55 000 | | 55 000 | | | | | | | | | gross area | 12.00 kℓ/Ha | | | | 66 | 83 | 3 |
| | | | | Streets | 1 | | | 46 138 | | 46 138 | | | | | | | | | | | | | | | | |
| Subtotal | | | 341 207 | | | | 341 207 | 179 390 | 261 852 | 3 000 | | | | | 833 | | | | | | | 2 190 | 2 738 | 82 | | |
| Rietfontein* ₅ | RE/129/301-IQ | JW3271 | 837 886 | Residential (Single Dwelling) | 1 | 50.0 | | 174 960 | | 174 960 | 972 | 90 | 60 | unit | 0.60 kℓ/d | 583 | gross area | 21.00 kℓ/Ha | or | unit | 0.45 kℓ/d | 437 | 729 | 29 | | |
| | | | | Flats (Social Housing) | 3 | 30.0 | 0.9 | 167 755 | 150 980 | 117 429 | 3 014 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 815 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 1 953 | 2 441 | 96 | | |
| | | | | Flats (RDP Housing) | 3 | 30.0 | 0.9 | 167 336 | 150 603 | 117 135 | 3 014 | 50 | 200 | 500m ² Floor | 2.70 kℓ/unit* ₆ | 813 | 100m ² Floor | 1.20 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 1 948 | 2 435 | 96 | | |
| | | | | Business* ₂ | 1 | 60.0 | 0.4 | 21 389 | 8 556 | 12 833 | | | | | | 500m ² Floor | 1.65 kℓ/unit* ₆ | 28 | gross area | 21.00 kℓ/Ha | or | 100m ² Floor | 0.65 kℓ/unit* ₆ | 56 | 70 | 3 |
| | | | | Creche/ECD Centre* ₂ | 1 | 60.0 | 0.4 | 9 695 | 3 878 | 5 817 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 23 | 29 | 1 |
| | | | | Primary School* ₂ | 1 | 60.0 | 0.4 | 60 352 | 24 141 | 36 211 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 145 | 181 | 7 |
| | | | | Secondary School* ₂ | 1 | 60.0 | 0.4 | 50 659 | 20 263 | 30 395 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 122 | 152 | 6 |
| | | | | Church* ₂ | 1 | 60.0 | 0.4 | 9 695 | 3 878 | 5 817 | | | | | | | | | 100m ² Floor | 0.30 kℓ/unit* ₆ | and | gross area* ₁ | 12.00 kℓ/Ha | 19 | 23 | 1 |
| | | | | Post Office/ICT Access Point* ₂ | 1 | 60.0 | 0.4 | 1 961 | 784 | 1 177 | | | | | | | | | gross area | 20.00 kℓ/Ha | or | 100m ² Floor | 0.60 kℓ/unit* ₆ | 5 | 6 | 0 |
| | | | | Recreation (Sports & Parks) | 1 | | | 62 222 | | 62 222 | | | | | | | | | gross area | 12.00 kℓ/Ha | | | | 75 | 93 | 4 |
| | | | | Streets | 1 | | | 111 861 | | 111 861 | | | | | | | | | | | | | | | | |
| Subtotal | | | 837 886 | | | | 837 886 | 363 083 | 675 858 | 7 000 | | | | | 2 240 | | | | | | | 4 781 | 6 159 | 185 | | |
| Total | | | 1 206 194 | | | | 1 206 194 | 566 578 | 956 776 | 10 489 | | | | | 3 203 | | | | | | | 7 284 | 9 287 | 365 | | |

*₁ = Grounds water requirement
 *₂ = Assumed FAR (Red Book)
 *₃ = Includes 20% UAW
 *₄ = Includes PHF of 3
 *₅ = Parameters inflated by (x) 1.94
 *₆ = Unit as specified in the UWD Type field

2. BACKGROUND

The two (2) proposed developments each fall within a separate water district study area:

- Rietfontein – Lenasia & Lehae Water District for which GLS compiled the master plan report for JW in August 2015 (JWAT-C-1206-01-12-0715).
- Ennerdale X9 – Lawley & Ennerdale Water District for which GLS compiled the master plan report for JW in March 2016 (JWAT-C-1206-01-07-0215).

The two (2) proposed developments each fall within a separate sewage drainage basin:

- Rietfontein – Olifantsvlei Drainage Basin for which GLS compiled the master plan report for JW in June 2016 (JWAT-C-1206-03-32-0716).
- Ennerdale X9 – Ennerdale, Lenasia & Poortjie Drainage Basin for which GLS compiled the master plan report for JW in March 2016 (JWAT-C-1206-03-31-0416).

These reports and the latest hydraulic models (2019-08) formed the basis of the water/sewage impact study undertaken for the proposed developments. The existing JW master plans do make provision for the proposed developments however, with substantially lower densities investigated here-in. Therefore, the demands were updated in the models to investigate what effect the proposed developments will have on the current JW master plans and thereafter provide feedback with regards to the required master plan items to be implemented and their phasing.

4. SEWER SYSTEM

4.1 Background & Sewer Flow

4.1.1 Ennerdale X9 Development

The proposed Ennerdale X9 development is located in the North West parts of the Ennerdale Lenasia Poortjie drainage basin, and North West of the intersection between Samuel Road and Town road as shown in Figure SI038_S2.

The predominant landuse in the area is residential comprising of multiple dwelling unit buildings, clusters and dwelling houses, although there are some business and commercial areas present.

The total estimated peak daily dry weather flow (PDDWF) and max flow for the proposed development are shown in Table SI038_S2.

4.1.2 Rietfontein Development

The proposed Rietfontein development is located in the Southern parts of the Olifantsvlei drainage basin, south of Lenasia X10 and Themb'Elihle as shown in Figure SI038_S3.

The predominant landuse in the area is residential comprising of multiple dwelling unit buildings, clusters and dwelling houses, although there are some business and commercial areas present.

The total estimated peak daily dry weather flow (PDDWF) and max flow for the proposed development are shown in Table SI038_S4.

4.2 Existing Sewer Services & Proposed Connection Points

4.2.1 Ennerdale X9 Development

Figure SI038_S2 has reference. Sewage from proposed development drains via a 300/1050 mm Ø pipeline in a westerly direction until it reaches Ennerdale WWTW.

The existing system analysis plus the additional sewage contribution from the proposed development indicates that the existing infrastructure has sufficient capacity. The ultimate scenario analysis plus the additional sewage contribution from the proposed development indicates that the collector pipes downstream of the development will need to be upgraded. It should be noted that there is no as-built information available for this reticulation, therefore the reticulation downstream of the development would need to be surveyed to determine the extent of the work required. It is proposed that all the collectors downstream of the development be surveyed but it should be noted that only a few sections of pipe are

critical. The bulk pipes downstream of the proposed development have a relative spare capacity greater than 15% (i.e. pipes larger than 450 mm Ø) for the existing and ultimate scenarios. For details of the MP items affected downstream of Ennerdale Extension 9, refer to Table SI038_S3.

4.2.1 Rietfontein Lenasia Development

Figure SI038_S3 has reference. Sewage from proposed development drains via a 250/1350 mm Ø pipeline Northwards until it reaches Olifantsvlei WWTW.

The bulk pipes downstream of the proposed development have a relative spare capacity greater than 15% (i.e. pipes larger than 450 mm Ø) for the existing and ultimate scenarios. It is proposed that collectors be implemented to service the Rietfontein development. The collectors proposed on both the east and west sides of the development will be implemented until they tie into the downstream bulk outfall sewers. The design considered connecting the proposed collectors to neighboring existing collectors but that would result in capacity issues for those existing collectors so it was opted to only tie in at the bulk outfall sewers. For details of the proposed Future Main items downstream of Rietfontein development, refer to Table SI038_S5.

4.3 WWTW

4.3.1 Ennerdale X9 Development

A portion of the sewage from the Ennerdale Lenasia Poortjie basin drains into Ennerdale WWTW which, according to JW personnel, has a design treatment capacity of 8 ML/d.

According to the JW records (Operations) the current flow discharging to the Ennerdale WWTW is approximately 10 ML/d (2018). This exceeds the existing design capacity by 2 ML/d. The WWTW will not have sufficient capacity to accommodate an additional 2.1 ML/d from the proposed development and will need to be upgraded. JW personnel have completed the investigation to upgrade Ennerdale WWTW to 16 ML/d, the project is scheduled to commence in the third quarter of 2020. Once implemented there will be sufficient treatment capacity to accommodate the additional flow.

4.3.2 Rietfontein Development

All sewage from the Olifantsvlei basin drains into Olifantsvlei WWTW which, according to JW personnel, has a design treatment capacity of 240ML/d.

According to the latest JW data simulated in the hydraulic sewer models for the Johannesburg network, the current flow discharging to the Olifantsvlei WWTW is approximately 200 ML/d. Therefore, the current spare capacity is estimated to be 40 ML/d. Thus, according to the latest JW data (billing and consumption



data, June 2019), the Olifantsvlei WWTW has sufficient capacity to accommodate the additional flows (4.8 ML/d) from the Rietfontein development.

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Table SI038_S2: Sewer Flow (Ennerdale X9)

| PDDWF (kl/day) | Max Flow (l/s) |
|-----------------------|-----------------------|
| 2 100 | 35 |

Table SI038_S3: Bulk and Reticulation MP items (Ennerdale X9)

| Item Type | Item No. | Extent | Size (Rev. MP) | Task/Comment | Cost |
|---|-------------|----------|----------------|--|--------------------|
| Required Works - Existing Infrastructure | | | | | |
| MPI | ELP_ENN1.1 | 69 m x | 450 mm Ø | Ennerdale Ext 9 Upgrades/ Survey to confirm upgrade requirements (Critical) | R 459 000 |
| MPI | ELP_ENN1.1a | 164 m x | 450 mm Ø | Ennerdale Ext 9 Upgrades/ Survey to confirm upgrade requirements | R 868 000 |
| MPI | ELP_ENN1.2 | 189 m x | 355 mm Ø | Ennerdale Ext 9 Upgrades/ Survey to confirm upgrade requirements (Critical) | R 792 000 |
| MPI | ELP_ENN1.2a | 1224 m x | 355 mm Ø | Ennerdale Ext 9 Upgrades/ Survey to confirm upgrade requirements | R 4 398 000 |
| MPI | ELP_ENN1.3 | 15 m x | 250 mm Ø | Ennerdale Ext 9 Upgrades/ Survey to confirm upgrade requirements (Critical) | R 154 000 |
| MPI | ELP_ENN1.3a | 399 m x | 250 mm Ø | Ennerdale Ext 9 Upgrades/ Survey to confirm upgrade requirements | R 1 156 000 |
| Total | | | | | R 7 827 000 |

Table SI038_S4: Sewer Flow (Rietfontein)

| PDDWF (kl/day) | Max Flow (l/s) |
|-----------------------|-----------------------|
| 4 800 | 80 |

Table SI038_S5: Bulk and Reticulation MP items (Rietfontein)

| Item Type | Item No. | Extent | Size (Rev. MP) | Task/Comment | Cost |
|---|-----------|----------|----------------|-----------------------------|---------------------|
| Required Works - Proposed Developments | | | | | |
| FM | OLF_LS4.1 | 857 m x | 315 mm Ø | New Outfall to service area | R 2 261 000 |
| FM | OLF_LS4.2 | 242 m x | 250 mm Ø | New Outfall to service area | R 571 000 |
| FM | OLF_LS4.3 | 2844 m x | 315 mm Ø | New Outfall to service area | R 7 356 000 |
| FM | OLF_LS4.4 | 183 m x | 250 mm Ø | New Outfall to service area | R 445 000 |
| Total | | | | | R 10 633 000 |

5. SUMMARY

The main findings and recommendations from this investigation are:

Investigation - General

- i. The developer intends to establish two housing developments comprising of 10 000 units plus supplementary facilities.
- ii. The existing JW master plans do make provision for the proposed developments however, with substantially lower densities investigated here-in.

Water Investigation - Rietfontein

- iii. The Rietfontein development (6 159kL/d) is located within in the Lenasia Low Level (Cosmos) Reservoir zone. The existing zonal demand is 23 175kL/d. This will increase to 29 334 kL/d (incl. UAW) once the development is established. The ultimate demand will be approximately 49 247kL/d.
- iv. The 43.6ML Cosmos Reservoir currently possesses 45h x AADD storage. This will drop to 36h x AADD when the Rietfontein development materialises and starts using water, and is therefore sufficient.
- v. The model indicates the existing 675mm Ø bulk supply pipe to Cosmos Reservoir does not have sufficient capacity to supply even the existing rate, given the previously logged peak pressures at the connection (170m). The new bulk supply from RW1984 to Cosmos and Hospital Hill reservoir is required immediately, as discussed in Section 3.2.1.2.
- vi. The existing system analysis indicates the robust distribution system upstream is sufficient with added demand of the proposed developments. No upgrades besides internal distribution/reticulation of the development are required for the Rietfontein development.
- vii. Furthermore, although not required immediately, certain additions/revisions to the master plan are required as a result of the development. These are discussed in Section 3.2.1.4.
- viii. The fire flow analysis indicates the required fire flow can be supplied through the existing/proposed distribution and reticulation systems at the required pressures, outside the development site. This could not be tested internally, as the reticulation layout is not available at this point.

Water Investigation – Ennerdale X9

- ix. The Ennerdale X9 development (2 738kL/d) is located within the Ennerdale Reservoir zone. The existing zonal demand is 14 920kL/d. This will increase to 17 659 kL/d (incl. UAW) once the

development is established. The ultimate demand will be approximately 40 393 kL/d. An Ennerdale Tower zone (supplied from Ennerdale Reservoir) will also be created in future, with an ultimate demand of 2 233kL/d.

- x. The 2 x 11.4 ML Ennerdale Reservoirs currently possess 37h x AADD storage. This will drop to 31h x AADD when the Ennerdale X9 development materialises and starts using water, and are therefore sufficient.
- xi. The model indicates the RW bulk supply (T5/T4) does not have sufficient capacity to supply even the existing rate, which concurs with current problems experienced with supply, as reported by JW Operations. The bulk supply must be upgraded – to be implemented by RW themselves (details not provided here-in).
- xii. The existing system analysis indicates the distribution and reticulation system requires extensive upgrading to accommodate the proposed Ennerdale X9 development, as discussed in Section 3.2.2.3.
- xiii. Furthermore, although not required immediately, certain additions/revisions to the master plan are required as a result of the development. These are discussed in Section 3.2.2.4.
- xiv. The fire flow analysis indicates the required fire flow can be supplied through the existing/proposed distribution and reticulation systems at the required pressures, outside the development site. This could not be tested internally, as the reticulation layout is not available at this point.
- xv. **On a more general planning note, the extensive existing bulk supply for the Cosmos/Lenasia water districts that will require significant upgrading along its entirety to accommodate future development and densification in the region. This coupled with the fact that Midvaal Local Municipality is located directly east of the district, has previously drawn attention to a regional consideration of the future bulk supply to this area. This regional bulk supply would consist of a new strategically positioned RW reservoir on the boundary of both municipalities, supplied by the RW Spioenkop Reservoir, to serve the Lenasia and Lehae water district as well as potential future Midvaal developments (as per latest Midvaal SDF). An initial review of this option (as discussed in SP_447 – Southern Farms Impact Investigation Report) indicates it will likely present a much shorter route of supply thus more optimal supply option from both RW's and JW's perspective. Further investigation of this bulk supply option in consultation with Rand Water, Midvaal and Johannesburg Water, is recommended, prompted again by further revisions to upgrade requirements to the existing bulk supply system discussed here-in.**

Sewer Investigation – Ennerdale X9

- xvi. The bulk pipes which will receive sewage flow from the Ennerdale Extension 9 development will have sufficient capacity in the existing and ultimate scenarios.
- xvii. The MP items listed in Table SI038_S3 will need to be implemented in line with the proposed development.
- xviii. Ennerdale WWTW has insufficient capacity for the existing flows, therefore it will not be able to accommodate the additional sewage flow from the Ennerdale Extension 9 development. Upgrading Ennerdale WWTW has been investigated and will be implemented in 2020. Once implemented there will be sufficient treatment capacity to accommodate the additional flow.

Sewer Investigation - Rietfontein

- xix. The bulk pipes which will receive sewage flow from the Rietfontein Lenasia development will have sufficient capacity in the existing and ultimate scenarios.
- xx. The MP items listed in Table SI038_S5 will need to be implemented in line with the proposed development.
- xxi. According to the analysis the Olifantsvlei WWTW currently has sufficient treatment capacity to accommodate the proposed development.

We trust you find the above sufficient regarding your request.

Yours faithfully

GLS CONSULTING (PTY) LTD
REG. NO.: 2007/003039/07

A handwritten signature in black ink, appearing to be 'JK', is written over a faint, light-colored signature line.

Per: MR JK COMPION (Pr.Eng.)
(Senior Executive)

