MVD Kalahari

CIVIL ENGINEERING BULK SERVICES REPORT

FOR

PROPOSED UITKOMS DEVELOPMENT IN KATHU

November 2018

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Client: Anglo American

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EXECUTIVE SUMMARY

This report investigates the current availability of bulk services for the proposed UITKOMS residential development in Kathu as per the land use layout as presented by Macroplan Town Planners (see Annexure A). This report is a revision of the initial report submitted by MVD Kalahari on 10 March 2015. The initial report included both the proposed development at SIMS and UITKOMS whereas this updated report only concerns the proposed UITKOMS development.

Me. Jani Bruwer from Macroplan on behalf of SIOC requested MVD Kalahari to revise the Civil Engineering Bulk Civil Engineering Services Report for the proposed development at UITKOMS due to the lesser amount of housing opportunities on the latest UITKOMS layout from Macroplan.

This report should be read in conjunction with previous reports done by Aurecon / WorleyParsons, Report Numbers 7733/108297/Report Version no: AA and 6115/ 108297/Report Version no: AC.

This report highlights the approach followed and findings that address the bulk services and infrastructure status quo for the proposed UITKOMS development only.

It is important to note that there is long term development planning envisaged for the greater Kathu area.

The proposed infrastructure upgrades for UITKOMS include the following:

- Reservoir Storage 24 hours: 0,35 Mℓ (To be accommodated in the existing Kathu East reservoir)
- Elevated Tower: 0,074 Mℓ or 74 kℓ (To be accommodated in the existing Kathu East tower)
- Sewerage Pump Station: 5,34 ℓ/s (New pump station)
- Sewer Rising Main: 125 mm uPVC Class 12 (New rising main)
- Bulk Water Supply Line: 160 mm uPVC Class 12 (New supply line)
- Additional WTW Capacity: 0.365 Mℓ/day (To be accommodated within the new proposed works next to Lategan Dam)
- Additional WWTW Capacity: 0,16 Mℓ/day (Can be accommodated in the existing WWTW)
- Traffic Impact Assessment for Frikkie Meyer Street (Upgrade of existing street)

1. INTRODUCTION

1.1. Background of Scope

MVD Kalahari consulted with personnel of the Gamagara Municipality and Worley Parsons during the preparation of the initial report and also studied the reports as received as mentioned previously.

Seeing that there is future planning in place for the Kathu area and also other developments by other developers, the purpose of this report is to determine the civil engineering bulk requirements for the proposed UITKOMS development and the expected costs for the bulk supply services. This report will also indicate the status quo of the available civil engineering bulk services and any possible constraints.

It should be noted that this study does not include the detail designs of any bulk infrastructure nor internal reticulation networks i.e. water and sewer as well as the roads and storm water for the proposed UITKOMS development.

2. DESIGN REQUIREMENTS AND DESIGN CRITERIA

2.1. Design Criteria: Bulk Water and Internal Reticulation Network

2.1.1. Design Requirements

The Guidelines for Human Settlement Planning and Design (CSIR, 2005), commonly referred to as the Red Book, was used to determine the minimum design requirements. Table 1 below lists the primary minimum design requirements that will be used during the analyses (Refer to the following sub section for the minimum fire requirements).

No	Description		Criterion	Source
1	Average annual daily demand	RES I RES II RES III	250 ℓ/c/d 197,5 ℓ/c/d 180 ℓ/c/d	MVD & WORLEY PARSONS
2	Peak factor for developed areas		4	RED BOOK
3	Maximum head under zero flow conditions		90 m	RED BOOK
4	Minimum head under instantaneous peak demand		24 m	RED BOOK
5	Reservoir storage capacity (recommended)		48 hours	RED BOOK
6	Reservoir storage capacity (taking into consideration the number of sources and the reliability of these sources)		24 hours	RED BOOK
7	Elevated storage capacity (supplied by a one duty and one standby pump configuration)		4 hours	RED BOOK
8	Elevated storage capacity (supplied by a one duty and one standby pump configuration with standby power generation)		2 hours	RED BOOK

Table 1: Minimum design requirements

2.1.2. Fire Requirements

The fire-risk category is based on the proposed zoning of the development. This residential development is zoned; residential zone 1. The required fire water storage is determined by the highest category in the supply area. The place of worship is the only other zoned area. This supply area is classified as a Low-risk, group 1 area.

The fire requirements for a Low-risk, group 1 area is as indicated in the below Table 2. The developments generally require a rational fire design based on their fire risk category in accordance with SANS 10400 and SANS 10090.

No	Description	Fire-Risk Category	Source
		Low-risk, Group 1	
1	Minimum design fire flow	900 ℓ/min (15 ℓ/s)	RED BOOK
2	Maximum number of hydrants discharging simultaneously	1 (max. 240m apart)	RED BOOK
3	Minimum Hydrant flow rate for each hydrant	900 ℓ/min	RED BOOK
4	Minimum residual head under fire flow conditions	7 m	RED BOOK
5	Duration of design fire flow	2 hours	RED BOOK

Table 2: Minimum design fire requirements

2.1.3. Design Criteria

The proposed design criteria for the reservoir and tower sizing are shown in Table 3 below.

No	Description	Criterion
	Reservoir and tower sizing	
1	Reservoir storage (AADD)	24 hours (AADD)
2	Tower storage (peak flow)	2 hours (Peak flow)
3	Fire water storage	Low Risk
	Hydraulic of bulk supply lines	
1	Minimum pipe diameter	110 mm diameter
2	Pipe velocities	0.6 m/s
3	Maximum pipe velocities	1.2 m/s
4	Pipe material	uPVC
5	Pipe roughness Manning coefficient	0.012

Table 3: Design criteria

2.2. Design Criteria: Bulk Sewer and Internal Reticulation Network

2.2.1. Design Requirements

The Guidelines for Human Settlement Planning and Design (CSIR, 2005), commonly referred to as the Red Book, was used as the guideline to determine the minimum design requirements. Table 4 below lists the primary minimum design requirements.

No	Description		Criterion	Source
1	Average annual dry weather flow	RES I RES II RES III	200 ℓ/c/d 157,5 ℓ/c/d 115 ℓ/c/d	MVD & WORLEY PARSONS
2	Self-cleansing velocity		0.7 m/s	RED BOOK
3	Minimum pipe diameter		160 m	GAMAGARA MUNICIPALITY
4	Flow depth		80%	MVD
5	Maximum spacing between manholes		80 m	GAMAGARA MUNICIPALITY

Table 4: Minimum design requirements

2.2.2. Design Criteria

The proposed design criteria for the sizing of pump stations and rising mains is as shown in Table 5 below.

No	Description		Criterion	Source
1	Peak factors		2.5	RED BOOK
2	Storm water ingress		15%	RED BOOK
3	Pipe velocities: Minimum (Internal reticulation) Maximum (Rising Mains)		0.7 m/s 2.5 m/s	RED BOOK RED BOOK
4	Pipe materials:	Rising mains Gravitational lines	uPVC, Class 12 uPVC, Class 34	-
5	Pipe roughness Manning coefficient		0.012	-

Table 5: Design criteria

3. INFRASTRUCTURE REQUIREMENTS FOR BULK WATER AND BULK SEWER; STATUS QUO, CONSTRAINTS AND COST ESTIMATES

3.1. Uitkoms: Bulk Water

Description	Unit	Quantity	Rate	AADD ℓ/day	Flow ℓ/s
Residential AADD					
Res I	ℓ/stand/day	159	1 250	198 750	2.30
Institutional AADD					
Open I – Park 1,403 ha	ℓ/ha/day	1,403	15 000	21 045	0.24
Inst I – Worship	ℓ/stand/day	1	2 000	2 000	0.02
TOTAL AADD (ℓ/day)				221 795	2.56
Gross AADD = AADD + 10% losses				243 975	2.82
Summer Peak Demand (SPD) = AADD x 1,1 x 1,5				365 962	4.23
Instantaneous Peak Demand (IPD) = AADD x 4				887 180	10.24
Instantaneous Peak Demand + Fire Flow for Low Risk (2 Hours @ 15 ℓ/s)				995 180	11.52
Instantaneous Peak Demand + 20%				1 064 616	12.32
Reservoir Storage = Gross AADD + Fire Flow (2 Hours @ 15 ℓ/s)				351 975	4.1

Table 6: Calculation of Average Annual Daily Demand (AADD)

3.1.1. Additional Storage Capacity Required for the Project

Reservoir:
Overall 24 hours (1 day storage): 0,35 Mℓ (351 975 ℓ/day) or Overall 48 hours (2 days storage): 0,70 Mℓ (351 975 ℓ/day x 2 days)
Elevated tower (2 hrs of IPD): 0,074 Mℓ (887 180 ℓ/day x 2/24)

3.1.2. Main Water Supply Line to the Reservoir Required for the Project

Based on a maximum flow velocity of 1,2 m/s: 110 mm uPVC Class 12.

3.1.3. Additional Water Treatment Capacity Required for the Project

Daily additional WTW capacity: 0,35 Mℓ/day.

3.1.4. Supply Line Required between Elevated Tower and the Project

Based on a maximum flow velocity of 1,2 m/s and a flow of 12,32 ℓ/s: 160 mm uPVC Class 12.

3.2. Uitkoms: Bulk Sewer

Description	Unit	Quantity	Rate	AADWF ℓ/day	Flow ℓ/s
Residential AADWF					
Res I	ℓ/stand/day	159	1 000	159 000	1.84
Institutional AADWF					
Inst I – Worship	ℓ/stand/day	1	1 500	1 500	0.02
TOTAL AADWF (ℓ/day)				160 500	1.86
ADD 2,5 Peak Hour Flow Factor (Red Book)				401 250	4.64
ADD 15% Storm Water Ingress				461 438	5.34

Table 7: Calculation of Average Annual Dry Weather Flow (AADWF)

3.2.1. Outfall Sewer Required for the Project

The minimum diameter required is:

160 mm Class 34 uPVC pipe laid at a slope of 1:150 and design velocity of 0,820 m/s.

Manhole spacing: Maximum at 80 m centres and at all changes in gradient and direction.

3.2.2. Additional Sewage Pump Station Capacity Required for the Project

Pump station: 5.34 ℓ/s.

3.2.3. Additional Sewer Rising Main Required for the Project

Based on a maximum flow velocity of 0,7 m/s: 125 mm uPVC Class 12.

3.2.4. Additional Waste Water Treatment Capacity Required for the Project

WWTW: 0,16 Mℓ/day.

3.3. BULK WATER INFRASTRUCTURE FOR PROPOSED UITKOMS DEVELOPMENT

3.3.1. Status Quo and Constraints

Information as received from the Geohydrologist at the mine in Kathu indicated that there are two possible boreholes that may be utilized on the Racecourse (Equestrian Centre), namely borehole SW380 and borehole KM9.

The utilizing of borehole SW380 is not advisable as this borehole is also being used by the Kathu Golf Club. This poses a risk for the UITKOMS development. Borehole KM9 capacity will be insufficient to provide the UITKOMS development with a sustainable supply.

3.3.2. Cost Estimate

When using boreholes a suitable water purification package plant has to be incorporated with the resultant extra operational and maintenance costs.

For the purposes of this report we have accepted that the UITKOMS development, being a small development, will be able to utilize the Kathu East Reservoir and Tower, which are in close proximity from the UITKOMS development. See Annexure B for location of the mentioned rewervoir.

The proposed development will be fed by a bulk gravity line from the Kathu East pressure tower with a length = 425m, Class 12 uPVC, 160mm Ø, non-return, air valve and stop valves. The total construction cost estimate including professional fees and excluding VAT = R576,000.00.

3.4. Bulk Sewer Infrasructure for proposed Uitkoms Development

3.4.1. Status Quo and Constraints

WorleyParsons has done a report on the temporary connection from Bestwood via the Rooisand sewer infrastructure and the Kathu East Outfall Sewer. The peak flow from Bestwood was reported as being 6,1 ℓ/s, this temporary connection to be decommissioned during December 2014, thus making this capacity available again.

The peak flow from UITKOMS is 5,34 ℓ/s and it is assumed that the current infrastructure in Rooisand can accommodate this flow as was in the case of Bestwood.

The AADWF of 0,16 Mℓ/day from UITKOMS can be accommodated within the existing WWTW, but for the purposes of this report we have accepted that a financial contribution should be made as with all other current developments.

A dedicated sewage pump station and rising main will have to be allowed for once this development commence. The rising main to link up to a suitable point within the Rooisand development from where the sewage will gravitate.

3.4.2. Cost Estimate

To arrive at cost estimates the following publication was used namely *"An Industry Guide to Infrastructure Service Delivery Levels and Unit Costs – Version 6.0"* as published by the Department of Cooperative Governance and Traditional Affairs as well as MVD Kalahari's knowledge about recent development costs in Kathu.

Provision of a pump station to pump 5,34 ℓ/s Peak Wet Weather Flow (PWWF), inclusive of the structure, Mechanical and Electrical Equipment but excluding Electrical Connection:	R 3,094,000.00
Provision of sewer rising main to Rooisand: 125 mm uPVC, Class 12, Length ± 1500 m:	R 1,894,200.00
Crossing of Frikkie Meyer Street:	R 210,000.00
Total Cost Estimate:	R 5,198,200.00

The waste water treatment cost for expansion of the works if required for the additional effluent of 0,16 Mℓ/day is to be discussed and finalized with the Gamagara Local Municipality when the Service Agreement is done between the Gamagara Local Municipality and the Developer.

Please note that the cost estimate should be treated as indicative only and may be influenced significantly by several factors.

Cost estimates above exclude VAT, but include professional fees and are based on September 2018 rates.

4. BULK ROAD AND STORM WATER INFRASTRUCTURE STATUS QUO, CONSTRAINTS AND COST ESTIMATES

4.1. Status Quo and Constraints

Upgrading of Frikkie Meyer Street were done in the near past from the N14 intersection. Once a Traffic Impact Study has been done will the recommendations be implemented and further upgrading done if recommended by the traffic impact study.

Traditionally all storm water in the greater Kathu area has been allowed to run off road surfaces and to drain into the highly permeable sands or the use of shallow gravel storm water drains.

In most of the residential areas in Kathu, where there are hard calcrete formations present near the surface, the status quo becomes a challenge for design engineers. The Kathu area has a very flat topography and excavations are very expensive due to the hard calcretes present.

Little or no formal major (bulk) storm water infrastructure is in place and all storm water run-off eventually finds its way towards the mining area via small localised channels, open shallow trenches and the odd box culverts, the latter being too small in most instances to accommodate the current storm water run-off from new residential developments.

4.2. Cost Estimates

To do a construction cost estimate for the roads and storm water bulk infrastructure; is not currently possible due to the unavailability of a Traffic Impact Study and updated Storm Water Management Plan. A Traffic Impact Study will be required to determine if the current road system connected to the proposed development is sufficient or not to cope with the future traffic load of the proposed development.

5. CONCLUSION

5.1. Final design drawings for all bulk civil engineering services will have to be submitted to the municipality for approval once commencement of the project is initiated.

5.2. The UITKOMS development has no major constraints other than approval from the Gamagara Local Municipality for connection of services to the existing Kathu East reservoir (pressure tower) and the sewer network in the existing Rooisand Development.

5.3. Bulk service contributions i.e. water, sewer, roads and storm water to be discussed and finalized between the Gamagara Local Municipality and the Developer when the Services Agreement is to be signed.

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ANNEXURE A

Layout Plan of Proposed Development

ANNEXURE B

Location of proposed UITKOMS Development