



CIVIL ENGINEERING SERVICES REPORT

TOWNSHIP ESTABLISHMENT FOR THE PROPOSED POPO MOLEFE INFORMAL SETTLEMENT (BOITEKONG EXT 39) IN RUSTENBURG LOCAL MUNICIPALITY

CLIENT:

AKHA MADUNA PROPERTY DEVELOPERS
14 LIVING STONE STREET
VRYBURG

PREPARED BY:

CC GROUP (PTY) LTD
251 TIMBAVATI STREET
MORELETA PARK
PRETORIA
e: info@ccgroupafrica.com
c: 078 219 3946
w: www.ccgrouppafrica.com

5th November 2019



CC Group
Proprietary
Limited

20161438/607



TABLE OF CONTENTS

DECLARATION	4
1. INTRODUCTION.....	5
2. BACKGROUND	7
2.1. General.....	7
3. TERMS OF REFERENCE.....	7
4. LEVEL OF SERVICE	7
5. SITE DESCRIPITON	8
6. BULK SERVICES	8
6.1. Bulk water supply: Existing Sources.....	9
6.2. Waste Water Management	11
6.3. Access Roads	14
6.4. Bulk Solid Waste Disposal.....	14
6.5. Bulk Stormwater Drainage	15
7. INTERNAL SERVICES	15
7.1. Water	15
7.2. Sewer	15
7.3. Rain and Storm Water	16
7.4. Refuse Removal	16
8. OPERATION AND MAINTENANCE.....	16
9. OTHER CONSTRAINTS UNDER INVESTIGATION	17
9.1. Environmental Impact Assessment	17
9.2. Floodline Report	18
10. SUMMARY.....	18
11. CONCLUSION AND RECOMMENDATION	18



List of Tables

TABLE 1: DESIGN WATER DEMAND	10
TABLE 2: FIRE WATER DEMAND	11
TABLE 3: SEWER DEMAND.....	12

List of Figures

FIGURE 1: LOCATION OF POPO MOLEFE	6
FIGURE 2: ZOOMED LOCALITY - POPO MOLEFE.....	6
FIGURE 3: PROPOSED DEVELOPMENT LAYOUT	8
FIGURE 4: EXISTING BULK WATER LAYOUT	10
FIGURE 5: EXISTING BULK SEWER LAYOUT	11
FIGURE 6: TREATMENT WORKS LAYOUT.....	13
FIGURE 7: PROPOSED ACCESSES	14
FIGURE 8: AVERAGE TERRAINE OF POPO MOLEFE INFORMAL SETTLEMENT	16
FIGURE 9: HEXREVIER LAYOUT	17



DECLARATION

I certify that this CIVIL ENGINEERING SERVICES REPORT –TOWNSHIP ESTABLISHMENT FOR PROPOSED POPO MOLEFE INFORMAL SETTLEMENT (BOITEKONG EXT 39) IN RUSTENBURG LOCAL MUNICIPALITY was prepared by me and I have experience and training in the field of civil engineering.

Signed.....

Date: 05 November 2019

Name : **Abraham Mukokanduku**
Qualification : **B.Sc. Hons Civil Engineering**
ECSA Registration # : **201570199**
Firm: : **C C GROUP (PTY) LTD**



1. INTRODUCTION

Akha Maduna Property Developers (Pty) Ltd (herein referred as “Akha Maduna”), was appointed by Programme Management Unit (herein referred as “The Department”) to coordinate and implement human settlements related project (township establishment for proposed Popo Molefe Informal Settlement – Boitekong ext 39) within the jurisdiction of Rustenburg Local Municipality in Bojanala Platinum District in the North West Province (herein referred as “Rustenburg”). As part of the appointment, Akha Maduna appointed C C Group (pty) Ltd (herein referred as C C Group) on 19th August 2019 to conduct Civil Engineering Services Confirmation for the township establishment for proposed Popo Molefe Informal Settlement (Boitekong ext 39) in Rustenburg Local Municipality.

C C Group undertook engineering assessment around the area to determine the requirement for engineering services and the availability of bulk services.

The Department has embarked on a mission to eradicate informal settlements in Rustenburg, and Popo Molefe informal settlement was highlighted as one of the areas that required to be formalized. Popo Molefe, an informal settlement, has no bulk water servicing the settlement as there is already water shortage in Rustenburg according to Rustenburg Master Plan.

The proposed development is situated on Boitekong ext 39 approximately 2.5km East of R510 on Molapo Drive, East of Boitekong Ext. 9, 10 and 11 township settlement. The total area of the development is approximately 210.6353Ha (**2,106,353m²**). There are approximately 4,300 proposed stands for the development in the final layout as presented to Rustenburg in October 2019.

The project is situated in Rustenburg Local Municipality (Rustenburg) along the right side of R510 East of Boitekong Ext. 9, 10 and 11 Township. The coordinates of the access roads of the development are:

1. Road to the north:
25-38-01,43 S (Lat)
27-17-07,47 E (Long)
2. Road to the south:
25-39-14,11 S (Lat)
27-18-18,21 E (Long)

The project location in terms of the provincial and regional context is shown in **Figure 1** below.



2. BACKGROUND

2.1. General

Rustenburg's policy on informal settlements states that Popo Molefe is an informal settlement. The Department has the plans to upgrade the informal settlement. The following engineering services next to / around the development are available: A site layout is attached showing the location of services on the western site of Popo Molefe Informal township.

- a) Bulk water - bulk water will be supplied from Rustenburg Water Treatment Works as indicated on the Bulk Services Masterplan with 250mm bulk pipeline that ends in Boitekong Ext 11. The anticipated water demand from the formalized settlement will be approximately 2.Ml/day and this will be sufficiently met as there is an upgrade project for the water supply in Rustenburg that will be completed in March 2020 and other future water schemes.
- b) Bulk sewer - there is a sewer treatment plant (Boitekong Water Treatment Plant) which is being upgraded from 12ML/day to 24ML/day design capacity and it is currently operating at 12ML/day. The upgrade will be completed at the end of the 2020/21 financial year (June 2021). Popo Molefe sewage will be accommodated on it.
- c) Internal Water and Sewer Reticulation – there area is not serviced with water and sewer.
- d) Access roads – there are formal access roads on the site (Molapo Drive, East of R510) . This will need to be upgraded during the formalization of the informal settlement as recommended by the Traffic Engineers – refer to the Traffic Impact Assessment Report.

3. TERMS OF REFERENCE

The scope of the appointment includes the formalization of Popo Molefe informal Settlement (Boitekong Ext 39) in Rustenburg. The purpose of this Engineering Report is to document the identification and requirement of engineering services and infrastructure for the informal settlement.

In addition, the report is further intended to demonstrate compliance with the philosophy and design parameters as set out by Department of Water and Sanitation (DWS) in conjunction with Rustenburg in terms of the Technical Guidelines for the Development of Water and Sanitation Infrastructure (2007 Revision).

4. LEVEL OF SERVICE

The current level of service is limited to access roads, bulk and internal water and sewer reticulation, which have in the meantime been provided through illegal connections and informal poor-conditioned accesses.

The analysis of the existing and proposed reticulation networks will be done with reference to the current DWAF guidelines entitled “Technical guidelines for planning and design in the development of water and sanitation services” (DWAF, 2004). The DWAF technical guidelines will also be checked against the recommendations made in the definitive publication on urban planning and infrastructure standards, Guidelines for human settlement planning and design (Department of Housing, 2000).

5. SITE DESCRIPTION

The location of the proposed development (Popo Molefe) as indicated on *Figure 1: Locality Plan* is situated approximately 6km North-East of Rustenburg in North West, at latitude 25-38-01,43 S and longitude 27-17-07,47 E. The site lies east of and borders the existing Boitekong Ext 9, 10 and 11, and is accessed via the R510 Main Road, through Molapo Drive and characterised by an existing informal settlement with tarred access road (which are generally in fair to poor condition).

Topographically the site is fairly flat to gently sloping towards the northwest. The boundaries of the proposed development emerges east of Boitekong Ext 9,10 and 11 and have Road R510 on the west side with several gravel roads dissecting through the proposed site, with two streams within, one on the north-east part of the development and the other on the south-west part. Currently the land is informally occupied, with wide-open spaces as Greenfield and cemetery.



Figure 3: Proposed Development Layout

6. BULK SERVICES

The following engineering services are being addressed in this engineering report:



- Water Supply (bulk and reticulation),
- Wastewater management (bulk and reticulation),
- Access Roads (main access and reticulation),
- Stormwater management (bulk and reticulation), and
- Solid waste disposal and Landfill

The engineering assessments are based on the guidelines for Human Settlements Planning & Design for the estimation of water and sewerage services. Limited calculations to determine the demand for the various services were prepared to obtain an indication of the size of the bulk services. The actual sizes of the bulk services will have to be determined through a final design process after the relevant details (final site layout plan, number of units, size and coverage of the various land uses etc) have been finalized.

6.1. Bulk water supply: Existing Sources

Potable water for the town of Rustenburg and Boitekong is obtained from the Rustenburg Water Treatment Works. The Rustenburg Water Treatment Works has a design capacity of 12Mℓ/day. The Proposed Development will have an approximate additional demand of 4Mℓ/day which, compared to the current treatment capacity is minor and amounts to approximately 3% of the total daily design treatment capacity for the whole of Rustenburg. There are three bulk water sources serving the whole of Rustenburg namely:

1. Rand Water – 45MI;
2. Magalies Dam – 75MI
3. Rustenburg Water Treatment Works – 12MI (being upgraded to 24)

Existing Bulk Water infrastructure is available within the proposed development and a proposed reservoir will be erected between Kanana and Boitekong, which is approximately 2km from the development. Refer to the attached Figure 2 below

The Proposed Development will be supplied with water from the Rustenburg Reservoir via existing bulk distribution pipelines, which is asbestos, and PVC (portion where maintenance has been done). A bulk water connection for the proposed development can be made to the existing 250mm diameter bulk pipeline located on the western border of the Proposed Development. The capacity, condition and available pressure of this pipeline should be verified before the bulk water connection is made.

Water Demand & Pressure

Applying the typical water consumption quantities to the proposed land use (as prescribed by the guidelines for human settlements “Red Book”), the total expected average annual daily demand (AADD) for the proposed development is 1695 kl/day with

an instantaneous peak flow rate (excluding fire flow) of 47.09 l/s.

Table 1: Design Water Demand

Land use rights	Number of units	Design Criteria (80l/c/day)	Total AADD* (l/day)	Total Demand (l/s)	Peak Factor	Peak Water Demand (l/s)
Residential	4 237	80	=80 x 4237 x 5 = 1 694 800 = 1694,8 (KL/day) (D2)	19.62 (l/sec)	2.4 =2.4 x 1 694 800 = 4 068 KL/day	47.09 (l/s)
TOTAL						11.11 l/s



Figure 4: Existing Bulk Water Layout

The critical factor that dictates the minimum required peak flow rate for the proposed development is fire flow demand.

The development is assumed to be low risk-Group 2 developments according to the design fire flow classification (CSIR Building and Construction Technology, 2000). The requirements for fire flow are as shown in **Table 2** below.



Table 2: Fire Water Demand

Minimum design fire flow:	= 500 ℓ/min
Minimum design fire flow per day (F):	= 720 kℓ /day
Residual pressure (R_p) - at peak domestic demand and hydrant discharge	$5\text{ m} \leq R_p$

The Rustenburg Local Municipality could not confirm the current operating pressure of the bulk supply pipeline on the eastern border of the site at the time of this report. It is proposed that a rational fire design incorporating various determining factors such as occupation class, fire water storage, on site fire network installation etc. be conducted as part of the detailed Engineering and Architectural design of the Proposed Development. Through the GIS department, Rustenburg confirmed the size of the bulk pipeline on the eastern border of the Proposed Development also with the help of the existing As-Built drawings.

6.2. Waste Water Management

The Boitekong Waste Water Treatment Plant (WWTP) located on northwestern outskirts of the development and has a hydraulic capacity of 12Mℓ/day which is in the process of upgrade to 24 Mℓ/day due for completion in June 2021. The plant is currently treating an average of 12Mℓ/day, which is being upgraded upgraded to 24 Mℓ/day, operational by December 2019. Sufficient capacity will therefore be available for the treatment of the sewage generated by the Proposed Development in the future.

Sewerage generated from Boitekong township flows under gravity via a Ø 525 mm sewer line towards the waste water treatment works. The Ø 525 mm sewer line is located on the northern part of the proposed development as indicated on the attached plan/layout (figure 2).



Figure 5: Existing Bulk Sewer Layout

Due to the natural topography, sewage generated by the Proposed Development will



flow towards the northern border of the site from where a connection can be made to the existing Ø 525 mm gravity sewer main referred to above should invert levels dictate.

The Rustenburg Local Municipality experiences a number of problems with sewer overflows on the bulk sewer line mainly attributed to the lack of sufficient water in the sewer network to self-cleanse the system. Other problems reported relates to the presence of inorganic materials in the network such as rags, rocks and sand. A detailed analysis of this portion of the pipeline is proposed which should include cleaning and inspection of the pipeline for roots and breakages. The sewer network of the Proposed Development should be designed to contribute to the self-cleansing capacity of the pipeline. Only upon verification of the condition of the pipeline can an assessment of the true capacity of the pipeline be conducted to evaluate whether or not the pipe diameter should be increased as part of the development.

Sewerage Flow

Applying prescribed Red Book rates, the peak hydraulic sewerage flow expected to be generated by the proposed development will be 1 355 kℓ/day with an average annual daily flow (AADF) of 3 898 kℓ/day.

Table 3: Sewer Demand

Average daily (A):	= 80% x 80 = 64 ℓ/Capita/day (CSIR Building and Construction Technology, 2000)
Total population to be serviced (B):	4 237 Units @ 2 bedroom per unit = 5 people x 4237 = 21 185 People
Daily peak factor (PF):	= 2,5
Extraneous flows factor (EF)	= 1,15
Design Sewerage Flow rate (D_i)= A×B×PF×EF	= 64 x 21 185 x 2,5 x 1,15 = 3 898 000 ℓ /day = 3 898 kℓ /day = 0.045m³/s
Assuming a scour velocity of 0,75m/s	Diameter of Pipe = $\sqrt{[(4 \times \text{Design Flowrate}) / (\text{Velocity} \times \Pi)]}$ = $\sqrt{[4 \times 0.045] / (0,75 \times 3.142)} = 0,276\text{m}$ = 276mm ≈ 300mm Pipe

The existing Ø 525mm gravity main sewer line located on the northern border of the proposed development should have sufficient capacity to handle the additional flow, which will take up an additional capacity of the line. Regular sewer overflows occur on this line as mentioned above. Before the detailed design of the sewer connection is



undertaken, a detailed analysis of the condition, capacity and slope of the sewer line should be conducted and, where necessary, alternatives proposed.

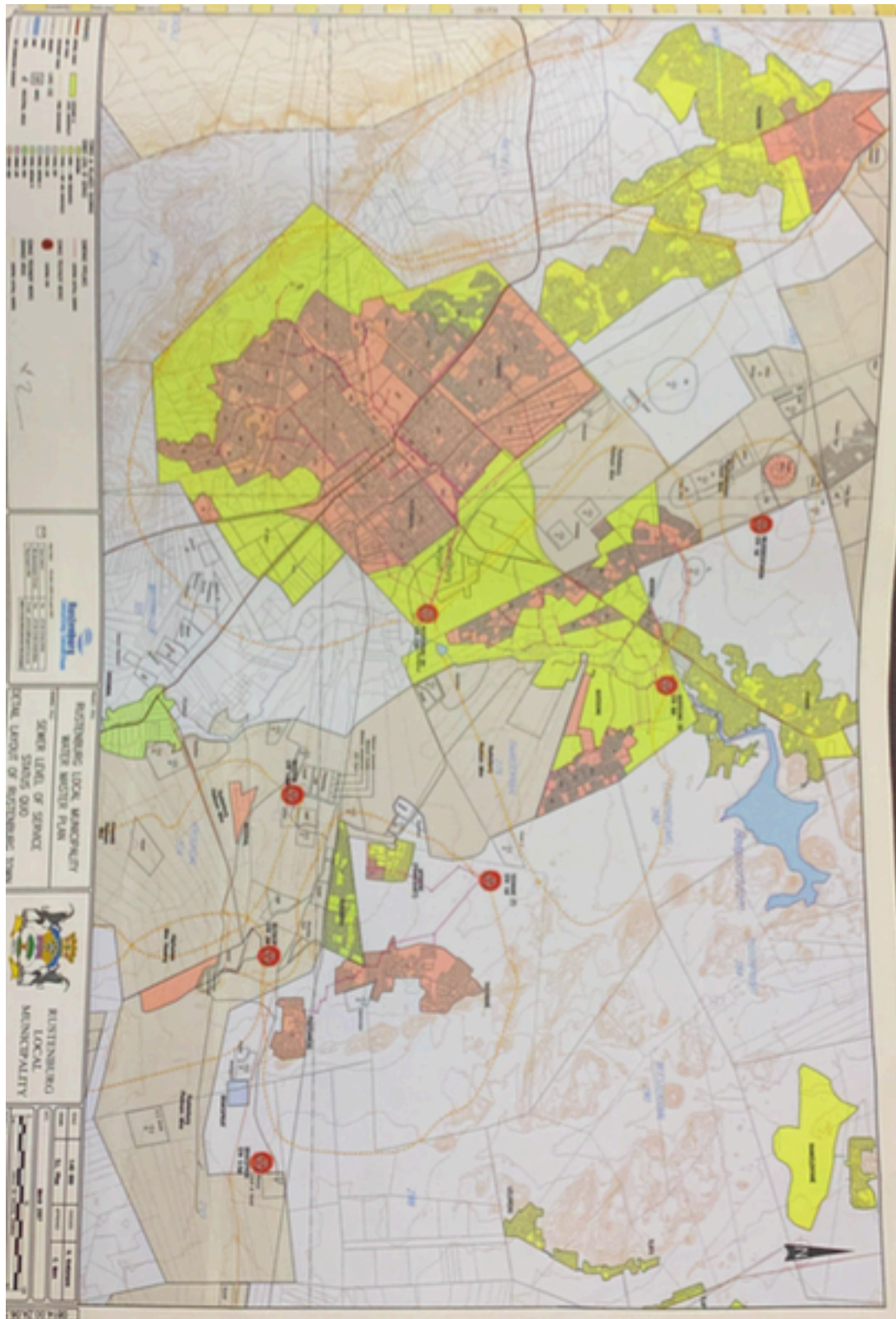


Figure 6: Treatment Works Layout

6.3. Access Roads

The Proposed Development has an existing formal access from Molapo Drive, connecting Popo Molefe to R510 along the northern border of the Proposed Development. Due to the proximity of this formal access road to the intersection with R510 and considering the road category of Molapo Drive, access from this road is needs to be upgraded.

Alternative access to the Proposed Development can be provided from Old Marikana Road on the southern border of the property. This alternative as well as the proximity to the intersection mentioned above, sight distances and traffic impact will be dictated by the Traffic Impact Study.



Figure 7: Proposed Accesses

6.4. Bulk Solid Waste Disposal

The average Municipal Solid Waste (MSW) generation by a Lower Middle income equates to 0.78 kg/capita/day as per USAID 2009 publication on Environmental Guidelines for Activities in Africa (EGSAA). The total estimated waste to be generated by the proposed development as follows:

- Total solid waste = 19.83 ton / day

The encouragement of an integrated waste management system will dramatically reduce MSW and promote Reduce, Reuse and Recycle practices. Solid waste removal is a function of the Waste & Environmental Management Division of the Rustenburg Local Municipality. The existing solid waste disposal site of Boitekong



has adequate capacity to accommodate the additional volumes of refuse expected to be generated by the development. The municipal dumping site is operated and maintained by the Community Services Department: Waste Management Division of the Municipality in accordance with the requirements of the Department of Water & Sanitation (DWS).

6.5. Bulk Stormwater Drainage

The natural topography slopes towards the western and southern boundary of the site from which discharge occurs into natural streams by means of a box culvert crossing Molapo Drive. Storm water generated in the western portion of the proposed development is conveyed by means of an open earth channel / culvert located on the southern border of the Proposed Development to the said crossing. The estimated additional storm water discharge generated by the proposed development is 1.886 m./s and 3.851 m./s for the 1:10 and 1: 100 year floods which is minor compared to the contributing areas.

Storm water infrastructure will be designed to accommodate runoff as surface flow in an open system. This will be achieved by designing internal roadways to disperse storm water towards the natural stream located west of the development. The existing residential area (Popo Molefe) does not have bulk storm water drainage.

7. INTERNAL SERVICES

7.1. Water

There is no formal connection for water in the informal settlement. The municipality indicated that water is supplied to the community (Popo Molefe) through water trucks at least twice a week.

The design of internal services will be dependent on the proposed development layout and subsequent approval by the Municipality. The following basic design guidelines will be followed:

- Use of uPVC and HDPE pipe materials of varying diameter according to designs of the Civil Engineer,
- Sufficient capacity to comply with fire flow demands,
- Installation of consumer water meters according to municipal policy.
- Provision of isolating valves, fire hydrants and air release valves to comply with the requirements and regulations the Municipality.

7.2. Sewer

There is no formal connection for wastewater in the informal settlement.

An internal sewer network of adequate diameter pipes with related connections and inspection eyes will be installed to comply with the minimum specifications stipulated in



the SANS 0400/89 Building Regulations. Manholes and rodding eyes will be constructed at necessary positions to allow for effective maintenance.

The internal sewer network will be connected to the existing main sewer infrastructure as elaborated in paragraph 2.2 above.

7.3. Rain and Storm Water

The Site Development Plan (SDP), to be submitted in future, will provide detail of internal access and storm water control considering the natural runoff patterns as discussed in Section 6.4 above.

Roads and storm water infrastructure will generally be designed to follow the 1.5-2.0% average slope on natural runoff patterns to avoid ponding and flooding of properties with associated damage.



Figure 8: Average Terrain of Popo Molefe Informal Settlement

7.4. Refuse Removal

Refuse removal is currently conducted by the Municipality in the other formal settlements and their services will be extended to the proposed development – refer paragraph 6.5 above. Refuse shall be removed by the Municipality at regular intervals as required.

8. OPERATION AND MAINTENANCE

The operation and maintenance arrangements for internal services will be defined by the municipality. The operation and maintenance of the external services will remain a function of the Municipality.

9. OTHER CONSTRAINTS UNDER INVESTIGATION

9.1. Environmental Impact Assessment

The proposed development traverses over Hexriver and this will trigger the need for Environmental Impact Review or Assessment.



Figure 9: Hexriver Layout

The absence of a proper solid waste disposal facility will unwillingly push the community to resort to the nearby river to deposit their waste. A call for a planned solid waste disposal plan bearing in mind the maintenance costs as outlined in the cost estimates below is hereby made. From an ecological perspective, the site is a favourable location for the development. There is sufficient space available at the site to accommodate the development within areas, which are not sensitive locally or from a regional perspective. Part of the wetland area and the river site that contains drainage lines and mesic area should be avoided. The majority of the intervening areas are however suitable for development and provided that sufficient measures to limit erosion potential are implemented; the ecological risks associated with the development are low.

It is recommended that after the development the developer must plant street trees to help in the process of photosynthesis and to fight against global warming.



9.2. Floodline Report

C C Group will be very willing to conduct a 1:100 flood line analysis of the Hexriver tributary, to ascertain the 50m buffer for rehabilitation and/or delineation of wetlands.

10. SUMMARY

The bulk water and sewer for the proposed development has been catered for in the Rustenburg Master Plan and has been accommodated in the existing upgrade of the water system and existing sewage disposal works respectively. Internal water and sewer reticulation needs to be done inline with the finalized layout. The informal access roads are to be upgraded to acceptable standards inline with proposed roadways and structural layers. Solid waste management to form part of the prioritized formalization processes.

11. CONCLUSION AND RECOMMENDATION

It is trusted that the above preliminary investigation provides sufficient information to evaluate the feasibility of the proposed development. The following can be concluded and recommended:

1. Bulk Sewer – the infrastructure is adequate for the development;
2. Bulk Water – there is adequate infrastructure but the volume of water is low;
3. Floodline Analysis – to be conducted for the development;
4. Environmental Impact Assessment – to be conducted for the development; and
5. A new reservoir to be constructed within the Development.