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CIVIL SERVICES REPORT

CIVIL SERVICES REPORT FOR THE PROPOSED NEW TOWNSHIP ESTABLISHMENT, CONSISTING OF APPROXIMATELY 750 ERVEN IN PAUL ROUX, FREESTATE

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CLIENT:

Attention: Mr P. de Bie

Tel: (0) 51 448 6006
Sel: (0) 82 415 6069

e-mail : piet@phethogo.co.za

ENQUIRIES:

Mr. S.J. Nortier

12 Lilyvale Road
Rayton
Bloemfontein,
9324

Tel: (0) 51 436 6721
Fax: (0) 51 436 1788

PREPARED BY:

CIVIL AND STRUCTURAL ENGINEERS (PTY)

Excellence in everything we do

P O Box 12079, Brandhof, Bloemfontein
Tel: (0) 51 436 6721, Fax: (0) 51 436 1788

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1. INTRODUCTION

SNA Civil & Structural Engineers (Pty) Ltd was appointed by ***Phethogo Consulting*** to compile a civil services report for the proposed new township establishment, consisting of approximately 750 erven in Paul Roux in the Freestate. The information contained in this report was based on the input provided by the ***Dihlabeng Local Municipality*** as well as visual inspections and on-site measurements.

1.1 PROPOSED NEW DEVELOPMENT

The proposed development entails the establishment of approximately 750 low income dwelling units in Paul Roux in the Freestate. Each of the dwellings requires water for domestic use, sanitation, electricity and access. Storm water management will also be investigated.

1.2. LOCATION

The proposed new development is located in Fateng-Tse-Ntso/Paul Roux adjacent to the Sand River and to the South of National Route 5 (N5) between Senekal and Bethlehem. See *locality layout 1.2.1* below.

2. SANITATION

2.1. EXISTING SANITATION INFRASTRUCTURE

Currently, the wastewater treatment works consists of oxidation ponds which are located next to the Sand River and to the South of Fateng-Tse-Ntso *(See Image 2.1.1 below).* A conventional Waste Water Treatment Works is currently under construction, to the North East of Paul Roux *(See Image 2.1.1 below)* and will replace the existing oxidation ponds. The design capacity of the new conventional Waste Water Treatment Works is ***3Ml/day***.

According to inputs from Dihlabeng Local Municipality, as well as on-site inspections and measurements, the existing sanitation system in Paul Roux consist of on-site septic tanks and VIP toilet system in Fateng-Tse-Ntso. A waterborne sewer reticulation network has been constructed in Fateng-Tse-Ntso but is not operational at this stage. The sewer reticulation network will be connected to a ***355mm dia u-Pvc*** outfall sewer line *(See Image 2.1.2 below)* which is currently under construction. The outfall sewer line will convey the generated sewer load from Fateng-Tse-Ntso to the newly constructed Waste Water Treatment Works. The new waterborne sewer reticulation network will be operational as soon as the outfall sewer line and the Waste Water Treatment Works has been completed.

Image 2.1.1: Position of new Waste Water Treatment Works and Existing Oxidation ponds.

Image 2.1.2: New 355mm diameter outfall sewer line.

2.2. OUTFALL SEWER LINE CAPACITY

The newly constructed outfall sewer line convey the existing sewer load of 1718 low income erven from Fateng-Tse-Ntso to the new conventional Waste Water Treatment Works. The capacity of the outfall sewer line is calculated by means of Manning's Equation:

$$Q = \left[\frac{1}{n} \times \left(\frac{A^{\frac{5}{3}}}{P^{\frac{2}{3}}} \right) \times S^{\frac{1}{2}} \right] \times 1000 \ )$$

Where: Q = Flow Rate (l/s)

A = Area for each flow depth

P = Wetted perimeter for each flow depth

S = Longitudinal slope between two inspection manholes

n = Manning's roughness coefficient (u-Pvc = 0.012)

2.2.1. Existing Sewer Load (Existing Capacity)

DESCRIPTION	Number of Dewlling Units (Low Income)	Litres/ Dwelling (l/day)
Fateng-Tse-Ntso	1718	500

2.2.1.1. Average Annual Daily Dry Weather Flow (AADDWF)

- For the above mentioned development = 1718 erven x 500 l/day
- Total Average Annual Daily Dry Weather Flow = 859 000 liter/day / 86 400

  = 9,942 l/s

2.2.1.2. Average Annual Daily Wet Weather Flow

- Add 15 % for extraneous flow
- Total Average Daily Wet Weather Flow = 9,942 l/s x 1.15

  = 11,433 l/s

2.2.1.3. Average Annual Daily Peak Flow (AADPF)

- Peak Factor = 2.5
- Peak Daily Flow = 11,433 l/s x 2.5

  = 28,584 l/s

2.2.2. Additional Sewer Load Generated (Required Capacity)

DESCRIPTION	Number of Dewlling Units (Low Income)	Litres/ Dwelling (l/day)
Proposed new development	750	500

2.2.2.1. Average Annual Daily Dry Weather Flow (AADDWF)

- For the above mentioned development = 750 erven x 500 l/day
- Total Average Annual Daily Dry Weather Flow = 375 000 liter/day / 86 400

  = 4,340 l/s

2.2.2.2. Average Annual Daily Wet Weather Flow

- Add 15 % for extraneous flow
- Total Average Daily Wet Weather Flow = 4,340 l/s x 1.15

  = 4,991 l/s

2.2.2.3. Average Annual Daily Peak Flow (AADPF)

- Peak Factor = 2.5
- Peak Daily Flow = 4,991 l/s x 2.5

  = 12,478 l/s

2.2.3. Outfall Sewer Line Capacity Calculations

Length (m)	*Dia (mm)*	n-Value	Area (m^2)	Wetted Perimeter (m)	Ave Slope (m/m)	Full Flow Capacity (m^3/s)	Full Flow Capacity (l/s)	80% Capacity (l/s)
1255	355	0.012	0.0990	1.1151	0.004	0.1038	***103.775***	83.020

2.2.4. Outfall Sewer Line Available Capacity

- Full Flow Capacity = 103,775 l/s
- Capacity at 80% full flow conditions = 83,020 l/s
- Existing Sewer Load *(Existing Capacity)* = 28,584 l/s
- Additional Sewer Load Generated *(Required Capacity)* = 12,478 l/s
- Available Capacity:

  = 80% Full flow capacity – Existing Sewer Load

  = 83,020 l/s – 28,584 l/s

  = 54,436 l/s

Available Capacity > Required Capacity (54,436 l/s > 12,478 l/s)

NOTE: The existing 355 mm diameter u-Pvc outfall sewer line would be sufficient to accommodate the additional sewer load generated as a result of the proposed new development.

2.3. WASTE WATER TREATMENT WORKS

The Waste Water Treatment Works consist of conventional Treatment Works with a design capacity of ***3 Ml/day.***

2.3.1 Existing Average Daily Dry Weather Flow (ADDWF)

DESCRIPTION	Number of Dewlling Units (Low Income)	Number of Dwelling Units (Medium Income)
Paul Roux	-	570
Fateng-Tse-Ntso	1718	-

- Paul Roux: 570 units x 750 l/unit/day = 427 500 l/day
- Fateng-Tse-Ntso: 1718 units x 500 l/unit/day = 859 000 l/day
- Existing Average Daily Dry Weather Flow (AADDWF) = 1 286 500 l/day

= *1,287 Ml/day*

2.3.2 Additional Average Daily Dry Weather Flow Generated (Required Capacity)

DESCRIPTION	Number of Dewlling Units (Low Income)	Litres/ Dwelling (l/day)
Proposed new development	750	500

- Proposed new development: 750 units x 500 l/unit/day = 375 000 l/day
- Additional Average Daily Dry Weather Flow (ADDWF) = 375 000 l/day

= *0,375 Ml/day*

The existing load to be treated by the new Waste Water Treatment works is ***1,287 ML/day*** with an available/surplus capacity of ***1,713 ML/day***. The additional sewer load generated as a result of the proposed development is ***0,375 ML/day***.

NOTE: The treatment works therefore has sufficient capacity to accommodate the additional sewer load generated by the proposed new development.

2.4 RECOMMENDATIONS

2.4.1 Outfall Sewer:

The existing 355mm diameter u-PVC outfall sewer line has a full flow capacity of 103,775 l/s and capacity at 80% full flow conditions of 83,020 l/s. The existing sewer load is calculated as 28,584 l/s and the additional sewer load generate by the proposed new township establishment is 12,478 l/s.

Available Capacity in Outfall Sewer = 83,020 l/s – 28,584 l/s = 54,436 l/s

Available Capacity (54,436 l/s) > Required Capacity (12,478 l/s) thus OK

The existing 355mm diameter u-Pvc outfall sewer line have sufficient capacity to accommodate the additional sewer load generated as a result of the proposed new development.

Recommendation: It is recommended to construct a pipeline from the proposed new development, across the Sand River and connect to the newly constructed (existing) 355mm diameter u-Pvc outfall sewer line. The length of the proposed pipeline will be approximately 1,5km from the new development to the proposed connection point as shown in figure 2.3.1 below.

2.4.2 Waste Water Treatment Works

The newly constructed Waste Water Treatment Works contains a surplus/available capacity of 1,713 Ml/day. The Required capacity as a result of the proposed new development is 0,375 Ml/day.

Surplus Capacity (1,713 Ml/day) > Required Capacity (0,375) thus OK

The existing Water Treatment Works have sufficient capacity to accommodate the additional sewer effluent load as a result of the proposed new development.

3. WATER

3.1. EXISTING WATER INFRASTRUCTURE

3.1.1. Water Resources

Potable water is pumped from the Bethlehem Water Treatment Works to the Paul Roux Storage Reservoirs. Currently there are two existing reservoirs in Paul Roux with a storage capacity of 2 ML and 3 ML respectively. These reservoirs provide water storage for Paul Roux and Fateng-Tse-Ntso.

3.1.2. Existing Water Reticulation Networks

According to As-built drawings and inputs provided by the Dihlabeng Local Municipality water is supplied from the storage reservoirs in Paul Roux via a 160mm diameter u-Pvc pipeline to the reticulation network in Fateng-Tse-Ntso, located to the East of the new township establishment. The existing water reticulation network in Fateng-Tse-Ntso consist of 90mm and 110mm diameter u-Pvc pipelines. It is proposed that the water supply from the new development can be connected to the existing reticulation network in Fateng-Tse-Ntso.

3.2. WATER PRESSURE READINGS

Water pressure readings were recorded during peak demand from 06:00 to 07:00 AM

The pressure readings are indicated in the *table 3.2.1* below.

More water pressure readings should be taken in peak times to confirm whether these readings are accurate. The water supply was cut off on two occasions while attempting to take further readings.

Table 3.2.1: *Water pressure readings during peak demand: 06:00 am – 07:00 am*

PRESSURE READINGS			
06:00 – 06:15	**06:15 – 06:30**	**06:30 – 06:45**	**06:45 – 07:00**
700 kPa	700 kPa	650 kPa	700 kPa

- Minimum Pressure Reading = 650 kPa
- Maximum Pressure Reading = 700 kPa

3.3. ADDITIONAL WATER DEMAND AND CAPACITY CALCULATIONS

Water demand calculations are based on the Guidelines for Human Settlement Planning and Design, Revised August 2003 edition. The additional water demand is calculated for the proposed new township establishment consisting of 750 low income houses.

3.3.1. Average Annual Daily Demand (AADD)

- Number of sites (Low Income) = 750 dwelling units
- Demand (l/dwelling/day) = 500 litre/dwelling/day
- Total Average Annual Daily Demand: 750 dwelling units x 500 l/du/day
  = 375 000 l/day / 86400
  = 4,340 l/s

3.3.2. Peak Daily Demand (PDD)

- Peak Factor = 4
- Peak Daily Demand: AADD x Pf
  = 4,340 l/s x 4
  = 17,36 l/s

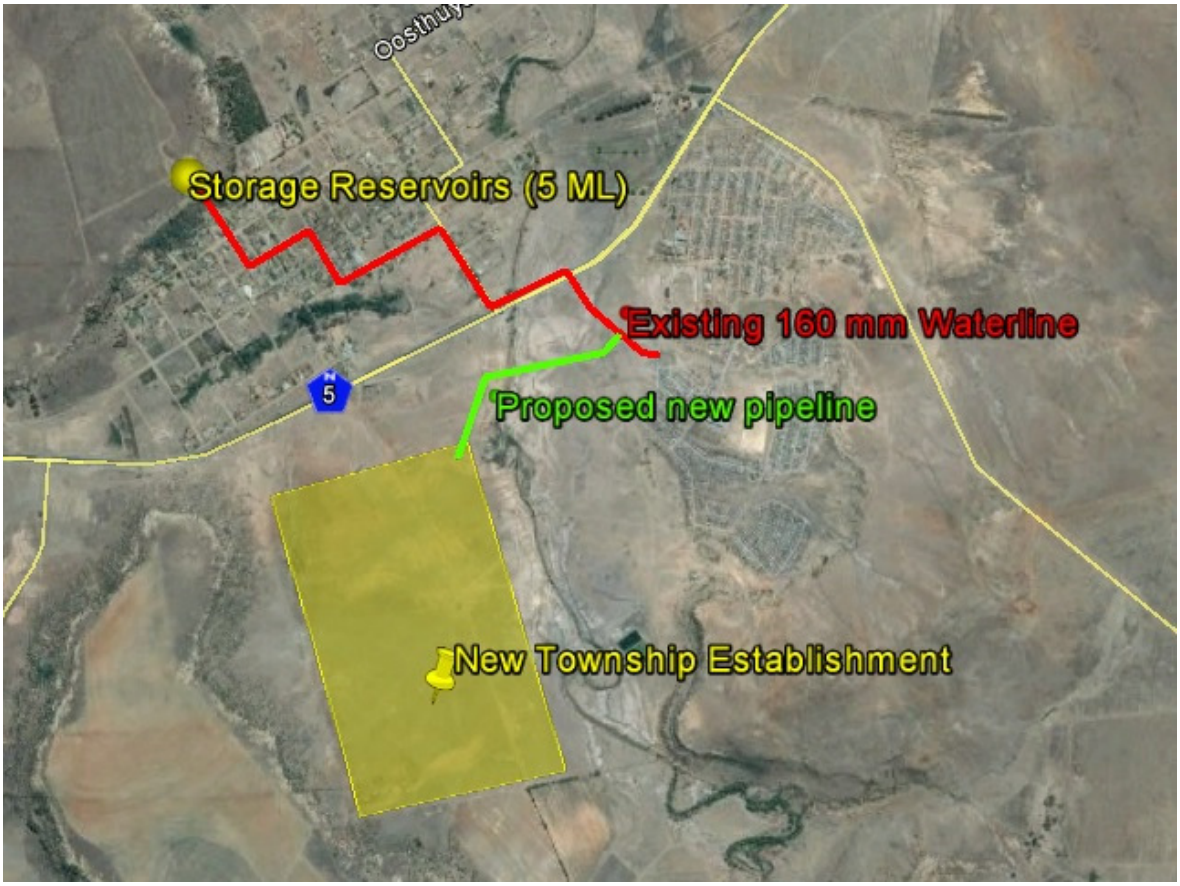
The capacity of the existing 160mm diameter pipeline from the Paul Roux Reservoir to the Fateng-Tse-Ntso reticulation network is 30,154 l/s at a velocity of 1.5 m/s.

Generated Peak demand for the proposed new development (17,36 l/s) < Capacity of the 160 mm diameter water main at 1.5 m/s flow (30,154 l/s)

The minimum head under instantaneous peak demand should not be less than 240 kPa or 24 m, and the maximum head under zero flow conditions should not exceed 900 kPa or 90m.The pressure readings measured was found to be 650 kPa or 65 m, which fall within the prescribed limits, thus the water supply is sufficient.

It is recommended to construct a pipeline (approximately 1km) from the new development, across the Sand River and connect to the existing 160mm diameter u-Pvc pipeline (See figure 3.3.2.1 below) providing water from the storage reservoirs in Paul Roux to the water reticulation network in Fateng-Tse-Ntso.

Figure 3.3.2.1: Proposed water connection



3.4. WATER STORAGE

Currently there are two existing reservoirs in Paul Roux with a combined storage capacity of ***5 ML.***

3.4.1 Required Storage

DESCRIPTION	Number of Dwelling Units (Low Income)	Number of Dwelling Units (Medium Income)
Paul Roux	-	570
Fateng-Tse-Ntso	1718	-
Proposed new development	750	-
TOTAL	**2468**	**570**

- Average Annual Daily Demand: (2468 x 500 l/du/day) + (570 x 750 l/du/day)
  = 1 661 500 l/ day
  = 1,661 ML/day

- Required 48 hour Storage: 1,661 ML/day x 2 days (48 hours)
  = 3,322 ML

Existing storage (5 ML) > Required Storage (3,322 ML)

Therefore the existing 5ML storage would be sufficient to accommodate the required 48 hour storage of the proposed new development.

4. STORM WATER DRAINAGE

Internal stormwater drainage will be designed upon the approval of the final layout of the development. The layout design should make provision for storm water servitudes should it be required. Storm water drainage to be designed in accordance with the philosophy of providing a minor and major system. Minor storms will be accommodated by either a surface channel system or a subsurface pipe system. The road reserve shall be used to accommodate the major storms.

The Sand River to the Eastern side of the development can be used to discharge stormwater away from the development. The ***1:100 year floodline*** for the Sand River must be determined and should be taken into consideration during the Town Planning stage.

5. CONCLUSION

5.1. Sanitation

It is recommended to construct a sewer line from the new development across the Sand River and connect to the existing 355 mm diameter outfall sewer line. The existing outfall sewer line have sufficient capacity to accommodate the additional sewer effluent load generated by the proposed new development.

5.2. Waste Water Treatment

The new Waste Water Treatment Works (3ML/day) have sufficient capacity to accommodate the additional sewer load.

5.3. Water

It is proposed to construct a water line from the new development across the Sand River and connect to the existing 160mm diameter water line providing water from the Paul Roux Reservoirs to the water reticulation network in Fateng-Tse-Ntso.

Alternatively a shorter water line can be constructed from Northern side of the N5, West of the Sand River. However correspondence with SANRAL would be required for the zoning of a new servitude and a new crossing constructed underneath the N5. This option could be both costly and time consuming compared to the proposed water line.

5.4. Storage Reservoirs

The Existing 5Ml storage reservoirs have sufficient capacity to accommodate the required 48 hour storage from the proposed new development.

Compiled by J.J. Blomerus, and revised by N Fourie.

Checked by S.J. Nortier (Pr. Eng)