



2 August 2021

## **CLEAR EDGE PROJECTS**

51 Kelvin Place  
DURBAN  
4051

**ATTN.: Mr Mat Carlisle**

Dear Sir,

## **RE: MSIMBAZI RIVER ESTATE – SEWAGE TREATMENT PLANT**

### **Introduction**

The proposed Msimbazi River Estate will consist of 720 2-bedroom units, for which an onsite sewage treatment plant is required. Treated water is to be reused on site for irrigation purposes.

### **Size of Development and Basis for design**

WRC's "Process Design Guide for Small Wastewater Works" (WRC report No TT 389/09) recommends 750 l/day design guideline for 2-bedroom units, with a maximum capacity of 4 people per unit. However, not all units will be fully occupied with 4 people and therefore the total flow is estimated to be 80% of the guideline value.

### Sewage Volume

- Housing Units: 720 units @ 750 l/unit/day x 80% = 432 kl/d (average dry weather flow, ADWF)
- Add 15% for wet weather ingress. Therefore total flow = 497 kl/d, say 500 kl/d ADWF.



## Biological Load

- COD: 500 kl/d @ 700 mg/l = 350 kg/d
- BOD: 500 kl/d @ 350 mg/l = 175 kg/d
- NH<sub>4</sub>-N: 500 kl/d @ 60 mg/l = 30 kg/d

## **Selected Process for Plant**

Advanced biological treatment utilizing submerged media technology for Msimbazi will incorporate the following unit treatment processes:

- Inlet works with bar screen;
- Suspended solids removal in a septic tank (anaerobic reactor) which will also be used for hydraulic flow balancing;
- Aerobic, biological carbonaceous material removal and nitrification in bioreactors (submerged media bioreactors, also called moving-bed bioreactors, MBBRs);
- Biomass removal in a secondary clarifier;
- Disinfection using liquid chlorine (sodium hypochlorite);
- Sludge digestion in the anaerobic reactors with desludging to and sludge drying in on-site drying beds.

## **Septic Tank**

Septic tanks (anaerobic reactors) typically remove 60-70% of suspended solids and about 40-50% of COD/BOD from the raw sewage. For conservative design purposes, it is assumed that only 30% COD/BOD is removed in the septic tank and the bioreactors are therefore sized to remove the remaining 70% fraction.

- COD in raw sewage = 350 kg/d



- Assume a 30% reduction through the septic tank
- Then COD leaving septic tank = 245 kg/d

### ***Submerged Media Reactors***

Based on the estimated COD load we recommend the provision of not less than 365 m<sup>3</sup> of submerged media volume.

This can be accommodated in three reactors in series, each with dimensions of 5.1 x 10.8 x 2.5 m.

We strongly recommend that a gravity recycle controlled by a suitable valve be provided on the third (final) bioreactor to recirculate effluent back to the final chamber of the septic tank for denitrification purposes. (The water level in the third bioreactor tank must be higher than the level in the septic tank to ensure gravity flow.) This will create an anoxic zone, whereby aerobic bacteria are starved of molecular oxygen and therefore need to break up bound oxygen that will be obtained from nitrates and nitrites formed during nitrification in the aerobic bioreactors. The recycle rate should be 100% (based on ADWF) of the feed to the reactors.

### ***Settling Tank (Clarifier)***

Peak hydraulic flows will be balanced in the septic tank from where it is pumped to the aerobic bioreactors. Therefore, all equipment downstream of the anaerobic reactors can be sized for peak flows not exceeding 1.5 x ADWF, thereby reducing costs and space requirements.

The settler will have an area of 36 m<sup>2</sup>, which allows for a settling rate of less than 1 m<sup>3</sup>/m<sup>2</sup>.h at PF= 1.5 ADWF. The sludge return gravity line should be sized with a minimum pipe size of 50 mm and fitted with a timer controlled valve. Typical desludging times are 3-5 min open every hour, to be set during commissioning.

### ***Chlorination***

We recommend the plant use liquid chlorine dosing in the form of sodium hypochlorite. This will require regular checking of dosing chemical levels.



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A contact tank of at least 30 min at the peak flow rate downstream of the septic tank should be provided. In addition, the chlorine contact tank can be used for additional hydraulic storage capacity.

## **Conclusion**

We trust that the information provided is adequate. Please contact us should any matter require discussion or further clarification.

Yours faithfully,  
for **Aquarius Consult cc**

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