ELEMENT Consulting Engineers

A FIFTH DIMENSION TO ENGINEERING

ROBBEN ISLAND
WASTEWATER TREATMENT WORKS

DESIGN REPORT

YOUR REF NO. PO0011044

March 2021

PREPARED FOR:

Robben Island MUSEUM

ROBBEN ISLAND MUSEUM
V&A Waterfront
Clock Tower
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ROBBEN ISLAND

WASTEWATER TREATMENT WORKS

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ANNEXURES

GLOSSARY OF ABBREVIATIONS

AADD	Average Annual Daily Demand
ADWF	Average Dry Weather Flow
AWWF	Average Wet Weather Flow
DWS	Department of Water and Sanitation
ECE	Element Consulting Engineers
kl/d	Kilolitres per day
l/c/d	Litres per capita per day
m^3/d	cubic meters per day
RBC	Rotating Biological Contactor
WWTW	Wastewater Treatment Works

1 INTRODUCTION

Robben Island is situated in Table Bay, approximately 10 km north of the V&A Waterfront in Cape Town. The island covers an area of 5.08 km^2 and is relatively flat, only a few meters above sea level. The Robben Island Museum is a popular tourist attraction and, while the island has a relatively small permanent population of only about 200 residents, it is visited by as many as 3 200 day visitors during the peak tourist season.

There is currently no formal wastewater treatment works (WWTW) on Robben Island. All sewage is pumped by six pump stations to a collection sump near Robert Sobukwe's former residence, where it is macerated and pumped along the outfall sewer pipeline to discharge through a diffuser 465 m offshore.

WSP|Parsons Brinckerhoff was appointed by the Coega Development Corporation in 2016 to design and implement a new WWTW for Robben Island. Infrastructure proposals were made during the concept and viability stage of the project, but due to a lack of available funding, the project never progressed to the design development stage.

2 APPOINTMENT AND SCOPE OF WORKS

Element Consulting Engineers (ECE) was appointed on 26 February 2020 by the Robben Island Museum to review WSP|Parsons Brinckerhoff's reports and implement the proposed WWTW infrastructure through the following stages of the project:

- Stage 3: Design Development
- Stage 4: Documentation and Procurement
- Stage 5: Contact Administration and Inspection
- Stage 6: Close-Out.

The appointment was only for the design and implementation of the new WWTW and excludes any investigations to the condition of the existing sewer reticulation infrastructure, pump stations and outfall sewer.

3 PREVIOUS REPORTS

WSP|Parsons Brinckerhoff was appointed by the Coega Development Corporation in 2016 to design and implement a new WWTW for Robben Island. They prepared the following two reports during the concept and viability stage of the project:

- Robben Island WWTW Inception Report, 18 November 2016

- Robben Island WWTW Preliminary Design Report, 29 June 2017

The main findings of these report on which the design of the new WWTW is based, are briefly discussed in this section.

3.1 Environmental Considerations

The proposed project triggers activities that are subject to a Basic Assessment and it was deemed necessary to do a Basic Assessment Report (BAR). The BAR was approved, and authorization was given to construct a new WWTW on the condition that the works comply to the following items:

- The plant will be partially submerged to reduce visual impact;
- The plant will be sized to approximately 300 m^3/day or 108 000 m^3/annum;
- The WWTW will produce 120 m^3 sludge per annum;
- The footprint of the WWTW will not exceed 310 m^2;
- The footprint of the sludge dry beds will not exceed 50 m^2;
- The total development footprint, including the outfall sewer pump station and associated pipework, will not exceed 600 m^2;
- The WWTW and associated infrastructure will require a boundary area of 1 400m^2, around which a security fence will be installed.

The environmental authorization lapsed on 27/03/2020 and a new application for environmental authorization is required for the proposed activities to be undertaken.

3.2 Wastewater Generation

3.2.1 Theoretical wastewater flows

WSP|Parsons Brinckerhoff calculated the average daily water demand for Robben Island as 71.94 m^3, based on 200 permanent residents with no allowance for future population growth and a water demand of 150 l/c/d, and an average of 3 196 persons visiting the island daily with a water demand of 18.75 l/c/d.

During a meeting with the Client's project team, they indicated that allowance should be made for an eventual 250 permanent residents on the island and 4 000 visitors per day. These revised population figures were used to determine the water demand for Robben Island, considering unit water demands of 150 l/c/d for the permanent residents and 20 l/c/d for the day visitors, in line with the *Guidelines for Human Settlement Planning and Design* for residential developments.

The average dry weather flow (ADWF) of wastewater generated due to domestic water usage, typically equates to 70% of the water demand. 15% can be added to the ADWF to allow for stormwater infiltration to estimate the average wet weather flow (AWWF), which is generally considered in determining the required capacity of treatment infrastructure.

Table 3-1 summarises the following theoretical water demand and sewage flows for Robben Island:

- AADD: Average Annual Daily Demand (number of units x consumption per unit)
- ADWF: Average Dry Weather Flow (AADD x 70% = sewage generated)
- AWWF: Average Wet Weather Flow (ADWF +15% infiltration for sizing of WWTW)

Table 3-1 Water Demand and Sewage Flows

Description	Number	Water Requirements		Sewage Generated	
		Consumption (l/c/d)	AADD (m^3/d)	ADWF (m^3/d)	AWWF (m^3/d)
Permanent Residents	250	150	37.50	26.25	30.19
Day Visitors	4 000	20	80.00	56.00	64.40
Total wastewater to WWTW			**117.50**		**94.59**

Table 3-1 shows that the average sewage flows to be treated at the proposed WWTW is 94.59 m^3/day.

3.2.2 Wastewater flow as function of potable water production

The potable water production rate of the desalination plant was obtained from bulk water meter readings and is summarised in Table 3-2. These readings were used to estimate the wastewater production rate, allowing for 10% water losses in the water distribution network to calculate the water consumption and accepting that 70% of the domestic water consumption will typically contribute to wastewater production. An additional 15% was added for stormwater infiltration to give the AWWF for which the WWTW should be sized.

Table 3-2 Water Demand and Sewage Flows

Description	Month	
	December 2020	January 2021
Total Plant Operating Hours	480	528
Average Operating Hours per day	18	17
Total potable water produced (m^3)	4 247	5 398
Average potable water production rate (m^3/day)	137.00	174.13

Description	Month	
	December 2020	January 2021
Less total conveyance losses (10%)	123.30	156.72
Wastewater produced (70%)	86.31	109.70
Stormwater infiltration (15%)	12.95	16.46
Total wastewater to WWTW, AWWF (m^3/day)	**99.26**	**126.16**

Table 3-2 shows that the average potable water production rate for January 2021 was 174.13 m^3/d, which is similar to the average potable water production rate of 169.63 m^3/d measured for the period of 03/01/2017 to 23/01/2017, as tabulated in the Preliminary Design Report.

The estimated wastewater production rate for January 2021, as shown in Table 3-2, is 126.16 m^3/d, which is 33% higher than the theoretical wastewater flows shown in Table 3-1, but lower than the estimated wastewater production rate of 156.1 m^3/d for the period of 03/01/2017 to 23/01/2017, as tabulated in the Preliminary Design Report. It should be noted that the PDR did not allow for water conveyance losses and assumed that 80%, instead of 70%, of the domestic water use will eventually end up at the WWTW.

3.2.3 Groundwater infiltration

The PDR demonstrated that the groundwater infiltration is 38.59%, based on TDS sampling over an extended period. Accepting this percentage, will result in a total wastewater flows as shown in Table 3-3.

Table 3-3 Water Demand and Sewage Flows

Description	PDR, 2017		Design Report, 2021	
	Allowance	Flow (m^3/d)	Allowance	Flow (m^3/d)
Average potable water production rate		169.63		174.13
Less total conveyance losses	0	169.63	10%	156.72
Wastewater produced	80%	135.70	70%	109.70
Stormwater infiltration	38.59%	52.37	38.59%	42.33
Total wastewater to WWTW (AWWF)		**188.07**		**152.04**

3.2.4 Flushing of sewer pipelines with brine

The PDR reported that the sewer pipelines are intermittently flushed with brine from the desalination plant to clean pipelines that get clogged due to low sewage flow conditions. This is still the current practise, as confirmed by the desalination plant operator. With the TDS levels of brine in the order of 65 000 mg/l, this practise is a major contributing factor to the high TDS levels in the wastewater.

3.3 Capacity of proposed WWTW

The estimated AWWF of wastewater to be treated at the proposed Robben Island WWTW, varies from 94.59 m^3/d to 152.04 m^3/d, as shown in Table 3-1, Table 3-2 and Table 3-3. Accepting the more conservative figure of 152.04 m^3/d, a WWTW with a capacity of 200 kl/d should be sufficient.

The PDR also indicated that a WWTW with a capacity of 200 kl/d should be sufficient, but suggested that a WWTW with a capacity of 300 kl/d be provided, in line with the environmental authorization given and listed in the BAR, to compensate for reduced biological activity in saline conditions.

The recommendation of this report, however, is that a WWTW with a capacity of 200 kl/d be provided, considering the following:

1. Although Robben Island is relatively flat, the elevation of the residential area is between 6 m and 13 m above mean sea level. The groundwater level on Robben Island is unknown, but it is unlikely that it will be 1.5 m below the natural ground level. The installation depth of the sewer reticulation pipelines is typically be between 1.0 m and 1.5 m, which means that the entire sewer reticulation network should be above sea level and also above the groundwater level. Infiltration might occur at the sewer pump station sumps, but these can be sealed to prevent infiltration.

2. Much of the high TDS levels in the wastewater can be attributed to the flushing of the pipelines with brine from the desalination plant. This practise should cease, and when it does, the TDS levels in the wastewater will reduce.

3. The pipelines forming part of the Robben Island sewer reticulation network, are old and most likely of asbestos cement. The long-term solution to combat groundwater infiltration, is not to spend additional funds to increase the size of the WWTW, but rather to procure funding for the future replacement of the aging infrastructure. This will also prevent groundwater pollution which might be caused by damaged or leaking pipes and pump station sumps. If funding is available, it can be considered to include the replacement of the old sewer pipelines in the scope of this project.

4 PREFERRED WWTW TECHNOLOGY

Rotating biological contactor technology is considered the preferred wastewater treatment solution for this project, offering the best balance between robustness, a relatively small footprint, simple and low-cost operation and maintenance with low power requirements, lesser visual and noise impact and a plant which produces a final effluent of acceptable quality.

The plant is also scalable, which means that additional RBC units can be added to increase the capacity of the plant, if required in future.

The plant will be constructed complete with preceding reinforced concrete septic tank, a humus tank, recycling pumps, disinfection infrastructure and sludge drying beds.

5 LAYOUT AND COMPONENTS OF PROPOSED WWTW

5.1 Layout of proposed WWTW

Figure 5-1 shows a schematic layout of a typical small RBC treatment works, while Figure 5-1 shows the plan view and section of a typical larger RBC treatment works. Refer to the drawings in Annexure D for the proposed layout of the WWTW for Robben Island.

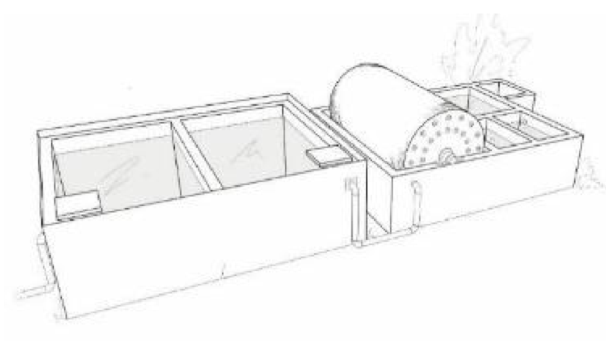

Figure 5-1 Schematic layout of typical RBC treatment works

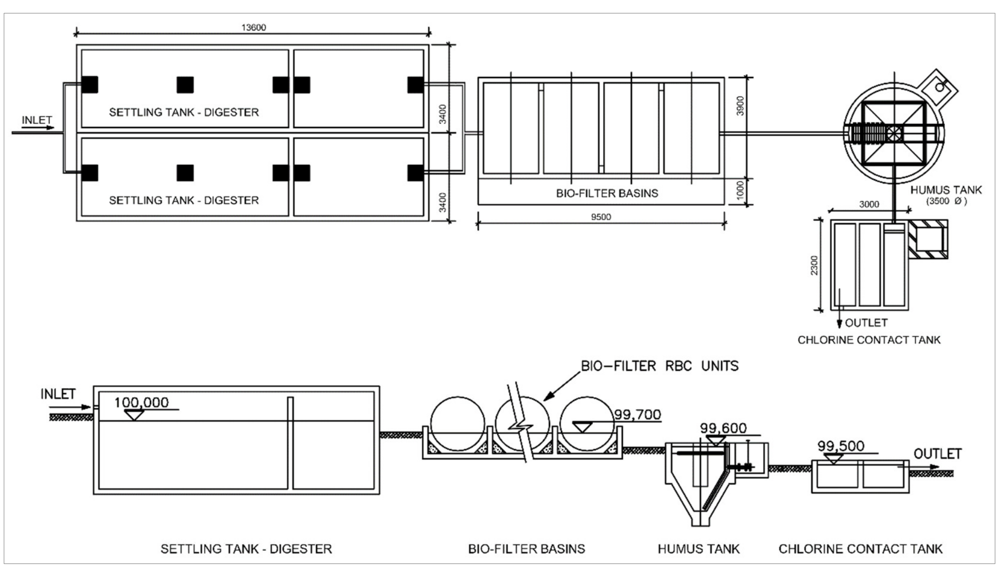

Figure 5-2 Plan view and section of typical 200 kl/d RBC treatment works

5.2 Components of proposed WWTW

The RBC treatment works proposed for Robben Island, will comprise the civil components discussed below.

5.2.1 Inlet structure

Raw sewage will flow through a simple civil concrete inlet structure upstream of the primary settling tank with a hand rake screen which provides a facility to remove un-organic objects from the sewage influent. The screen should be cleaned daily with a rake and the screenings disposed of in a solid waste bin. The hand rake screen will be constructed from stainless steel grade 304.

Flow measurement will be done downstream of the hand rake screen by means of an ultrasonic level sensor and a prefabricated GRP Parshall flume to be constructed in the inlet channel.

The inlet structure will not make allowance for grit removal. Due to the relatively small size of the sewer reticulation network, there will not be many opportunities for grit ingress into the sewer network and, therefore, not much grit is expected in the influent to the WWTW. Grit that does ingress, will settle in the primary settling tank from where it can be removed periodically with the settled sludge.

5.2.2 Primary Settling Tank (Anaerobic and Anoxic Reactor)

After screening, raw sewage will flow into a septic tank. The capacity of the septic tank should allow for at least 24 hours retention of the AWWF, therefore a capacity of 200 kl will be provided.

The septic tank will comprise two chambers, with anaerobic conditions prevailing in the first chamber to allow for the gross removal of organic material by settlement and anaerobic oxidation. Anoxic conditions will prevail in the second chamber, which allows for de-nitrification to take place during which nitrogen is removed and the organic material is further reduced.

The septic tank will make provision for the accumulation of settled material and has design features incorporated to ensure that this activity does not cause unnecessary blockages across the tank.

5.2.3 Rotating Biological Contactors (Aerobic Reactor)

From the septic tank, sewage will gravitate to the RBC stage where further organic reduction and ammonia nitrification is achieved under aerobic conditions. The aerobic conditions are achieved by the rotation of the discs, on which the micro-organisms are attached and growing, at a low speed of approximately 3 to 4 RPM.

The rotary disc filters will comprise a series of 2 m diameter discs, fitted to a central shaft, compressed between two spiders, one at each end, and suitably drawn up to form a unit rotor construction. Each RBC unit will be fitted into its own individual shaft mounted drive.

The scope of supply for this contract is six rotors, each capable of treating thirty kilolitres of domestic sewerage per day. The RBC disc filters will be 100% locally manufactured.

a) Biological Discs

The biological discs will be 2 m diameter x 10 mm thick monolithically cast, incorporating integrally cast reinforced hard plastic bosses which fit over the central shaft. The discs shall be formed by injection moulding from polyurethane plastic material having a density of not less than 120 kg/m^3 and shall be free of significant water absorbent properties (less than 5%). The discs are to be complete with integrally cast spacers to provide 15mm spacing between discs.

b) Shafts

The rotor shafts will comprise of fabricated square profile mild steel shafts, suitably reinforced and capable of withstanding the stresses experienced by forces on the rotors. Each shaft will be fitted with high-grade axle-steel stub shafts at either end and will be fitted with suitable splash plates and compression nuts.

The shafts will be cleaned, primed and treated with two coats of high quality epoxy paint for corrosion protection.

c) Spiders

The spiders comprising of two units per shaft will be fabricated from an 8 mm mild steel compression plate to which 50 mm x 35 mm galvanised mild steel spider arms are fitted. The spiders will be finished off with two coats of high quality epoxy paint.

d) Through Rods

Each rotor will be fitted with twenty-four 12mm mild steel tensioning rods. The tension rods will be correctly adjusted together with the central compression nuts to ensure a solid rotor construction.

e) Bearings

Each rotor will be mounted on one pair of self-aligning sealed type plumber block bearings which will be mounted on the disc filter basin walls on mild steel bearing plates by means of high-tension foundation bolts.

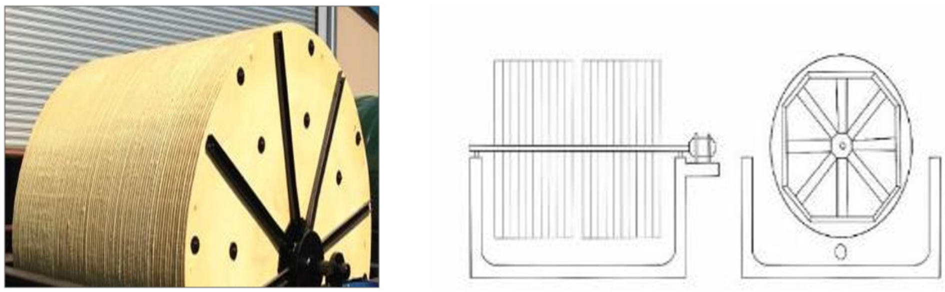

Figure 5-3 A complete rotor unit – visible are blades, spiders, through rods, shaft and bearing

f) Drive Motors

The rotor will be fitted with a direct shaft mounted geared unit, driven by a 0.75 kW 380/400 V close coupled direct shaft mounted reduction gearbox. The geared motor will be adequately rated to drive the disc rotor under all operating conditions at 3.5 rpm. See attached data sheet for reference. The drive motors will be fitted with VSD drives, which will allow the operation of the plant at various speeds. This will make it possible to increase or decrease the oxygen levels in the aerobic zone, which will allow more control over the quality of the treated effluent.

The drives will be capable of operating on a 24 hour/day basis and should therefore be rated for this duty cycle.

g) Rotor Covers

The rotor will be covered with a semi-circular GRP cover, complete with lifting handles.

Figure 5-4 Rotor and gearbox covers in various colours

5.2.4 Secondary Settling Tank (Humus Tank)

From the RBC, sewage will gravitate to the secondary settling tank or humus tank where settleable sludge will be removed and continuously recycled to the first chamber of the septic tank for anaerobic digestion.

The humus tank will comprise a civil structure with a prefabricated structural steel bridge that supports the inlet stilling tube, clear water overflow pipework and a desludging pipe that removes the settleable sludge under gravity to a sludge sump from where it will be recycled with a de-sludge pump to the septic tank. All the steelwork below the water level in the humus tank will be manufactured from stainless steel grade 304. The bridge will be manufactured from epoxy coated galvanised mild steel.

The humus tank and all its associated equipment will be sized for an AWWF of 200 kl/d.

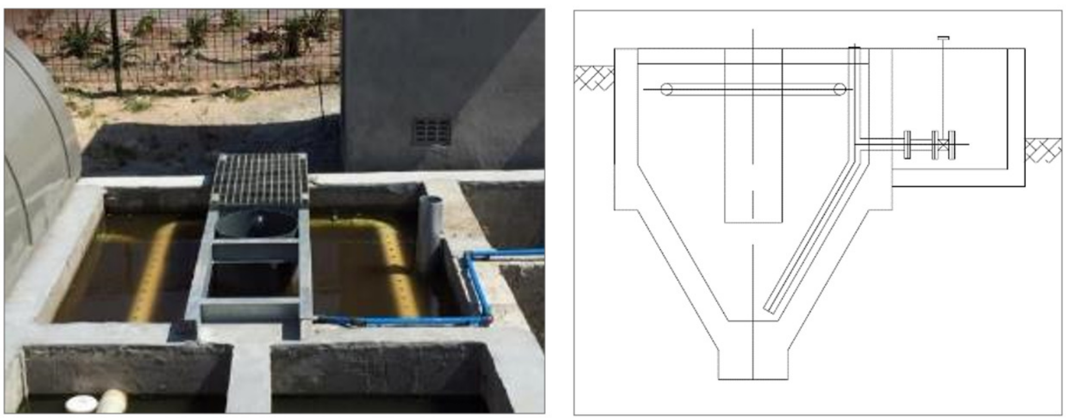

Figure 5-5 Humus tank with bridge, stilling tube and overflow pipework visible

5.2.5 Phosphate Removal

Phosphate removal is generally not considered when general limits must be achieved, since the removal process is costly and requires proper control. Phosphate removal will not be incorporated at the Robben Island WWTW.

5.2.6 De-sludge and Recirculation Pumps

Suitably rated de-sludge / recirculation pumps will be supplied to recycle effluent from the aerobic basins to the anoxic zone of the septic tank, and to recycle settled sludge from the humus tank to the anaerobic zone of the septic tank. The pumps will be HQ Pumps' VS.40.04.2MA Vortex type pump (or similar) with the following characteristics:

- Duty pump only, no standby;
- Pump casings completely made in cast iron material;
- Submersible vortex type with integral float;

- Minimum 35 mm solids handling ability;
- 0.4 kW Single phase motor equipped with a thermal protector build in that stop the pump if the motor reaches a temperature of about 120℃;
- Installed complete with gate valve, flap-type non-return valve and the necessary couplings and pipework to ensure that the pump can be easily be removed for inspection purposes.

5.2.7 Disinfection

The effluent from the secondary settling tank will gravitate to the chlorine contact channel where it will be dosed with a disinfectant. Two options were considered for disinfection of the final treated effluent:

1. Dosing with liquid sodium hypochlorite by means of a dosing pump with dosing rate to be adjusted automatically or manually to suit the flow rate;
2. Installation of a pod system (Klorman Solutions, or similar approved) and dosing by means of chlorine tablets.

The pod system is the simplest way of disinfecting the effluent and requires little operation and maintenance and no power supply. Therefore, this option is proposed for the Robben Island WWTW.

Figure 5-6 Klorman Solutions pod disinfection system

The chlorination contact channel will be sized to ensure at least 30 minutes contact time between the effluent and the disinfectant at the AWWF.

5.2.8 Power Supply, Motor Control Panel and Equipment

A three phase 4-wire 380-volt electrical supply will be brought to the site from the nearest transformer on Robben Island.

The WWTW will be supplied complete with an outdoor weather-proof motor control centre (MCC), accommodating all the control equipment for the WWTW, including the RBC units, the de-sludge pumps and the flow measurement instrumentation. The MCC will be fully wired and tested in the factory prior to dispatch and installation on site. The equipment will comprise the following:

a) Main interlock able isolating switch.

b) A three-phase direct-on-line starter for each individual motor unit, complete with inverse-time-overload, anti-single-phase protection and circuit breaker.

c) Pilot control circuits as required for the plant.

d) Emergency stop lock buttons at each RBC unit and isolating switches at each pump unit.

e) One ultrasonic level sensor with associated instrumentation for flow measurement of the raw sewage at the inlet works.

f) Q-log GSM monitoring system which is battery powered and uses GSM/GPRS channels for communication with the MyCity server. The transmitter unit is supplied with a sim card on which a SMS bundle is loaded. Selected cellular phone numbers will receive SMS's in the event of equipment failure.

   Q-log is compatible with 1-10 V or 4-20 mA signals from inline monitoring equipment such as flow meters and probes which measures dissolved oxygen, PH and EC in the final effluent. Note that the installation of these probes is not included as part of this project, and water quality monitoring will be done by means of sampling and laboratory testing on a weekly basis.

   The system will have the following characteristics and functionalities:

   - 2 x digital pulse inputs ("on-off" input to indicate whether plant is operational);
   - 2 x 4-20 mA analog inputs (closed loop system for automatic adjustment of equipment, e.g. chlorine dosing rates in line with measured flow rates);
   - 4 x 1-10 V digital-analog inputs (for measurement of dissolved oxygen, PH and EC in the final effluent);
   - 2 x digital outputs to control two devices, solenoid or relays;

- Send SMS with run-stop confirmation to operator mobile phone;
- Flow rate measurement and communicating information to MyCity server;

The specifications of the GSM system to be included in the tender documentation, will be confirmed with the Client prior to tender.

Table 5-1 summarises the power requirements of the proposed WWTW.

Table 5-1 Power Requirements

Component	Number	Power required	
		Per unit	Total
RBC rotor	6	0.5 kW	3.0 kW
Sludge return pump	1	0.4 kW	0.4 kW
Total			**3.4 kW**

5.2.9 Rising Main for Final Effluent Reuse

The current practice of intermittently flushing of the sewer pipelines with brine from the desalination plant to clean pipelines needs to cease and alternative solutions considered to prevent clogging due to low sewage flow conditions.

One such alternative solution will be to flush the pipes with potable water from the desalination plant. This will, however, be a rather costly exercise and is not recommended.

Another alternative will be to flush the pipelines with final effluent from the WWTW. This will require the installation of a 75 mm diameter x 1.4 km welded HDPE rising main to convey the treated effluent from the existing sewage collector sump at the proposed WWTW site to the connection point near the desalination plant, using the existing sewer pump (duty of existing pump to be confirmed).

5.3 Reuse of Existing WWTW Infrastructure

The final treated effluent will gravitate to the existing sewage collector manhole from where it will be pumped via the existing outfall sewer to sea, or via a new rising main to a manhole on the existing sewer pipeline network near the desalination plant.

Allowance was made in the cost estimate for this project to replace the existing booster pump with a new pump with sufficient capacity to deliver the treated effluent to the desalination plant.

6 QUALITY SPECIFICATIONS

Treated effluent will gravitate to the existing sewage collector sump at the proposed WWTW site from where it will be pumped along the existing outfall sewer pipeline to discharge through a diffuser 465 m offshore.

The proposed WWTW will deliver treated effluent that conforms to the DWA general wastewater limit values, as shown in Table 6-1, to enable release into the environment.

Table 6-1 Limits of Determinates in Discharged Effluent

Substance / Parameter	Limit
Fecal Coliforms (per 100 ml)	0
Chemical Oxygen Demand (mg/l)	30
PH	5.5 – 7.5
Ammonia (ionized and un-ionized) as Nitrogen (mg/l)	2
Nitrate/Nitrite as Nitrogen (mg/l)	1.5
Chloride as Free Chloride (mg/l)	0
Suspended Solids (mg/l)	10
Electrical Conductivity (mS/m)	50 above intake
Orthophosphate as phosphorous (mg/l)	1
Fluoride (mg/l)	1
Soap, oil or grease (mg/l)	0
Dissolved Arsenic (mg/l)	0.01
Dissolved Cadmium (mg/l)	0.001
Dissolved Chromium (VI) (mg/l)	0.02
Dissolved Copper (mg/l)	0.002
Dissolved Cyanide (mg/l)	0.01
Dissolved Iron (mg/l)	0.3
Dissolved Lead (mg/l)	0.006
Dissolved Manganese (mg/l)	0.1
Mercury and its compounds (mg/l)	0.001
Dissolved Selenium (mg/l)	0.02
Dissolved Zinc (mg/l)	0.04
Boron (mg/l)	0.5

7 COST ESTIMATE

Table 7-1 shows the estimated construction cost for this project, based on the components to be installed as discussed in Section 5.2 of this report.

Table 7-1: Estimated Construction Cost

Description	Amount (R)
Construction Costs	
M&E capital cost, including delivery, installation, commissioning and training	2 596 000
Civil works (excavation, inlet works, septic tank, clarifier, contact channel)	2 606 000
Disinfection infrastructure	30 000
Effluent reuse, booster pump	75 000
Effluent reuse, rising main	493 000
Electrical supply	40 000
Security / fencing of site (allow for 200 m of 2.4 m high Clearvu-type fence)	418 000
	6 258 000
Contingencies (10%)	625 800
Sub-Total, Construction Cost	6 883 800
Indirect Costs	
Professional fees, normal services stage 3-6 (based on R7m construction cost)	833 100
Additional services	
Construction supervision (R45 000 per month x 6 months)	270 000
Health & Safety (specifications and safety agent)	40 000
Environmental (specification and environmental control officer)	70 000
Geotechnical survey	50 000
Recoverable expenses (plotting, printing and binding)	32 000
Travelling & parking (allowing that ECE does not have to pay for ferry crossings)	10 000
Sub-Total, Indirect Costs	1 305 100
Total Project Cost (excluding VAT)	8 188 900
15% VAT	1 228 335
TOTAL PROJECT COST (INCLUDING VAT)	**9 417 235**

8 BUDGET

The funding available for this project is R 10 800 000 in total, including professional fees and excluding VAT.

9 PROJECT PROGRAMME

Table 9-1 shows the proposed program for this project, which will have an envisaged 6-month construction period.

Table 9-1: Project Programme

Activity	Milestone Date
Design Report Submitted	5 March 2021
Design Report Approved	12 March 2021
Detail Design Commences	12 March 2021
Tender Documentation Preparation Commences	26 March 2021
Tenders Advertised (determined by date of EA)	9 April 2021
Tenders Close (5-week tender period)	14 May 2021
Tender Evaluation Report Submitted	28 May 2021
Appointment of Contractor	11 June 2021
Commencement of Construction Contract	18 June 2021
Construction Completed	10 December 2021

10 CONCLUSIONS AND RECOMMENDATIONS

Element Consulting Engineers (ECE) was appointed on 26 February 2020 by the Robben Island Museum to review WSP|Parsons Brinckerhoff's Inception Report and Preliminary Design Report and to design and implement the proposed WWTW infrastructure.

Rotating biological contactor technology is considered the preferred wastewater treatment solution for this project, offering the best balance between robustness, a relatively small footprint, simple and low-cost operation and maintenance with low power requirements, lesser visual and noise impact and a plant which produces a final effluent of acceptable quality.

It is recommended that a WWTW is constructed, employing RBC technology, complete with preceding reinforced concrete septic tank, a humus tank, recycling pumps, disinfection infrastructure and sludge drying beds.

It is also recommended that the current practice to flush the existing sewer pipelines with brine from the desalination plant be ceased, and to provide the required infrastructure to convey treated effluent to a connection point near the desalination plant, to enable flushing of the sewer pipelines with treated effluent instead.

If sufficient funding is available, if should be considered to include the replacement of the old sewer reticulation pipelines in the scope of this project.

The environmental authorization lapsed on 27/03/2020 and a new application for environmental authorization is required for the proposed activities to be undertaken.

Annexure A

Layout of Proposed WWTW