CIVIL CONCEPTS
Consulting Civil and Structural Engineers

CAMBRIDGE COLLEGE KNOPJESLAAGTE BULK WATER AND SEWER REPORT

C2594/BSR/W&S/001
MARCH 2019

CIVIL CONCEPTS CONSULTING ENGINEERS, Civil Concepts (Pty) Ltd, 50 15th Street, Menlo Park, Pretoria, PO Box 36148, Menlo Park, Pretoria, 0102 Tel: 012 460 0008, Fax 012 460 0005, Email: Mail@civilconcepts.co.za

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ANNEXURES

1 GENERAL INFORMATION

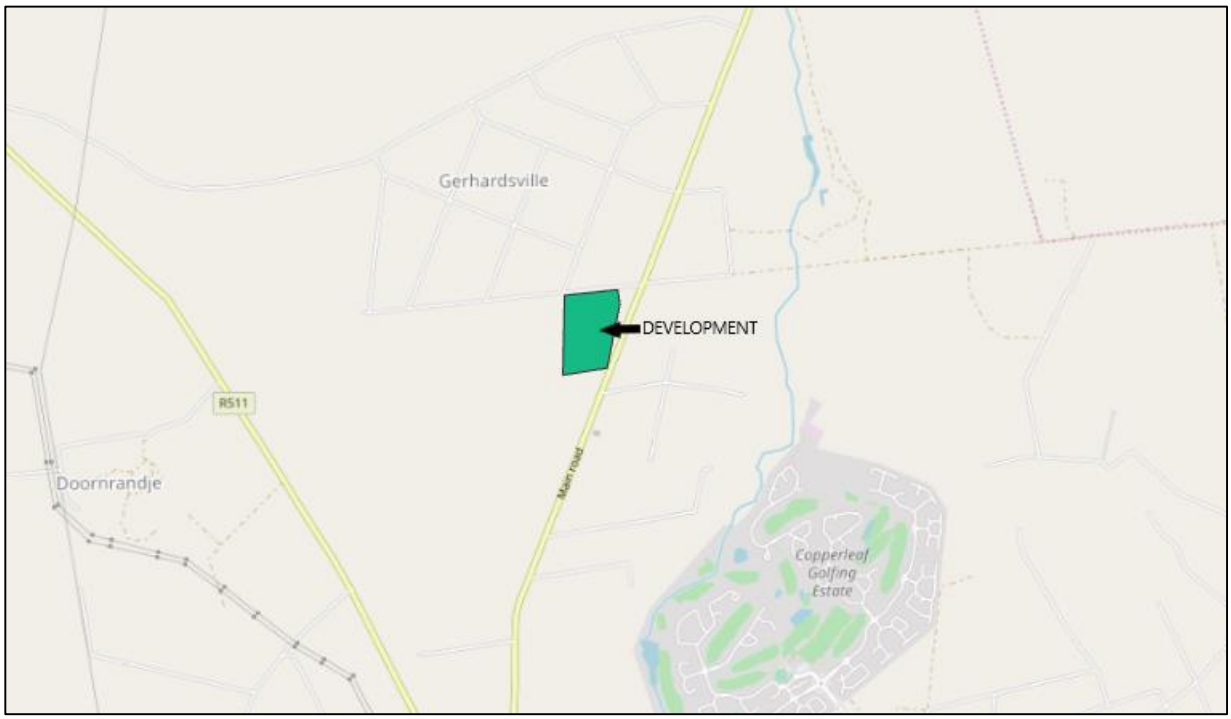
1.1 Location of the Area Concerned

The proposed development is situated on Part of Portion 16 and Part of Portion 66 of The Farm Knopjeslaagte 385-JR.

The Township application no for Gerhardsville X2 is **Item no 29859.**

It is bounded by:

- Mimosa Avenue / Gerhardsville A.H. to the north;
- K46 to the east;
- Remainder of Portion 66 of the Farm Knopjeslaagte to the south and;
- Remainder of Portion 16 of the Farm Knopjeslaagte to the west.



1.2 Current Land Owner

Xerus Group
PO Box 2000
Witkoppen
2068

Contact Person: Ms. Jeanne Rose
Tel: 083 251 4325
Mail: jeanne@xerusgroup.co.za

1.3 Future Land Owner and Developer

WFA Christian Business School
PO Box 722
Midstream Estate
0692

Contact Person: Mr. Wayne Langridge
Tel: 082 457 5023
Mail: wayne@wfaconsult.co.za

1.4 Consulting Engineers

Civil Concepts (Pty) Ltd
Reg. No: 95/12428/07
P O Box 36148
Menlo Park
0102
Tel: 012 460 0008
Fax: 012 460 0005

Physical Address:
50, 15th Street
Menlo Park
0081

Mail: werner@civilconcepts.co.za

The responsible person is: Mr. Werner Stander (Reg. No 20060017).

1.5 Proposed Development Information

The property is currently zoned Agricultural. A proposed township establishment application for Part of Portion 16 and Part of Portion 66 of the Farm Knopjeslaagte 385-JR will be submitted by SFP Townplanning for the rights in the table below.

Land Use	Size (m²)	Number of pupils/rooms
School	10,000	2 000
Hostel	20,000	2 000
Sporting grounds	55,000	-

Refer to the proposed township layout below.

Note that the concept of the school is based on compulsory hostel residency, hence the number of pupils and rooms being the same.

2 WATER

Below full details of the water provision for the township.

A GLS assessment has been conducted for the development (refer to **Annexure A**) and the content of this section is based on the outcome thereof.

2.1 Demand

The water demand is based on the current COT standards:

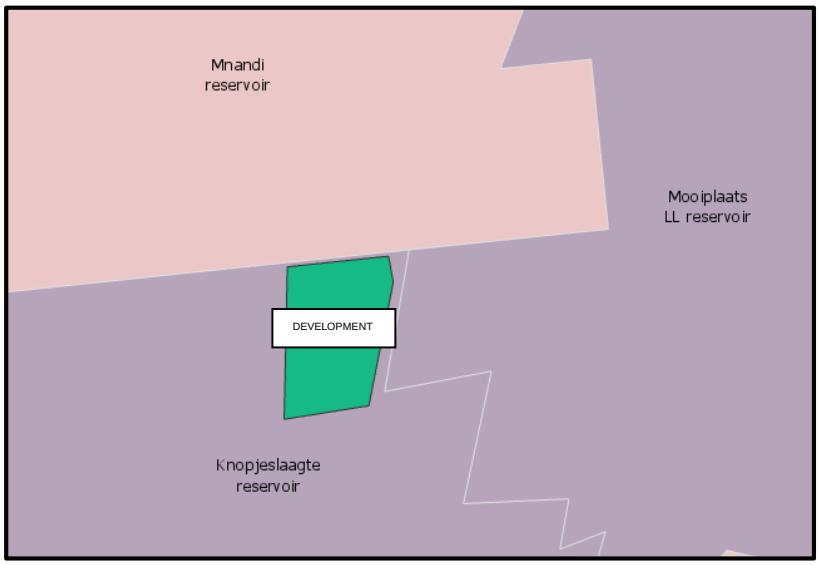
Land Use	Size (m²)	Number of pupils/rooms	Unit demand	Total Demand kL/day
School	10,000	2 000	0.06 kℓ/pupil	120 kℓ
Hostel	20,000		0.9 kℓ/100 m²	180 kℓ
Sporting grounds*	55,000	-	Nil	nil

Note, no demand is calculated and applied for irrigation of sport grounds. With the outflow from the hostels, grey water harvesting will be implemented, stored and if required supplemented from existing boreholes and rainwater harvesting on the property. However, compulsory residency will generate significant effluent from the grey water system to be used for irrigation.

Note the GLS Assessment demand is not based on recent standards as published by CoT. The GLS assessment will therefore have to be amended accordingly.

2.2 Existing Infrastructure

The development falls within the Mnandi Reservoir zone will in future fall under Knopjeslaagte reservoir zone. Being part of the Vaal River basin there is sufficient watersource for the development.



2.3 Proposed Upgrades and New Infrastructure

A GLS assessment as conducted. The following upgrades were proposed:

1.4.1 Bulk Items

Items required to alleviate existing problems in the bulk water system:

• MNR.B1	1	x	700	mm Ø Bulk connection (Rand Water)	R	1 778 000
• MNR.B1.1	1	x	400	mm Ø Valve to install and close	R	-
• MNR.B2	14	m x	700	mm Ø Pipe to install	R	1 073 000
• MNR.B5	71	m x	500	mm Ø Pipe to install	R	550 000
				Total	R	**3 401 000**

1.4.2 Reticulation Items

Items required to alleviate existing problems in the water distribution system:

- None

Sub-Total R -

Items required to accommodate the proposed development (**excluding** fire flow requirements):

• KLR.47	585	m	x	355	mm Ø main pipe	R 1 811 000
• KLR.48	320	m	x	315	mm Ø main pipe	R 1 006 000
					Sub-Total	R 2 817 000

Items required to accommodate the proposed development (**including** fire flow requirements):

- As above

Sub-Total R -

Total R **2 817 000**

2.4 Proposed Connections

A minimum 160 mm ø connection to the existing network will be proposed Mimosa Avenue and Tweede Avenue to the north of the development

2.5 Conclusion

The development is serviceable and network upgrades will be undertaken once finally negotiated with the City of Tshwane. This includes the identified bulk water upgrades which is already being implemented by City of Tshwane, i.e. Rand Water connection (As confirmed by Mr. Odwa Badi).

The developer is committed to ensure a sufficient grey water system is installed to provide sufficient water for irrigation of sport grounds and open areas. A separate network will be provided for this purpose.

3 SEWER

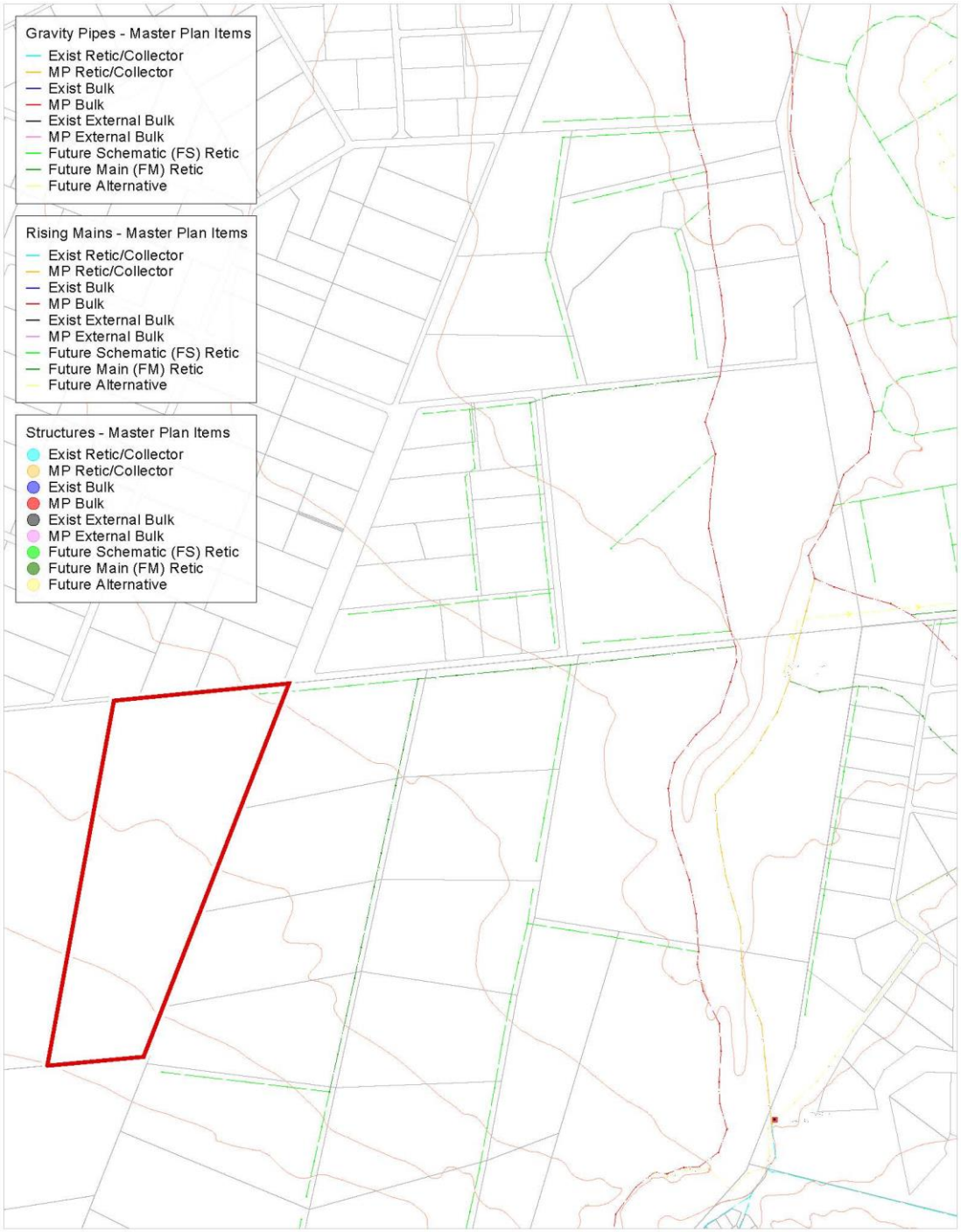
3.1 Sewer Flow

Land Use	Size (m²)	Number of pupils/rooms	Unit flow	Total Demand kl/day
School	10,000	2 000	0.06 kℓ/pupil	120 kℓ
Hostel	20,000		0.9 kℓ/100 m²	180 kℓ
Sporting grounds*	55,000	-	Nil	nil

3.2 Existing Infrastructure

To our knowledge there are no existing infrastructure in the vicinity and was also confirmed by GLS. The nearest is Copperleaf Golf Estate serviced with a Private treatment works.

Refer to extract on the following page of future sewer networks.


Gravity Pipes - Master Plan Items
Exist Retic/Collector
MP Retic/Collector
Exist Bulk
MP Bulk
Exist External Bulk
MP External Bulk
Future Schematic (FS) Retic
Future Main (FM) Retic
Future Alternative
Rising Mains - Master Plan Items
Exist Retic/Collector
MP Retic/Collector
Exist Bulk
MP Bulk
Exist External Bulk
MP External Bulk
Future Schematic (FS) Retic
Future Main (FM) Retic
Future Alternative
Structures - Master Plan Items
Exist Retic/Collector
MP Retic/Collector
Exist Bulk
MP Bulk
Exist External Bulk
MP External Bulk
Future Schematic (FS) Retic
Future Main (FM) Retic
Future Alternative
N
0
400 m
Scale 1:12000
Sewer: MP Items

3.3 Proposed Sewer treatment

Seeing there are no existing network nearby, it is proposed as for other remote developments not currently serviced with a municipal gravity system, that the development is serviced with a private treatment plant.

There are various examples of such solutions recently approved in absence of a municipal service. This firm has recently submitted a proposal for a development to be known as Rietvlei Country Estate in Grootfontein based on a Scarab system, which was approved in principle by City of Tshwane.

This arrangement was discussed with the planning department and Mr. S Notoane at the time where it was consented that the CoT will evaluate private plants more favourable if no network exist and provision of such infrastructure is planned for the near future.

Part of the service provider's contract will include a ten year maintenance program from the installer. In addition maintenance guarantees will be provided as maybe required from City of Tshwane.

All treated flow will be stored in on site lined dams that will be used for irrigation purposes. It is anticipated that just the hostels will generate a total of 180 kℓ/day, whereas the sports field and open areas require 82,5 kℓ/day. Excess flow will be deposited into the stormwater system.

It is also future enabled if a sewer system would be provided.

As an alternative, a network can be installed in terms of the Sewer Masterplan with an interim pump station and rising main with a final outlet at the Copperleaf Private Treatment Works. However, maintenance of the pump station are not considered favourably

Two systems were investigated

3.3.1 **Scarab Water.**

This system's maintenance requirements are exceptionally low, with a maximum of 3 months sludge dumping intervals. It is therefore a cost-effective system with limited maintenance cost. The maintenance schedule and responsibility of the system will initially form part of the Developer's responsibility, which is eventually transferred to the School Administration. Refer to **Annexure B.**

Initial Capital Cost:

Pre- Digestion tanks 100 m³ x 3	R 520,000
Quote from Scarab	R 4,000,000
Allowance for other civil	R 250,000
	R 4,770,000

Daily – check, ensure power is on, ensure diesel back up, included in service contract.
Weekly – With Ozone, no requirement, basic review for leaks and operational, water is clean and odourless
Monthly – open valve (3s) on Bio tanks, to ensure no sludge build up
Annually – General Service of pumps,
General Service Ozone units
Pre Digestion chambers – Sediment grit removal

Reaction time of 24 hours for any event

Monthly charge	-	R	5000 per month x 12	=	R 60,000 per annum
Annual charge	-	R	32 x R 1500 + R 4500 x 8		R 80 000 per annum

Total Operational and Maintenance cost R 140,000 per annum

3.3.2 **Becon Watertech**. This system is also well known and the company also offers a Maintenance contract. Their proposal and pro forma contract are included in **Annexure C**. It has a more intense maintenance and operational requirement than the other proposal

Initial Capital Cost R 9,800,000

Daily
1. Rake the bar screen at inlet works (if installed)
2. Check that all rotors are operating
3. Spray top of humus tank with waterhose to break up floating humus
4. Desludge humus tank by opening sludge valve at pump sump
5. Check that re-circulation pump at humus tank is operating correctly
6. Check that chlorination system is operating and chlorine is available

Monthly
1. Check drive units (replace oil every 12 months)
2. Grease rotor bearings (replace bearings when required)
3. Check septic tank sludge level and desludge if required
4. Grease chains (chain drive models only)

Annually
1. Desludge septic tank
2. Open manhole covers of septic tank and stir contents well
3. Draw sludge from septic tank by pumping out on to sludge beds or remove by tanker or otherwise
4. Clean plant & repaint all exposed steelwork
5. Service pump

Daily work		not included in Contract, to be conducted by owner		
Monthly charge	-	R	16,124 per month x 12 =	R 193,488 per annum
Annual charge	-	R	6200	R 6,200 per annum

Total Operational and Maintenance cost R 199,688 per annum

3.4 Proposed Network and Treatment plant position

The treatment plant will be located in the lowest part of the property including the storage dams.

Due to the lower operational and maintenance effort and associated cost, we propose the Scarab system

3.5 Accommodation of Upstream Developments

The higher lying property situated immediately west of this portion will soon be submitted for township application. This entails an equestrian low density residential development, including an equestrian academy.

Both owners intent to combine sewer flow in one plant as described in 3.3 above. The generation of treated effluent flow will be favourable for irrigation demand of both these developments.

The proposed system can also be easily upgraded as it is a modular system.

3.6 Maintenance and operational guarantees

Part of the service provider's contract will include a ten year maintenance contract from the installer. A pro forma Contract will be provided on request

Maintenance and operational cost is R 140,000 per annum.

A 5 year maintenance guarantee for the above amount escalated at 10% will be provided in favour of City of Tshwane, thus R 800,000.This will be arranged by a reputable financial institution on the format of CoT Legal and needs to be renewed every 5 years.

6. CONCLUSION

Bulk water can be provided with the upgrades as per the GLS report.

The nearest outfall sewer system is approximately 8.8 km away and there are no direct plans to install the gravity sewer. The proposed on site treatment works from Scarab will provide sufficient effluent treatment which will be to special standard and stored for irrigation of sport grounds and open areas to also reduce demand on potable water. Operational and maintenance efforts are low.

A 10 year maintenance contract secure the operational and maintenance of the plant which will be accompanied by a maintenance guarantee in favour of City of Tshwane.

The township application should therefore be supported on this basis.

Compiled by:
Werner Stander
PrEng 20060017
March 2019

ANNEXURE A
GLS ASSESSMENT

D09-01

19 November 2018

Executive Director: Water and Sanitation
City of Tshwane Metropolitan Municipality
PO Box 6338
PRETORIA, 0001

ATTENTION: Ms Lenah Sojane
Sub Section: System Development

Ma'am,

WATER AND SEWER MASTER PLANS: DEVELOPMENT OF PROPOSED TOWNSHIP – KNOPJESLAAGTE 385-JR PTN 66

The attached request from Civil Concepts (Tanya van Niekerk) dated 10 September 2018 with regards to accommodating the proposed development in the Tshwane water systems has reference.

Although the City of Tshwane has water master plans, you requested this further analysis and report because:

- ✓ The development has large fire flow requirements (e.g. 20ℓ/s, 25ℓ/s or 50ℓ/s which is usually the case for higher density cluster developments, schools, industry, general business, shopping centres or high-rise flats >= 4 storeys.
- ✓ The development has a substantially higher water demand than used in the master plan.
- ✓ The reservoir which will supply the development in future will be different to the reservoir which currently supplies the development (i.e. a change in reservoir supply zones).
- ✓ The reservoir zone in which the development falls is currently experiencing inadequate bulk water system capacity.

This report is a technical report stating upgrades required in the water networks in the vicinity of the proposed development. The City of Tshwane engineering professional (yourself) will accept the report or suggest changes and will make a final decision on works to be implemented by the proposed development.

Water master plans are updated every quarter. The latest master plans used in this analysis were the June 2017 master plans.

1 WATER DISTRIBUTION NETWORK

1.1 Water Resources

The City of Tshwane (CoT) straddles two primary water catchments namely: - the Crocodile River basin in the west and the Olifants River basin in the east. The dividing line between these two catchments runs in a north-south direction approximately through Cullinan. Water resources in the Crocodile River basin in the west, together with imports from the Vaal River basin via the Rand Water system, are sufficient to supply CoT reservoirs in this basin. However, water resources in the Olifants River basin in the east are fully committed and cannot supply **additional** water to any existing or future CoT reservoirs without additional Rand Water supply through new pipelines, especially to the Cullinan WTP and Bronkhorstspruit WTP.

The CoT Water **Resources** Master Plan (2014) indicates that the reservoir listed in section 1.2 below is supplied from the water source shown in the table below. From this information it can be seen that this water source is adequate to cater for the proposed development.

Catchment	Water Source	%	Comment
Vaal River basin	Rand Water (con. no. RW5609)	80%	The master plan calculates the water volumes required at all Rand Water (RW) connections to supply applicable reservoirs. These calculations are supplied by CoT to RW and CoT obtains agreements from RW for these volumes.

1.2 Distribution Zone

The proposed development was taken into consideration in the water master plan as part of Knopjeslaagte 385-JR Ptn 16 future development area but was taken into account as an existing stand with a land use of Rural.

The master plan indicates that the proposed development currently falls in the Mnandi reservoir zone but in the future will form part of the Knopjeslaagte reservoir zone as shown in **Figure C1-1 (Water)** attached.

1.3 Revised Water Demand

The combined AADD for the proposed development as originally calculated and used in the analysis of the water distribution network in the master plan was 72 kℓ/d.

The revised AADD, peak flow and fire flow calculated for the proposed development and used in this re-analysis of the water distribution network was 645 kℓ/d.

Development name	Anticipated Landuse	New Dev. Area (ha)	Density (Units/ ha)	FSR	Floor space (ha)	No. of Units	FSR Units	UWD Type	UWD (inc.UAW)		AADD (inc.UAW) (kl/d)
	MASTER PLAN										
Knopjeslaagte 385-J	Rural	19.703	1	-	-	20	-	area gross	3	kℓ/unit/d	59
Vlakplaats 5A	LD Residential	1.306	4	-	-	5	-	area gross	10	kℓ/unit/d	13
Master Plan Total		**21.009**	-	-	**0.000**	**25**	**0**	-	-	-	**72**

Comment/ Reference		Anticipated Landuse	New Dev. Area (ha)	Density (Units/ ha)	FSR	Floor space (ha)	No. of Units	FSR Units	UWD Type	UWD Tshwane (inc.UAW)		AADD (inc.UAW) (kl/d)
		Schools: live-in student	2.42	826			2000		unit	300	ℓ per student	600
		School, crèche, educational (grounds only)	3.02						area	15	kℓ per hectare	45
		New Master Plan Total	**5.44**	-	-	**0.000**	**2 000**	**0**	-	-	-	**645**

- Peak flow using zone peak hour factor of: 3.6‡ = 26.9 ℓ/s
- Fire flow for type: Business – moderate risk = 50 ℓ/s @ 15m

1.4 Accommodation of Proposed Development in the Existing Water System

Accommodation of the proposed development, with its revised AADD, requires implementation of the following additions and adjustments to the *existing* water system as indicated in **Figure C1-3 (Water)**:

1.4.1 Bulk Items

Items required to alleviate existing problems in the bulk water system:

• MNR.B1	1	x	700	mm Ø Bulk connection (Rand Water)	R	1 778 000
• MNR.B1.1	1	x	400	mm Ø Valve to install and close	R	-
• MNR.B2	14	m x	700	mm Ø Pipe to install	R	1 073 000
• MNR.B5	71	m x	500	mm Ø Pipe to install	R	550 000
				Total	R	**3 401 000**

The current Mnandi reservoir zone AADD plus UAW ("scenario 5" in WADISO) in the m2017-06 Tshwane water model is 8069 kℓ/d. The capacity of the existing Mnandi reservoir is 15 000 kℓ. The existing FCV is set at 135 ℓ/s. Using these three input variables in a reservoir sizing spreadsheet, it shows that the remaining spare capacity of 1788 kℓ is sufficient to cater for the proposed development.

Currently the Mnandi reservoir is supplied via a PRV on the Pretoriusrand bulk supply. The 600mm bulk supply main to Pretoriusrand also supplies Midrand (JW). See the "**Bulk Water Supply to Pretoriusrand – Water Distribution Zones" figure**. This pipeline experience low residual pressures due to the large area it supplies and the direct zones feeding off it.

The temporary supply to Mnandi reservoir needs to be replaced with a connection off the RW H35 pipeline which traverses directly past the Mnandi reservoir site. **Figure C1-3 (Water)**

‡ Higher peak flow factors might be applicable for internal networks.

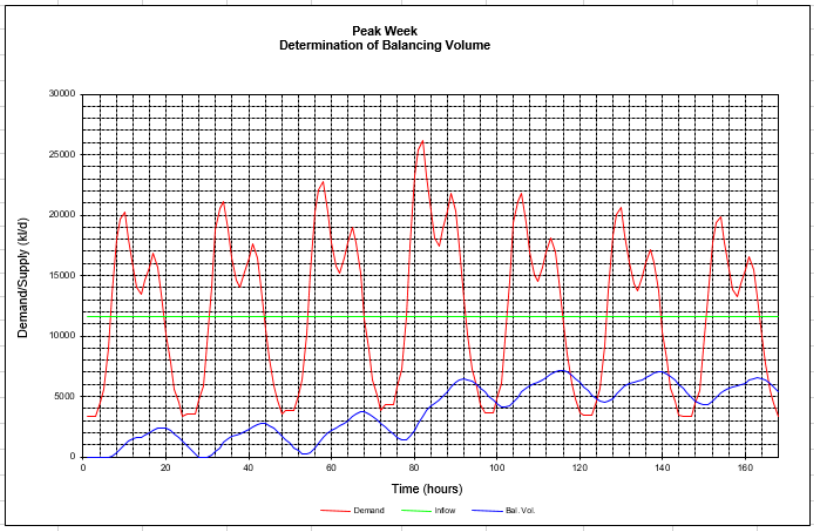
The feeder main to the proposed Knopjeslaagte reservoir serves as a reticulation pipe from Mnandi reservoir to Peach Tree and Gerhardsville. When the RW H35 pipe is in place, and when the Knopjeslaagte reservoir is being constructed, this feeder main can also get a separate connection on the H35 pipe in order to disconnect it from the Mnandi system.

DETERMINATION OF RESERVOIR BALANCING VOLUME and/or REQUIRED SUPPLY RATE

Mnandi reservoir

Present

AADD	**8069**	kl/d		
PDF	**1.80**	* AADD		
PWF	**1.50**	* AADD		
P3DF	1.62	* AADD		
Supply	**1.44**	* AADD		
=	11619	kl/d		
=	134.5	l/s	Pipe @ 1.8m/s	
			0.308	
Bal.Vol.	7160.2	kl		
=	21.3	h*AADD		
			%	
Pattern 1	Residential	Large	**0.0%**	
Pattern 2	Residential	Medium	**100.0%**	
Pattern 3	Residential	Small	**0.0%**	
Pattern 4	LC Housing		**0.0%**	
Pattern 5	B/C-Indust	Medium	**0.0%**	
Pattern 6	B/C-Indust	Large	**0.0%**	
Pattern7	Even	To a res.	**0.0%**	
Must add up to 100 --> check			100.0%	



VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)

Capacity	15000	kl	=	44.6	h x AADD
Required balancing	7160	kl	=	21.3	h x AADD
Available volume	7840	kl	=	23.3	h x AADD
Required emergency	6052	kl	=	**18.0**	h x AADD
Spare capacity	1788	kl	=	5.3	h x AADD

Items required to accommodate the proposed development in the bulk water system:

- As above

Total R -

1.4.2 Reticulation Items

Items required to alleviate existing problems in the water distribution system:

- None

Sub-Total R -

Items required to accommodate the proposed development (**excluding** fire flow requirements):

• KLR.47	585	m	x	355	mm Ø main pipe	R	1 811 000
• KLR.48	320	m	x	315	mm Ø main pipe	R	1 006 000

Sub-Total R 2 817 000

Items required to accommodate the proposed development (**including** fire flow requirements):

- As above

Sub-Total R -

Total R **2 817 000**

The proposed connection point to the existing water distribution system is shown in **Figure C1-1 (Water)**.

1.5 Internal Reticulation

The internal network design on the property of the proposed development is beyond the scope of this report. However, the consulting engineer for the development is required to allow for the fire flow demand as listed in 1.2 above on the internal networks.

For internal network design purposes the water distribution network provides the following energy gradelines (EGLs) at the proposed connection point B (see **Figure C1-1 (Water)**):

		POINT B (Current)	POINT B (Master Plan)
• Static EGL	=	1481 m a.s.l. (88.5 m)	1490 m a.s.l. (97.5 m)
• Residual EGL	=	1472.8 m a.s.l. (80.3 m)	1469 m a.s.l. (76.5 m)
• Fire Flow EGL	=	1464.5 m a.s.l. (72 m)	1457.4 m a.s.l. (64.9 m)
• Ground Level	=	1392.5 m a.s.l.	1392.5 m a.s.l.

1.6 Adjustments to the Master Plan

No adjustments to the water master plan are required due to the revised AADD of the proposed development.

2 BULK CONTRIBUTIONS AND COSTING OF REQUIRED WORKS

GLS hereby confirms that any contributions of the developer to the required construction of infrastructure and/or the upgrading of existing infrastructure, whether it be in the form of a capital contribution or in the form of constructing sections of new infrastructure, is a matter to be discussed and agreed upon between the developer and the City of Tshwane (CoT).

All costs shown in this report are year 2018/19 Rand value **estimates** and **include** 40% surcharge for P&Gs, contingencies and fees but **exclude** VAT.

Yours sincerely,

_____

Per: Dr BF Loubser
GLS Consulting

(Report done by: C. van der Merwe)

REQUEST FROM CONSULTANT TO GLS

From: Tanya Van Niekerk [mailto:tanya@civilconcepts.co.za]
Sent: Monday, 10 September 2018 09:47
To: Adie Vienings <adie@gls.co.za>
Subject: GLS Assessment Quotation
Importance: High

Good day Adie,

Could you please provide me with a quotation for a GLS Assessment for the attached development situated on Portion 66 of the Farm Knopjeslaagte 385-JR.

The development will be a 2000 pupil school with a 2000 pupil hostel.

Regards,

Tanya van Niekerk
GIS Operator / CAD Operator
tanya@civilconcepts.co.za
Civil Concepts (Pty) Ltd, Reg No: 95/12428/07
50, 15th Street, Menlo Park (Cnr 17th Street & Justice Mahomed (Charles) Street)
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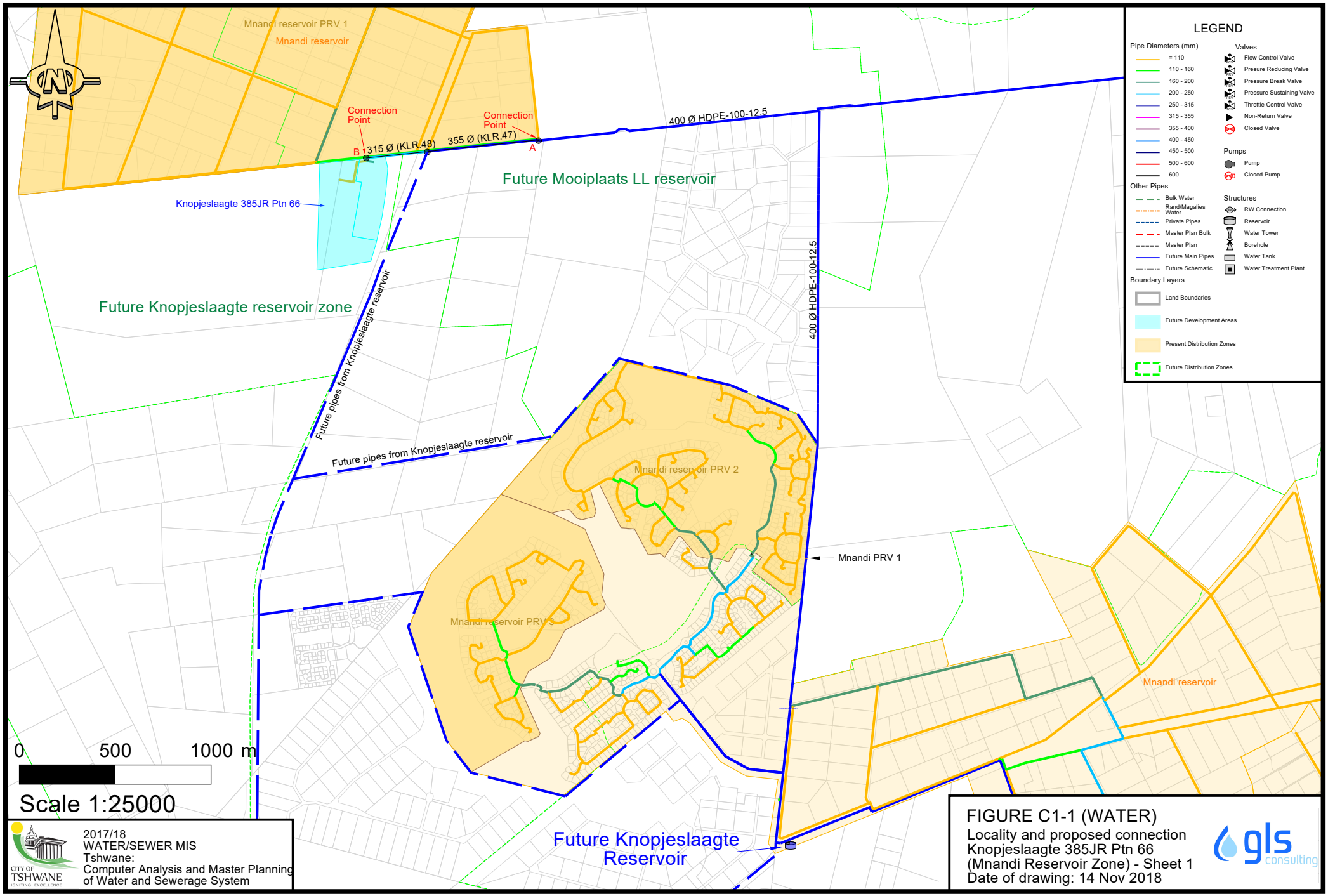
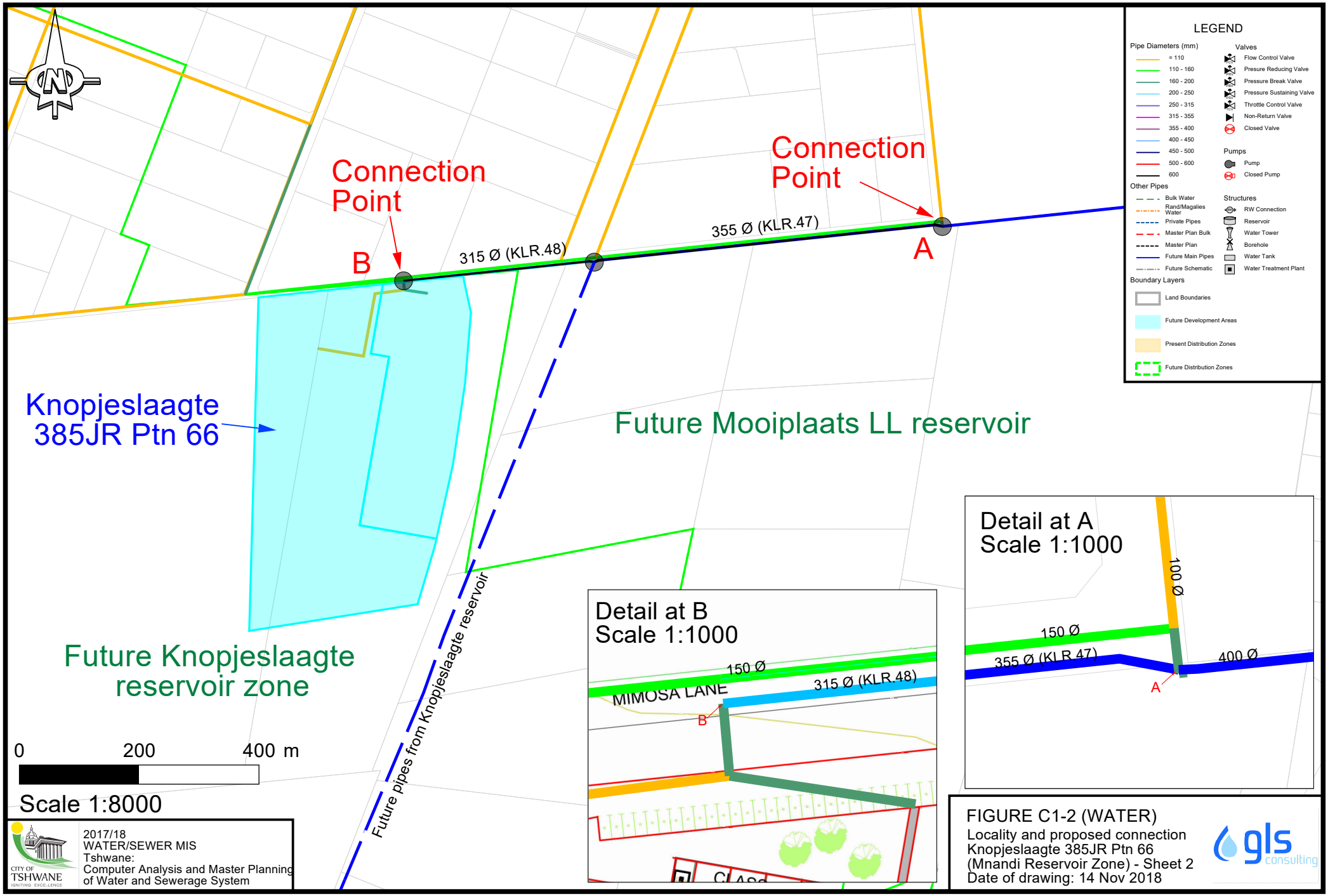
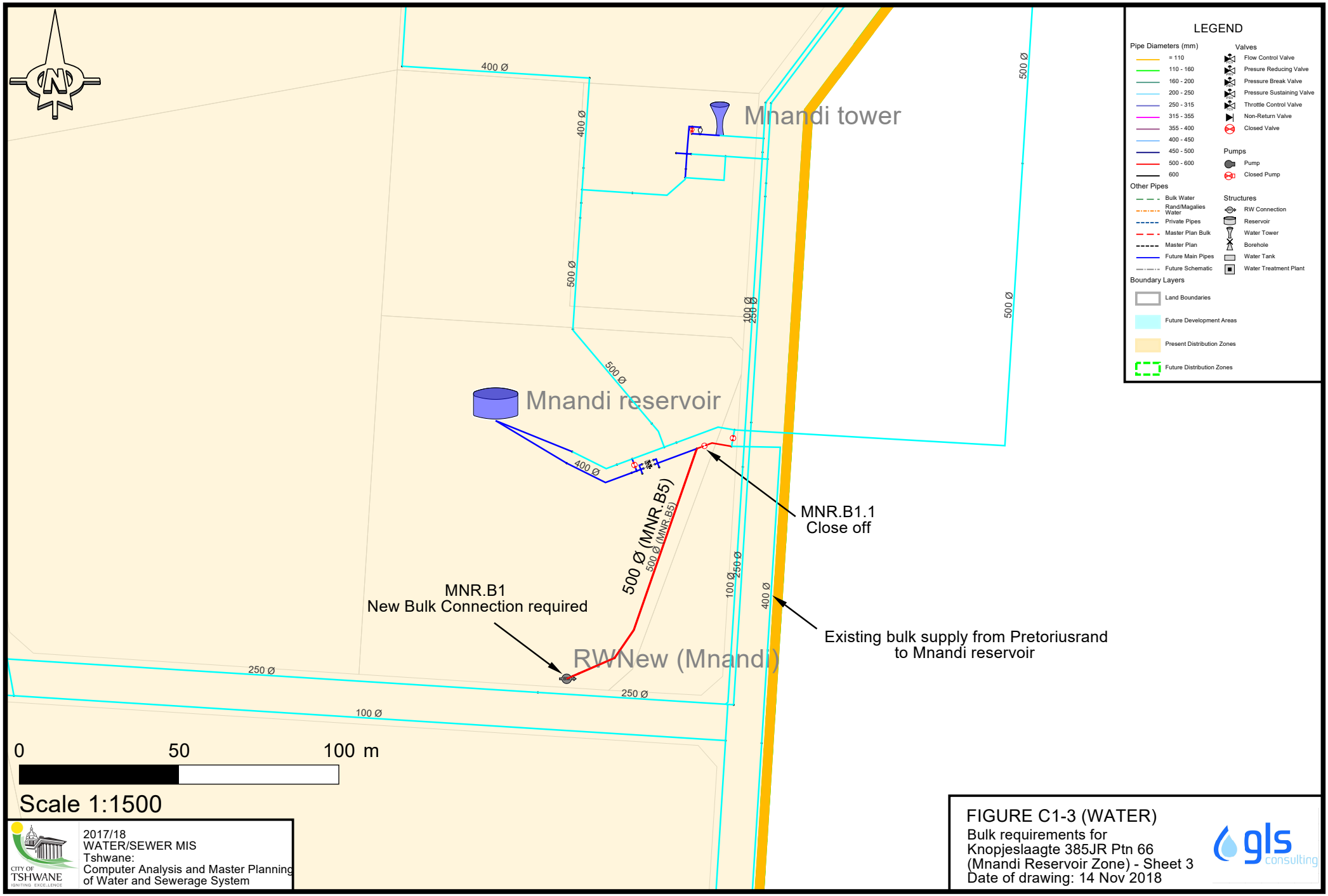
www.civilconcepts.co.za


Mnandi reservoir PRV 1
Mnandi reservoir
Connection Point
Connection Point
B
315 Ø (KLR.48)
355 Ø (KLR.47)
A
400 Ø HDPE-100-12.5
Future Mooiplaats LL reservoir
Knopjeslaagte 385JR Ptn 66
Future Knopjeslaagte reservoir zone
Future pipes from Knopjeslaagte reservoir
Future pipes from Knopjeslaagte reservoir
400 Ø HDPE-100-12.5
Mnandi reservoir PRV 2
Mnandi PRV 1
Mnandi reservoir PRV 3
Mnandi reservoir
Future Knopjeslaagte Reservoir
LEGEND
Pipe Diameters (mm)
= 110
110 - 160
160 - 200
200 - 250
250 - 315
315 - 355
355 - 400
400 - 450
450 - 500
500 - 600
600
Valves
Flow Control Valve
Presure Reducing Valve
Pressure Break Valve
Pressure Sustaining Valve
Throttle Control Valve
Non-Return Valve
Closed Valve
Pumps
Pump
Closed Pump
Other Pipes
Bulk Water
Rand/Magalies Water
Private Pipes
Master Plan Bulk
Master Plan
Future Main Pipes
Future Schematic
Structures
RW Connection
Reservoir
Water Tower
Borehole
Water Tank
Water Treatment Plant
Boundary Layers
Land Boundaries
Future Development Areas
Present Distribution Zones
Future Distribution Zones
0
500
1000 m
Scale 1:25000
2017/18
WATER/SEWER MIS
Tshwane:
Computer Analysis and Master Planning of Water and Sewerage System
FIGURE C1-1 (WATER)
Locality and proposed connection
Knopjeslaagte 385JR Ptn 66
(Mnandi Reservoir Zone) - Sheet 1
Date of drawing: 14 Nov 2018


Connection Point
B
315 Ø (KLR.48)
355 Ø (KLR.47)
Connection Point
A
Knopjeslaagte 385JR Ptn 66
Future Mooiplaats LL reservoir
Future Knopjeslaagte reservoir zone
Future pipes from Knopjeslaagte reservoir
0 200 400 m
Scale 1:8000
LEGEND
Pipe Diameters (mm)
= 110
110 - 160
160 - 200
200 - 250
250 - 315
315 - 355
355 - 400
400 - 450
450 - 500
500 - 600
600
Other Pipes
Bulk Water
Rand/Magalies Water
Private Pipes
Master Plan Bulk
Master Plan
Future Main Pipes
Future Schematic
Valves
Flow Control Valve
Presure Reducing Valve
Pressure Break Valve
Pressure Sustaining Valve
Throttle Control Valve
Non-Return Valve
Closed Valve
Pumps
Pump
Closed Pump
Structures
RW Connection
Reservoir
Water Tower
Borehole
Water Tank
Water Treatment Plant
Boundary Layers
Land Boundaries
Future Development Areas
Present Distribution Zones
Future Distribution Zones
Detail at B
Scale 1:1000
150 Ø
MIMOSA LANE
315 Ø (KLR.48)
B
Detail at A
Scale 1:1000
100 Ø
150 Ø
355 Ø (KLR.47)
400 Ø
A
CITY OF TSHWANE
IGNITING EXCELLENCE
2017/18
WATER/SEWER MIS
Tshwane:
Computer Analysis and Master Planning of Water and Sewerage System
FIGURE C1-2 (WATER)
Locality and proposed connection
Knopjeslaagte 385JR Ptn 66
(Mnandi Reservoir Zone) - Sheet 2
Date of drawing: 14 Nov 2018
gls consulting


LEGEND
Pipe Diameters (mm)
= 110
110 - 160
160 - 200
200 - 250
250 - 315
315 - 355
355 - 400
400 - 450
450 - 500
500 - 600
600
Valves
Flow Control Valve
Presure Reducing Valve
Pressure Break Valve
Pressure Sustaining Valve
Throttle Control Valve
Non-Return Valve
Closed Valve
Pumps
Pump
Closed Pump
Other Pipes
Bulk Water
Rand/Magalies Water
Private Pipes
Master Plan Bulk
Master Plan
Future Main Pipes
Future Schematic
Structures
RW Connection
Reservoir
Water Tower
Borehole
Water Tank
Water Treatment Plant
Boundary Layers
Land Boundaries
Future Development Areas
Present Distribution Zones
Future Distribution Zones
Mnandi tower
Mnandi reservoir
400 Ø
500 Ø
100 Ø
250 Ø
500 Ø (MNR.B5)
MNR.B1.1
Close off
MNR.B1
New Bulk Connection required
RWNew (Mnandi)
Existing bulk supply from Pretoriusrand
to Mnandi reservoir
0
50
100 m
Scale 1:1500
2017/18
WATER/SEWER MIS
Tshwane:
Computer Analysis and Master Planning
of Water and Sewerage System
CITY OF TSHWANE
IGNITING EXCELLENCE
FIGURE C1-3 (WATER)
Bulk requirements for
Knopjeslaagte 385JR Ptn 66
(Mnandi Reservoir Zone) - Sheet 3
Date of drawing: 14 Nov 2018
gls consulting

ANNEXURE B
SCARAB

Scarab Water (PTY) Ltd
No 1, 3rd Avenue Industria Park
Bela Bela South Africa
P.O Box 44 Bela Bela South Africa 0480
CK no: 2013/173726/07
Vat no: 4590268522
Phone +27 (0)14 736 3463
Cell 082 441 9549
Email: steve@scarabsa.co.za
Web: www.scarabsa.co.za

Sustainable Sewage Solutions

27th February 2019

Our Ref *S201945*

SUBMISSION OF QUOTATION TO

Werner Stander
Civil Concepts

Johannesburg South

Attention: Werner

Cell 082 416 8190

Email : werner@civilconcepts.co.za

FOR

Supply and Installation of
STS 150 exe
Scarab Treatment Plant

Validity

Quotation is valid for 30 days

As featured on

Scarab Water

Sustainable Water Solutions

Company: Civil Concepts
Address: Pretoria
Name: Werner Stander
Email: werner@civilconcepts.co.za
Tel: 082 416 8190

Treatment Systems

27th February 2019

Subject: Waste Water Treatment

Dear Werner,

Thank you for the opportunity to present you with a proposal for a Scarab Biological Treatment Plant.

Scarab Water understands the following about the requirements:

1. Supply and install Water Treatment Plant to treat effluent of up to 300 000 litres per day.
   Our Scarab Systems typically treat domestic wastewater to the following standards

Parameter	Units	DWAF Standard	Scarab Achieves
E. coli *	colonies per 100ml	1000	410
Suspended solids at 105°C	mg/l	<25	<10
Chemical oxygen demand	mg O2/l	<75	<44
Ammonia	mg N/l	6	2

By installing a Scarab Plant, there will be benefits in 5 key areas:

- The waste water will be treated consistently as required.
- On-going operating and maintenance costs will be minimal.
- The system is modular and pods can be added with the expansion of the site.
- Aeration equipment and pumps can be removed and replaced without the need to empty tanks.
- Scarab is the only System that can sweep from the bottom of the tanks, thereby keeping the sludge from settling.

Scarab Water

Sustainable Water Solutions

Company: Civil Concepts
Address: Pretoria
Name: Werner Stander
Email: werner@civilconcepts.co.za
Tel: 082 416 8190

Treatment Systems

27th February 2019

Quotation

Scarab STS 150 exe	To treat up to 300 000L effluent per day	
Bio-Tower	16 x 15 000L Heavy Duty Tank	
Disinfection (chlorine)	1 x 5000L Heavy duty tank	
Media	160 bags Bio Pac media (2500 units per bag)	
Aeration Pump	32 x Dab 0.75kw 220V Centrifugal Pump	
Submersible Pump	2 x V0.75F 0.75kw Submersible Pump (from septic tank)	
Black Pump Boxes	32 x Black Boxes (Housing for Pumps in Bio-Towers)	
Chlorine Disinfection	Not applicable	
Venturi's	32 x Scarab Venturi'	
PVC Fittings	50mm Class 12 PVC Pipe	
	50mm PVC Fittings	
	24 x 50mm PVC Ball Valves	
	Price excl VAT	R 3 691 702.00
Delivery and Installation (Gauteng)	Price excl VAT	R 152 000.00
Ozone Disinfection	8 x 4 g/h Gram/hour ozone generator	
	Complete with 0.37kw centrifugal pump	R 123 200.00
Booster system (for irrigation)	1 x 0.37 kw submersible pump,	
(optional)	2500 litre collector tank and outlet	R 6 500.00

Scarab Water

Sustainable Water Solutions

Company: Civil Concepts
Address: Pretoria
Name: Werner Stander
Email: werner@civilconcepts.co.za
Tel: 082 416 8190

27th February 2019

Product and Operational Description

Pre-Digestion Tanks

The first stage, and a pre-requisite for the installation of a Scarab Treatment System, is correctly installed Predigestion (PD) Chambers. In the Predigestion Chambers, the process begins with the physical and biological breakdown of the solid matter into simple liquids, which the Scarab plant processes efficiently. This PD comprises three chambers, each equal to the expected daily volume – in this case 300m3 (per chamber). The required treated water quality of special standards needs this volume to allow for additional biological process which will reduce the food in the water (COD) whilst still in the anaerobic stage. PD is considered as civilworks, as these structures are often underground requiring specialist contractors, and therefore, not covered in our prices.

Scarab Biological Filter (Bio-Tower)

The Scarab Bio-Tower is comprised of 5 sections for the processing of sewage effluent.

1. Constant Header unit

This unit performs the function of controlling the flow of sewage through the Bio-Tower. Internal adjustments allow the Scarab to be set to meet each individual customer's requirement.

2. Mixing Chamber

The Sewage Effluent is introduced into the Bio-Tower and is mixed constantly with pre-oxygenated effluent.

3. Circulation Chamber

This Chamber circulates the effluent from the Pressurization Chamber back into the Mixing Chamber. Each litre of effluent is re-oxygenated at least once every hour, thereby creating the highest possible concentration of Oxygen in the effluent at all times.

Scarab Water

Sustainable Water Solutions

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Tel: 082 416 8190

Treatment Systems

27th February 2019

4. Accelerated Oxygenation Unit

A centrifugal pump circulates the effluent through the Pressurization Chamber, where the effluent is oxygenated, under high pressure, to allow for the maximum absorption of oxygen. Micro bubbles are formed in this process which decreases their buoyancy, and thus increasing the contact time. Based on our research on a 10kl tank (3 meters high), we achieved a bubble path-length of 11 meters.

5. Media Chamber

The media chamber is packed with Bio-Pak to allow for the highest possible surface Area. It is on these surfaces that Bio-Mass forms. Bio-Mass is responsible for biological refinement of the effluent.

Pathogen Treatment Tank

Before final discharge it is imperative to disinfect the water for any remaining Pathogens, or other Bacteria. Options available for disinfection are Chlorine, or Ozone for ecologically sensitive areas. This ensures that discharged effluent is compliant and totally environmentally friendly.

Clarifiers – Optional - NB

We very rarely install clarifiers, and although we achieve the required suspended solids standard, clarifies may still be required after disinfection. We have not included this in our prices since we don't have updated prices. As soon as we know the costs, we will forward same to you. If required, we would install 4 x 5000 litre clarifiers, and this may change the platform size, thus civilworks.

Phosphate Removal - Optional

Again, we do not often offer phosphate removal equipment, particularly in domestic wastewater applications, for several reasons. In a majority of installations, there is no source of phosphates entering the sewer system, and therefore the resultant final effluent has little, or no phosphates. And, this process requires chemical dosing equipment, which we like to avoid.
However, Ozone does remove small traces of organic phosphates, and it is Ozone we have offered in this proposal, as a disinfectant.

Scarab Water

Sustainable Water Solutions

Company: Civil Concepts
Address: Pretoria
Name: Werner Stander
Email: werner@civilconcepts.co.za
Tel: 082 416 8190

27th February 2019

Plant Specifications

Construction Material:	
LLDPE	Tanks (Heavy duty) and internal Piping
PVC	Standard external Fittings
Pumps:	
Centrifugal	0.75kw single phase 220 volt pump (Bio-Tower)
	0.37kw single phase 220 volt pumps (Ozone Disinfection - optional)
Submersible	0.75kw single phase 220 volt pump
Ozone	4g/h, 100w single phase 220 volt (optional)
Media:	Bio-Pak
Pathogen Treatment:	Ozone

Water Quality Standards

All Scarab Treatment Systems are designed to conform to the specifications required by the Department of Water Affairs and Forestry (DWAF) in terms of the General and Special Standards, of the Water Act. Irrigation of lawns, washing of cars and water features is a preferred method of disposal, as opposed to releasing the treated water directly into a water course.

Electrical Supply

We require a 220 volt / 85 amp power supply within 2 meters of the plant position, which would include earth leakage protection.

Civil works

No allowance has been made for any civil works, bar the normal trenching and back-filling, during installations. It may be necessary to build a concrete base/ platform for the disinfection tank / booster , which is considered civil works. See above – Predigestion chambers (as discussed)

Scarab Water

Sustainable Water Solutions

Company: Civil Concepts
Address: Pretoria
Name: Werner Stander
Email: werner@civilconcepts.co.za
Tel: 082 416 8190

27th February 2019

Conditions of Sale

South Africa

Payments / Deposit	50% Deposit - with order
	Balance after Installation - within 7 days
Factory completion	28 working days
Warrantee	12 months on all equipment

Exports

Payments / Deposit	50% Deposit - with order
	Balance after factory completion
Factory completion	14 working days
Warrantee	12 months on all equipment

Please contact me should you require anything further.

Regards

Steve Nicol 082 441 9549
Scarab Water (Pty) Ltd

ANNEXURE C
BECON WASTEWATER

BECON WATERTECH
Reg. no. 1995/001511/07
DIRECTORS: W.P. VAN DER MERWE & W. OLIVIER
Tel: +27 (0) 11 752 1191
Email: info@becon.co.za
11 Coopersklooof Street / P.O Box 3771 / Glenharvie / Westonaria / South Africa / 1786
www.beconwatertech.com

18 February 2019

Project Method Statement

1 Purpose

1.1 Introduction

The proposal of this outline method statement is to describe all of the major activities and methods proposed in carrying out the works pertaining to this project. This document will be enhanced and supplemented as the project progresses.

Project Organization is intended that the project organization shall consist of the following personnel:

- Project Manager.
- Installation Supervisors.
- Health and Safety Officer

The project manager will be the principle point of contact through the duration of the project and through the team will be responsible for: -

- Progress of the works.
- Safety of the works.
- Drawing and information items required to ensure progress.
- Procurement of material to meet the site requirement.
- Provide full liaison and support to the client and the other Trade Contractors.
- Resource Management in line with the planned progress.
- Production of project cost breakdown suited for progress billing
- Financial
- Review of Documentation Issued.
- Production of Control Points Schedules.
- Production of System Graphics.
- Production of Description of Operation.
- Issue for Approval.
- Control Software The project manager shall be responsible for:

a) Progress of the works.

The project manager will monitor, record and document the progress of each aspect of the works from information provided by the project team and from this information determine the status of the overall works in relation to the project as a whole. The project manager will ensure that adequate resources are available in order to maintain sufficient progress in every aspect of the works.

b) Safety of the works.

The project manager will ensure that all works are carried out in accordance with the site health and safety requirements. Toolbox talks will be held on a regular basis and will cover a topic relevant to the current works. Regular visits will be made from Head office to ensure compliance with the Site requirements and also with Pan Gulf Industrial System's own code of practice for carrying out works away from Company premises. All employees are tasked with making sure that they take reasonable care of their own health and safety.

c) Drawing and information items required ensuring progress.

The project manager in association with the design engineer and the installation supervisor will document and monitor all requests for information for the works.

d) Procurement of material to meet the site requirement.

The project manager will place, document and monitor progress on all orders for materials. The project materials procurement schedule will be updated on a daily or weekly basis as necessary.

e) Provide full liaison and support to other Trade Contractors.

The project manager will attend regular meetings with the Engineer and other Contractors as necessary to ensure that all matters of co-ordination are satisfactorily resolved to avoid any undue impact upon the program of works.

f) Resource Management in line with the planned progress.

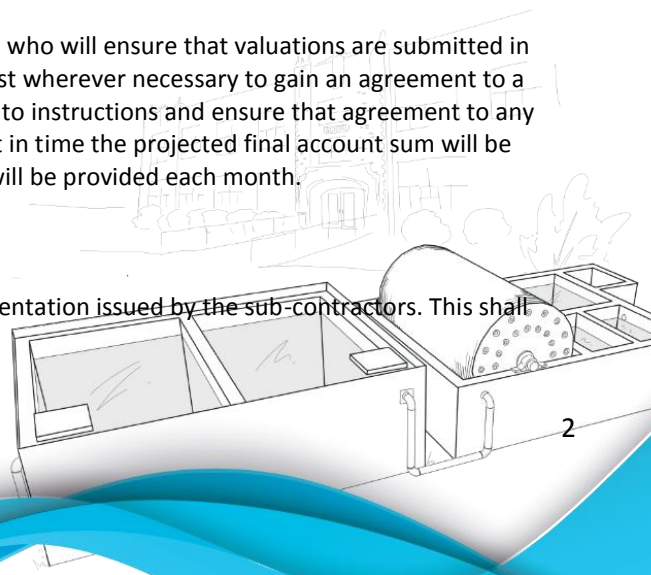
The project manager will ensure resources are made available as indicated in advance by the on-going monitoring of the contract program.

g) Financial

The project manager will be assisted by an Engineer / QS who will ensure that valuations are submitted in line with the agreed valuation dates and will seek to assist wherever necessary to gain an agreement to a value for certification. The project engineer will respond to instructions and ensure that agreement to any time or cost implication is reached such that at any point in time the projected final account sum will be substantially agreed. A complete statement of account will be provided each month.

h) Review of Documentation Issued.

The project manager shall review all information/documentation issued by the sub-contractors. This shall include all specifications, drawings and schedules.



i) Production of System Design.

When the contract is agreed the design shall be carried out in accordance with the specification. This shall be produced in accordance with building layouts and schematics, construction drawings and any manufacturer literature issued.

j) Issue for Approval.

The package of information shall include a print schedule incorporating all system points entered into the system and a copy of the description of operation.

1.2 Key Dependencies

The installation progress will be governed in time and sequence by the availability of areas, and those responsible for installing the equipment that may require interfacing to.

a) Before installation can begin the following requirements should be met

- Approval of system containment/pipe routes attained
- Unhindered access to all associated areas of the building

b) Before commissioning can begin the following requirements should be met

- Power available to panels
- Water supplies available
- Unhindered access to all associated areas of the building
- Confirmation from contractor that all other site contractors have been advised
- Necessary witnessing personnel have confirmed attendance
- Necessary approved testing procedure is available
- Relevant operating & Maintenance manuals available

1.3 Project Mobilization

As soon as Becon Watertech are advised that the contract package has been successfully awarded to them, the Project Team will be brought together with the Bid Team to handover the project and to plan the site set up. All principal sub-contractors will be notified that a sub contract order is about to be placed. The factory/warehouse and supplies will also be advised of the impending product demand. During this pre-site period the Bid Team will remain heavily involved in the project to ensure that the design concept is fully understood and to address any subsequent questions. Several members of the bid team will continue to have a proactive role in the project right through to completion. This illuminates unnecessary internal co-ordination problems. The main aim of the team will be to initiate the project and compile a fully functional project team within a matter of days and to ensure that all key personnel have been given full safety inductions.

1.4 Design Development & Approval

The design engineer in co-operation with the project manager will begin the task of firming up the design information and will raise necessary “Request-for-Information” forms to enable the preparation of schedules and other ancillary equipment. All design documentation will be produced to an agreed schedule to allow adequate time for manufacture and delivery to site. These drawings will be submitted for approval and subject to amendment for comments will form the detail that the equipment is configured to. There will be a cycle to allow for the update and re-submission of documents in accordance with any comments made by the client.

1.5 Installation & Testing

b) Installation

All works will be carried out in accordance with: -

- Industry standards
- Project specifications

All works/operations will be carried out in accordance with all proven methods and industry standards. All due care shall be taken to comply with the relevant safety procedures to ensure the highest degree of safety is always maintained. Where applicable, all manufactures equipment handbooks and manuals will be utilized and filed on site to aid all installations works and testing.

c) Safety Regulations

In accordance with the regulations Becon Watertech will: Co-operate with the Engineer so far, as is necessary to comply with the relevant statutory provisions, site rules and the health and safety plan. Provide the Engineer with all information which might affect the safety of anyone involved or affected by the project or which might require a review of the health and safety plan. Comply with the rules applicable to the health and safety plan. Ensure that before work is allowed to commence the following information has been given to each of his employees and sub-contractors:

- The name of the Planning Supervisor:
- The name of the Engineer:
- The contents of the health and safety plan, or such parts that are relevant to our works, and made aware of any health and safety issues relating to our works.
- Once on site Becon will continually monitor on site safety.
- Attend the on-site safety meetings.

d) Material Handling

- Materials will be co-ordinated through the Project manager.

f) Installation Equipment:

- Equipment are delivered to site on an as & when required bases to ensure an effective installation process.

g) Rubbish Removal

- Rubbish will be cleared away at regular intervals. All staff will be briefed in the importance of this requirement, particularly from an environmental & safety perspective.

h) Snagging Project Closeout

- The installation works will be continuously checked by our Installation Supervisor to check that they conform to specified and statutory standards. In addition, as each zone / area is completed it will be thoroughly snagged and offered to the construction manager for acceptance. This approach will ensure that at the end of the project the amount of snagging is minimal and will allow the witnessing and demonstration phase of the project to continue unhindered. In the event of snagged items being raised then these will be attended to as soon as practically possible.

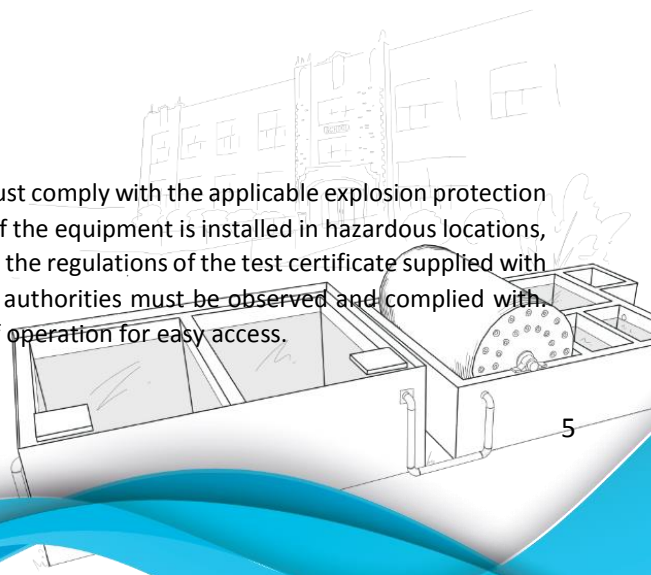
Field installation check prior to commissioning:

Item	Action	Operation
Systems field installation	Visual check	General layout/ Routes/Supports
General Inspection.	Visual check	Fitting/Layout/Location
Configuration of systems	Visual check	Check in accordance with design documentation
Input/output termination's	Visual check	All associated wiring
Mechanical -Piping	Visual check	All fittings secure, supports fitted
Electrical – Cable works	Visual check	All cable/conduit terminated and where applicable earthed
Field devices.	Visual check	Check device type against specification, device location and labeling or tagging
Operational check.	Visual check	Full operational check

1.7 Installation at Site

1.7.1 Safety Regulations

Electrical equipment operated in hazardous locations must comply with the applicable explosion protection regulations. This is indicated on the motor rating plate. If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate must be kept close to the location of operation for easy access.



1.7.2 Civil Works

All civil work required must have been prepared in accordance with the specifications & dimensions stated in the mechanical GA drawings provide. This to ensure proper interfacing with civil & mechanical equipment.

1.7.3 Installing the Mechanical equipment

All equipment are installed once civil works are inspected for suitability.

Certified lifting personnel & equipment are used to load & off load equipment on site.

All mechanical equipment are properly secured with the most appropriate fixtures.

All mechanical equipment are installed according to specific to type installation procedures. Examples of such procedures are

Once equipment are installed & aligned to specification the base plates are grouted.

1.7.4 Alignment of all drive train equipment

All components must be levelled & aligned during system installation & be thoroughly checked. If necessary, realigned. Data are recorded on the pre-commissioning sheets to confirm alignment.

Improper alignment of the units can cause injury or damage to both the coupling and the unit itself!

1.7.5 Safety Guards

- In compliance with the accident prevention regulations the equipment must not be operated without required protective guards.

1.7.6. Bearing Lubrication

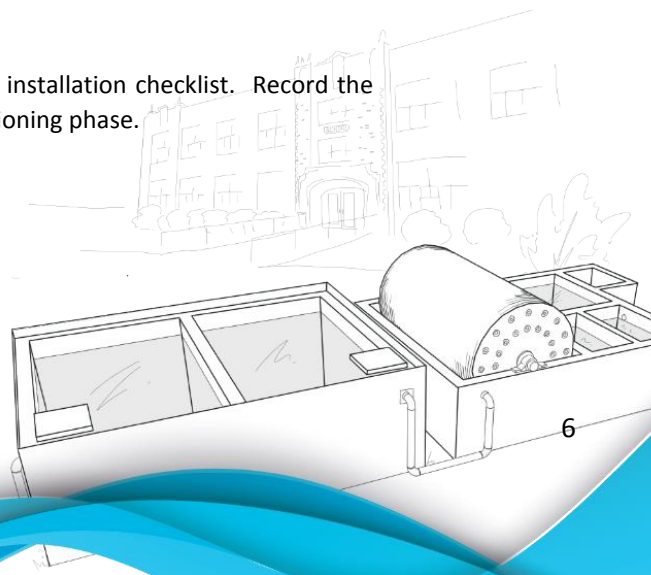
- Appropriate personal protective equipment should be worn when handling lubrication fluids. Regular lubrication checks should also be performed to prevent damage to the equipment.

1.7.7 Final Check

Verify the correctness of the installation by using the relevant installation checklist. Record the required data onto the checklist. File checklist for Pre-commissioning phase.

1.7.8 Site de-establishment

Clear area and make good to the project specification.



1.8 Pre-commissioning

All works will conform to the standards set out. The entire system will be systematically checked to establish the suitability for commissioning. The commissioning and/or projects engineer shall inspect each area with the installation technician or sub-contractor to verify that the installation works are completed. Interfacing with other trades, if required.

Electrical connections shall be made by qualified & suitably trained staff.

Perform dry run of the approved test procedure.

Record the required data onto the checklist. File checklist for Commissioning phase.

Confirm rotating direction.

Confirm Amps drawn are not exceeded.

Confirm Emergency Stop systems are functional.

1.9 Commissioning, Start-up and Shutdown

Prior to commencement of our commissioning activities, we shall require the following:

a) Power, permanent or temporary, to system panels and associated items.

b) Water supply for the systems.

c) Confirmation of all lubricants, connections & safety regulations.

d) Pre-commissioning check lists

e) Engineer

Throughout this process, detailed records of findings and settings will be made.

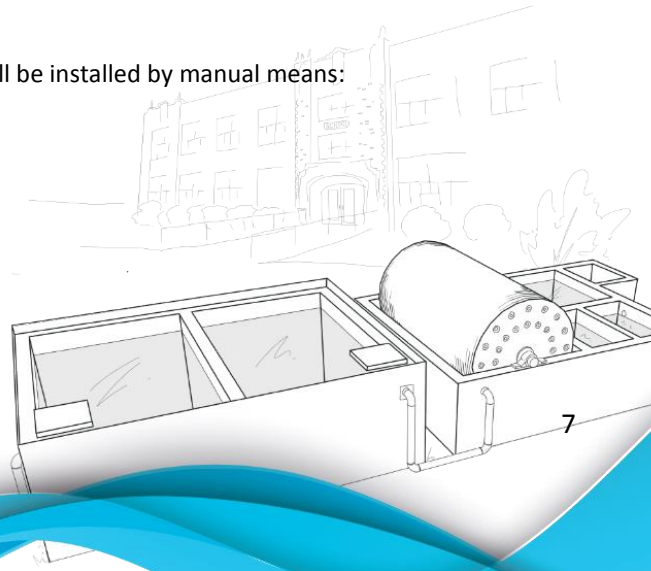
1.10 O&M Manuals

The descriptions of operation, description of maintenance procedures will form the O & M manual which will be supplemented with test documentation. This will be submitted at commissioning stage.

1.11 Plant and Equipment

The following plant and equipment will be utilized as the plant will be installed by manual means:

1) Certified crane incl rigger.
2) Transport vehicle for equipment
3) Standard Fitter toolbox.
4) Standard Hand power tools.
5) Certified lifting equipment including slings and hoists.



1.12 Manpower

The plant will be installed by the required number of installation teams each consisting of:

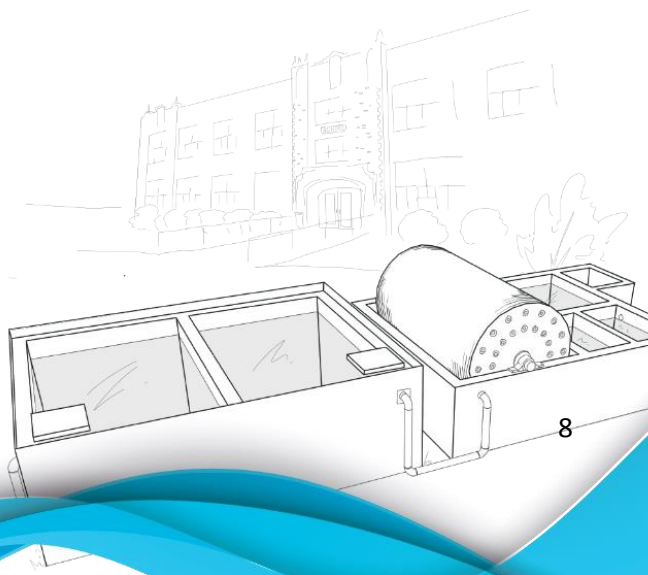
1) 1 x suitably qualified and experienced installation fitter.
2) 1 x suitably qualified and experienced installation assistants.

1.13 Safety

The following procedures shall be adhered to:

1) All personnel working at site shall attend HSE induction / awareness training programs conducted by the Safety Engineer / Officer.
2) No permits to work will be issued without prior risk assessment approval.
3) Nominated supervisor will remain at site during the execution of the work.
4) The project safety file shall always be accessible on site.
5) Daily toolbox talks to be conducted, attendance register signed, and minutes kept.
6) Necessary safety precautions shall be implemented for all activities associated with Electrical/Mechanical installations.
7) PPE shall always be worn.
8) Safety Officer will remain present at site and will ensure that the provisions made in the Project SHEQ plan are complied with.

All necessary precautionary / safety measures such as putting warning tapes in place shall be taken to prevent unauthorized ac.



"WE Clean Water for Future Generations"

15 February 2019

Civil Concepts

Pretoria

Contact number : +27824168190

E-mail address : werner@civilconcepts.co.za

Dear Mr. Werner Stander

Project Name: Gerhardsville School Extension 2 Full time boarders

Product Discription : Be-Pac 300

Internal Number: ***6015***

Operations and maintenance manual for the Becon Watertech Waste Water Treatment plant

Tel: +27
info@becon.co.za | www.beconwatertech.com
11 Cooperskloof Street | P.O Box 3771
Glenharvie, Westonaria, South Africa, 1786
Directors W.P Van der Merwe | W. Olivier

Setting the Standard

GREEN BUILDING COUNCIL OF SOUTH AFRICA

INDEX

1. THE BIO-FILTER RBC PRINCIPLE

The Bio-Filter plant is comprised of a primary septic tank, Bio-Filter RBC rotor units, a humus tank and a chlorine contact tank as shown in the plant layout drawing.

The effluent from standard septic tanks or primary sedimentation tanks receiving waste and soiled water from domestic sources passes through semi-circular troughs in which the Bio-Filter RBC disc filters at slow speed.

Biological films form on the discs, similar to those found on standard trickling filters and absorb the organic pollutants present in the effluent and convert these to readily settle-able solids that are removed by sedimentation in the humus tank.

The biological film acting aerobically as oxygen is absorbed from the atmosphere by diffusion into the wet film surface on the discs during rotation, and no offensive odours are therefore produced.

As a result of the large amount of active organisms present on the discs, the process can temporarily absorb large organic shock loads or high hydraulic overloads.

Under the above adverse conditions, the biomass cannot be washed out of the system, and the Bio-Filter unit will thus continue to remove a fixed amount of waste material from the effluent.

Bio-Filter RBC plants are simple to operate and are fitted with continuously rated motors, transmissions and bearings which will function for many years with the minimum of attention, if correctly maintained.

2. BIO-FILTER RBC OPERATING PROCESS

2.1. SEPTIC TANKS

Raw sewage flows into the first compartment of the septic tank where primary sedimentation and anaerobic digestion takes place.

From the second compartment of the septic tank, the effluent flows to the Bio-Filter RBC stage, where aerobic treatment takes place.

It should be noted that over a period of time, sludge build-up occurs in the septic tank, and needs to be drawn-off, as a rule of thumb every 8 – 12 months onto sludge beds, adjacent lands, or carted away by vacuum tanker.

Site measurements to determine the level of Settleable Solids carryover in the septic tank effluent (2.5ml/l maximum settled over 45 minutes) and/or the physical measurement of settled sludge across the septic tank (should not exceed 40% of the available volume) can confirm whether desludging is required.

THE DE-SLUDGE PROCESS OF THE SEPTIC TANK IS A MOST IMPORTANT OPERATION AND SHOULD BE PLANNED FOR ONCE A YEAR.

2.1. BIO-FILTER RBC UNITS

Septic tank effluent flows through the Bio-Filter basins where aerobic treatment takes place, by the RBC units.

Primary rotors will show more intense bacterial growth on the discs that the secondary rotors due to the variety of organisms present.

Bio-Filter rotors must rotate at all times, except during the maintenance shutdown periods. Individual rotors may be stopped by depressing the stop-lock buttons adjacent to each machine.

These buttons are unlocked by a twist motion.

Emergency stop push button.

De-sludge chamber with de-sludge valve and Humus return pump

Containerised and tank unit Humus tank with Humus return pump.

Clarifier with internal launder pipes, bridge and stilling tube.

Containerised and tank unit clarifier (humus tank).

Geared motor drive (gearbox)

NOTE: Rotor discs should not be cleaned under normal operating conditions, as the apparent growth on the discs is in fact the bacteria that clean the water. Excessive growth (exceeding 3mm thickness) on discs should however, be removed periodically by water hose.

2.3 HUMUS TANK

Effluent from the Bio-filter plant flows to the humus tank where the humus is settled out.

The settled humus sinks to the bottom of the cone from which it is returned to the septic tank by means of the humus return pump through the automatic re-circulation arrangement, fitted in the adjacent pump sump.

It should be noted that some humus may float on top of the humus tank, but a water- spray from a hose easily disperses this daily.

A manual sludge draw-off valve is installed in the pump sump and should be opened for 3 minutes twice daily, in the morning and afternoon, to DESLUDGE the humus tank.

2.4 DISINFECTION TANK

Clarified effluent from the humus tank is disinfected in the contact tank by means of either:

a) A Gas Chlorination System

b) Liquid disinfection system (Sodium Hypochlorite or diluted chlorine granules)

c) Chlorine tablets

d) An Ozone System

Chlorine dosing should be at a rate of 4 – 6 mg/l

Ozone dosing should be at a rate of 0, 5 mg/l

Residual chlorine level should periodically be tested at the outlet of the chlorine contact tank.

(A basic chlorine residual test-kit would suffice to ensure that a suitable residual chlorine level of 0, 4 – 0, 5 mg/l is available at this point.)

2.5 ELECTRICAL CONTROL PANEL

All Bio-Filter plants are supplied with an electrical control panel that is fitted with separate starting equipment for each motor.

The electrical control systems are fitted with circuit and equipment protection relays, which may trip out under abnormal load, or low voltage conditions.

The units may be reset by depressing the reset buttons on the relays inside this panel.

Should continuous tripping occur, the cause must be investigated by an authorised competent person i.e. Electrician

NOTE: SWITCH OFF MAIN CIRCUIT BREAKER ON CONTROL PANEL BEFORE RESETTING ANY RELAYS.

ALL WORKS PERFORMED MUST BE DONE BY AN AUTHORISED COMPETANT PERSON.

2.6 GENERAL

It is recommended that the sewage purification plant and site be kept in a clean and neat condition. The various parts of the plant should therefore be periodically hosed down.

2.7. PLANT START-UP

To start-up plant:

a) Fill plant up with clean water

b) Switch Bio-Filter rotors ON

c) Switch Humus Pump to AUTO

d) Start-up Disinfection System

It should now take some 2 weeks for the plant to stabilize biologically, and clean effluent cannot therefore be expected in less than 7 days.

2.8 INADVERTENT SHUTDOWN

Should the plant be inadvertently shut down for a period longer than 5 days, the effluent in the Bio-Filter basins, humus tank and chlorine tank will become anaerobic and odours could develop. For prolonged shutdown periods, empty the Bio-Basins.

On restarting the plant after this shutdown period, the following procedure should be adopted:

a) The sludge blanket that has developed on the chlorine contact tank and the humus tank should be removed by spade and discarded in sludge beds for drying or be buried in a suitable location.
b) The sludge from the humus cone must be pumped onto the sludge beds or buried. This is done by un-coupling the union at the humus pump, attaching a hose and pumping the sludge by means of this extended pipe to a suitable place.
When clear water becomes visible from this pipe, the excess sludge has been removed and the pump may be reconnected to the original delivery line.
c) The Bio-Filter rotors and the plant may now be started up and become operational again.

It is to be noted that it will take approximately 2 – 3 weeks before the plant has re-stabilised and a good effluent quality obtained again.

3. BIO-FILTER RBC FAULT FINDING CHART

3.1. BIO-FILTERS

Should the Bio-Filter discs not rotate, check the following:

a) Check that main power supply is available
b) Emergency stop buttons may be depressed
c) Motor overloads or control panel may be tripped
d) Motor on gearbox may be faulty

3.2. HUMUS TANK

Should a sludge blanket be observed floating on the top of the humus tank, undertake the following:

a) Spray the top of tank with a hose to break up sludge
b) Check whether the Humus / recirculation pump or system is operating.
c) Check and ensure the flow rate through the plant is correct and within design specifications.

3.3. HUMUS PUMP

Should the humus pump not be operating satisfactorily, check the following:

a) Check if pump is operating as electrical overload may have tripped (a vibration on the delivery pipe indicates that the pump is running)
b) Check that shut-off valve on delivery main is open
c) Check if delivery pipeline is blocked
d) Finally, check if pump is clogged by withdrawing pump from sump, inspecting and cleaning. You may need to open the
e) impeller cage at bottom of pump, remove clogging material and re-install.

(Ensure all safety precautions are observed before working on any equipment)
ALL WORKS PERFORMED MUST BE DONE BY AN AUTHORISED COMPETANT PERSON.

3.4 CHLORINATOR

Should the disinfection not operate satisfactorily, check the following:

a) Check if disinfectant is available (Gas or Liquid Types)

b) Check if water supply is available (Gas or Liquid Types)
c) Check if water filter is clogged (Gas units only)
d) Check if chlorinator venturi is clogged, by unscrewing chlorine supply pipe and feeling for suction on the delivery line at this point (Gas Type only)

3.5. BIO-FILTER PLANT

An excess amount of black floating sludge in the Bio-Filter tanks, may be an indication that the sludge level in the septic tank is high, and this should be checked, and if necessary remedied, by desludging the septic tank. Overloaded Bio-Filter plants can be upgraded if required (Contact Becon Watertech (Pty) Ltd)

3.6. OVERFLOWS

Should the Bio-Filter basins overflow, it can be assumed that interconnecting pipe-work is blocked and should be cleared.

Excessive inflow to plant can also cause overflows and should, where possible, be regulated to match the plant flow design.

4. BIO-FILTER OPERATING PROCEDURES

4.1. DAILY

a) Rake bar screens (if installed)
b) Inspect the primary (inlet) sides of the septic tanks and remove any large foreign material (plastic bags etc.)
c) Check that Bio-filter rotors are rotating
d) Check re-circulation pump (Humus pump) is operating and draws down sump

e) Open sludge valves at humus tank for 3 minutes, close valve and draw down sump.
(Always monitor the de-sludge process to ensure the dark coloured sludge is being removed. Do not de-sludge excessively)
f) Spray top and walls of humus tank and stilling chamber with hose to disperse floating matter if required
g) Check chlorine / disinfectant supply

4.2. WEEKLY

a) Check chlorinator / disinfection system operation and test for residual chlorine level of 0,4 – 0,5 mg/l at the outflow
b) Clean sides of humus tank cone with brush
c) Clean sides of chlorine tank with brush

4.3. MONTHLY

a) Lubricate Bio-Filter bearings with lithium grease (replace bearings when faulty)
b) Check oil level in gearboxes and top up if necessary.
c) Clean and treat all exposed metals with epoxy tar paint.
d) Check sludge level in septic tank.
(Use measuring tool to check. Sludge level should not exceed 40%)
e) Lubricate drive chains (chain drive models only)

4.4. ANNUAL SHUTDOWN

a) De-sludge septic tank (if necessary)
b) Withdraw humus pump(s) for cleaning and checking
c) Replace oil in gearboxes
d) Clean and lubricate rotor bearings with grease

e) Clean and repaint steel items in need of painting with epoxy tar paint
f) Remove geared motor drives, clean and re-lubricate rotor drive shaft with factory recommended grease for the geared drive.

4.5. SEPTIC TANK DE-SLUDGING PROCEDURE

De-sludge septic tank at least once every 12 - 18 months, using the following procedure:

a) Stop rotor plant
b) Open manhole covers of septic tank and stir contents well
c) Draw off sludge from septic tank by pumping out into tanker truck or to sludge ponds
d) Let septic tank fill up again by using full plant inflow
e) Alternatively, have the tanker suck off the sludge from the septic tank bottom (without stirring the septic tank) This process should always be supervised to ensure the sludge is effectively removed. Always retain approx. 5 % of the sludge to aid with the ongoing process.

NOTE: DO NOT STIR SEPTIC TANK UNLESS DESLUDGING IS UNDERTAKEN

5. THE BIO-FILTER RBC DETAILED OPERATING DESCRIPTION

5.1. INTRODUCTION

The sewage treatment plant has been designed to cater for the loading arising from domestic sewage flow from the project.

5.2. GENERAL PRINCIPLES OF SEWAGE TREATMENT

Sewage purifies naturally in watercourses, rivers and lakes. Organisms present in the water and sewage develop spontaneously and feed on the constituents. The population of the organisms grows to match the amount of food (sewage) available.

Certain types of organisms carry out this process in the absence of oxygen in which case they are designated as anaerobic organisms. However, a large variety of organisms require oxygen to carry out their purification reactions. These are termed aerobic organisms. Aerobic purification is necessary when high quality effluent is required since aerobic organisms oxidize and breakdown the complex organic molecules almost completely to their basic constituents of carbon dioxide and water.

Pollution of lakes or rivers occurs when the amount of oxygen demanded by the purification process exceeds the natural supply of the system. Dissolved oxygen normally present in water is then used up and disappears from the river as a result of excessive sewage entering the stream. The natural life that occurs in the river then dies off. Increasing the oxygen level in the water can prevent pollution.

Sewage purification plants are necessary to ensure that purification is carried out prior to the discharge of effluents and the pollution of rivers and streams is prevented. Pollution also prevents the destruction of most of the naturally occurring aquatic life. The water would then remain safe of humus recreation purposes or potable use.

5.3. DESCRIPTION OF PURIFICATION PLANT

The Bio-Filter plant comprises of a combined anaerobic/aerobic system. Raw sewage passing through the sewer system enters the septic tank usually by either gravity flow or pumped flow.

In the septic tank, which has two compartments, solid material present in the sewage is settled out. This takes place mostly in the first compartment but also to a certain extent in the second compartment. The solids settle at the bottom of the tank, then decompose anaerobically which reduces their mass, volume and strength (oxygen demand).

A reduction of approximately 40% of the raw sewage organic strength, typically measured as Chemical Oxygen Demand (COD) is expected across the septic tank.

The settled effluent then flows by displacement and gravity to a rotating discs unit (Becon Bio-Filter) where it is purified aerobically.

One or more banks of rotating discs are provided for aerobic purification. The Bio-Filter RBC rotor units each consist of polyurethane discs mounted on a horizontal shaft. The discs filters rotate slowly and continuously causing part of the discs to be alternatively immersed and lifted out of a trough through which the settled sewage is flowing.

Aerobic organisms develop on the rotating discs surface in the form of a biological slime. These organisms feed on the sewage as it passes down the channels. Successive discs then remove more and more of the material in the sewage, which requires purification. If an adequate number of discs are provided, the sewage is purified to an acceptable standard for discharge.

Purification, as mentioned previously, takes place by the continuous development of biological slime growths on the surfaces of the discs. These increase in size and thickness to a stage where they become too thick to adhere to the discs and slough or fall off into the liquid. The effluent from the rotating biological contactors therefore contains a significant proportion of settle-able material, which consists of waste purifying organisms. The latter must be removed before the effluent can be discharged. A settling tank or humus is provided for this purpose.

Additional COD is oxidised across the Bio-Filter process while ammonia nitrification (the conversion of ammonia to nitrates in the presence of readily available oxygen) occurs and is achieved through the action of specific nitrifying bacteria, mostly *nitrobacter* and *nitrosomonas.* Nitrification is not available across any other stage in the Bio-Filter process; hence continual rotation of the rotor unit is vital during normal operating conditions.

The humus tank is a circular tank with a conical bottom of 60º slopes. Effluent from the biological contactors enters at the centre of the tank and flows from a stilling chamber upwards to the discharge pipes. The settleable material or humus sludge passes downwards and rolls to the bottom of the cone where it is automatically removed by hydraulic displacement through a de-sludge valve, and flows to the adjacent pump sump.

The humus sludge removed in this way is automatically pumped into the septic tank where it is broken down anaerobically in similar fashion to the raw sludge sewage solids.

Dedicated recycling of nitrate enriched wastewater will encourage denitrification across the primary phase separation stage, effectively reducing the nitrate concentration in the final effluent that is discharged.

The overflow from the humus tank passes to the chlorine contact tank where any remaining pathogenic (disease causing) organisms are killed off by the action of chlorine. The effectiveness of the disinfection process can be determined by measuring whether any residual chlorine remains at the point of discharge from the chlorine contact tank. The effluent, at this stage should be of good quality and comply with the General Limit standard set by the Department of Water & Sanitation in the General Authorisation legislation, for discharge to a water- course.

Where specific phosphorus removal is stipulated in water licence conditions, chemical dosing is implemented to meet the relevant specified phosphorus standard.

The Bio-Filter plant has been designed for minimal operating attention. All that is normally necessary to obtain satisfactory operation of this type of plant is to ensure that all mechanical equipment operates continuously. The rotating biological contactors should operate at all times, and the re-circulation pump operates intermittently on float control. The chlorinator should operate at all times and to ensure that this occurs, it is necessary to have adequate water pressure at the ejector and sufficient chlorine in the gas bottle. Should the float tube read zero, both the pressure of the water to the ejector and the quantity of chlorine in the cylinder should be checked (gas units).

In the longer term, it will also be necessary to remove accumulated sludge or solids from the septic tank. It is difficult to predict the frequency required for this operation as it depends largely on the nature of the sewage, the number of contributors and the effectiveness of the anaerobic reactions taking place in the units. Generally, sludge removal may be required between every eight months to once a year. Sludge level should be checked periodically by lifting the manhole cover over the first compartment in the septic tank and testing the depth of the sludge by means of a dipstick. When the depth of sludge is

approximately half of the total depth of the tank to top water level, the tank will need to be desludged and arrangements should be made for this to be undertaken. Sludge removed from the septic tank, should be taken to a suitable site for disposal or buried. Alternatively, arrangements can be made with desludging contractors.

5.4. DETAILED DESCRIPTION OF UNITS AND PLANT LAY-OUT

From the enclosed flow sheet, it will be seen that the plant operates as follows:

5.4.1. Septic tank

Raw sewage is deposited in the septic tank. The tank is provided with two compartments, the first compartment being two thirds of the volume and the second, one third the total volume of the plant. The bulk of settle-able material will therefore collect in the first compartment where the anaerobic digestion process will take place. Effluent from a septic tank which is performing well should contain little suspended matter and although somewhat hazy should fairly clear in appearance. It should also not smell of raw sewage. It is possible in the operation of septic tanks for the process to be upset by intermittent deliberate or accidental discharge of substances, which are harmful to the anaerobic process, which takes place in a septic tank.

Strong disinfectants, solvents, paint, oil, fats and various other petrochemical or organic compounds may upset the process.

Should it be noted that the plant appears to perform satisfactorily for a number of days or weeks, followed by a sudden deterioration, and should this cycle occur fairly frequently, an investigation should be carried out in order to determine whether foreign substances have been dumped into the sewers or whether the ablution blocks are being periodically cleaned with strong disinfectants. Disinfectants are available which do not cause damage to the septic tank process.

Apart from periodic removal of sludge, the septic tank should require little attention.

However, should the quality of the final effluent from the plant deteriorate, a sample should be taken of the septic tank effluent.

- If this effluent is fairly clear, and not offensive, the problem will lie with the operation of the rotating biological contactors.
- If however, the effluent from the septic tank contains relatively large amounts of solids and / or is darkly coloured and smells offensive, then it can be concluded that the septic tank is not performing satisfactorily. This may be due to the compartments having been filled completely with sludge or to discharges of substances that are harmful to the process. Excessive volumes of sludge reduce the volume of tank available for settlement and self-flocculation of solids in the liquid.

5.4.2. Rotating Biological Contactors

The rotating biological contactors usually comprise of one or more sets of rotor banks each with discs mounted on a common shaft driven by a motor and gearbox, at a speed of between 3 and 5 rpm.

Effluent from the septic tank enters a channel through which the discs of the first bank are rotated. This will pass along the channel where the sewage makes contact with the surfaces of each disc in turn.

Organisms developing on the discs feed on material present in the effluent and purify it aerobically. The organisms on each disc obtain oxygen from the air during the period between immersions when they are exposed to the atmosphere through the rotating action of the discs.

Purification taking place in the early stages of the process consists largely of reduction in oxygen demand. The organisms present feed upon the carbonaceous material converting it to end products of carbon dioxide and water. In successive stages towards the end of the treatment sequence, organisms that oxidize ammonia to nitrates are present. In monitoring and assessing the performance of such a process, the presence of nitrates is therefore always an indication that purification has gone to virtual completion. Should no nitrates be present and more than 10mg/l ammonia be detected, it would indicate that the process is being overloaded or the purification is being impaired by the presence of toxic substances. This may occur even though carbonaceous purification as measured by chemical oxygen demand is essentially complete. As mentioned previously, the overall loading on the plant should always be considered when assessing the performance.

No attention is required to this stage of the process apart from ensuring that all banks of discs rotate continuously. However, the purification performance should be monitored on a routine monthly basis by taking a sample either of the effluent from the discs, or the effluent overflowing the humus tank, for inspection.

If the effluent from the humus tank is not clear with low colour, and if this effluent displays an odour, it indicates deterioration in the purification process. In such a case, a sample of effluent from the rotating biological contactors themselves, should be taken and allowed to settle for about an hour. If this effluent is clear and does not display any odour, then the problem lies in the humus tank.

If however, this effluent is also coloured and displays an unpleasant odour, then the problem lies with the discs themselves. One or more banks may not be rotating or other mechanical problems may have occurred. Alternatively, the problem could arise from deterioration in performance of the septic tank, due to excessive sludge build-up.

5.4.3. Humus tank

The sedimentation, settling or humus tank is provided to settle out solids, which are discharged from the discs of the rotating biological contacting units.

The solids present in the effluent from the biological contactors consist of purifying organisms that have been sloughed off the discs after a continuous process of build-up of film to excessive thickness, with resultant separation from the disc surface, and discharge.

If allowed to remain in the effluent, these solids would contaminate it and lead to non-compliance with quality standards set out by the Department of Environmental Affairs. They would also lead to secondary pollution as the settled material will purify and decompose causing nuisance and odour. Removal of solids by sedimentation is therefore essential.

The humus tank consists of a settlement tank with a conical bottom. Effluent from the biological contactors enters the tank at the centre inside a stilling chamber. It is discharged from under the stilling chamber into the centre of the tank and then flows upwards to the off take tubes. Settle-able solids entering the tank move downwards and settle on the cone from where they roll to the bottom of the cone and are removed by hydraulic displacement.

The effluent from a humus tank should be clear and free from solids at all times. If solids are present, this may be due to either (or both) of two causes.

- If the solids are in finely divided form and are carrying over sporadically, it tends to indicate that the tank is hydraulically overloaded. This means that the flow of the water or effluent passing through the tank considerably exceeds the design rate and therefore the upward flow rate in the tank is greater than the downward settlement rate of the particles concerned.
- A second reason for carry-over of sludge solids (and in our experience more likely) is blockage of the underflow system. Should the sludge removal pipe block solids, they will accumulate in the tank until: either they have filled the cone and built up to near the off-take level and/or will remain long enough in the tank to reach a stage where they begin to ferment and decompose. In such a situation, the solids tend to rise due to the presence of gas bubbles, which are produced in the decomposition process. The gas bubbles then lift the sludge to the surface where the solids pass through the draw-off tubes and into the effluent.

In order to ensure satisfactory operation of the settlement tank, it is necessary to check that the sludge removal system operates continuously.

The sand pipe in the sump adjacent to the tank should therefore be checked at least twice a day to see that effluent containing the solid particles is flowing on a continuous basis. Also twice a day, the scour valve should be opened and the underflow stream allowed to flow strongly for approximately 3 minutes.

The high flow will assist on dislodging particles which have become attached to the walls of the cone and which are not settling to the bottom and being removed through the continuous under-flow system.

It is also our experience that compaction and build-up on the walls and cone occur in the long term in tanks that are not mechanically desludged. We therefore recommend that a small scraper, brush or squeegee device with a long handle be provided so that the sides of the cone and the walls of the tank can be manually cleared on a weekly basis.

The waste from the humus tank is automatically pumped back to the septic tank by means of the humus return pump situated in the pump sump adjacent to the humus tank.

Apart from this, the only attention required at the humus tank, is to ensure that the surface of the tank and stilling chamber be kept clean by hosing down on a daily basis. The walls of the tank should also be hosed and brushed down periodically to prevent slime growths from accumulating.

5.4.4. Disinfection

The disinfection installation may consist of a Gas Type, Liquid Type or a Pill Type chlorinator system, or an Ozone disinfection system.

a) The gas chlorinator unit consists of a bottle mounted vacuum regulator with a float tube and an ejector assembly mounted on a water supply.

Fresh water passes through the ejector and into the chlorine contact tank. In passing through the ejector, it creates a vacuum in the throat of the ejector that sucks chlorine from the cylinder into the stream where it goes into solution. The vacuum regulator and float tube with needle valve on the cylinder regulates the amount of chlorine gas, which is allowed to pass under vacuum from the bottle into the liquid stream.

The solution of chlorine in water is added to the effluent from the humus tank at the entrance point to the chlorine contact tank. The purpose of the contact tank is to provide sufficient time for disinfection to take place and go to completion (a 15 minute contact time is required).

The purpose of chlorine addition to treated sewage effluent is to kill off any pathogenic (disease causing) organisms. The efficiency of this process can be guaranteed under normal circumstances if an adequate residual concentration of chlorine is measurable at the discharge of the contact tank. It is recommended that a chlorine residual concentration of approximately 0, 4 – 0, 5 mg/l be aimed at.

CAUTION!

Chlorine is a dangerous and poisonous gas. Care should be taken when changing cylinders. Always ensure that the valve on the chlorine cylinder is properly closed. A key is normally provided for this purpose.

If this has been lost, the valve can be closed using a shifting or set spanner. However, care is required in this case as damage to the cylinders may lead to an excess charge being levied by the suppliers.

Chlorine is an extremely strong oxidizing agent and reacts vigorously and even explosively with any organic substances. Normal gasket compound such as rubber and cork cannot be used, and normal lubricants and greases will ignite spontaneously in chlorine atmosphere.

Only special sealing washers and gaskets provided by the suppliers should be used, and the agents of the equipment, manufacturers or the suppliers of the chlorine should normally carry out lubrication using special lubricants.

b) Where liquid chlorine is use, the dosing tank should be replenished on a daily basis. Use two cups of HTH on 100 litres of water in the tank. Dosing pump rate can be adjusted to suit flow conditions.

c) Where a pill chlorinator is used, one swimming pool pill is deposited into the pill holder every second day, or as required.

d) Where Ozone systems are used, all functional parts should be checked on a daily basis and or in conjunction with the manufacturer specifications.

6. ROUTINE EFFLUENT TESTS

In accordance with the recommendations of the Department of Water & Sanitation, monthly tests of plant-effluent is usually required and should therefore be undertaken, and the test results be available for inspection. Becon Watertech can include such routines as part of a post commissioning service.

7. SEWAGE INFLOW QUALITY

It is to be noted that your Becon Bio-Filter plant has been designed and rated to handle domestic sewage only. The operation of the plant could be seriously impaired should this plant receive foreign matter in the form of industrial waste including oils, paints or strong disinfectants.

It is therefore extremely important to ensure that foreign matters not enter the sewage system.

All kitchens should be fitted with screens and grease traps at the outlet sewers from these kitchens where oils, fats and food residues are intercepted and not be allowed to enter the sewer systems.

Under no circumstances must any motorcar oils or large volumes of cooking oils be decanted into the system.

For cleaning purposes, we recommend only using biodegradable soaps and cleaning agents. Use only environmental friendly disinfectants.

Pricing:

Silver Maintenance Agreement Per Month	De -Sludg yearly
R 16 124.31	R6200.00

A. Please note an annual increase will apply based on the current inflation rat, On the annivisary of the maintenance agreement

B. Should you by any change cancel the maintenance agreement one month notice must be given.

OPERATING INSTRUCTIONS

DAILY

1. RAKE THE BAR SCREEN AT INLET WORKS (IF INSTALLED)
2. CHECK THAT ALL ROTORS ARE OPERATING
3. SPRAY TOP OF HUMUS TANK WITH WATERHOSE TO BREAK UP FLOATINGHUMUS
4. DESLUDGE HUMUS TANK BY OPENING SLUDGE VALVE AT PUMP SUMP
5. CHECK THAT RE-CIRCULATION PUMP AT HUMUS TANK IS OPERATING CORRECTLY
6. CHECK THAT CHLORINATION SYSTEM IS OPERATING AND CHLORINE IS AVAILABLE

MONTHLY

1. CHECK DRIVE UNITS (REPLACE OIL EVERY 12 MONTHS)
2. GREASE ROTOR BEARINGS (REPLACE BEARINGS WHEN REQUIRED)
3. CHECK SEPTIC TANK SLUDGE LEVEL AND DESLUDGE IF REQUIRED
4. GREASE CHAINS (CHAIN DRIVE MODELS ONLY)

ANNUALLY

1. DESLUDGE SEPTIC TANK
2. OPEN MANHOLE COVERS OF SEPTIC TANK AND STIR CONTENTS WELL
3. DRAW SLUDGE FROM SEPTIC TANK BY PUMPING OUT ON TO SLUDGE BEDS OR REMOVE BY TANKER OR OTHERWISE
4. CLEAN PLANT & REPAINT ALL EXPOSED STEELWORK
5. SERVICE PUMP

We trust the above meets your approval and look forward to your instruction in this regard.

Yours sincerely,

Geraldine Esterhuizen

For: Becon Watertech