A.L. ABBOTT AND ASSOCIATES (PTY) LTD
(Reg. No. 1982/004379/07) Established 1964

Process & Chemical Consultants Specialists in Water & Waste Water Treatment

No. 1. Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK. CAPE
7915
SOUTH AFRICA
Telephone (021)448 6340/1
After Hours (021)712 0940
Telefax (021)448 6342
e-Mail Address :
alabbott@iafrica.com

EXECUTIVE SUMMARY

OVERSTRAND MUNICIPALITY

BUFFELSRIVIER WATER TREATMENT PLANT

Date of Sampling: 8 December 2016

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1. The treated water was of excellent quality and complied with all the Blue Drop and SANS 241-1:2015 chemical limits.

2. The raw water turbidity decreased slightly from 1.8 to 1.2 NTU, but the colour increased from 146 to 152 mg/l as Pt.

3. Jar tests indicated that the alum dosing rate could be decreased slightly to 75.0 mg/l.

4. Both filters are in operation.

5. Disinfection was excellent at satisfactory residual chlorines.

N. VAN BINSBERGEN Pr.Sci.Nat.
DIRECTOR

TO: OVERSTRAND MUN.
Private Bag X3
KLEINMOND
7195

031/1/2/5684
15 December 2016

Att. : D. VAN RHODIE

A.L. ABBOTT AND ASSOCIATES (PTY) LTD
(Reg. No. 1982/004379/07) Established 1964

Consulting Chemists & Chemical Engineers Specialists in Water & Waste Water Treatment

No. 1. Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK. CAPE
7915
SOUTH AFRICA
Telephone (021)448340/1
After Hours (021)712 0940
Telefax (021)448 6342
e-Mail Address :
info@alabbott.co.za

TYPE OF PLANT : WATER TREATMENT

TREATMENT PROCESS : FLOCCULATION. SETTLING & FILTRATION

DATE OF SAMPLING : 8 December 2016

A. MANAGEMENT DATA

1.	PLANT NAME :	BUFFELSRIVIER
2.	LOCATION :	OVERSTRAND
3.	CO-ORDINATES :	S34°19.96' / E18°50.26'
3.	TEL. NO. :	082 786 2188
4.	NAME OF SUPERINTENDENT :	-
5	NAME OF SENIOR OFFICIAL INTERVIEWED :	E. AUGUST
6.	REGION :	WESTERN CAPE

B. PLANT CAPACITY

1.	Rated Capacity of Plant	m^3/d	5 500	l/sec	63.7
2.	Present Flow through Plant	m^3/d	2751	l/sec	55.4
3.	Operating Rate	h/month	414	m^3/h	199

C. RAW WATER

1.	Origin of Raw Water	Borehole		River	
		Dam	+	Lake	
2.	Water Supply to Plant	Elec. Pump		Diesel Pump	
		Hand Pump		Gravity	+
3.	FLOW MEASUREMENT :	V-Notch	+	Flume	
		Doppler		Orifice Plate	
4.	Type of Flow Meter :	Manual	+	Electronic	
5.	Flow Chart Present	Yes	+	No	

Continued/....

C. RAW WATER (continued)					
6.	INTEGRATED FLOWS :	Yes	+	No	
	Totalizer Reading on 1st of Month :	01-November	2448416	01-December	2530938
	Daily Flow (m^3/d)	Average	2751	l/sec	55.4
	Totalizer Reading Last 24 Hours :	07-December	2549999	08-December	2553131
	Daily Flow	m^3/d	3132	l/sec	55.4
7.	RAW WATER CHARACTER :	Clear/White		Clear/Colour	+
		Turbid		Muddy	
	Turbidity	NTU	1.2		
	Colour	mg/l as Pt	152		
	pH	6.10			
8.	Odour Noticeable :	None	+	Slight	
		Severe			
9.	**COMMENTS :**				
	The plant was operating at 55.4 l/sec during sampling.				
	The raw water turbidity was little changed at 1.2 NTU, but the colour increased slightly from 146				
	to 152 mg/l as Pt.				

D. FLOCCULATING CHEMICALS							
1.	**Type of Chemical** (SG Alum 1.287; SG Soda Ash 1.104)	**Al_2O_3**		**Alum**		**Soda Ash SG = 1.140**	
		m/m	**m/v**	**m/m**	**m/v**		
2.	Solution Strength (%)	7.4	9.5	46.3	59.5	%	12.3
3.	Dose Rate : (ml/min)	440		440		-	880
	(mg/l)	12.6		78.8		pH adjust	32.6
4.	Last Recommended (mg/l)	12.7		79.3		pH adjust	48.0
5.	Flocculating pH	Recomm.		6.00		Measured Site	5.87
6.	Flocculating pH	5.98					
	Turbidity (NTU)	1.2					
	Colour (as Pt)	6					
	Aluminium (µg/l as Al)	87					
	Iron (µg/l as Fe)	<24					

continued/....

D. FLOCCULATING CHEMICALS (continued)				
7.	**NEW RECOMMENDATIONS**			
		as Al_2O_3	**as Alum**	**Soda-Ash**
	Dose Rate : (mg/l)	12.0	75.0	280
	(ml/min)	419	419	6638
8.	**COMMENTS :**			
	The mixing race pH was slightly low. Metal precipitation was nevertheless adequate.			
	Jar tests indicated that the alum dosing rate could be decreased slightly to 75.0 mg/l.			
	Control the mixing race pH at 6.00 at all times.			

E. SETTLING TANKS					
1.	Type of Tanks	Horizontal Flow	+	Radial Flow	
2.	Number of Tanks	Provided	4	In Use	4
3.	Dimensions of Each Tank	Length (m)	22 x 2 18 x 2	Width (m)	5 x 2 6 x 2
		Radius (m)	-	Surface Area (sq.m)	110 x 2 108 x 2
4.	Total Surface Area (m^2)	436			
5.	Upflow Velocity (m^2)	At Design Flow	-	At Present Flow	0.46
		Max. Recomm.	1.0	Adequate	Yes
6.	Turbidity of Settled Water	NTU	0.91		
7.	Colour of Settled Water	mg/l as Pt	5		
8.	pH	5.73			
9.	Desludge Frequency	Days	Once	Adequacy	-
10.	**COMMENTS :**				
	Settling tanks desludging daily. Very little carry-over occurred and adequate colour removal was				
	achieved. (Turbidity 0.91 NTU ; Colour 5 mg Pt/l ; pH 5.73)				

F. FILTERS					
1.	Type of Filters	Slow		Rapid Gravity	+
		Pressure			
2.	Media	Sand	+	Multi-Media	
3.	Number of Filters	Provided	2	In Use	2

continued/....

F. FILTERS (continued)					
4.	Dimensions of Each tank	Length (m)	5.5	Width (m)	5.5
		Radius (m)		Surface Area (sq.m)	30.3
5.	Total Surface Area (sq.m)	60.6			
6.	Surface Loading Rate (cub.m/sq.m/h)	At Design flow	2.2	At Present	3.3
		Max. Recomm.	5	Adequate	Yes
7.	**COMMENTS :**				
	Filtration was effective.				
	(Turbidity 0.86 NTU ; Colour <4 mg Pt/l ; pH 6.04)				

G. STABILIZATION					
1.	Stabilization Chemical	Soda Ash	+	Lime	
		Caustic Soda		None	
2.	Dosing Equipment	Dry Feeder		Solution	+
		g/min		ml/min	-
3.	Applied Dose	Solution SG	1.142		
		Solution %	12.3		
		g/min		ml/min	280
		mg/l		mg/l	10.4
4.	Required Dose : Soda Ash	mg/l (add.)	-	mg/l (total)	10.4
		ml/min (add)	-	ml/min (total)	280
5.	Treated Water pH	Measured	7.17	Required	-
6.	Langelier Saturation Index	Measured	-	CCPP	-
7.	Colour	mg/l as Pt	4		
8.	Turbidity	NTU	0.30		
9.	**COMMENTS :**				
	Additional alkalinity testing is required to determine the stabilization of this water.				

continued/....

H. DISINFECTION					
1.	Method of Disinfection	Hypo-chlorite		Gas	+
		HTH		Other	
2.	DOSE :				
	Hypochlorite	ml/min		mg/l	
	Gas	g/h	320	mg/l	1.6
	HTH Granules	kg/d		Solution	
3.	Residual Chlorine (mg/l)	Free	0.78	Total	0.79
4.	Required Chlorine (mg/l)	Free	0.40	Total	0.60
5.	Dose Required	mg/l	1.6	g/h	320
6.	Bacteriological (organisms per 100 ml)	Coliforms	<1	E.coli	<1
7.	Total Plate Count	org. per ml	4		
8.	Chlorine Odours	Yes		No	+
9.	Leaks Apparent	Yes		No	+
10.	Aspirator Available	Yes	+	No	
11.	**COMMENTS :**				
	Chlorine residuals were satisfactory.				
	Disinfection was virtually complete.				

I. GENERAL					
1.	Is the plant run well?	Plant	Yes	Surrounds	Yes
2.	Do the Operators know their duties?	Operators	Yes	Labourers	Yes
3.	Are records adequate?	Information	Yes	Complete-ness	Yes
4.	At what frequencies are the following measured?	Coliforms	Weekly	E.coli	Weekly
		Chemical Doses	Hourly	Flows	Daily
		pH	Hourly	Turbidity	Daily
		Chlorine Dose	Hourly	Residuals	Hourly
5.	Are Chemical Stores -	Weather-proof	Yes	Clean and Tidy	Yes
6.	Laboratory : Proper Calibration	Instruments	Yes	Solutions	Yes
7.	Are Works Manned?	Night	Standby	Weekend	Yes

continued/....

I. GENERAL (continued)	
8.	**COMMENTS :**
	The treated water complied with all the Blue drop and SANS 241 -1:2015 chemical limits.

J. RECOMMENDATIONS	
1.	Maintain the flocculating pH between 6.0-6.2.
2.	Jar tests indicated that the alum dosing rate could be decreased slightly to 75.0 mg/l.
3.	Maintain present chlorine dosing rate.

N. VAN BINSBERGEN Pr.Sci.Nat.
DIRECTOR

SAMPLER : M. VAN RHYN

031/1/2/5684
15 December 2016
cc/NvB/lc

TO: OVERSTRAND MUNICIPALITY
Private Bag X3
KLEINMOND
7195

Att. : D. VAN RHODIE

BUFFELSRIVER WATER TREATMENT PLANT

APPENDIX 2

TEST NO.	1	2	3	4	5	6
Alum (mg/l)	70.0	75.0	79.0	85.0	90.0	95.0
Aluminium (µg/l as Al)	<100	<100	<100	<100	<100	<100
Flocculation	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
pH Established	6.00	6.00	6.00	6.00	6.00	6.00
Soda Ash (mg/l)	253	280	301	320	345	364
Order of Flocculation	6	5	4	3	2	1
Colour after Filtration (mg/l as Pt)	8	4	4	5	7	7

RECOMMENDED TREATMENT	
Treatment Rate :	55.4 l/sec
Alum :	75.0 mg/l (414 ml/min)
Flocculating pH :	6.00

.....

N. VAN BINSBERGEN Pr.Sci.Nat.
DIRECTOR

031/1/2/5684
15 December 2016

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e-Mail Address :
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T0276

No. 1. Vine Park
Vine Road
7925
P.O. Box 483
WOODSTOCK. CAPE
7915
SOUTH AFRICA

Certificate of Analysis

OVERSTRAND MUNICIPALITY : SC 1466/2014

Buffelsrivier Water Treatment Plant

Date Sampled 08 December 2016 **Report no.: 5684**

SAMPLE	Raw Water	Settled Water	Filtered Water	Treated Water	Mixing Race				Blue Drop	SANS 241-1:2015
pH (at 25 °C)	5.77	5.73	6.04	7.17	5.98	-	-	-	≥5 - ≤9.7	≥5 - ≤9.7 Operational
pH (at 25 °C) Field	6.10	5.99	6.25	7.90	5.87	-	-	-	≥5 - ≤9.7	≥5 - ≤9.7 Operational
Conductivity (mS/m) (at 25 °C)	13.5	-	-	26.5	-	-	-	-	≤170	≤170 Aesthetic
Turbidity (NTU)	1.2	0.91	0.86	0.30	1.2	-	-	-	≤1.0 Opt.	≤5 Ast ≤1 Operational
Colour (mg/l as Pt)	152	5	<4	4	6	-	-	-	≤15	≤15 Aesthetic
Total Alkalinity (mg/l as CaCO3)	-	-	-	-	-	-	-	-	N/A	N/A
Total Hardness (mg/l as CaCO3)	-	-	-	14.9	-	-	-	-	N/A	N/A
Calcium Hardness (mg/l as CaCO3)	-	-	-	5.5	-	-	-	-	N/A	N/A
Calcium (mg/l as Ca)	-	-	-	2.2	-	-	-	-	N/A	N/A
Magnesium Hardness (mg/l as CaCO3)	-	-	-	9.4	-	-	-	-	N/A	N/A
Magnesium (mg/l as Mg)	-	-	-	2.3	-	-	-	-	N/A	N/A
Sodium (mg/l as Na)	-	-	-	-	-	-	-	-	≤200	≤200 Aesthetic
Potassium (mg/l as K)	-	-	-	-	-	-	-	-	N/A	N/A

Report no 5684

SAMPLE	Raw Water	Settled Water	Filtered Water	Treated Water	Mixing Race				Blue Drop	SANS 241-1:2015
Chloride (mg/l as Cl)	-	-	-	-	-	-	-	-	≤300	≤300 Aesthetic
Fluoride (mg/l as F)	-	-	-	-	-	-	-	-	≤1.5	≤1.5 Chronic Health
Sulphate (mg/l as SO4)	-	-	-	-	-	-	-	-	≤250	≤250 Ast -≤500 Ac H-1
Total Dissolved Solids (mg/l)	-	-	-	-	-	-	-	-	≤1200	≤1200 Aesthetic
Iron (µg/l as Fe)	336	-	-	<24	<24	-	-	-	≤300	≤300 Ast -≤2000 Chr H
Aluminium (µg/l as Al)	347	-	-	80	87	-	-	-	≤300	≤300 Operational
Free Chlorine (mg/l)	-	-	-	0.78	-	-	-	-	≤5.0	≤3 Chronic Health
E.coli (count per 100 ml)	-	-	-	<1	-	-	-	-	<1	Not Det. Acute Health-1
Total Coliform Bacteria (count per 100 ml)	-	-	-	<1	-	-	-	-	≤10	≤10 Operational
Heterotrophic Plate Count (count per ml)	-	-	-	4	-	-	-	-	N/A	≤1000 Operational

Not Det.= Not Detected

N.VAN BINSBERGEN (Pr.Sci.Nat.)
DIRECTOR

Sampler : M.Van Rhyn

APPENDIX 1 : SPECIFIC METHODS USED FOR THE ANALYSES OF PARAMETERS INDICATED IN THIS REPORT

ALA Method No.	Parameter	Method	Limit of Detection
45	Acidity (mg/l)	STD Method 2310 B (1992)	-
94	Alkalinity (mg/l as $CaCO_3$) *	Discrete Analyzer using the Gallery	11
N/A	Algae Identification and Count (per ml)	*(Outsourced)*	-
92	Aluminium (µg/l as Al) *	Based on SANS 11885:2008 (ICP)	12
3	Ammonia (mg/l as N) *	STD Method 4500-NH_3:C (1992)	0.15
95	Ammonia (mg/l as N) *	Discrete Analyzer using the Gallery	0.10
92	Antimony (µg/l as Sb) *	Based on SANS 11885:2008 (ICP)	10
92	Arsenic (µg/l as As) *	Based on SANS 11885:2008 (ICP)	3
92	Barium (µg/l) *	Based on SANS 11885:2008 (ICP)	1
92	Beryllium µg/l as Be) *	Based on SANS 11885:2008 (ICP)	1
Calc	Bicarbonate (mg/l)	Calculation	-
N/A	Biochemical Oxygen Demand (mg/l O_2)	*(Outsourced)*	-
47	Boron (mg/l as B)	Discrete Analyzer using the Gallery	0.10
N/A	Bromine (mg/l as Br)	*(Outsourced)*	1.0
N/A	Bromide (mg/l as Br-)	*(Outsourced)*	-
92	Cadmium (µg/l as Cd) *	Based on SANS 11885:2008 (ICP)	1
92	Calcium (mg/l as Ca) *	Based on SANS 11885:2008 (ICP)	0.32
Calc	Calcium Carbonate Precipitation Potential	Calculation	0.01
Calc	Calcium Hardness	Calculation	-
2	Chemical Oxygen Demand (mg/l) *	**SANS 6048**	8
25	Chloride (mg/l as Cl) *	**SABS 202**	1.0
96	Chloride (mg/l as Cl) *	Discrete Analyzer using the Gallery	1.0
69	Chlorine Demand (mg/l)	STD Method 2350 B (1992)	-
N/A	Chlorophyll-a (µg/l)	*(Outsourced)*	-
N/A	Clostridium Perfringens (cfu/100 ml)	*(Outsourced)*	-
92	Cobalt (µg/l as Co) *	Based on SANS 11885:2008 (ICP)	14
N/A	Colony Count (cfu/ml)	*(Outsourced)*	-
97	Colour (mg/l as Pt) *	Discrete Analyzer using the Gallery	4
Calc.	Combined Nitrate & Nitrate (mg/l as N)	Calculation	-
Calc.	Combined Trihalomethanes	Calculation	-
9	Electrical Conductivity (mS/m) (at 25 °C) *	STD Method 2501 A (1992)	0.30
92	Copper (µg/l as Cu) *	Based on SANS 11885:2008 (ICP)	6
N/A	Cryptosporidium (per 10 litres)	*(Outsourced)*	-
5	Cyanide (µg/l as CN^-)	Discrete Analyzer using the Gallery	20
N/A	Cytopathic Viruses (count per 10 litres)	Membrane / Culture	-
105	Dissolved Organic Carbon (mg/l as C)	Hach 10128	1.0
68	Dissolved Oxygen (mg/l)	STD Method 4500 O-G	1
78	Dissolved Solids (mg/l)	STD Method 2501 A (1992)	-
84	E.coli (count per 100 ml) *	**Colilert - 18 / Quanti-Tray Method**	1
87	Enterococci (count per 100 ml) *	Enterolert-24 / Quanti-Tray **Method**	1
86	Faecal Coliforms (count per 100 ml) *	**Colilert - 18 / Quanti-Tray Method**	1
87	Faecal Streptococcus (count per 100 ml) *	*(Outsourced)*	-
N/A	Formaldehyde	*(Outsourced)*	-
29	Fluoride (mg/l as F) *	Hach 8029	0.10
98	Fluoride (mg/l as F) *	Discrete Analyzer using the Gallery	0.10
66	Free Chlorine (mg/l)	Lovibond Method 3	0.05
N/A	Giardia (per 10 litres)	*(Outsourced)*	-
N/A	Helminth Ova (Total & Viable) (per 4 g dry weight)	*(Outsourced)*	-
88	Heterotrophic Plate Count (count per ml) *	Petrifilm ™ Aqua	1
N/A	Hexavalent Chromium (mg/l)	*(Outsourced)*	1.0
N/A	Hydrocarbons	*(Outsourced)*	-
46	Hydrogen Sulphide (mg/l)	Hach 8051	1.0
92	Iron (µg/l as Fe) *	Based on SANS 11885:2008 (ICP)	24
92	Lead (µg/l as Pb) *	Based on SANS 11885:2008 (ICP)	7
N/A	Legionella (cfu/l)	*(Outsourced)*	-
92	Lithium (mg/l as Li)	*(Outsourced)*	-
92	Manganese (µg/l as Mn) *	Based on SANS 11885:2008 (ICP)	19
92	Magnesium (mg/l as Mg) *	Based on SANS 11885:2008 (ICP)	1.1

ALA Method No.	Parameter	Method	Limit of Detection
Calc	Magnesium Hardness	Calculation	-
92	Mercury (µg/l as Hg)	Based on SANS 11885:2008 (ICP)	5
N/A	Monochloramine (mg/l)	Lovibond Method	-
92	Molybdenum (µg/l as Mo) *	Based on SANS 11885:2008 (ICP)	91
N/A	Mould (cfu/100 ml)	(Outsourced)	-
92	Nickel (µg/l as Ni) *	Based on SANS 11885:2008 (ICP)	1
4	Nitrate Nitrogen (mg/l as N) *	Hach 8039 *(Applicable to Sewage Analysis)*	0.20
4B	Nitrate & Nitrite Nitrogen (mg/l as N) *	Lovibond Method using Brucine *(Applicable to Water Analysis)*	0.20
100	Nitrate Nitrogen (mg/l as N) *	Discrete Analyzer using the Gallery	0.20
5	Nitrite Nitrogen (mg/l as N) *	Lovibond **(Griess-Ilosvay's Reagent)**	0.08
99	Nitrite Nitrogen (mg/l as N) *	Discrete Analyzer using the Gallery	0.20
Calc	Nitrate Nitrogen (mg/l as N) *	Calculation	-
18	Oil & Grease (mg/l)	SABS 1051 (Nov. 1982)	1
76	Odour (Threshold Odour Number)	STD Method 2150 (B)	1
N/A	Organochlorine Pesticides (OCP)	*(Outsourced)*	-
N/A	Organophosphorus Pesticides (OPP)	*(Outsourced)*	-
10	Ortho Phosphate (mg/l as P) *	Hach 8114	0.20
101	Ortho Phosphate (mg/l as P) *	Discrete Analyzer using the Gallery	0.10
1	Oxygen Absorbed (mg/l as O) *	SANS 5220 : 2005	-
N/A	Pesticides (µg/kg)	*(Outsourced)*	-
N/A	Pseudomonas Aeroginosa (cfu/100 ml)	*(Outsourced)*	-
19	pH (at 25 °C) – Lab *	**SABS 11**	2.00
19	pH (at 25 °C) – Field	**SABS 11**	-
52	Phenols (mg/l)	Discrete Analyzer using the Gallery	0.01
N/A	Polychlorinated Biphenyls (PCB's)	*(Outsourced)*	-
92	Potassium (mg/l as K) *	Based on SANS 11885:2008 (ICP)	0.32
N/A	Salmonella (per 100 ml)	*(Outsourced)*	-
92	Selenium (µg/l as Se) *	Based on SANS 11885:2008 (ICP)	10
67	Settleable Solids (ml/l)	STD Method 2540 F (1992)	0.10
92	Silica (mg/l) *	Based on SANS 11885:2008 (ICP)	27
32	Sodium (mg/l as Na) *	Based on SANS 11885:2008 (ICP)	0.36
N/A	Somatic Coliphages (count per 10 ml)	*(Outsourced)*	-
92	Strontium (mg/l) *	Based on SANS 11885:2008 (ICP)	4
24	Sulphate (mg/l as SO_4) *	Hach 8051	4
102	Sulphate (mg/l as SO_4) *	Discrete Analyzer using the Gallery	1.0
46	Sulphide (mg/l as S^{2-})	STD Method 4500-S^2D (1992)	-
92	Tin (µg/l as Sn) *	Based on SANS 11885:2008 (ICP)	10
92	Titanium (mg/l as Ti)	*(Outsourced)*	-
28	Total Alkalinity (mg/l as $CaCO_3$)	STD Methods 2320 (1992)	1
N/A	Total Carbonate Species (mg/l)	*(Outsourced)*	-
66	Total Chlorine	Lovibond Method 3	0.05
92	Total Chromium (µg/l as Cr) *	Based on SANS 11885:2008 (ICP)	7
85	Total Coliforms Bacteria (count per 100 ml) *	**Colilert - 18 / Quanti-Tray Method**	-
7	Total Dissolved Solids	STD Method 2501 A (1992)	1
Calc	Total Hardness (mg/l as $CaCO_3$)	Calculation	1
15	Total Kjeldahl Nitrogen (mg/l)	Hach 8075	0.15
N/A	Total Microcystin (µg/l as LR)	(Outsourced)	-
105	Total Organic Carbon (mg/l as C)	Hach 10128	1.0
N/A	Total Petroleum Hydrocarbons (TPH)	*(Outsourced)*	-
11	Total Phosphate (mg/l as P)	STD Method 4500-PB (1992) / Hach 8114	0.20
13	Total Plate Count (count per ml) *	Petrifilm ™	1
N/A	Total Trihalomethanese (µg/l)	(Outsourced)	-
N/A	Trihalomethane (Chloroform)	(Outsourced)	-
N/A	Trihalomethane (Bromodichloromethane)	(Outsourced)	-
N/A	Trihalomethane (Dibromochloromethane)	(Outsourced)	-
N/A	Trihalomethane (Bromoform)	(Outsourced)	-
N/A	Tungsten	*(Outsourced)*	-
27	Turbidity (NTU) *	Hach 8237	0.08
6A	Total Suspended Solids (mg/l) *	STD Method 2540 D (1992)	4

ALA Method No.	Parameter	Method	Limit of Detection
N/A	TOX (mg/l)	(Outsourced)	-
92	Uranium (µg/l as U)	Based on SANS 11885:2008 (ICP)	-
N/A	UV Absorption (nm)	*(Outsourced)*	-
92	Vanadium (µg/l as V) *	Based on SANS 11885:2008 (ICP)	139
N/A	Viable Helminths	*(Outsourced)*	-
N/A	Vibrio Cholerae (per 100 ml)	*(Outsourced)*	-
17	Volatile Fatty Acids (mg/l)	STD Method 5560 C (1992)	-
68	Volatile Suspended Solids (mg/l)	STD Method 2540 E (1992)	4
N/A	Yeast (cfu/100 ml)	(Outsourced)	-
92	Zinc (mg/l as Zn) *	Based on SANS 11885:2008 (ICP)	0.001

NOTE : ***Tests marked "SANAS Accredited" in this report and are included in the SANAS Schedule of Accreditation for this laboratory.**
Schedule of Accreditation excludes Sampling
All bacteriological analyses carried out by Colilert Method unless otherwise indicated on the Certificate of Analysis.
Uncertainty of Measurement and Method Descriptions will be provided upon request.

TERMS AND CONDITIONS OF BUSINESS

All work is undertaken by A.L. Abbott and Associates (Pty) Ltd, (hereinafter called "the Company") on the following conditions :

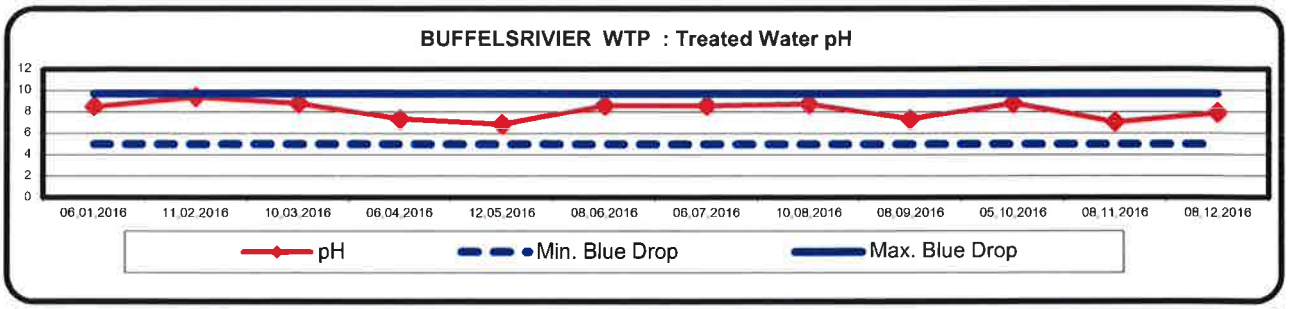
(i) That the total liability of the Company, its officers, servants, agents or sub-contractors for any loss or damage caused by or resulting from improper or negligent performance, purported performance or non-performance of such work shall not exceed the sum equal to fifteen times the fee payable by the client or R6000, whichever is the lesser sum.

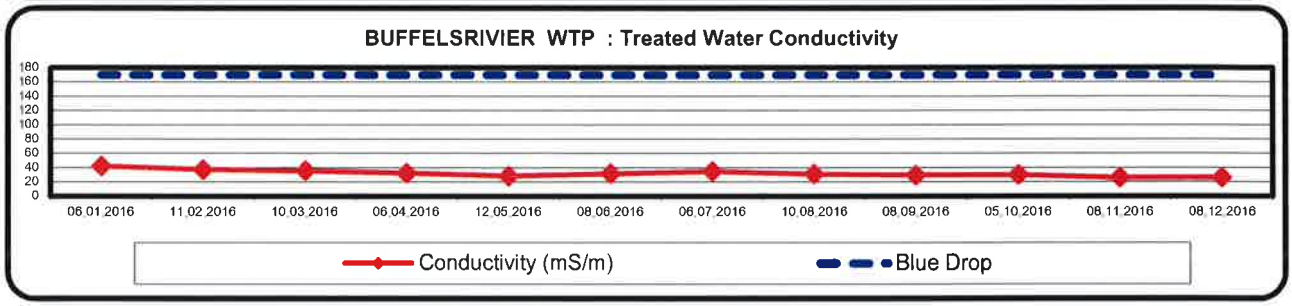
(ii) That the person with whom the Company shall have contracted to have performed the said work will indemnify the Company, its said officers, servants, agents and sub-contractors against all claims made by the third parties consequent upon the performance, purported performance or non-performance of such work to the extent to which the aggregate of such claims exceeds the maximum liability specified in paragraph (i) above.

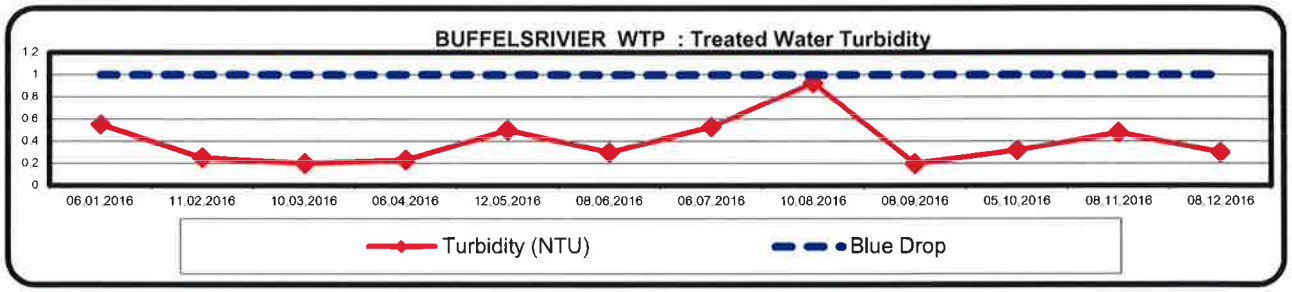
(iii) Without the prejudice to the foregoing every person who is or becomes an officer, servant, agent or sub-contractor of the Company shall have the benefit of the limitation of liability and indemnity contained in these conditions as if they were expressly made for his benefit and so far as relates to such conditions any contract entered into by the Company is entered into not only on its own benefit but also as agent and trustee for every such person as aforesaid.

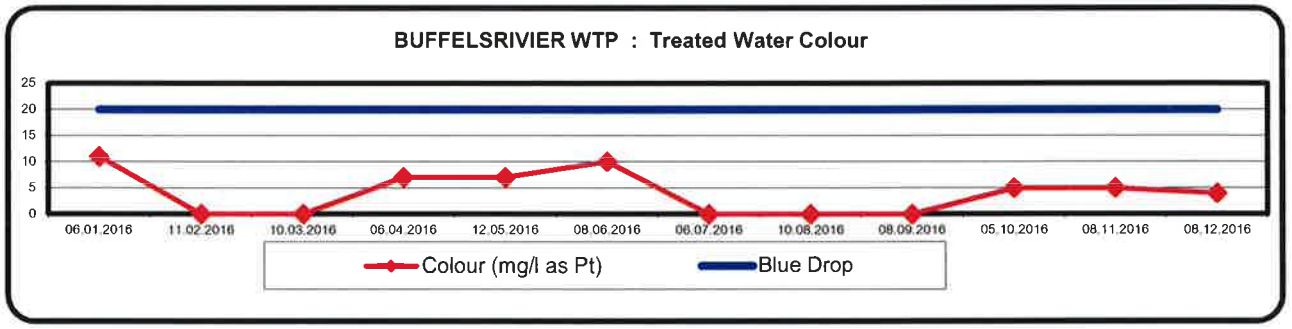
(iv) No employee, agent or representative of the Company (other than a Director) has authority to alter or waive or make any representation which will in any way conflict with or override any of the terms of these conditions.

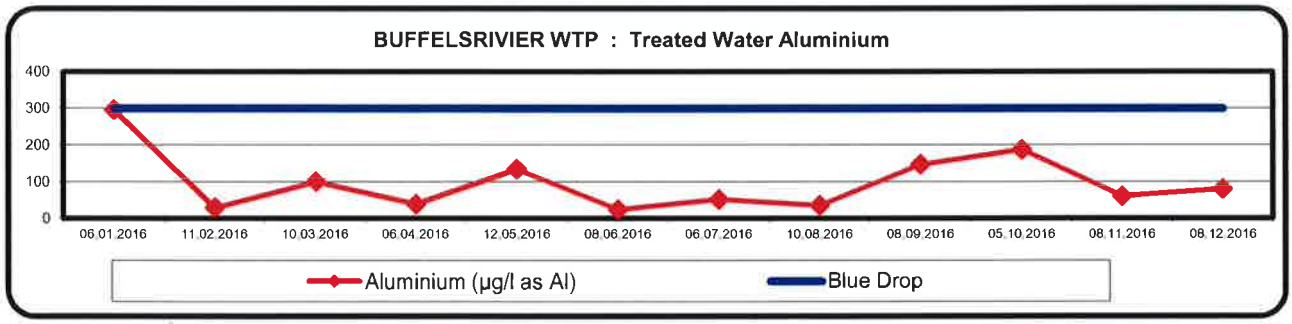
(v) The present conditions shall be governed by South African law and all disputes arising in relation thereto and/or in connection therewith shall be determined by the South African courts.

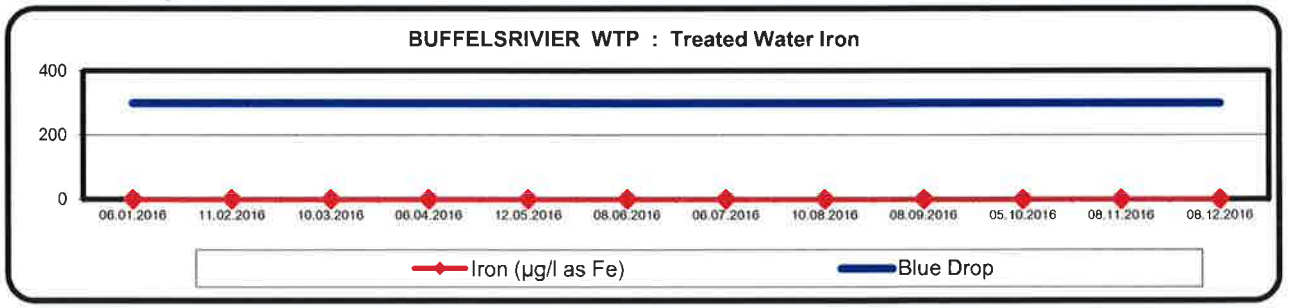

BUFFELSRIVIER WTP : Treated Water pH
12
10
8
6
4
2
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
pH
Min. Blue Drop
Max. Blue Drop

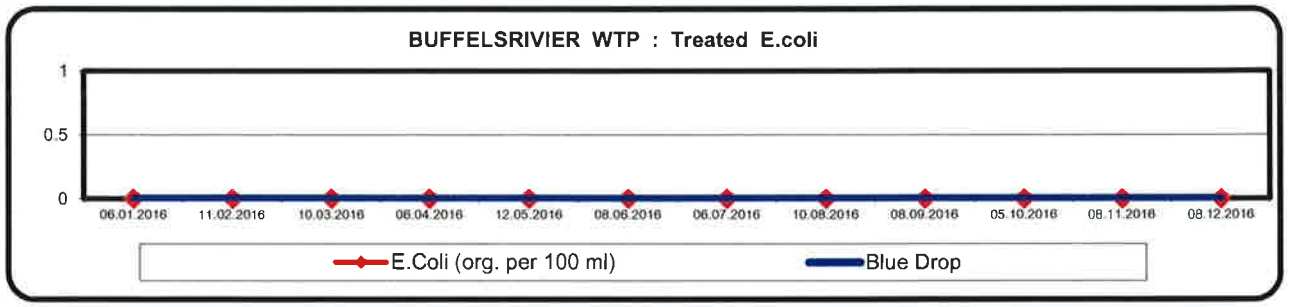

BUFFELSRIVIER WTP : Treated Water Conductivity
180
160
140
120
100
80
60
40
20
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
Conductivity (mS/m)
Blue Drop


BUFFELSRIVIER WTP : Treated Water Turbidity
1.2
1
0.8
0.6
0.4
0.2
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
Turbidity (NTU)
Blue Drop


BUFFELSRIVIER WTP : Treated Water Colour
25
20
15
10
5
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
Colour (mg/l as Pt)
Blue Drop


BUFFELSRIVIER WTP : Treated Water Aluminium
400
300
200
100
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
Aluminium (µg/l as Al)
Blue Drop


BUFFELSRIVIER WTP : Treated Water Iron
400
200
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
Iron (µg/l as Fe)
Blue Drop


BUFFELSRIVIER WTP : Treated E.coli
1
0.5
0
06.01.2016
11.02.2016
10.03.2016
06.04.2016
12.05.2016
08.06.2016
06.07.2016
10.08.2016
08.09.2016
05.10.2016
08.11.2016
08.12.2016
E.Coli (org. per 100 ml)
Blue Drop