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18 May 2015

Andre Barkhuizen  
Chlorine Free Water Treatment  
Cel: 0815805371  
E-mail: andreeoxwc@gmail.com

Dear Mr. Barkhuizen,

### **Removal of iron from groundwater**

GEOSS were recently involved with a project on the farm Sandfontein in Napier to determine the sustainable yield and groundwater quality of the boreholes on the farm. From the investigation it was clear that the groundwater had a high dissolved iron concentration.

Mr Frik Barkhuizen and Mr Andre Barkhuizen (C L FREE water systems) approached GEOSS to investigate the new groundwater treatment system they installed at all the boreholes on the farm to treat the iron in the groundwater.

GEOSS went to site on the 10<sup>th</sup> of April 2015 to investigate the groundwater treatment system. **eOxide Lq 85 - 0.85% ClO<sub>2</sub>** (which is 8500 ppm and 99.9% pure chlorine dioxide) is dosed down the borehole while the pump is running where it mixes with the groundwater and is pumped out again by means of the submersible pump. The **eOxide LQ 85 - 0.85% ClO<sub>2</sub>** oxidises the iron from the ferrous state (Fe<sup>2+</sup>) to ferric iron (Fe<sup>3+</sup>) where it then precipitates out as it is no longer dissolved in the groundwater. The groundwater is pumped into a concrete reservoir and all the iron collects at the bottom of the concrete reservoir. The dissolved iron concentration seems to have decreased by using the treatment technique. The iron precipitate at the bottom of the concrete reservoir is cleaned out by means of flushing the reservoir by opening the valve at the bottom of the reservoir.

The dissolved iron concentration in the groundwater (BH4) has decreased from 9.39 mg/L to 0.04 mg/L after treatment (see **Table 1** and **Table 2** respectively).

From the site visit seeing how the treatment system is set up and the chemistry results obtained an initial assessment is that the process is effective in significantly reducing the iron content of boreholes and also the groundwater abstracted from the borehole. As always with groundwater use on-going maintenance of the borehole and treatment system is essential. GEOSS would like to see the process tested at other sites where the iron content in groundwater is high.

**Julian Conrad**

Report No.: **WT9198**

Julian Conrad  
GEOSS (Pty) Ltd  
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Stellenbosch  
7600

### Water Analyses Report

Date received: 30/08/2013

Date tested: 02/09/2013

Reference No.	Lab. No.	pH	EC mS/m	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Fe mg/l	Cl mg/l	CO <sub>2</sub> mg/l	HCO <sub>3</sub> mg/l	SO <sub>4</sub> mg/l	B mg/l	Mn mg/l	Cu mg/l	Zn mg/l	P mg/l	NH <sub>4</sub> -N mg/l	NO <sub>3</sub> -N mg/l	F mg/l	TDS mg/l	Alkalinity mg/l	
Bh-1	9198	6.3	27	35.91	11.48	8.97	4.34	8.88	57.51		30.62	14.49	0.00	3.944	0.000	0.000	0.150	0.000	0.000	0.070	175	30.120	
Bh-2	9199	6.4	24	29.36	11.00	8.57	4.26	11.27	53.08		38.28	11.02	0.00	3.617	0.000	0.010	0.191	0.000	0.070	0.050	155	27.610	
Bh-3	9200	6.6	31	54.65	7.44	7.47	5.51	17.50	110.59		30.62	6.24	0.00	1.065	0.000	0.000	0.014	0.000	0.170	0.000	201	20.080	
Bh-4	9201	6.1	28	42.02	9.65	8.02	4.84	9.39	101.74		22.97	14.03	0.00	2.767	0.007	0.000	0.191	0.000	0.040	0.110	180	17.570	
Bh-5	9202	6.0	28	41.99	10.03	8.07	4.98	6.13	88.47		30.62	15.31	0.02	2.635	0.003	0.009	0.164	0.000	0.060	0.000	181	15.060	
Bh-6	9203	6.7	24	31.79	14.74	9.22	5.02	4.07	61.93		61.24	10.00	0.00	3.786	0.000	0.009	0.006	0.000	0.000	0.110	156	37.650	
Method*		3136	3135	3132	3132	3132	3132	3132	3138	3137	3137	3132	3132	3132	3132	3132	3132	3133	3134				

\*Refer to BemLab work instructions

Order no.: 1102

**Sample condition:** Samples received in good condition.

**Statement:** The reported results may be applied only to samples received. Any recommendations included with this report are based on the assumption that the samples were representative of the bulk from which they were taken.

Dr. Pieter Raath  
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for BemLab

05-09-2013  
.....  
Date Reported

## Certificate of Analyses

Report No.: WT4755

Allison McDuling  
GEOSS (Pty) Ltd

### Water Analyses Report

Date received: 05/05/2015

Date tested: 08/05/2015

Reference No.	Lab. No.	Fe mg/l	Date Sampled	Temperature °C
✓ B4 Oorkant Pad	4755	0.04	10/04/2015	19.200
Dam	4756	0.03	10/04/2015	19.000

Order no.: 1102

**Statement:** Samples received in good condition. Sample temperature at reception is stipulated in the results table. Ideally the sample(s) should reach the laboratory within 6 hours, or be kept at <10°C and delivered within 24 hours. If these conditions are not maintained, analysis will proceed but interpretation of the results generated is at the clients own discretion. The reported results may be applied only to samples received. Any recommendations included with this report are based on the assumption that the samples were representative of the block from which they were taken.

08-05-2015  
Date Reported



**Dr. Pieter Raath**  
PhDAgric. (Soil Science)  
General Manager



**Petra Mouton**  
MSc (Microbiology)  
Laboratory/Quality Manager



**Sandisiwe Mbula**  
Nat.Dipl. (Chemistry)  
Technical Signatory(Water and chemistry)



**Marilize van Lill**  
Nat.Dipl. (Agriculture)  
Technical Signatory(Soil, leaves and fruit)

—————END OF REPORT—————