NOTES ON TREATED WATER SAMPLE ANALYSIS RESULTS, AUGUST 2020

1 INTRODUCTION

On 13th August 2020, four samples of treated water from the four water treatment works (WTW) on St Helena Island were collected from the freight forwarders, Zedcore, and delivered to the CSIR Laboratories in Stellenbosch. The samples had been shipped from St Helena in a cooler box with ice bricks and were apparently kept on board MV *Helena* in the cold storage room. When they were collected from Zedcore, the samples were in a cold condition. The results for the four WTW samples are largely consistent with previous results and therefore, I have no doubt that the samples were maintained in a cold condition throughout their transport. The results certificates received from the Laboratory are included in Appendix A.

2 TREATED WATER SAMPLE RESULTS

In this section, the results received are compared to the results of the two previous samples from each WTW and interpreted in terms of their suitability for domestic use, using Table 1 as a reference. In order to facilitate the interpretation of the results in terms of the fitness for domestic use, the following colour codes have been used:

No shading: water is within the guideline limits
Green: water will have slight aesthetic effects (taste, colour), but no adverse health effects;
Yellow: water will have moderate aesthetic effects, but no significant health effects;
Orange: water will have severe aesthetic effects and minor to moderate health effects;
Red: water will have very severe aesthetic effects and moderate to significant health effects.

Table 1: Range of fitness classes for domestic use

Parameter (all as mg/l except where indicated)	**Within guideline limits for no adverse effects**	**Slight aesthetic effects; no adverse health effects**	**Moderate aesthetic effects; no significant health effects**	**Severe aesthetic effects; minor to moderate health effects**	**Very severe aesthetic effects; moderate to significant health effects**
Sodium (Na)	<100	100 - 400	400 - 600	600 - 1,000	>1,000
Ammonia (NH_4)	<1	1 - 2	2 - 10	>10	
Sulphate (SO_4)	<200	200 - 400	400 - 600	600 – 1,000	>1,000
Chloride (Cl)	<100	100 - 200	200 - 600	600 – 1,200	>1,200
Nitrate (NO_3)	<6	-	-	6 - 20	>20
Conductivity (eC) as mS/m	<70	70 – 150	150 - 300	300 - 450	>450
pH units	6 - 9	-	-	4 – 6 9 - 11	<4 >11
Aluminium (Al)	<0.15	0.15 – 0.5	>0.5 (in presence of Fe and Mn)	>1	
Copper (Cu)	<1	1 - 3	3 - 30	30 - 200	>200
Iron (Fe)	<0.1	0.1 – 0.3	0.3 – 1.0	1 - 10	>10
Lead (Pb) as ppb	<10	-	-	10 - 100	>100
Manganese (Mn)	<0.05	0.05 – 1.0	1 - 5	5 - 14	>14
Zinc (Zn)	<3	3 - 5	5 - 10	10 - 50	>50

2.1 Red Hill WTW

The latest results for treated water from the Red Hill WTW are shown in Table 2 below. Note that the Feb18 samples were analysed by the same laboratory at the CSIR in Stellenbosch, while the Nov18 samples were analysed by the Hospital Lab on St Helena using new equipment. The latest results are slightly higher than the two previous results, but there are no worrying trends. Both iron and manganese have improved since November 2018, although it is not clear if this is a function of the laboratory used or an actual improvement in WTW operation, or dilution of the inflow waters following good rains.

Table 2: Red Hill WTW: treated water samples

Parameters (mg/l except where indicated)	RH23 Feb18	RH23 Nov18	RH23 Aug20
Potassium	1.4	1.4	1.8
Sodium	36	33.4	41
Magnesium	4.6	2.38	7.4
Calcium	3.8	0.09	6.3
Sulphate	12	8	NR
Chloride	49	NR	62
Nitrate	<0.1	0.3	0.06
Phosphate	<0.05	0.34	<0.05
Conductivity (mS/m)	23	22.4	33
pH (units)	7.4	ND	7.1
Aluminium	0.02	0.006	0.05
Copper	<0.01	0	<0.01
Iron	0.05	0.505	0.13
Manganese	<0.01	0.5	<0.03

2.2 Hutt's Gate WTW

The quality of the treated water from Hutt's Gate WTW has improved slightly compared to the two previous results in relation to all the main cations and anions, but iron concentrations have increased to a level (0.38 mg/l) that will give the water a moderate bitter or metallic taste, but there will be no significant adverse health effects (Table 3). Manganese is now within acceptable limits.

Table 3: Hutt's Gate WTW: treated water samples

Parameters (mg/l except where indicated)	HG22 Feb18	HG22 Nov18	HG22 Aug20
Potassium	1.6	1.1	1.4
Sodium	45	31.1	30
Magnesium	7.7	3.29	3.5
Calcium	8.3	NR	3.9
Sulphate	9.2	6	NR
Chloride	66	NR	48
Nitrate	0.1	0.4	<0.05

Parameters (mg/l except where indicated)	HG22 Feb18	HG22 Nov18	HG22 Aug20
Phosphate	0.05	0.45	0.05
Conductivity (mS/m)	32	23.9	22
pH (units)	7.7	ND	7.2
Aluminium	0.03	0.008	0.04
Copper	<0.01	0	<0.01
Iron	0.12	0.019	0.38
Manganese	<0.01	0.7	<0.03

2.3 Levelwood WTW

Again the cation and anion results from the latest sample are fairly consistent with previous results, although closer to the Feb18 result than that from the Hospital lab in Nov18. However, the aluminium concentration has increased, such that it will give the water a noticeable adverse aesthetic effect (colour), especially in association with the elevated iron concentration. The increase in iron is worrying, but the impacts will be aesthetic (colour and taste) rather than from a health perspective. Manganese is now within the range where no aesthetic or health effects are apparent.

Table 4: Levelwood WTW: treated water samples

Parameters (mg/l except where indicated)	LW20 Feb18	LW20 Nov18	LW20 Aug20
Potassium	1.8	1.5	2.0
Sodium	26	25.8	43
Magnesium	4.9	15.82	4.1
Calcium	6.4	2.16	4.5
Sulphate	8.1	6	NR
Chloride	55	NR	66
Nitrate	<0.1	0.6	<0.05
Orthophosphate	0.1	0.45	0.07
Conductivity (mS/m)	21	19.58	29
pH (units)	7.5	ND	7.0
Aluminium	0.07	0.04	0.19
Copper	<0.01	0.45	<0.01
Iron	0.15	0.136	0.37
Manganese	<0.01	0.4	<0.03

2.4 Jamestown WTW

The latest cation and anion results are similar to the Feb18 results. Although there has been a very slight decrease in salinity (in terms of sodium, chloride and conductivity), the water will still have a slightly salty taste, but no adverse health effects. Aluminium concentrations have increased significantly to 0.64 mg/l, which together with the elevated iron concentrations (0.44 mg/l) mean that the water may cause staining, have some colour and will have a moderate bitter or metallic taste. Manganese is within acceptable limits.

Table 5: Jamestown WTW: treated water samples

Parameters (mg/l except where indicated)	JT21 Feb18	JT21 Nov18	JT21 Aug20
Potassium	2.5	2.9	2.9
Sodium	92	74.7	88
Magnesium	14	1.64	10
Calcium	11	<0.05	8.7
Sulphate	30	27	NR
Chloride	114	NR	107
Nitrate	0.3	0.8	0.13
Orthophosphate	0.14	0.72	0.12
Conductivity (mS/m)	58	55	54
pH (units)	7.9	ND	7.4
Aluminium	0.08	0.007	0.64
Copper	<0.01	0.01	<0.01
Iron	0.16	0.47	0.44
Manganese	<0.01	0.5	<0.03

2.5 Summary

All samples are fit for human consumption from a health perspective, based on the inorganic results received from the August 2020 set of samples. The samples were not analysed for microbiological constituents due to the lag time between sample collection and sample analysis, which is too long for microbiological analyses. The following points summarise the situation:

- There is generally a high degree of correlation between the cation and anion results for the earlier and latest samples;
- In terms of salinity, the Red Hill and Levelwood samples demonstrate a slight increase in salinity, while the Jamestown and Hutt's Gate treated water has improved very slightly in this regard;
- The salinity of the Jamestown water will impart a slightly salty taste to the water;
- Aluminium has increased significantly in the Jamestown and Levelwood samples, where, with elevated iron concentrations, adverse aesthetic impacts may be experienced (colour). The increase in aluminium is unlikely to be from the surrounding environment;
- Iron concentrations have decreased at Red Hill, but have increased in the Hutt's Gate and Levelwood WTW samples, which will cause some negative aesthetic effects (taste);
- Manganese levels are well within limits for all four samples showing a marked improvement since the Nov18 samples, but are similar to those obtained in Feb18. This may be a function of the laboratory equipment, or improved water treatment practices, or increased dilution following good rains.

3 RECOMMENDATIONS

There is only one recommendation arising from this short review:

- Continue to monitor aluminium on a quarterly basis as per the monitoring protocol.

Bryony Walmsley, PrSciNat

APPENDIX A: RESULTS CERTIFICATES

CSIR
our future through science
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sanas Testing Laboratory
T0093

CSIR Smart Places
Jan Celliers Street
Stellenbosch, 7600
P O Box 320
Stellenbosch, 7599

Chemistry Laboratory - Stellenbosch

Certificate of Analysis

Report NO: SAL-2020-15798
Customer: Connect Saint Helena Ltd
Address: Seales Corner
Jamestown St Helena Island STHL 1ZZ

Contact: Bryony Walmsley
Phone: +(290)22255 Fax:
Email: bwa@saiea.co.za

Sample Description: Water samples in 2L plastic bottles with blue caps
No of Samples 4
Sample Condition: Chilled
Date Received: 13-Aug-2020
Date Completed: 27-Aug-20
Order No: Paid

Sample Disposal
a) Liquid Sample
One Month - After issuing of final Certificate of Analysis
b) Solid Sample
Three Months - After issuing of final Certificate of Analysis

Lab No		2015798-106743FW	2015798-106744FW	2015798-106745FW	2015798-106746FW
Sample Date					
Sample ID		Hutts Gate Treatment	Jamestown Water Treatment works	Levelwood Water treatment	Red Hill Treatment
Analysis	**Unit**				
Potassium as K Dissolved	mg/l	1.4	2.9	2.0	1.8
Sodium as Na Dissolved	mg/l	30	88	43	41
Calcium as Ca Dissolved	mg/l	3.9	8.7	4.5	6.3
Magnesium as Mg Dissolved	mg/l	3.5	10	4.1	7.4
Chloride as Cl Dissolved	mg/l	48	107	66	62
Nitrate + Nitrite as N *	mg/l	<0.05	0.13	<0.05	0.06
ortho Phosphate as P	mg/l	0.05	0.12	0.07	<0.05
Electrical Conductivity	mS/m (25°C)	22	54	29	33
pH (Lab) (20°C)		7.2	7.4	7.0	7.1
Total dissolved salts (Calc) *	mg/l	141	346	186	211
Hardness as CaCO3 *	mg/l	24	63	28	46
Turbidity *	NTU	3.2	11	2.4	1.9
Suspended Solids *	mg/l	<1	<1	9	2
Aluminium as Al Dissolved	mg/l	0.04	0.64	0.19	0.05
Copper as Cu Dissolved	mg/l	<0.01	<0.01	<0.01	<0.01
Iron as Fe Dissolved	mg/l	0.38	0.44	0.37	0.13
Manganese as Mn Dissolved	mg/l	<0.03	<0.03	<0.03	<0.03
Ca Hardness as CaCO□ *	mg/L	9.7	22	11	16
Mg Hardness as CaCO□ *	mg/L	14	41	17	30

Remarks: * Method is not SANAS accredited and is not included in the SANAS Schedule of accreditation for this laboratory. # Subcontracted Analysis
Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

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Efraim Fieland - Technical Signatory

Sebastian Brown - Technical Manager

End of Report