

VAN DER KOOY

Water Quality

Testing, Consulting & Treatment



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Water Quality Report

| | |
|-----------------|----------------------------------|
| CLIENT: | AfriForum |
| PROJECT: | Hammanskraal – Human Consumption |

Attention: Mr. Jaco Grobbelaar

Date: 2019-08-18

Report compiled by: *Johan van der Kooy (Cert.Sci.Nat.)*

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CERTIFICATE OF ANALYSIS:

Date received: 2019-08-16

Date Completed: 2019-08-18

Company Name: AfriForum

Address:
P.O. Box 17216,
Lyttleton, Pretoria

Contact:
Mr. Jaco Grobbelaar

| Analysis (All results in mg/l unless otherwise stated) | Results | | SANS 241-2015 (Limits for Drinkability) |
|--|----------------|------------|---|
| | Police Academy | Hospital | |
| pH - Value @ 25 °C | 7.6 | 7.5 | ≥5 to ≤ 9.7 |
| Electrical Conductivity in mS/m @ 25°C | 89.1 | 89.2 | ≤170 |
| Total Dissolved Solids @ 180°C | 474 | 502 | ≤1200 |
| Colour in PtCo Units | 23 | 19 | ≤15 |
| Turbidity in N.T.U | 1.4 | 1.1 | ≤1 / ≤5 |
| Total Alkalinity as CaCO ₃ | 208 | 208 | --- |
| Langelier Index at 25°C | -0.1 | -0.2 | --- |
| Chloride as Cl | 80 | 80 | ≤300 |
| Sulphate as SO ₄ | 83 | 80 | ≤500 / ≤250 |
| Fluoride as F | 0.3 | 0.3 | ≤1.5 |
| Nitrate as N | 9.4 | 9.5 | ≤11 |
| Nitrite as N | 2.7 | 2.6 | ≤0.9 |
| Combined Nitrate & Nitrite | 3.9 | 3.8 | ≤1 |
| Silica as SiO ₂ | 16.01 | 16.01 | --- |
| Total Organic Carbon as C | 4.7 | 4.4 | ≤10 |

| Analysis (All results in mg/l unless otherwise stated) | Results | | SANS 241-2015 (Limits for Drinkability) |
|--|----------------|------------|---|
| | Police Academy | Hospital | |
| E. coli / (100 ml) | 7 | 0 | Not detected |
| Free and Saline Ammonia as N | 11 | 10 | ≤1.5 |
| Sodium as Na | 90 | 89 | ≤200 |
| Potassium as K | 18.5 | 18.9 | --- |
| Calcium as Ca | 37 | 40 | --- |
| Magnesium as Mg | 17 | 17 | --- |
| Aluminium as Al (µg/l) | <100 | <100 | ≤300 |
| Antimony as Sb (µg/l) | 1 | 1 | ≤20 |
| Arsenic as As (µg/l) | 4 | 2 | ≤10 |
| Barium as Ba (µg/l) | <25 | <25 | ≤700 |
| Boron as B (µg/l) | 97 | 99 | ≤2400 |
| Cadmium as Cd (µg/l) | <1.0 | <1.0 | ≤3 |
| Total Chromium as Cr (µg/l) | <25 | <25 | ≤50 |
| Copper as Cu (µg/l) | 112 | <10 | ≤2000 |
| Iron as Fe (µg/l) | 255 | 186 | ≤ 2000 / ≤300 |
| Lead as Pb (µg/l) | <1.0 | <1.0 | ≤10 |
| Manganese as Mn (µg/l) | 109 | 120 | ≤ 400 / ≤100 |
| Mercury as Hg (µg/l) | <1 | <1 | ≤6 |
| Nickel as Ni (µg/l) | <25 | <25 | ≤70 |
| Selenium as Se (µg/l) | <1 | <1 | ≤40 |
| Uranium as U (µg/l) | <1 | <1 | ≤ 30 |
| Zinc as Zn | 0.037 | <0.025 | ≤5 |

The results reflected on this report only relates to the samples received. All parameters are analysed at a SANAS accredited laboratory. Primary Laboratory Water Test Report is attached.



Johan van der Kooy (Cert.Sci.Nat)

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INTRODUCTION

1. Mr. Jaco Grobbelaar of AfriForum has provided Municipal water quality test results in order to receive a consultation report based on the water quality results.
2. The report will discuss the results in respect to the SANS 241-2015 for drinkability.
3. Sample Names:
 - *Police academy*
 - *Hospital*

RESULTS

Sample: *Police Academy*

Inorganic

1. The Total Dissolved Salts (TDS) are below the limits. The TDS is an indication of the sum of all the salts present in the water.

(That means all the anions and cations (Cl, SO₄, F, NO₃ and all the metals for example).

- a. Turbidity and Colour (1,4 N.T.U / 23 PtCo)

- i. The Turbidity and Colour concentrations exceeded the SANS 241-2015 limits for drinkability.
- ii. Colour is strongly related to Turbidity.
- iii. The presence of organic compounds, iron & manganese compounds are the main cause of colour in water.

2. The Fluoride, Sulphate and Chloride values, which will affect your Acute and Chronic health and aesthetic value also fell below the limits.

- a. Nitrite (2,7 mg/l)

- i. The Nitrite concentration of 2,7 mg/l exceeded the SANS 241-2015 limits for drinkability.
- ii. The South African Water Quality Guidelines state the following regarding the absorption of Nitrates and Nitrites:

“Upon absorption, nitrite combines with the oxygen-carrying red blood pigment, haemoglobin, to form methaemoglobin, which is incapable of carrying oxygen.

This condition is termed methaemoglobinaemia”

b. Ammonia (11 mg/l)

- i. High Ammonia concentration has an aesthetic effect in drinking water in the form of taste and odour but carries a health risk in the capability of forming nitrates in the distribution system.
- ii. The South African Water Quality Guidelines state the following regarding a Ammonia concentration of 11 mg/l in drinking water:

*“Unacceptable in domestic water. Danger of formation of nitrite
Likelihood of fish deaths in aquaria.
Chlorination is severely compromised”*

3. The pH has a neutral value of **7,6** and is safely between the allowable limits of 5 and 9.7
4. The metals that was analysed complies with the limits set out by the SANS 241-2015 except for the Manganese (Mn) concentration.

a. Manganese (109 µg/l / 0,109 mg/l.)

- i. Manganese occur naturally in rock and soil but can be the result of pollution.
- ii. The metal very rarely occurs alone and is typically found in Iron-bearing waters.
- iii. Low concentrations of as low as **0,02 mg/l** can cause stains on everything the water encounters.

Organic

- a. A Total Organic Carbon (TOC) test was done on the water sample which will indicate any organic carbon content.
- b. Concentration of less than 10 mg/l were detected which is still inside the prescribed limit of 10 mg/l or less.

Bacteriological Content

- a. E. Coli bacteria which had a colony count of **7 colonies per 100 ml** exceeded the SANS 241-2015 limit of **0** colonies per 100 ml for safe drinking water.
- b. The E. coli bacteria is the preferred and definite indication of sewage pollution.

WATER STABILITY

Langelier Saturation Index (LSI)

1. The Langelier Saturation Index is an index that is calculated from the pH, Calcium, TDS and Alkalinity values. Its purpose is to indicate if the water is scale forming or corrosive.
2. The LSI value of **- 0,1** indicates the slightly corrosive but non-scale forming character of the water.

| LSI Value | Indication |
|---------------------|--|
| -2,0 - <-0,5 | Serious Corrosion |
| -0,5 - <0 | <i>Slightly corrosion but non-scale forming</i> |
| LSI = 0 | Balanced but pitting corrosion possible |
| 0,0 - <0,5 | Slightly scale forming and corrosive |
| 0,5 – <2,0 | <i>Scale forming but non-corrosive</i> |

Sample: Hospital

Inorganic

1. The Total Dissolved Salts (TDS) are below the limits. The TDS is an indication of the sum of all the salts present in the water.

(That means all the anions and cations (Cl, SO₄, F, NO₃ and all the metals for example).

b. Turbidity and Colour (1,1 N.T.U / 19 PtCo)

- i. The Turbidity and Colour concentrations exceeded the SANS 241-2015 limits for drinkability.
 - ii. Colour is strongly related to Turbidity.
 - iii. The presence of organic compounds, iron & manganese compounds are the main cause of colour in water.
5. The Fluoride, Sulphate and Chloride values, which will affect your Acute and Chronic health and aesthetic value also fell below the limits.

a. Nitrite (2,6 mg/l)

- i. The Nitrite concentration of **2,6 mg/l** exceeded the SANS 241-2015 limits for drinkability.
- ii. The South African Water Quality Guidelines state the following regarding the absorption of Nitrates and Nitrites:

“Upon absorption, nitrite combines with the oxygen-carrying red blood pigment, haemoglobin, to form methaemoglobin, which is incapable of carrying oxygen.

This condition is termed methaemoglobinaemia”

b. Ammonia (10 mg/l)

- i. High Ammonia concentration has an aesthetic effect in drinking water in the form of taste and odour but carries a health risk in the capability of forming nitrates in the distribution system.
- ii. The South African Water Quality Guidelines state the following regarding an Ammonia concentration of 11 mg/l in drinking water:

*“Unacceptable in domestic water. Danger of formation of nitrite
Likelihood of fish deaths in aquaria.
Chlorination is severely compromised”*

6. The pH has a neutral value of **7,5** and is safely between the allowable limits of 5 and 9.7

7. The metals that was analysed complies with the limits set out by the SANS 241-2015 except for the Manganese (Mn) concentration.

a. Manganese (120 µg/l / 0,120 mg/l.)

- i. Manganese occur naturally in rock and soil but can be the result of pollution.
- ii. The metal very rarely occurs alone and is typically found in Iron-bearing waters.
- iii. Low concentrations of as low as **0,02 mg/l** can cause stains on everything the water encounters.

Organic

1. A Total Organic Carbon (TOC) test was done on the water sample which will indicate any organic carbon content.
2. Concentration of less than 10 mg/l were detected which is still inside the prescribed limit of 10 mg/l or less.

Bacteriological Content

1. E. Coli bacteria which had a colony count of **0 colonies per 100 ml** complied to the SANS 241-2015 limit of **0 colonies per 100 ml** for safe drinking water.
2. The E. coli bacteria is the preferred and definite indication of sewage pollution.

WATER STABILITY

Langelier Saturation Index (LSI)

1. The Langelier Saturation Index is an index that is calculated from the pH, Calcium, TDS and Alkalinity values. Its purpose is to indicate if the water is scale forming or corrosive.
2. The LSI value of **- 0,2** indicates the slightly corrosive but non-scale forming character of the water.

| LSI Value | Indication |
|---------------------|--|
| -2,0 - <-0,5 | Serious Corrosion |
| -0,5 - <0 | <i>Slightly corrosion but non-scale forming</i> |
| LSI = 0 | Balanced but pitting corrosion possible |
| 0,0 - <0,5 | Slightly scale forming and corrosive |
| 0,5 – <2,0 | <i>Scale forming but non-corrosive</i> |

CONCLUSION and RECOMMENDATIONS

1. Sample: ***Police Academy***
 - 1.1) The Turbidity, Colour, Ammonia, Nitrite, E. coli bacteria and Manganese concentration did not comply to the SANS 241-2015 limits for safe drinking water.
 - 1.2) Because of the above mentioned non-compliance to safe drinking water standards it can be stated that the water **is not fit for human consumption in its current state.**
2. Sample: ***Hospital***
 - 2.1) The Turbidity, Colour, Ammonia, Nitrite and Manganese concentration did not comply to the SANS 241-2015 limits for safe drinking water.
 - 2.2) Because of the above mentioned non-compliance to safe drinking water standards it can be stated that the water **is not fit for human consumption in its current state.**

3. The presence of Nitrate and Ammonia in combination with the E. coli bacteria (Police academy) indicates that the pollution most likely originated from a sewage source.
4. The harmful bacterial pathogens as indicated by the E. coli bacteria can be successfully eliminated with proper disinfection (chlorine, UV sterilization)
5. The Turbidity and Colour can be removed with proper filtration in the form of sand filters or activated carbon.
6. The results indicate poor treatment and both water sources carry a significant risk to human health.

BIBLIOGRAPHY

1. South African National Standards: Drinking Water (SANS 241-2015)
2. World Health Organisation: Guidelines for Drinking Water Quality.
3. Department of Water and Sanitation: South African Water Quality Guidelines: Domestic Use



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T0391

CERTIFICATE OF ANALYSES

GENERAL WATER QUALITY PARAMETERS

Date received: 2019-08-06
Project number: 1000

Report number: 85256

Date completed: 2019-08-16
Order number:

Client name: Afri Forum
Address: P.O. Box 17216, Lyttleton, Pretoria
Telephone: 012 644 4300

Facsimile: 012 664 1281

Contact person: Mr. J. Grobbelaar
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Mobile: 081 216 9570

| Analyses in mg/ℓ (Unless specified otherwise) | Method Identification | Risk | SANS 241 : 2015 Limits | Sample Identification: Hammanskraal | | |
|--|--------------------------|---------|------------------------------|-------------------------------------|----------|------|
| | | | | Police Academy | Hospital | |
| Sample Number | | | | 071055 | 071056 | |
| Date/Time Sampled | | | | N/A | N/A | |
| pH - Value @ 25 °C | A | WLAB065 | Operational | ≥5 to ≤ 9.7 | 7.6 | 7.5 |
| Electrical Conductivity in mS/m @ 25°C | A | WLAB002 | Aesthetic | ≤170 | 89.1 | 89.2 |
| Total Dissolved Solids @ 180°C | A | WLAB027 | Aesthetic | ≤1200 | 474 | 502 |
| Colour in PtCo Units | N | WLAB006 | Aesthetic | ≤15 | 23↓ | 19↓ |
| Turbidity in N.T.U | A | WLAB005 | Operational/Aesthetic | ≤1 / ≤5 | 1.4↓ | 1.1↓ |
| Total Alkalinity as CaCO ₃ | A | WLAB007 | --- | --- | 208 | 208 |
| Langelier Index at 25°C | A | WLAB053 | --- | --- | -0.1 | -0.2 |
| Chloride as Cl | A | WLAB046 | Aesthetic | ≤300 | 80 | 80 |
| Sulphate as SO ₄ | A | WLAB046 | Acute health/Aesthetic | ≤500 / ≤250 | 83 | 80 |
| Fluoride as F | A | WLAB014 | Chronic health | ≤1.5 | 0.3 | 0.3 |
| Nitrate as N | A | WLAB046 | Acute health | ≤11 | 9.4 | 9.5 |
| Nitrite as N | A | WLAB046 | Acute health | ≤0.9 | 2.7↓ | 2.6↓ |
| Combined Nitrate & Nitrite | A | WLAB046 | Acute health | ≤1 | 3.9↓ | 3.8↓ |
| Silica as SiO ₂ | N | WLAB046 | --- | --- | 16.0 | 16.0 |
| Total Organic Carbon as C | N | WLAB060 | Chronic health | ≤10 | 4.7 | 4.4 |
| E. coli / (100 ml) | A | WLAB021 | Acute health | Not detected | 7↓ | 0 |
| Free and Saline Ammonia as N | A | WLAB046 | Aesthetic | ≤1.5 | 11↓ | 10↓ |
| Sodium as Na | A | WLAB015 | Aesthetic | ≤200 | 90 | 89 |
| Potassium as K | A | WLAB015 | --- | --- | 18.5 | 18.9 |
| Calcium as Ca | A | WLAB015 | --- | --- | 37 | 40 |
| Magnesium as Mg | A | WLAB015 | --- | --- | 17 | 17 |
| Aluminium as Al (µg/l) | A | WLAB015 | Operational | ≤300 | <100 | <100 |
| Antimony as Sb (µg/l) | A | WLAB050 | Chronic health | ≤20 | 1 | 1 |
| Arsenic as As (µg/l) | A | WLAB050 | Chronic health | ≤10 | 4 | 2 |
| Barium as Ba (µg/l) | A | WLAB015 | Chronic health | ≤700 | <25 | <25 |
| Boron as B (µg/l) | A | WLAB015 | Chronic health | ≤2400 | 97 | 99 |
| Cadmium as Cd (µg/l) | A | WLAB015 | Chronic health | ≤3 | <1.0 | <1.0 |
| Total Chromium as Cr (µg/l) | A | WLAB015 | Chronic health | ≤50 | <25 | <25 |
| Copper as Cu (µg/l) | A | WLAB015 | Chronic health | ≤2000 | 112 | <10 |
| Iron as Fe (µg/l) | A | WLAB015 | Chronic health/Aesthetic | ≤ 2000 / ≤300 | 255 | 186 |
| Lead as Pb (µg/l) | A | WLAB015 | Chronic health | ≤10 | <1.0 | <1.0 |

J. Ngobeza - Chemical Technical Signatory

D.O. Mohlaloga - Microbiological Technical Signatory

A = Accredited N = Not Accredited S = Subcontracted

Tests marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this Laboratory.

Results marked "Subcontracted Test" in this report are not included in the SANAS Schedule of accreditation for this Laboratory.

Sample condition acceptable unless specified on the report.

The information contained in this report is relevant only to the sample/samples supplied to WATERLAB (Pty) Ltd. Details of sampling conducted by Waterlab (PTY) Ltd, according to WLAB/Sampling Plan and Procedures/SOP, are available on request.

Bacteriological parameters analysed on: 2019-08-06



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T0391

CERTIFICATE OF ANALYSES

GENERAL WATER QUALITY PARAMETERS

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Telephone: 012 644 4300

Facsimile: 012 664 1281

Contact person: Mr. J. Grobbelaar

e-mail: jaco.grobbelaar@afriforum.co.za

Mobile: 081 216 9570

| Analyses in mg/ℓ (Unless specified otherwise) | Method Identification | Risk | SANS 241 : 2015 Limits | Sample Identification: Hammanskraal | | |
|--|--------------------------|---------|------------------------------|-------------------------------------|----------|--------|
| | | | | Police Academy | Hospital | |
| Sample Number | | | | 071055 | 071056 | |
| Date/Time Sampled | | | | N/A | N/A | |
| Manganese as Mn (µg/ℓ) | A | WLAB015 | Chronic health/Aesthetic | ≤ 400 / ≤100 | 109↓ | 120↓ |
| Mercury as Hg (µg/ℓ) | N | WLAB047 | Chronic health | ≤6 | <1 | <1 |
| Nickel as Ni (µg/ℓ) | A | WLAB015 | Chronic health | ≤70 | <25 | <25 |
| Selenium as Se (µg/ℓ) | A | WLAB050 | Chronic health | ≤40 | <1 | <1 |
| Uranium as U (µg/ℓ) | A | WLAB050 | Chronic health | ≤ 30 | <1 | <1 |
| Zinc as Zn | A | WLAB015 | Aesthetic | ≤5 | 0.037 | <0.025 |
| % Balancing | N | --- | --- | --- | 97.6 | 98.4 |

J. Ngobeza - Chemical Technical Signatory

D.O. Mohlaloga - Microbiological Technical Signatory

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Bacteriological parameters analysed on: 2019-08-06