# ANNEXURE A OF THE NOTICE FOR THE PROPOSED RESERVE DETERMINATION FOR THE BERG CATCHMENT IN THE BERG-OLIFANTS WATER MANAGEMENT AREA

## 1. GROUNDWATER QUANTITY COMPONENT

(1) The Groundwater Reserve, which includes the groundwater contribution to the EWR and the BHN per GRU for the Berg Catchment, is set out in terms of section 16(1) of the Act. The catchment receives an estimated total recharge of 620.78 $Mm^3/a$, of which 69.98 $Mm^3/a$ represents the groundwater contribution to the EWR and 2.35 $Mm^3/a$ represents the groundwater contribution to the BHN. The groundwater quantity component of the Reserve for the Berg catchment is 72.33 $Mm^3/a$, which accounts for 11.7% of the total recharge.

(2) The Berg catchment encompasses a total of 30 quaternary catchments, which are further delineated into 25 GRUs as are presented in **Figure 1**. It's important to note that groundwater systems may not always correspond directly to surface water catchments (i.e., GRUs can encompass one or more quaternary catchments, or portions thereof, depending on their geological and hydrogeological characteristics). Therefore, the extents of GRUs were determined considering factors such as the physical geometry of aquifer systems (largely influenced by surface and subsurface geology), groundwater recharge areas, and various aquifer boundary conditions.

(3) The Groundwater Quantity Component was calculated considering the total groundwater contribution to both the EWR and the BHN Reserves **(**see **Table 1.1).**

(a) **Groundwater Contribution to Basic Human Needs**
The groundwater component of the BHN addresses individuals without access to a formal water supply and residing beyond 500 meters from a perennial river (known as the Qualifying Population). The Qualifying Population was calculated as 257,331 individuals within the Berg catchment, with a daily water demand set at a fixed value of 25 ℓ/p/d. Therefore, the groundwater component of the BHN Reserve was determined to be 2.35 $Mm^3/a$ **(Table 1.1).**

(b) **Groundwater Contribution to Ecological Water Requirements**
Quantifying the groundwater component of the EWR involved using a baseflow separation technique, wherein groundwater discharge was calculated using monthly flow data calibrated to meet Target Ecological Categories (TECs) for all river nodes and priority estuaries. A balancing and routing tool factored in cumulative flow downstream, allowing calculations of changes in flow and TECs. Therefore, to assess the groundwater contribution to the EWR, a detailed GIS-based catchment analysis re-evaluated incremental contributing catchments based on various factors, whereafter a recharge ratio was applied to the total dry-season contribution of groundwater to baseflow per GRU and associated aquifer types. The groundwater component of the EWR Reserve was calculated as 69.98 $Mm^3/a$ **(Table 1.1).**

**Table 1.1:** Groundwater Quantity Component of the Reserve for the Berg catchment.

| GRU | Associated Quaternary Catchments [a] | Area ($Km^2$) | Mean Annual Recharge ($Mm^3/a$) [b] | Qualifying Population | Groundwater Contribution Baseflow ($Mm^3/a$) | Water Use ($Mm^3/a$) | Groundwater Contribution to the EWR Reserve ($Mm^3/a$) | Groundwater Contribution to the BHN Reserve ($Mm^3/a$) | Groundwater Reserve ($Mm^3/a$) | Groundwater Reserve (% Mean Annual Recharge) |
|---|---|---|---|---|---|---|---|---|---|---|
| Adamboerskraal | G10K, G10L, G10M, G30A | 612.30 | 21.61 | 889 | 6.00 | 2.13 | 6.00 | 0.01 | 6.01 | 28% |
| Atlantis | G21A, G21B, G21D | 255.68 | 22.74[c] | 2801 | 0.08 | 1.70[d] | 0.08 | 0.03 | 0.11 | 0% |
| Cape Flats | G22C, G22D, G22E, G22H | 421.94 | 41.25[e] | 76862 | 0.51 | 12.00[f] | 0.51 | 0.70 | 1.21 | 3% |
| Cape Peninsula | G22A, G22B, G22C, G22D | 292.53 | 10.99 | 9346 | 5.43 | 0.07 | 5.43 | 0.09 | 5.52 | 50% |
| Cape Town Rim | G21E, G21F, G22A, G22B, G22C, G22D, G22E, G22G, G22H | 814.62 | 18.60 | 21348 | 0.87 | 6.21 | 0.87 | 0.20 | 1.07 | 6% |
| Darling | G10L, G21A, G21B, G21D | 408.82 | 9.95 | 1640 | 0.03 | 0.76 | 0.03 | 0.02 | 0.05 | 0% |
| Drakensteinberge | G10A, G10C, G22F, G22J, H60A, H60B | 164.95 | 27.60 | 372 | 2.88 | 0.05 | 2.88 | 0.00 | 2.88 | 10% |

[a] *Groundwater systems may not always align with surface water catchments. The quaternary catchments listed here encompass all those within the GRU.*
[b] *Unless otherwise stated, the rainfall recharge value was calculated from the first order Map-Centric Simulation method outlined in the project's specialist reports.*
[c] *The rainfall recharge value was obtained from a model-based calibrated recharge estimation (after CoCT, 2018).*
[d] *The water use value includes registered municipal abstraction by the CCT of 5 $Mm^3/a$ as per NWA Section 21(a) and Managed Aquifer Recharge (as per NWA Section 21(e) water use licence) of up to 4.2 $Mm^3/a$ (as a negative water use). The abstraction of 1 M $m^3/a$ by Eskom is not registered in the WARMS database, therefore excluded from the water use.*
[e] *The rainfall recharge value was obtained from a model-based calibrated recharge estimation (after CoCT, 2020).*
[f] *The water use value includes licenced municipal abstraction of 20 $Mm^3/a$ by the CCT in development as per NWA Section 21(a) and Managed Aquifer Recharge (as per NWA Section 21(e) water use licence) of up to 14.6 $Mm^3/a$ (as a negative water use).*

| GRU | Associated Quaternary Catchments [a] | Area ($Km^2$) | Mean Annual Recharge ($Mm^3/a$) [b] | Qualifying Population | Groundwater Contribution Baseflow ($Mm^3/a$) | Water Use ($Mm^3/a$) | Groundwater Contribution to the EWR Reserve ($Mm^3/a$) | Groundwater Contribution to the BHN Reserve ($Mm^3/a$) | Groundwater Reserve ($Mm^3/a$) | Groundwater Reserve (% Mean Annual Recharge) |
|---|---|---|---|---|---|---|---|---|---|---|
| Eendekuil Basin | G10F, G10H, G10J, G10K | 936.94 | 21.88 | 9968 | 6.95 | 4.85 | 6.95 | 0.09 | 7.04 | 32% |
| Elandsfontein | G10L, G10M, G21A | 532.57 | 15.47 | 545 | 6.39 | 1.09 | 6.39 | 0.01 | 6.40 | 41% |
| Groot Winterhoek | E10B, E10C, G10E, G10G, G10H, G10J | 379.26 | 22.50 | 1861 | 0.77 | 1.39 | 0.77 | 0.02 | 0.79 | 3% |
| Langebaan Road | G10L, G10M | 903.71 | 23.28 | 1891 | 5.52 | 8.59 | 5.52 | 0.02 | 5.54 | 24% |
| Malmesbury | G10D, G10F, G10L, G21B, G21C, G21D, G21E, G21F, G22C, G22E, G22G | 1600.36 | 52.65 | 37580 | 1.18 | 14.75 | 1.18 | 0.34 | 1.52 | 3% |
| Middle-Lower Berg | G10F, G10J, G10K, G10L, G10M, G30A | 1485.40 | 42.49 | 9355 | 11.15 | 2.23 | 11.15 | 0.09 | 11.24 | 26% |
| Northern Swartland | G10J, G10K, G10L, G21A, G21C, G21D | 1257.65 | 31.85 | 5149 | 0.20 | 1.79 | 0.20 | 0.05 | 0.25 | 1% |
| Paarl-Franschhoek | G10A, G10B, G10C, G10D, G21E, G22F, H10J, H60B | 368.50 | 26.61 | 13875 | 3.01 | 9.82 | 3.01 | 0.13 | 3.14 | 12% |
| Piketberg | G10H, G10K, G10M, G30A, G30D | 298.29 | 20.33 | 3965 | 2.07 | 5.58 | 2.07 | 0.04 | 2.11 | 10% |

| GRU | Associated Quaternary Catchments [a] | Area ($Km^2$) | Mean Annual Recharge ($Mm^3/a$) [b] | Qualifying Population | Groundwater Contribution Baseflow ($Mm^3/a$) | Water Use ($Mm^3/a$) | Groundwater Contribution to the EWR Reserve ($Mm^3/a$) | Groundwater Contribution to the BHN Reserve ($Mm^3/a$) | Groundwater Reserve ($Mm^3/a$) | Groundwater Reserve (% Mean Annual Recharge) |
|---|---|---|---|---|---|---|---|---|---|---|
| Steenbras-Nuweberg | G22J, G22K, G40A, G40B, G40C, G40D, H60A | 150.24 | 58.76[g] | 1709 | 1.16 | 8.00[h] | 1.16 | 0.02 | 1.18 | 2% |
| Stellenbosch-Helderberg | G10C, G21E, G22E, G22F, G22G, G22H, G22J, G22K, H60A | 570.58 | 41.52 | 26508 | 2.34 | 8.81 | 2.34 | 0.24 | 2.58 | 6% |
| Tulbagh | G10E, G10G, H10F | 291.38 | 10.87 | 2568 | 1.28 | 3.78 | 1.28 | 0.02 | 1.30 | 12% |
| Voëlvlei-Slanghoek | G10D, G10E, G10F, G10J, H10E, H10F, H10J | 184.26 | 14.10 | 739 | 1.62 | 0.13 | 1.62 | 0.01 | 1.63 | 12% |
| Vredenburg | G10M | 376.18 | 7.43 | 1227 | 0.00 | 1.16 | 0.00 | 0.01 | 0.01 | 0% |
| Wellington | G10D, G10F, G10J, G21E | 1068.81 | 39.49 | 25733 | 6.75 | 4.48 | 6.75 | 0.24 | 6.99 | 18% |
| Wemmershoek | G10A, G10B, G10C, H10J, H10K, H60B | 229.13 | 26.83 | 187 | 3.59 | 0.81 | 3.59 | 0.00 | 3.59 | 13% |
| Witzenberg | G10E, G10G, H10C, H10D, H10F | 39.95 | 2.78 | 243 | 0.18 | 0.08 | 0.18 | 0.00 | 0.18 | 7% |
| Yzerfontein | G10L, G10M, G21A | 320.33 | 9.20 | 970 | 0.02 | 0.26 | 0.02 | 0.01 | 0.03 | 0% |

[g] *The rainfall recharge value was obtained from the first order GRAII Spatial Distribution (modified after CoCT, 2022).*
[h] *Includes licenced municipal abstraction of 8 $Mm^3/a$ by CCT under development (phase 1) as per NWA Section 21(a)*

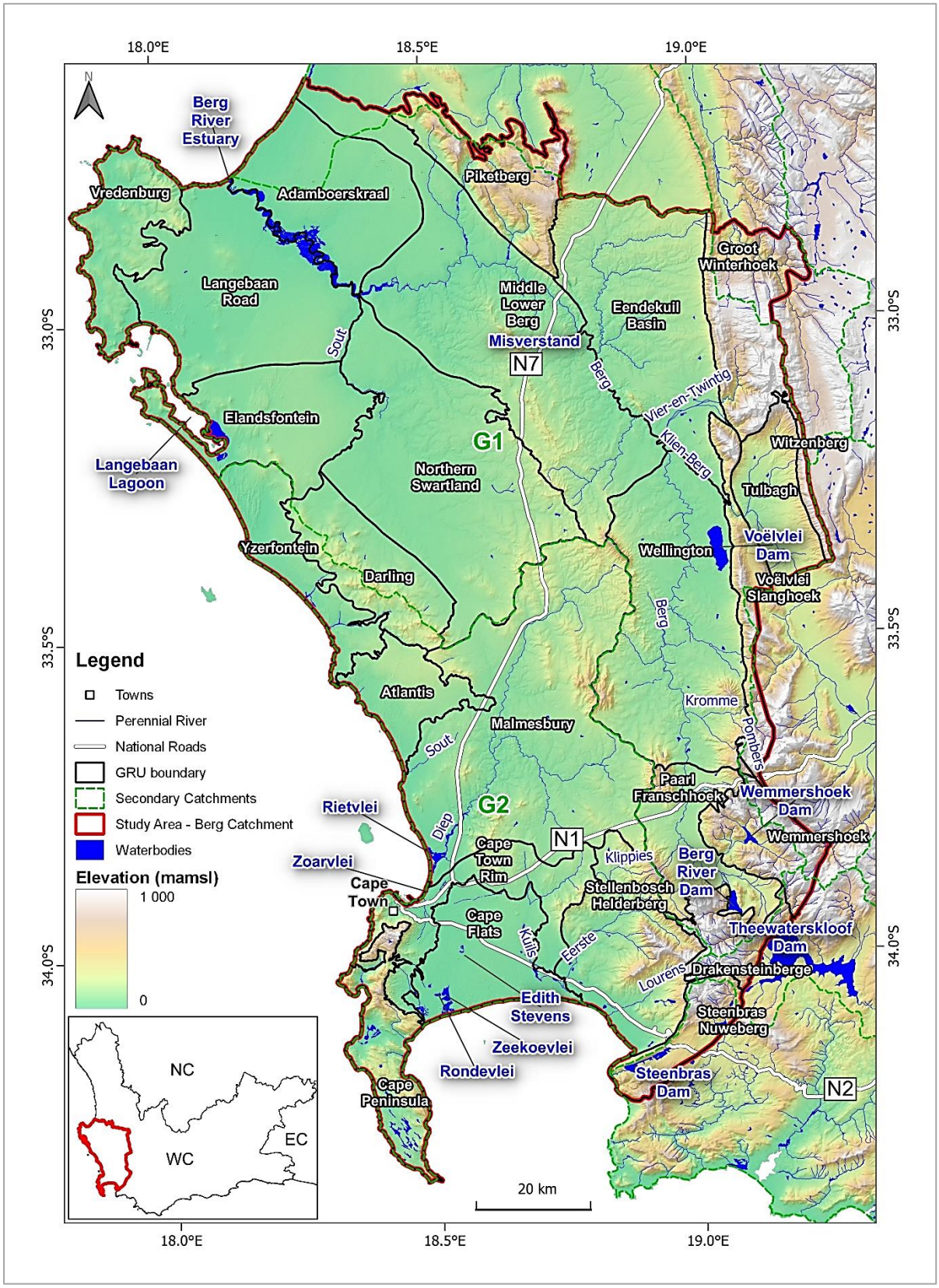


**Figure 1:** The Berg catchment area and the associated groundwater resource units (GRU's).

## 2. GROUNDWATER QUALITY COMPONENT

(1) The groundwater quality component of the Reserve for the Berg Catchment is defined by two components: 1) the Groundwater Quality Reserve, which is based on statistical analysis of the baseline and median + 10% concentrations of chemical parameters within specific aquifers in the GRUs, and 2) the Groundwater Quality Requirement for BHN, which is the upper limit of Class I Water Quality (Drinking) as outlined in **Table 2.1.**

(1) The Groundwater Quality Component of the Reserve is outlined in the GRU-specific tables (see **Table 2.2** below). The Groundwater Quality Component of the Reserve was determined by assessing two primary components, namely-

(a) **Groundwater Quality Reserve**
Determined based on statistical analysis of the baseline and median + 10% concentrations of specific chemical parameters within specific aquifers in the GRUs;

(b) **Groundwater Quality Requirement for BHN**
Upper limit of Class I Water Quality [Drinking] **(see Table 2.2**Error! Reference source not found.**)**.

(2) GRUs with limited water quality data, such as Drakensteinberge, Voëlvlei-Slanghoek, Witzenberg, Groot Winterhoek, Piketberg, Tulbagh, and Vredenberg, were excluded from the analysis, and no Groundwater Quality Component has been established. **Table 2.2** below.

### GENERAL CHEMISTRY

**Table 2.1:** General water chemistry (after South African Water Quality Guidelines, Volume 1: Domestic Water Use, 2nd Ed. 1996. Department of Water Affairs, Pretoria, South Africa).

| Chemical Parameter | Target Water Quality Ranges | | | | |
|---|---|---|---|---|---|
| | Units | Class 0 | Class I | Class II | Class III |
| pH | pH units | 6 - 9 | 5 - 6 & 9 - 9.5 | 4 – 5 & > 9.5 - 10 | < 4 or > 10 |
| Electrical Conductivity | mS/m | 0 - 70 | 70 - 150 | 150 - 300 | > 370 |
| Calcium as Ca | mg/l | 0 - 80 | 80 - 150 | 150 - 300 | > 300 |
| Magnesium as Mg | mg/l | 0 - 30 | 30 - 70 | 70 - 100 | > 100 |
| Sodium as Na | mg/l | 0 - 100 | 100 - 200 | 200 - 400 | > 400 |
| Chloride as Cl | mg/l | 0 - 100 | 100 - 200 | 200 - 600 | > 600 |
| Sulphate as $SO_4$ | mg/l | 0 - 200 | 200 - 400 | 400 - 600 | > 600 |
| Nitrate as $NO_x$- N | mg/l | 0 - 6 | 6 - 10 | 10 - 20 | > 20 |
| Fluoride as F | mg/l | 0 - 1 | 1 - 1.5 | 1.5 - 3.5 | > 3.5 |

**Class 0:** Water is classed as ideal drinking water, suitable for lifetime use. The values are essentially the same as the target water guideline in the South African Water Quality Guideline for Domestic Use.

**Class I:** Water is still safe for lifetime use; however, some mild health effects may, in very rare cases, occur. They may also be some aesthetic effects.

**Class II:** Water allowable for limited short term or emergency use. Health effects may be felt more commonly, as compared to Class I, especially by those who are long term users of the water. Therefore, it is not recommended that the water be used continuously for life. This is only class in the guideline which is not specific in terms of the exact duration that the water can be used for. It states that it can be used for short term use; but does not define what length of time “short term” refers to.

**Class III:** Class III water will cause serious health effects, particularly in infants and elderly people. Use of this water is not recommended for drinking purposes.

**Table 2.2:** Groundwater Quality Component of the Reserve for the Berg catchment.

| GRU | Aquifer Unit | Parameter | Unit | No. BHs | No. Samples | Baseline Conc. [i] | Min Conc. | Max Conc. | Median Conc. | Groundwater Quality Reserve [j] | BHN Threshold [k] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adamboerskraal | Primary/ Intergranular Aquifer | pH | | 2 | 3 | 7 | 6.5 | 7 | 6.6 | 7 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 2 | 3 | 499.1 | 499.1 | 823.2 | 752 | 823.2 | 150 |
| | | Sodium as Na | mg/l | 2 | 3 | 874.9 | 874.9 | 1374.9 | 1367.8 | 1374.9 | 200 |
| | | Calcium as Ca | mg/l | 2 | 3 | 42 | 42 | 67.4 | 58 | 63.8 | 150 |
| | | Magnesium as Mg | mg/l | 2 | 3 | 73.8 | 73.8 | 145.1 | 140.7 | 145.1 | 70 |
| | | Chloride as Cl | mg/l | 2 | 3 | 1540 | 1540 | 2513.3 | 2442.1 | 2513.3 | 200 |
| | | Sulphate as SO4 | mg/l | 2 | 3 | 52.2 | 52.2 | 164 | 143.3 | 157.63 | 400 |
| | | Nitrate + Nitrite | mg/l | 2 | 3 | 0.1 | 0.02 | 0.1 | 0.02 | 0.1 | 10 |
| | | Fluoride as F | mg/l | 2 | 3 | 0.31 | 0.3 | 0.5 | 0.31 | 0.341 | 1.5 |
| | | Ammonia as NH3 | mg/l | 2 | 3 | 0.19 | 0.18 | 0.62 | 0.19 | 0.209 | - |
| | | Orthophosphate as PO4 | mg/l | 2 | 3 | 0.24 | 0.036 | 0.243 | 0.051 | 0.24 | - |
| | | Potassium as K | mg/l | 2 | 3 | 11.28 | 9.34 | 11.28 | 10.95 | 11.28 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Atlantis | Primary / Intergranular Aquifer | pH | | 27 | 42 | 7.73 | 2.60 | 8.35 | 7.60 | 8.35 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 27 | 42 | 99.74 | 38.10 | 156.70 | 85.55 | 99.74 | 150 |
| | | Sodium as Na | mg/l | 27 | 42 | 116.14 | 22.60 | 219.40 | 95.35 | 116.14 | 200 |
| | | Calcium as Ca | mg/l | 27 | 42 | 46.05 | 4.80 | 183.50 | 59.55 | 65.51 | 150 |
| | | Magnesium as Mg | mg/l | 27 | 42 | 17.28 | 4.90 | 35.80 | 9.90 | 17.28 | 70 |
| | | Chloride as Cl | mg/l | 27 | 42 | 240.93 | 37.10 | 435.40 | 145.85 | 240.93 | 200 |
| | | Sulphate as SO4 | mg/l | 27 | 42 | 24.70 | 2.00 | 355.70 | 19.80 | 24.70 | 400 |
| | | Nitrate + Nitrite | mg/l | 27 | 42 | 0.05 | 0.02 | 2.19 | 0.02 | 0.05 | 10 |
| | | Fluoride as F | mg/l | 27 | 42 | 1.16 | 0.05 | 1.33 | 0.15 | 1.16 | 1.5 |
| | | Ammonia as NH3 | mg/l | 27 | 42 | 1.16 | 0.02 | 1.22 | 0.06 | 1.16 | - |
| | | Orthophosphate as PO4 | mg/l | 27 | 42 | 0.10 | 0.00 | 1.30 | 0.03 | 0.10 | - |
| | | Potassium as K | mg/l | 27 | 42 | 5.57 | 0.35 | 6.86 | 2.87 | 5.57 | - |

[i] *In the Berg catchment, determining true baseline concentrations, unaffected by human activities, was challenging due to diverse anthropogenic influences. Therefore, an approximation of the baseline was made using monitoring sites in areas with minimal human impact. To mitigate outliers, the 95$^{th}$ percentile statistical method was favoured over maximum concentrations, capturing the majority of data while excluding extreme values.*

[j] *The Groundwater Quality Reserve was determined by taking the Median concentration plus 10%. If this value was lower than the Baseline concentration, the Baseline value was chosen. If it exceeded the Maximum concentration, then the Maximum value was selected.*

[k] *The BHN threshold was selected based on the upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide).*

| GRU | Aquifer Unit | Parameter | Unit | No. BHs | No. Samples | Baseline Conc. | Min Conc. | Max Conc. | Median Conc. | Groundwater Quality Reserve | BHN Threshold |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cape Flats | Primary / Intergranular Aquifer | pH | | 37 | 581 | 8.30 | 5.07 | 8.55 | 7.84 | 8.55 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 37 | 581 | 113.72 | 13.00 | 578.00 | 88.85 | 113.72 | 150 |
| | | Sodium as Na | mg/l | 37 | 581 | 111.36 | 3.30 | 784.00 | 58.90 | 111.36 | 200 |
| | | Calcium as Ca | mg/l | 37 | 581 | 112.16 | 3.81 | 266.50 | 101.50 | 112.16 | 150 |
| | | Magnesium as Mg | mg/l | 37 | 581 | 14.62 | 1.00 | 124.70 | 11.60 | 14.62 | 70 |
| | | Chloride as Cl | mg/l | 37 | 581 | 209.22 | 5.00 | 1993.00 | 100.00 | 209.22 | 200 |
| | | Nitrate + Nitrite | mg/l | 37 | 581 | 8.35 | 0.02 | 23.20 | 1.12 | 8.35 | 400 |
| | | Fluoride as F | mg/l | 37 | 581 | 0.26 | 0.05 | 3.05 | 0.15 | 0.26 | 10 |
| | | Ammonia as NH3 | mg/l | 37 | 581 | 0.08 | 0.02 | 31.89 | 0.06 | 0.08 | 1.5 |
| | | Orthophosphate as PO4 | mg/l | 37 | 581 | 0.03 | 0.00 | 1.35 | 0.01 | 0.03 | - |
| | | Potassium as K | mg/l | 37 | 581 | 2.95 | 0.15 | 53.66 | 1.90 | 2.95 | - |
| | | Sulphate as SO4 as SO4 | mg/l | 37 | 581 | 44.40 | 2.00 | 326.00 | 45.40 | 49.94 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Cape Peninsula | Fractured Table Mountain Group Aquifer | pH | | 11 | 11 | 6.96 | 6.54 | 7.57 | 7.10 | 7.57 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 11 | 11 | 25.80 | 25.80 | 119.00 | 89.80 | 98.78 | 150 |
| | | Sodium as Na | mg/l | 11 | 11 | 31.30 | 31.30 | 115.40 | 89.10 | 98.01 | 200 |
| | | Calcium as Ca | mg/l | 11 | 11 | 3.60 | 3.60 | 109.60 | 30.70 | 33.77 | 150 |
| | | Magnesium as Mg | mg/l | 11 | 11 | 3.50 | 3.50 | 31.40 | 16.70 | 18.37 | 70 |
| | | Chloride as Cl | mg/l | 11 | 11 | 54.70 | 54.70 | 207.10 | 147.20 | 161.92 | 200 |
| | | Sulphate as SO4 | mg/l | 11 | 11 | 12.20 | 12.20 | 107.40 | 72.20 | 79.42 | 400 |
| | | Nitrate + Nitrite | mg/l | 11 | 11 | 0.07 | 0.02 | 10.89 | 0.32 | 0.35 | 10 |
| | | Fluoride as F | mg/l | 11 | 11 | 0.26 | 0.05 | 0.33 | 0.15 | 0.26 | 1.5 |
| | | Ammonia as NH3 | mg/l | 11 | 11 | 0.02 | 0.02 | 2.51 | 0.02 | 0.02 | - |
| | | Orthophosphate as PO4 | mg/l | 11 | 11 | 1.02 | 0.01 | 1.08 | 0.02 | 1.02 | - |
| | | Potassium as K | mg/l | 11 | 11 | 1.79 | 0.83 | 46.71 | 5.95 | 6.55 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Cape Town Rim GRU | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 21 | 21 | 7.78 | 7.00 | 8.62 | 7.47 | 8.22 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 21 | 21 | 105.10 | 21.00 | 659.00 | 92.00 | 105.10 | 150 |
| | | Sodium as Na | mg/l | 21 | 21 | 142.60 | 28.20 | 1048.00 | 128.40 | 142.60 | 200 |
| | | Calcium as Ca | mg/l | 21 | 21 | 45.50 | 2.30 | 259.80 | 15.80 | 45.50 | 150 |
| | | Magnesium as Mg | mg/l | 21 | 21 | 19.10 | 1.70 | 119.10 | 20.60 | 22.66 | 70 |
| | | Chloride as Cl | mg/l | 21 | 21 | 240.60 | 44.00 | 2100.00 | 220.00 | 242.00 | 200 |
| | | Sulphate as SO4 | mg/l | 21 | 21 | 8.50 | 5.50 | 350.00 | 34.10 | 37.51 | 400 |
| | | Nitrate + Nitrite | mg/l | 21 | 21 | 0.28 | 0.02 | 6.57 | 0.13 | 0.28 | 10 |
| | | Fluoride as F | mg/l | 21 | 21 | 0.14 | 0.12 | 2.60 | 0.27 | 0.30 | 1.5 |
| | | Ammonia as NH3 | mg/l | 21 | 21 | 0.02 | 0.02 | 0.75 | 0.02 | 0.02 | - |
| | | Orthophosphate as PO4 | mg/l | 21 | 21 | 0.01 | 0.00 | 0.13 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 21 | 21 | 3.05 | 0.87 | 13.20 | 3.02 | 3.32 | - |

| GRU | Aquifer Unit | Parameter | Unit | No. BHs | No. Samples | Baseline Conc. | Min Conc. | Max Conc. | Median Conc. | Groundwater Quality Reserve | BHN Threshold |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Darling | Fractured and Intergranular Basement Aquifer (CGS) | pH | | 9 | 9 | 6.80 | 6.70 | 7.86 | 7.20 | 7.86 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 9 | 9 | 192.00 | 108.60 | 1100.00 | 281.60 | 309.76 | 150 |
| | | Sodium as Na | mg/l | 9 | 9 | 299.20 | 151.90 | 1907.00 | 416.30 | 457.93 | 200 |
| | | Calcium as Ca | mg/l | 9 | 9 | 16.90 | 9.30 | 251.00 | 46.60 | 51.26 | 150 |
| | | Magnesium as Mg | mg/l | 9 | 9 | 38.80 | 11.50 | 236.10 | 57.60 | 63.36 | 70 |
| | | Chloride as Cl | mg/l | 9 | 9 | 499.10 | 332.70 | 3413.80 | 766.10 | 842.71 | 200 |
| | | Sulphate as SO4 | mg/l | 9 | 9 | 96.10 | 10.70 | 542.20 | 96.10 | 105.71 | 400 |
| | | Nitrate + Nitrite | mg/l | 9 | 9 | 0.83 | 0.02 | 4.16 | 0.83 | 0.91 | 10 |
| | | Fluoride as F | mg/l | 9 | 9 | 0.15 | 0.10 | 1.50 | 0.56 | 0.62 | 1.5 |
| | | Ammonia as NH3 | mg/l | 9 | 9 | 0.02 | 0.02 | 0.08 | 0.02 | 0.02 | - |
| | | Orthophosphate as PO4 | mg/l | 9 | 9 | 0.01 | 0.00 | 0.02 | 0.00 | 0.01 | - |
| | | Potassium as K | mg/l | 9 | 9 | 8.06 | 7.01 | 43.63 | 11.42 | 12.56 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Eendekuil | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 10 | 10 | 8.20 | 7.86 | 8.45 | 8.14 | 8.45 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 10 | 10 | 205.00 | 42.10 | 583.00 | 233.00 | 256.30 | 150 |
| | | Sodium as Na | mg/l | 10 | 10 | 323.20 | 41.70 | 967.10 | 444.10 | 488.51 | 200 |
| | | Calcium as Ca | mg/l | 10 | 10 | 25.50 | 10.60 | 151.00 | 20.85 | 25.50 | 150 |
| | | Magnesium as Mg | mg/l | 10 | 10 | 58.20 | 18.40 | 342.00 | 55.05 | 60.56 | 70 |
| | | Chloride as Cl | mg/l | 10 | 10 | 543.60 | 92.80 | 1873.40 | 664.90 | 731.39 | 200 |
| | | Sulphate as SO4 | mg/l | 10 | 10 | 52.60 | 7.30 | 219.00 | 79.55 | 87.51 | 400 |
| | | Nitrate + Nitrite | mg/l | 10 | 10 | 0.84 | 0.04 | 5.39 | 0.85 | 0.94 | 10 |
| | | Fluoride as F | mg/l | 10 | 10 | 0.94 | 0.20 | 1.87 | 1.01 | 1.11 | 1.5 |
| | | Ammonia as NH3 | mg/l | 10 | 10 | 0.02 | 0.02 | 0.05 | 0.02 | 0.02 | - |
| | | Orthophosphate as PO4 | mg/l | 10 | 10 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 10 | 10 | 11.27 | 1.28 | 44.80 | 4.22 | 11.27 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Elandsfontein | Primary / Intergranular Aquifer | pH | | 3 | 5 | 7.49 | 7.17 | 7.60 | 7.35 | 7.60 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 3 | 5 | 49.10 | 45.50 | 101.90 | 49.10 | 54.01 | 150 |
| | | Sodium as Na | mg/l | 3 | 5 | 55.93 | 50.90 | 109.70 | 54.40 | 59.84 | 200 |
| | | Calcium as Ca | mg/l | 3 | 5 | 37.26 | 26.50 | 83.40 | 34.20 | 37.62 | 150 |
| | | Magnesium as Mg | mg/l | 3 | 5 | 3.50 | 3.50 | 12.60 | 3.50 | 3.85 | 70 |
| | | Chloride as Cl | mg/l | 3 | 5 | 100.82 | 97.50 | 195.10 | 101.00 | 111.10 | 200 |
| | | Sulphate as SO4 | mg/l | 3 | 5 | 12.90 | 12.10 | 29.20 | 12.10 | 13.31 | 400 |
| | | Nitrate + Nitrite | mg/l | 3 | 5 | 4.62 | 0.15 | 4.62 | 1.51 | 4.62 | 10 |
| | | Fluoride as F | mg/l | 3 | 5 | 0.24 | 0.17 | 0.82 | 0.19 | 0.24 | 1.5 |
| | | Ammonia as NH3 | mg/l | 3 | 5 | 0.14 | 0.04 | 0.14 | 0.12 | 0.14 | - |
| | | Orthophosphate as PO4 | mg/l | 3 | 5 | 0.19 | 0.01 | 0.30 | 0.19 | 0.21 | - |
| | | Potassium as K | mg/l | 3 | 5 | 1.99 | 0.48 | 2.03 | 1.02 | 1.99 | - |

| GRU | Aquifer Unit | Parameter | Unit | No. BHs | No. Samples | Baseline Conc. | Min Conc. | Max Conc. | Median Conc. | Groundwater Quality Reserve | BHN Threshold |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Langebaan Road | Primary / Intergranular Aquifer | pH | | 8 | 92 | 8.41 | 6.77 | 8.71 | 8.11 | 8.71 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 8 | 92 | 59.50 | 59.50 | 289.50 | 152.00 | 167.20 | 150 |
| | | Sodium as Na | mg/l | 8 | 81 | 202.80 | 61.00 | 445.30 | 198.52 | 218.37 | 200 |
| | | Calcium as Ca | mg/l | 8 | 84 | 72.80 | 27.00 | 175.00 | 68.89 | 75.78 | 150 |
| | | Magnesium as Mg | mg/l | 8 | 86 | 17.90 | 5.30 | 97.92 | 17.71 | 19.48 | 70 |
| | | Chloride as Cl | mg/l | 8 | 88 | 385.60 | 110.00 | 780.80 | 334.69 | 385.60 | 200 |
| | | Sulphate as SO4 | mg/l | 8 | 89 | 25.18 | 0.60 | 467.60 | 25.50 | 28.05 | 400 |
| | | Nitrate + Nitrite | mg/l | 8 | 87 | 0.25 | 0.02 | 9.81 | 0.06 | 0.25 | 10 |
| | | Fluoride as F | mg/l | 8 | 82 | 0.70 | 0.22 | 2.11 | 0.61 | 0.70 | 1.5 |
| | | Ammonia as NH3 | mg/l | 8 | 90 | 0.14 | 0.00 | 0.55 | 0.03 | 0.14 | - |
| | | Orthophosphate as PO4 | mg/l | 8 | 90 | 0.04 | 0.00 | 0.24 | 0.03 | 0.04 | - |
| | | Potassium as K | mg/l | 8 | 83 | 4.81 | 1.00 | 27.75 | 4.80 | 5.28 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Malmesbury | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 66 | 197 | 7.15 | 1.00 | 8.60 | 7.64 | 8.40 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 66 | 197 | 1549.90 | 29.66 | 2110.00 | 107.90 | 1549.90 | 150 |
| | | Sodium as Na | mg/l | 66 | 191 | 282.03 | 25.00 | 1726.90 | 156.40 | 282.03 | 200 |
| | | Calcium as Ca | mg/l | 66 | 194 | 178.18 | 3.50 | 219.30 | 16.98 | 178.18 | 150 |
| | | Magnesium as Mg | mg/l | 66 | 193 | 66.07 | 4.30 | 205.00 | 18.68 | 66.07 | 70 |
| | | Chloride as Cl | mg/l | 66 | 197 | 655.78 | 50.00 | 2879.60 | 257.01 | 655.78 | 200 |
| | | Sulphate as SO4 | mg/l | 66 | 196 | 172.57 | 1.50 | 360.70 | 33.30 | 172.57 | 400 |
| | | Nitrate + Nitrite | mg/l | 66 | 194 | 503.08 | 0.02 | 589.68 | 0.56 | 503.08 | 10 |
| | | Fluoride as F | mg/l | 66 | 191 | 0.26 | 0.03 | 2.94 | 0.38 | 0.42 | 1.5 |
| | | Ammonia as NH3 | mg/l | 66 | 195 | 0.10 | 0.00 | 1.27 | 0.03 | 0.10 | - |
| | | Orthophosphate as PO4 | mg/l | 66 | 195 | 0.10 | 0.00 | 14.00 | 0.02 | 0.10 | - |
| | | Potassium as K | mg/l | 66 | 192 | 18.77 | 1.10 | 50.31 | 3.67 | 18.77 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Middle-Lower Berg | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 46 | 60 | 7.63 | 3.11 | 8.71 | 7.70 | 8.47 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 46 | 60 | 841.00 | 20.68 | 1212.00 | 636.00 | 841.00 | 150 |
| | | Sodium as Na | mg/l | 46 | 57 | 1345.50 | 75.00 | 2376.10 | 930.60 | 1345.50 | 200 |
| | | Calcium as Ca | mg/l | 46 | 58 | 166.30 | 4.70 | 218.40 | 63.36 | 166.30 | 150 |
| | | Magnesium as Mg | mg/l | 46 | 58 | 204.00 | 2.85 | 353.00 | 135.16 | 204.00 | 70 |
| | | Chloride as Cl | mg/l | 46 | 58 | 2627.50 | 25.52 | 4393.30 | 1972.70 | 2627.50 | 200 |
| | | Sulphate as SO4 | mg/l | 46 | 58 | 342.80 | 3.52 | 799.60 | 196.90 | 342.80 | 400 |
| | | Nitrate + Nitrite | mg/l | 46 | 58 | 6.16 | 0.02 | 24.96 | 1.24 | 6.16 | 10 |
| | | Fluoride as F | mg/l | 46 | 58 | 0.57 | 0.17 | 2.22 | 0.67 | 0.74 | 1.5 |
| | | Ammonia as NH3 | mg/l | 46 | 58 | 0.02 | 0.02 | 1.37 | 0.04 | 0.04 | - |
| | | Orthophosphate as PO4 | mg/l | 46 | 58 | 0.01 | 0.00 | 0.13 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 46 | 57 | 22.53 | 1.73 | 79.19 | 24.37 | 26.81 | - |

| GRU | Aquifer Unit | Parameter | Unit | No. BHs | No. Samples | Baseline Conc. | Min Conc. | Max Conc. | Median Conc. | Groundwater Quality Reserve | BHN Threshold |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Northern Swartland | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 31 | 31 | 7.59 | 5.55 | 8.13 | 7.70 | 8.13 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 31 | 31 | 532.00 | 49.70 | 1175.50 | 400.00 | 532.00 | 150 |
| | | Sodium as Na | mg/l | 31 | 31 | 984.70 | 65.50 | 2133.50 | 614.00 | 984.70 | 200 |
| | | Calcium as Ca | mg/l | 31 | 31 | 35.70 | 3.80 | 286.50 | 52.40 | 57.64 | 150 |
| | | Magnesium as Mg | mg/l | 31 | 31 | 81.00 | 9.90 | 437.30 | 76.50 | 84.15 | 70 |
| | | Chloride as Cl | mg/l | 31 | 31 | 1643.10 | 135.10 | 4123.90 | 1121.80 | 1643.10 | 200 |
| | | Sulphate as SO4 | mg/l | 31 | 31 | 114.70 | 7.90 | 484.70 | 114.70 | 126.17 | 400 |
| | | Nitrate + Nitrite | mg/l | 31 | 31 | 0.87 | 0.02 | 21.53 | 0.96 | 1.06 | 10 |
| | | Fluoride as F | mg/l | 31 | 31 | 0.72 | 0.15 | 1.25 | 0.70 | 0.77 | 1.5 |
| | | Ammonia as NH3 | mg/l | 31 | 31 | 0.02 | 0.02 | 0.52 | 0.02 | 0.02 | - |
| | | Orthophosphate as PO4 | mg/l | 31 | 31 | 0.01 | 0.00 | 0.11 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 31 | 31 | 23.46 | 1.48 | 116.34 | 14.00 | 23.46 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Paarl-Franschoek | Fractured and Intergranular Basement Aquifer (CGS) | pH | | 1 | 1 | 7.04 | 7.04 | 7.04 | 7.04 | 7.04 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 1 | 1 | 14.40 | 14.40 | 14.40 | 14.40 | 14.40 | 150 |
| | | Sodium as Na | mg/l | 1 | 1 | 18.20 | 18.20 | 18.20 | 18.20 | 18.20 | 200 |
| | | Calcium as Ca | mg/l | 1 | 1 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 150 |
| | | Magnesium as Mg | mg/l | 1 | 1 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 70 |
| | | Chloride as Cl | mg/l | 1 | 1 | 27.50 | 27.50 | 27.50 | 27.50 | 27.50 | 200 |
| | | Sulphate as SO4 | mg/l | 1 | 1 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 400 |
| | | Nitrate + Nitrite | mg/l | 1 | 1 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 | 10 |
| | | Fluoride as F | mg/l | 1 | 1 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 1.5 |
| | | Ammonia as NH3 | mg/l | 1 | 1 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | - |
| | | Orthophosphate as PO4 | mg/l | 1 | 1 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | - |
| | | Potassium as K | mg/l | 1 | 1 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Steenbras-Nuweberg | Fractured Table Mountain Group Aquifer (Peninsula) | pH | | 16 | 54 | 7.18 | 4.87 | 9.35 | 6.80 | 7.48 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 16 | 58 | 14.00 | 2.47 | 38.00 | 13.00 | 14.30 | 150 |
| | | Sodium as Na | mg/l | 16 | 27 | 6.60 | 3.70 | 79.20 | 8.15 | 8.97 | 200 |
| | | Calcium as Ca | mg/l | 16 | 57 | 2.78 | 0.50 | 50.10 | 5.20 | 5.72 | 150 |
| | | Magnesium as Mg | mg/l | 16 | 38 | 1.83 | 0.20 | 7.60 | 1.30 | 1.83 | 70 |
| | | Chloride as Cl | mg/l | 16 | 27 | 18.01 | 1.40 | 31.00 | 13.25 | 18.01 | 200 |
| | | Sulphate as SO4 | mg/l | 16 | 53 | 1.49 | 0.20 | 61.00 | 4.20 | 4.62 | 400 |
| | | Nitrate + Nitrite | mg/l | 16 | 38 | 1.05 | 0.00 | 1.20 | 0.10 | 1.05 | 10 |
| | | Fluoride as F | mg/l | 16 | 54 | 0.28 | 0.10 | 0.76 | 0.50 | 0.55 | 1.5 |
| | | Ammonia as NH3 | mg/l | 16 | 58 | 0.12 | 0.00 | 12.00 | 0.10 | 0.12 | - |
| | | Orthophosphate as PO4 | mg/l | 16 | 27 | 0.32 | 0.00 | 0.97 | 0.10 | 0.32 | - |
| | | Potassium as K | mg/l | 16 | 34 | 0.64 | 0.20 | 15.30 | 2.50 | 2.75 | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fractured Table Mountain Group Aquifer (Nardouw) | pH | | 16 | 27 | 5.91 | 4.63 | 8.61 | 5.57 | 6.13 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 16 | 38 | 10.00 | 2.00 | 24.20 | 9.00 | 10.00 | 150 |
| | | Sodium as Na | mg/l | 16 | 38 | 11.13 | 2.10 | 21.90 | 9.30 | 11.13 | 200 |
| | | Calcium as Ca | mg/l | 16 | 38 | 5.10 | 0.32 | 7.41 | 1.00 | 5.10 | 150 |
| | | Magnesium as Mg | mg/l | 16 | 27 | 5.35 | 0.20 | 6.60 | 1.10 | 5.35 | 70 |
| | | Chloride as Cl | mg/l | 16 | 34 | 19.95 | 1.00 | 37.80 | 17.00 | 19.95 | 200 |
| | | Sulphate as SO4 | mg/l | 16 | 54 | 6.50 | 0.40 | 17.70 | 3.35 | 6.50 | 400 |
| | | Nitrate + Nitrite | mg/l | 16 | 61 | 0.20 | 0.00 | 3.66 | 0.20 | 0.22 | 10 |
| | | Fluoride as F | mg/l | 16 | 54 | 0.50 | 0.05 | 0.50 | 0.10 | 0.50 | 1.5 |
| | | Ammonia as NH3 | mg/l | 16 | 56 | 2.88 | 0.01 | 12.22 | 0.10 | 2.88 | - |
| | | Orthophosphate as PO4 | mg/l | 16 | 56 | 0.20 | 0.00 | 0.20 | 0.10 | 0.20 | - |
| | | Potassium as K | mg/l | 16 | 27 | 1.00 | 0.09 | 14.10 | 0.93 | 1.02 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Stellenbosch-Helderberg | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 15 | 15 | 7.08 | 6.72 | 7.18 | 6.98 | 7.18 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 15 | 15 | 197.00 | 32.70 | 885.00 | 203.00 | 223.30 | 150 |
| | | Sodium as Na | mg/l | 15 | 15 | 297.30 | 54.10 | 1510.20 | 307.85 | 338.64 | 200 |
| | | Calcium as Ca | mg/l | 15 | 15 | 54.50 | 4.30 | 200.80 | 43.40 | 54.50 | 150 |
| | | Magnesium as Mg | mg/l | 15 | 15 | 28.90 | 5.90 | 376.90 | 56.85 | 62.54 | 70 |
| | | Chloride as Cl | mg/l | 15 | 15 | 610.60 | 86.50 | 3495.00 | 586.65 | 645.32 | 200 |
| | | Sulphate as SO4 | mg/l | 15 | 15 | 10.20 | 7.70 | 338.40 | 73.05 | 80.36 | 400 |
| | | Nitrate + Nitrite | mg/l | 15 | 15 | 0.02 | 0.02 | 5.61 | 0.21 | 0.23 | 10 |
| | | Fluoride as F | mg/l | 15 | 15 | 2.35 | 0.05 | 2.61 | 0.67 | 2.35 | 1.5 |
| | | Ammonia as NH3 | mg/l | 15 | 15 | 0.04 | 0.02 | 0.09 | 0.05 | 0.06 | - |
| | | Orthophosphate as PO4 | mg/l | 15 | 15 | 0.01 | 0.01 | 0.06 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 15 | 15 | 6.38 | 2.98 | 8.80 | 3.78 | 6.38 | - |
| | Fractured and Intergranular Basement Aquifer (CGS) | pH | | 6 | 6 | 7.00 | 6.41 | 7.48 | 7.00 | 7.48 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 6 | 6 | 68.40 | 17.60 | 197.00 | 48.90 | 68.40 | 150 |
| | | Sodium as Na | mg/l | 6 | 6 | 95.60 | 22.40 | 297.30 | 66.70 | 95.60 | 200 |
| | | Calcium as Ca | mg/l | 6 | 6 | 9.60 | 1.60 | 99.10 | 9.60 | 10.56 | 150 |
| | | Magnesium as Mg | mg/l | 6 | 6 | 13.80 | 2.90 | 35.80 | 9.00 | 13.80 | 70 |
| | | Chloride as Cl | mg/l | 6 | 6 | 167.20 | 34.50 | 610.60 | 115.90 | 167.20 | 200 |
| | | Sulphate as SO4 | mg/l | 6 | 6 | 14.80 | 2.00 | 289.80 | 5.90 | 14.80 | 400 |
| | | Nitrate + Nitrite | mg/l | 6 | 6 | 0.24 | 0.02 | 8.34 | 0.94 | 1.03 | 10 |
| | | Fluoride as F | mg/l | 6 | 6 | 1.25 | 0.16 | 2.46 | 0.41 | 1.25 | 1.5 |
| | | Ammonia as NH3 | mg/l | 6 | 6 | 0.04 | 0.04 | 0.11 | 0.05 | 0.06 | - |
| | | Orthophosphate as PO4 | mg/l | 6 | 6 | 0.01 | 0.01 | 0.08 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 6 | 6 | 7.07 | 0.96 | 7.07 | 3.15 | 7.07 | - |

| GRU | Aquifer Unit | Parameter | Unit | No. BHs | No. Samples | Baseline Conc. | Min Conc. | Max Conc. | Median Conc. | Groundwater Quality Reserve | BHN Threshold |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wellington | Fractured and Intergranular Basement Aquifer (Tygerberg) | pH | | 3 | 3 | 7.56 | 7.03 | 7.56 | 7.40 | 7.56 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 3 | 3 | 202.00 | 25.60 | 202.00 | 29.70 | 202.00 | 150 |
| | | Sodium as Na | mg/l | 3 | 3 | 290.80 | 33.90 | 290.80 | 36.50 | 290.80 | 200 |
| | | Calcium as Ca | mg/l | 3 | 3 | 42.30 | 1.90 | 42.30 | 9.70 | 42.30 | 150 |
| | | Magnesium as Mg | mg/l | 3 | 3 | 78.10 | 4.20 | 78.10 | 7.30 | 78.10 | 70 |
| | | Chloride as Cl | mg/l | 3 | 3 | 551.60 | 51.90 | 551.60 | 64.50 | 551.60 | 200 |
| | | Sulphate as SO4 | mg/l | 3 | 3 | 118.00 | 4.30 | 118.00 | 4.30 | 118.00 | 400 |
| | | Nitrate + Nitrite | mg/l | 3 | 3 | 1.39 | 1.26 | 1.39 | 1.28 | 1.39 | 10 |
| | | Fluoride as F | mg/l | 3 | 3 | 1.09 | 0.22 | 1.09 | 0.26 | 1.09 | 1.5 |
| | | Ammonia as NH3 | mg/l | 3 | 3 | 0.14 | 0.05 | 0.21 | 0.14 | 0.15 | - |
| | | Orthophosphate as PO4 | mg/l | 3 | 3 | 0.01 | 0.01 | 0.14 | 0.01 | 0.01 | - |
| | | Potassium as K | mg/l | 3 | 3 | 4.09 | 1.39 | 4.09 | 2.68 | 4.09 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Wemmershoek | Fractured Table Mountain Group Aquifer (Peninsula) | pH | | 4 | 31 | 8.26 | 6.40 | 10.01 | 7.30 | 8.26 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 4 | 31 | 9.27 | 4.66 | 16.00 | 8.10 | 9.27 | 150 |
| | | Sodium as Na | mg/l | 4 | 26 | 10.44 | 2.20 | 11.00 | 5.75 | 10.44 | 200 |
| | | Calcium as Ca | mg/l | 4 | 28 | 4.39 | 0.20 | 10.83 | 3.15 | 4.39 | 150 |
| | | Magnesium as Mg | mg/l | 4 | 28 | 0.46 | 0.20 | 7.00 | 0.60 | 0.66 | 70 |
| | | Chloride as Cl | mg/l | 4 | 28 | 13.77 | 6.00 | 17.62 | 8.05 | 13.77 | 200 |
| | | Sulphate as SO4 | mg/l | 4 | 19 | 3.45 | 0.20 | 20.90 | 0.72 | 3.45 | 400 |
| | | Nitrate + Nitrite | mg/l | 4 | 24 | 0.53 | 0.00 | 1.27 | 0.02 | 0.53 | 10 |
| | | Fluoride as F | mg/l | 4 | 4 | 0.16 | 0.05 | 0.39 | 0.11 | 0.16 | 1.5 |
| | | Ammonia as NH3 | mg/l | 4 | 28 | 0.45 | 0.01 | 0.66 | 0.05 | 0.45 | - |
| | | Orthophosphate as PO4 | mg/l | 4 | 22 | 0.05 | 0.00 | 0.43 | 0.02 | 0.05 | - |
| | | Potassium as K | mg/l | 4 | 20 | 8.20 | 0.10 | 8.43 | 0.75 | 8.20 | - |
| **GRU** | **Aquifer Unit** | **Parameter** | **Unit** | **No. BHs** | **No. Samples** | **Baseline Conc.** | **Min Conc.** | **Max Conc.** | **Median Conc.** | **Groundwater Quality Reserve** | **BHN Threshold** |
| Yzerfontein | Primary / Intergranular Aquifer | pH | | 49 | 142 | 7.97 | 1.00 | 8.76 | 7.24 | 7.97 | 5 – 9 |
| | | Electrical Conductivity | mS/m | 49 | 142 | 111.70 | 35.20 | 588.00 | 104.10 | 114.51 | 150 |
| | | Sodium as Na | mg/l | 49 | 138 | 146.72 | 41.80 | 864.80 | 141.65 | 155.82 | 200 |
| | | Calcium as Ca | mg/l | 49 | 140 | 24.06 | 6.20 | 221.70 | 19.20 | 24.06 | 150 |
| | | Magnesium as Mg | mg/l | 49 | 139 | 34.34 | 7.00 | 152.80 | 22.30 | 34.34 | 70 |
| | | Chloride as Cl | mg/l | 49 | 140 | 284.61 | 55.60 | 1646.00 | 263.25 | 289.58 | 200 |
| | | Sulphate as SO4 | mg/l | 49 | 140 | 109.04 | 2.00 | 277.90 | 40.13 | 109.04 | 400 |
| | | Nitrate + Nitrite | mg/l | 49 | 139 | 0.51 | 0.01 | 4.18 | 0.09 | 0.51 | 10 |
| | | Fluoride as F | mg/l | 49 | 136 | 0.44 | 0.03 | 0.88 | 0.20 | 0.44 | 1.5 |
| | | Ammonia as NH3 | mg/l | 49 | 139 | 0.11 | 0.02 | 1.16 | 0.04 | 0.11 | - |
| | | Orthophosphate as PO4 | mg/l | 49 | 139 | 0.05 | 0.00 | 0.81 | 0.06 | 0.07 | - |
| | | Potassium as K | mg/l | 49 | 138 | 4.22 | 1.17 | 49.00 | 4.52 | 4.97 | - |

## 3. QUANTITY COMPONENTS FOR RIVERS

Proposed results for the Reserve determination and ecological categorisation for the Berg Catchment (G10, G21, G22), where the Reserve amounts are expressed as a percentage of the MAR for the respective catchments (cumulative) in terms of section (16)(1).

**Table 3.1:** Summary of the quantity component for the Rivers which include the EWR & BHN.

| Quaternary Catchment | Node/ EWR site | Water Resource | PES | EIS | REC | NMAR (MCM)[1] | Ecological Reserve[3] (MCM) | BHN[4] Reserve (MCM) | Total Reserve[2] (% NMAR) |
|---|---|---|---|---|---|---|---|---|---|
| **G10A** | **Bviii1/EWR 1** | **Berg** | **D** | **High** | **C** | **141.683** | **44.062** | 0.244 | **31.272** |
| **G10A** | Biv5 | Franschoek | D | High | C | 34.851 | 8.234 | | 24.330 |
| **G10B** | Biii2 | Wemmershoek | D | High | C/D | 85.567 | 19.200 | 0 | 22.440 |
| **G10C** | Bvii14 | Dwars | C | Very High | B | 43.650 | 14.782 | 1.671 | 37.688 |
| **G10C** | Biii3 | Berg | D | Low | D | 418.079 | 92.242 | | 22.460 |
| **G10D** | Bvii3 | Krom/Kromme | D | Moderate | D | 18.195 | 2.582 | 0.511 | 16.998 |
| **G10D** | Bvii10 | Berg | D | Moderate | C/D | 461.597 | 153.247 | | 33.310 |
| **G10D** | Bvii15 | Doring | D | High | C | 3.841 | 0.849 | | 33.311 |
| **G10D** | **Bviii2/EWR 6** | **Krom/Kromme** | **D** | **Moderate** | **D** | **3.557** | **0.505** | | **28.556** |
| **G10D** | Bvii4 | Kompanjies | D | Moderate | D | 24.814 | 3.450 | | 15.960 |
| **G10D** | **Bvii5/EWR 3** | **Berg** | **D** | **Moderate** | **C/D** | **534.333** | **177.395** | | **33.294** |
| **G10E** | Biii4 | Klein Berg | D | Moderate | D | 84.212 | 12.161 | 0.107 | 14.567 |
| **G10F** | Bvii11 | Berg | D | Moderate | D | 557.017 | 115.094 | 0.243 | 20.703 |
| **G10J** | Biv4 | Vier-en-Twintig | D | Moderate | D | 165.478 | 24.139 | 0.225 | 14.726 |
| **G10J** | **Bvii6/EWR 4** | **Berg** | **D** | **Moderate** | **D** | **860.679** | **177.839** | | **20.686** |
| **G10J** | Bvii8 | Berg | D | Moderate | D | 896.408 | 185.221 | | 20.685 |
| **G10J** | Biv1 | Berg | D | Moderate | D | 678.963 | 140.291 | | 20.693 |

| Quaternary Catchment | Node/ EWR site | Water Resource | PES | EIS | REC | NMAR (MCM)[1] | Ecological Reserve[3] | BHN[4] Reserve | Total Reserve[2] (% NMAR) |
|---|---|---|---|---|---|---|---|---|---|
| **G10J** | Bvii17 | Sandspruit | C | Moderate | C | 9.248 | 1.927 | | 20.840 |
| **G10J** | Biii5 | Matjies | D | Moderate | D | 32.930 | 4.237 | | 13.553 |
| **G10J** | Bvii8 | Berg | D | Moderate | C | 896.405 | 185.221 | | 20.685 |
| **G10J** | Bvii18 | Moreesburgspruit | E | Moderate | D | 3.269 | 0.456 | | 20.833 |
| **G10K** | **Bvii12/EWR 5** | **Berg** | **D** | **High** | **D** | **901.794** | **377.955** | **0.084** | **41.919** |
| **G10L** | Bii1 | Sout | D | Low | D | 13.169 | 1.664 | 0.160 | 13.844 |
| **G10L** | Biv2 | Berg | D | Low | D | 924.535 | 222.974 | | 24.137 |
| **G21A** | Bviii3 | - | D | High | D | 0.959 | 0.140 | 0.094 | 24.442 |
| **G21B** | Bvii10 | Sout | E | High | D | 6.211 | 1.018 | 0.810 | 29.431 |
| **G21D** | **Bv1/ EWR Die1** | **Diep** | **D** | **Moderate** | **D** | **13.716** | **1.911** | 0.360 | **16.555** |
| **G21D** | Bvii4 | Swart | D | High | D | 2.325 | 0.332 | | 29.744 |
| **G21D** | Biv6 | Diep | D | High | D | 9.300 | 2.033 | | 28.634 |
| **G21E** | Biv7 | Mosselbank | D | High | D | 30.262 | 2.033 | 7.400 | 38.513 |
| **G22B** | Bviii6 | Hout Bay | D | High | D | 17.221 | 3.905 | 0.361 | 24.766 |
| **G22D** | Bvii7 | Keysers | D | High | D | 4.495 | 0.672 | 0 | 71.00 |
| **G22F** | **Biii6 / EWR Eer 1** | **Eerste (Jonkershoek)** | **C** | **High** | **C** | **36.585** | **8.582** | **0.156** | **23.046** |
| **G22G** | Biv9 | Klippies | | High | D | 18.225 | 2.641 | 0.484 | 5.297 |
| **G22J** | **Bvii21/ Lou 1** | **Lourens** | **D** | **Moderate** | **D** | **57.634** | **8.452** | **0.240** | **15.086** |
| **G22K** | Bviii9 | Sir Lowry's Pass* | C | High | C | 48.636 | 11.738 | 0.960 | 26.104 |
| **G40A** | **Bvii22/ EWR 8** | **Steenbras** | **C** | **Very High** | **B/C** | **34.807** | **4.696** | **0** | **13.49** |

[1] NMAR is the Natural Mean Annual Runoff.
[2] The total Reserve amount accounts for both the Ecological Reserve and the Basic Human Needs Reserve (BHN).
[3] This amount represents the long-term mean based on the NMAR. If the NMAR changes, this volume will also change.
[4] Represents the Basic Human Needs (BHN).

# 4. QUALITY COMPONENT FOR RIVERS

## 4.1 Water Quality Ecological Specifications

| Quaternary Catchment/ EWR Site | River | Sub-component | Indicator | Ecological Specifications |
|---|---|---|---|---|
| **G10A** | Berg | Nutrients | Phosphate as P (PO4-P) | ≤ 0.025 milligrams per Litre (mg/L) (50$^{th}$ percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 0.70 milligrams per Litre (mg/L) (50$^{th}$ percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 30 milligrams per Litre (mg/L) (95$^{th}$ percentile) |
| | | System variables | pH range | 4.5 ≤ pH ≤ 7.5 (5$^{th}$ and 95$^{th}$ percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | DO ≥ 8 milligrams per litre (mg/L) |
| | | Pathogens | *Escherichia coli* | ≤ 130 counts/100ml (95$^{th}$ percentile) |
| **G10C** | Berg | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50$^{th}$ percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50$^{th}$ percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95$^{th}$ percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5$^{th}$ and 95$^{th}$ percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | DO ≥ 6 milligrams per litre (mg/L) |
| | | Toxins | Ammonia | ≤ 0.073 counts/100ml (95$^{th}$ percentile) |
| | | | Altrazine | ≤ 0.079 counts/100ml (95$^{th}$ percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95$^{th}$ percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95$^{th}$ percentile) |
| **G10D** | Berg | Nutrients | Phosphate as P (PO4-P) | ≤ 0.125 milligrams per Litre (mg/L) (50$^{th}$ percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 3.00 milligrams per Litre (mg/L) (50$^{th}$ percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95$^{th}$ percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5$^{th}$ and 95$^{th}$ percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5$^{th}$ percentile) |
| | | Toxins | Ammonia | ≤ 0.073 counts/100ml (95$^{th}$ percentile) |
| | | | Altrazine | ≤ 0.079 counts/100ml (95$^{th}$ percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95$^{th}$ percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 cfu/100ml (95$^{th}$ percentile) |

| Quaternary Catchment/ EWR Site | River | Sub-component | Indicator | Ecological Specifications |
|---|---|---|---|---|
| **G10E** | Klein Berg | Nutrients | Phosphate as P (PO4-P) | ≤ 0.1075 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Ammonia | ≤ 0.073 counts/100ml (95th percentile) |
| | | | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 cfu/100ml (95th percentile) |
| **G10J** | Berg | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 1065 counts/100ml (95th percentile) |
| **G10K** | Berg | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95th percentile) |
| **G21D** | Diep | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50th percentile) |

| Quaternary Catchment/ EWR Site | River | Sub-component | Indicator | Ecological Specifications |
|---|---|---|---|---|
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 450 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95th percentile) |
| **G21D** | Diep | Nutrients | Phosphate as P (PO4-P) | ≤ 0.125 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 3.0 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 350 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95th percentile) |
| **G22B** | Hout Bay | Nutrients | Phosphate as P (PO4-P) | ≤ 0.125 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 3.0 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 1065 counts/100ml (95th percentile) |
| **G22D** | Keysers | Nutrients | Phosphate as P (PO4-P) | ≤ 0.125 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 3.0 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 85 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |

| Quaternary Catchment/ EWR Site | River | Sub-component | Indicator | Ecological Specifications |
|---|---|---|---|---|
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 4000 counts/100ml (95th percentile) |
| **G22F** | Jonkershoek | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Ammonia | ≤ 0.073 counts/100ml (95th percentile) |
| | | | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95th percentile) |
| **G22G** | Klippeis | Nutrients | Phosphate as P (PO4-P) | ≤ 0.125 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 3.0 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Ammonia | ≤ 0.073 counts/100ml (95th percentile) |
| | | | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 4000 counts/100ml (95th percentile) |
| **G22J** | Lourens | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | | Ammonia | ≤ 0.073 counts/100ml (95th percentile) |

| Quaternary Catchment/ EWR Site | River | Sub-component | Indicator | Ecological Specifications |
|---|---|---|---|---|
| | | Toxins | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95th percentile) |
| **G22J** | Sir Lowry's Pass | Nutrients | Phosphate as P (PO4-P) | ≤ 0.075 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 1.75 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 6.5 ≤ pH ≤ 8.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Ammonia | ≤ 0.073 counts/100ml (95th percentile) |
| | | | Altrazine | ≤ 0.079 counts/100ml (95th percentile) |
| | | | Endusulfan | ≤ 0.0013 counts/100ml (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 2500 counts/100ml (95th percentile) |
| **G40A** | Klippeis | Nutrients | Phosphate as P (PO4-P) | ≤ 0.025 milligrams per Litre (mg/L) (50th percentile) |
| | | | Total Inorganic Nitrogen (TIN) | ≤ 0.70 milligrams per Litre (mg/L) (50th percentile) |
| | | Salts | Electrical conductivity (EC) | ≤ 55 milli Siemens/metre (95th percentile) |
| | | System variables | pH range | 5.0 ≤ pH ≤ 7.5 (5th and 95th percentile) |
| | | | Water temperature | 2°C difference from ambient water temperature |
| | | | Dissolved Oxygen | ≥ 6 milligrams per litre (mg/L) (5th percentile) |
| | | Toxins | Iron | ≤ 0.1 milligrams per litre (mg/L) (95th percentile) |
| | | | Manganese | ≤ 0.18 milligrams per litre (mg/L) (95th percentile) |
| | | Pathogens | *Escherichia coli* | ≤ 1065 counts/100ml (95th percentile) |

## 5. ESTUARINE COMPONENT

**Table 5.1:** The ecological water requirements of Estuaries.

| Quat | Estuaries | Estuary Type | PES | REC | Natural MAR (MCM) | Present MAR (MCM) |
|---|---|---|---|---|---|---|
| **G10M** | Berg River Estuary | Permanently Open | D | C | 963.76 | 520.38 |
| **G10M** | Langebaan Estuary | Estuarine Bay | B | A | 4.94 | N/A |
| **G21F** | Rietvlei/Diep Estuary | Temporarily Open | D | D | 60.804 | 57.957 |
| **G22K** | Zandvlei Estuary | Temporarily Open | D | C | 31.68 | 29.59 |
| **G22D** | Zeekoe Estuary | Permanently Open | E | D | 18.36 | 17.14 |
| **G22A** | Wildvoelvlei Estuary | Temporarily Open | D | C | 6.299 | 9.269 |
| **G22H** | Eerste Estuary | Temporarily Open | E | D | 114.81 | 101.4 |
| **G22J** | Lourens Estuary | Temporarily Open | D | D | 70.027 | 59.221 |

## 6. ECOLOGICAL SPECIFICATIONS FOR ESTUARIES

Thresholds of potential concern (TPC) are defined as measurable end points related to specific abiotic or biotic indicators that if reached (or when modelling predicts that such points will be reached) prompts management action. In essence, TPCs should provide early warning signals of potential non-compliance to ecological specification (i.e. not the point of 'no return'). This implies that the indicators (or monitoring activities) selected as part of long-term monitoring programme need to include biotic and abiotic components that are particularly sensitive to changes in river inflow. The TPCs associated with each of the ecological specifications are also provided in **Tables 6.1 – 6.8**.

**Table 6.1:** Ecological Specifications and TPC for the Berg Estuary.

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Birds | • Retain at least 90% of the baseline species richness, abundance and diversity of the bird community. | • The number of non-passerine waterbird species recorded in counts decreases by more than 15% across five or more annual surveys<br>• The overall numbers of any of the defined groups decreases relative to the baseline average by more than 15% over a five-year period, after correcting for regional/global population changes.<br>• The numbers of any species decreases relative to the baseline average by more than 15% over a five-year period, after correcting for regional/global population changes. |

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Fish | • Retain the full complement of estuarine resident (7 species) and estuary associated marine (5 species) present in the estuary with population sizes sufficient to ensure their persistence in perpetuity.<br>• Ensure that exotic freshwater species do not increase to levels where they can exclude any more indigenous species through predation or competitive interactions | • Comprehensive survey of fish in the estuary (40 + sites sampled across full estuary with fine mesh seine net) during summer fails to confirm presence of viable populations of all 15 species.<br>• Abundance of exotic freshwater species increases by more than 50% above present levels |
| | • Maintain recruitment of adult and juvenile fish at present levels. This requires maintaining sufficient flow for freshwater plume (temperature, salinity, and olfactory gradient) entering the sea. This implies that there should be a significant number of 0 -1-year-old fish and no missing year classes. | • There are a missing year class within a species |
| Invertebrates | • Retain present species richness, distribution of species and mix (low species abundance, high dominance) in Zones A to the middle reaches of Zone C. One or two species will always be present at high densities compared to others (e.g. *Pseudodiaptomus hessei, Grandidierella* sp.) in these Zones (A to C). | • Species richness increases or decreases by more than 25% in any of the invertebrate categories (zooplankton, Subtidal zoobenthos or Intertidal benthos) in Zones A to C compared to present. |
| Invertebrates | • Indicator species such as Capitella capitata, should not dominate benthic species at any site. | • Capitella capitata exceeds 50% abundance of benthic species at any site |
| | • *Callianassa kraussi* and *Upogebia africana* distribution patterns remain similar to present state. | • Areas of distribution extend upstream or downstream by more than 4-5 km. |
| | • Maintain the present distribution (2003-2005) and abundance of the different plant community types and estuarine habitats (intertidal mudflats with *Zostera capensis* 206 ha, intertidal salt marsh 499 ha, open pan 1159 ha, halophytic floodplain 1521 ha, xeric floodplain 919.1 ha, reeds and sedges 586.6 ha and sedge pan 292.5 ha). | • Greater than 10% change in the area covered by different plant community types |
| Macrophytes | • Prevent an increase in mats of macroalgae in the lower intertidal reaches. | • Percentage cover should not exceed 100% in more than 50% of the quadrats. |
| | • Reduce the area covered by water hyacinth (*Eicchornia crassipes*) in the upper reaches by 50% compared to the present state (2003-2005). | • Upper reaches of the estuary with greater than 50% of estuary water channel covered by water hyacinth. |
| | • Prevent an increase in size of the open pan dry areas (1159 ha in 2003-2005) | • Greater than 10 % increase in area. |
| | • Prevent a decrease in size of the sedge pan areas (293 ha in 2003-2005). *Juncus maritimus,* and waterblommetjies *Aponogeton distachyos* are present. | • Greater than 10 % decrease in area. *Juncus maritimus,* and waterblommetjies *Aponogeton distachyos* are absent. |

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Macrophytes | • Control the spread of invasive aliens in the riparian zone (e.g. *Acacia mearnsii* and *Eucalyptus camaldulensis*) | • Greater than 10 % increase in area covered by invasive plants. |
| | • Maintain intact reed and sedge stands along the banks of the estuary by ensuring that salinity is not greater than 20 ppt for 3 months at 20 km from the month during summer. | • Dieback of reeds and sedges at 20 km and further upstream from the mouth. |
| | • Prevent an increase in bare ground in the halophytic and xeric floodplain habitats by maintaining the present-day flooding patterns | • Greater than 20% increase in bare ground in halophytic and xeric floodplain habitats |
| | • Maintain a low phytoplankton biomass with a small REI (i.e. 10 ppt to river +1 ppt) zone | • Phytoplankton biomass exceeds 15 µg/l chlorophyll a in summer and 10 ug/l chlorophyll a in winter<br>• Blue-green algae exceeds 10% of phytoplankton cell counts |
| Microalgae | • Maintain microalgal group diversity as measured under present state (2004) | • Flagellates cease to be the dominant group and diatoms become less diverse (<10 taxa per site) |
| Microalgae | • Maintain intertidal and subtidal microphytobenthic biomass as measured under present state (2004). | • Benthic microphytobenthic biomass exceed 40 mg/m2 chlorophyll a |
| | • Maintain a low frequency of dinoflagellates | • The frequency of dinoflagellates exceeds 5% of the total phytoplankton counts |
| Water quality | Salinity intrusion should not to cause exceedence of TPCs for fish, invertebrates, macrophytes and microalgae (see above) | • Salinity greater than 20 ppt for longer than 3 months at 20 km upstream from the mouth (brackish saltmarsh, reeds and sedges and invertebrates) – continuously monitored as 25 ppt measured at 11 km Kliphoek (G1H024)<br>• Salinity of groundwater increases to 45 ppt and depth to water table to 1 m. (Xeric flood plain salt marsh).<br>• Total dissolved solids (measure of 'salinity') of river inflow exceeds 3500 mg/l (phytoplankton) in river.<br>• Salinity in estuary exceeds 35 ppt (prevent hyper- salinity) (phytoplankton)<br>• Salinity greater than 0 ppt occurs above 40 km upstream of the mouth (fish) |
| | • System variables (pH, dissolved oxygen and transparency) not to exceed TPCs for biota (see above) | • River inflow:<br>7 < pH > 8.5<br>DO <4 mg/l<br>• Estuary:<br>Secchi disc depth in Zones A and B <1.0 m during low flow (< 1$m^3s^{-1}$)<br>7 < pH > 8.5<br>DO <4 mg/l |
| | • Inorganic nutrient concentrations not to cause in exceedance of TPCs for macrophytes and microalgae (see above) | • River inflow (< 1 $m^3s^{-1}$ – summer):<br>DIN >80 µg/l; DRP > 20 µg/l<br>• River inflow (>5 $m^3$**s**$^{-1}$ – winter):<br>DIN >800 µg/l; DRP >60 µg/l<br>• Estuary (lowflows < 1 $m^3$**s**$^{-1}$, summer):<br>DIN >300 µg/l; DRP >100 µg/l in Zones A and B<br>DIN >80 µg/l ; DRP >30 µg/l in Zones C and D<br>• Estuary (high flows > 5 $m^3s^{-1}$, winter):<br>DIN >800 µg/l; DRP >60 µg/l in Zones A-D |

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| | • Presence of toxic substances not to cause exceedence of TPCs for biota (see biotic components above) | • Trace metals: Concentrations in estuary exceed target values as per *SA Water Quality Guidelines for coastal marine waters* (DWAF 1995). TPCs for trace metals in sediments still need to be established.<br>• Pesticides/herbicides: Baseline studies to be undertaken before TPCs can be set. |
| Hydrodynamics | • Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality | • River inflow distribution patterns differ by more than 10% from that of Scenario 1 (i.e. Present day without BRD)<br>• River inflow decreases to below 0.5 m3s-1 at any time.<br>• River inflow below 1 m3s-1 persist for longer than 4 months.<br>• Changes in tidal amplitude at 2 km, 11 km, ~40 km and 51 km of more than 10% from present state (2004) |
| Sediment dynamics and morphology | • Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota (see above) | • Long-term river inflow distribution patterns (flood components) differ by more than 10% (in terms of magnitude, timing and variability) from that of the present state (2004)<br>• Suspended sediment concentration from river inflow deviates by more than 10% of the sediment load discharge relationship to be determined as part of baseline studies (present state 2004), i.e. from that of Present day without Berg. |
| | • Changes in sediment grain size distribution patterns not to cause exceedance of TPCs in benthic invertebrates (see above). | • The median bed sediment diameter over/under exceeds by more than 10% the range (envelope) to be determined as part of baseline studies (present state).<br>• Sand/mud distribution in all reaches change by more than 10% from present state range (envelope) (2004)<br>• Changes in the channel bathymetry (location of channel banks (say ML contours) and deepest bottom line) in all reaches change by more than 10% from present state (2004) envelope. |

**Table 6.2:** Ecological Specifications and TPC for the Langebaan Estuary.

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Microalgae | • Maintain low phytoplankton biomass (chlorophyll- a < 20 µg/ℓ) and a diversity of phytoplankton groups. | • Consistent high phytoplankton biomass (chlorophyll- a > 20 µg/ℓ ) due to nutrient input and change in dominance of phytoplankton groups. |
| Macrophytes | • Maintain the distribution and area cover of macrophyte habitats particularly the salt marsh and seagrass. Maintain the large groundwater fed rush habitat. | • Greater than 10 % change in the area covered by different macrophyte habitats due to disturbance, increase in nutrients and turbidity. However, seagrass *Zostera capensis* can be naturally variable. Die-back of groundwater dependent rushes and reeds. |
| Invertebrates | • In terms of Invertebrates Langebaan lagoon is currently in an A category. The invertebrate communities are in good health with species richness, abundances and composition scoring highly. | • Loss of any of the three identified estuarine species (*Afrochiltonia capensis*, *Exosphaeroma hylecoetes, Tomichia ventricosa*; Day 1959) dependant on fresh or brackish water. Species richness or abundance changes by more than 10%. |

| | | |
|---|---|---|
| Birds | • The estuary should contain an avifaunal community that includes representatives of all original groups. Significant numbers of waders should be present - a healthy population of migratory waders, and a healthy breeding population of resident waders. The estuary should support tens of thousands of birds in summer and thousands in winter. | |
| Fish | • The fish community should include healthy populations of exploited fish species, specifically the harders, white stumpnose, blacktail, elf and smoothhound shark juveniles should all be present in beach seine net sampling surveys (at least 10 hauls in 3 different sites) of the nearshore areas. Adults of these species should remain the main components in the catches of line and net fisheries in the lagoon, and catch rates should remain stable or increase. | • Exploited fish species become rare (mullet average of <100/haul, white stumpnose <20 per haul, other species present in some hauls) or disappear from seine net survey catches. |

**Table 6.3:** Ecological Specifications and TPC for the Diep Estuary.

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Hydrology | • Freshwater input from the catchment has been reduced to an estimated 61% of Reference mostly as a result of water use for irrigation. Flows from the Salt River, which historically used to share a common mouth with the Diep, have been diverted to a separate mouth. Flows are significantly augmented by wastewater from the Potsdam WWTW and serve to keep the mouthy permanently open at present. No further reduction in freshwater input from the catchment from present day levels should be considered. No further increases in waste water should be considered unless the quality of this water is greatly improved (to DWS Special Standards or better). | • Any further reduction in freshwater input from the catchment from present day levels. Any further increases in wastewater or reduction in quality of waste water discharged to the system. |
| Microalgae | • Maintain low phytoplankton biomass (chlorophyll-a <20 µg/ℓ) and a diversity of phytoplankton groups.<br>• Control harmful algal blooms e.g. *Microcystis* in Flamingovlei by reducing nutrient inputs. | Consistent high phytoplankton biomass (chlorophyll- a >20 µg/ℓ) throughout the estuary and vlei system. |
| Invertebrates | • Category D. The estuary should have a viable population of *Callichirus kraussi* in Milnerton lagoon (30/$m^2$). At least 5 other estuarine species should be present in Milnerton lagoon and in the channel to Rietvlei. At least three marine dependant invertebrate species present near the mouth. | • Sparse population of *Callichirus kraussi* in Milnerton lagoon (<10/$m^2$). Number estuarine species drops below 5 in Milnerton lagoon and Channel region. Less than 3 marine dependant invertebrate species present near the mouth. |
| Macrophytes | • Maintain diversity of habitats particularly remaining salt marsh areas through salinity and water level fluctuations.<br>• Control growth of aquatic invasive plants by improving water quality (nutrient inputs from stormwater canals as well as WWTW input).<br>• Control spread of terrestrial invasive alien plants in riparian and floodplain habitats. No further encroachment of development and loss of estuary habitat. | • Greater than 10% change in the area covered by different macrophyte habitats. Salt tolerant species such as *Sarcocornia* and *Limonium* present.<br>• Terrestrial and aquatic invasive plants cover more than 10% of the total estuary area. Increase in bare, disturbed areas. |

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Fish | • Fish assemblage should include at least 5 estuarine breeding species (Category I) and 5 estuary dependent or associated marine species (Category II) Estuarine residents, estuary dependent marine species and marine vagrants (Category III) should all be present in the fish community and the relative abundance of estuary residents and estuary associated marine species may fluctuate but should not fall below 10% for either category. | • Proportion of either estuary residents or estuary dependent marine species drops below 10 % numerically. Decrease in average diversity of indigenous fish species to < 10 species. |

**Table 6.4:** Ecological Specifications and TPC for the Zandvlei Estuary.

| Component | Ecological Specification | Threshold of Potential Concern |
|---|---|---|
| Invertebrates | • A or BAS = D, current category. The estuary should maintain its population of *Callichirus kraussi* in the lower reaches and main basin in its current condition. In addition the number of invertebrate species associated with soft sediment should not decrease below 10 species. At least three marine invertebrate species present near the mouth. | • Loss of *Callichirus kraussi* populations from lower reaches and main basin.<br>• Less than 8 estuarine invertebrate species found utilizing the soft sediment in the main basin. Less than 2 marine dependant species present at the mouth. |
| Fish | • Fish assemblage should include at least 5 estuarine breeding species (Category I) and 10 estuary dependent or associated marine species (Category II) Estuarine residents, estuary dependent marine species and marine vagrants (Category III) should all be present in the fish community and the relative abundance of estuary residents and estuary associated marine species may fluctuate but should not fall below 10% for either category. | • Proportion of either estuary residents or estuary dependent marine species drops below 10 % numerically. Decrease in average diversity of indigenous fish species to < 15.<br>• Increase in proportion of alien freshwater species in the estuary (the alien sharptooth catfish are currently increasing in abundance). |
| Birds | • The estuary should contain an avifaunal community that includes representatives of all original groups. A healthy population of migratory waders, a healthy breeding population of resident waders, a healthy and diverse population of wading birds and waterfowl should be present. The estuary should support thousands of birds in summer and in winter. | • Numbers of bird species drop below 20 for three consecutive months. |
| Microalgae | • Reduce phytoplankton blooms and occurrence of toxic cyanobacteria through water quality management. Maintain a diversity of phytoplankton groups. | • Phytoplankton biomass / water column chlorophyll-greater than 100 µg/ℓ for 50% of the year.<br>• Microcystin concentration greater than 1 µg/ℓ for 50% of the year |
| Macrophytes | • There should be no further loss of riparian vegetation due to development.<br>• Prevent the spread of reeds, rushes and sedges into the main channel<br>• Control growth of aquatic invasive plants by improving water quality.<br>• Prevent the spread of terrestrial invasive plants in the riparian and floodplain habitat. | • Unvegetated, cleared areas along the banks.<br>• Emergent macrophytes expand into the open water surface area due to shallowing and nutrient enrichment.<br>• Aquatic invasive plants cover > 10% of open water surface area and terrestrial invasive plants cover > 20%. |

**Table 6.5:** Ecological Specifications and TPC for the Zeekoe Estuary.

| Component | Ecological specification | Threshold of potential concern |
|---|---|---|
| Invertebrates | • A or BAS = E, current category. The estuary should have a population of *Callichirus kraussi* at least the mouth, or if this species is missing another estuarine species must be present in the lower reaches. At least one marine dependant species must be present at the mouth. | • Absence of *Callichirus kraussi*, or less than 2 estuarine species. No marine species present at the mouth. |
| Fish | • Reduce waste water flows to restore a fish assemblage in the estuary channel (Zeekoevlei weir to mouth) that includes at least 3 estuarine breeding species (Category I) and 3 estuary dependent or associated marine species (Category II). Estuarine residents, estuary dependent marine species and marine vagrants (Category III) should all be present in the estuary channel. The relative abundance of estuary residents and estuary associated marine species in the estuary channel may fluctuate but should not fall below 5% numerically for either category. Remove chemical barriers (wastewater, cut-off drain) and remove/bypass physical barriers to fish migration into Zeekoevlei allowing at least one successful recruitment event of at least one species of mullet every 3-5 years. | • Estuary residents and estuary dependent marine species absent from the lower estuary. Average diversity of indigenous fish species in the estuary channel drops below 5 and below 3 in Zeekoevlei (currently only 1 in both). |
| Birds | • The estuary should contain an avifaunal community that includes representatives of all original groups. A healthy population of migratory waders, waterfowl and a healthy breeding population of resident waders should be present. The estuary and vleis should support close to a thousand birds in summer and hundreds in winter. | • Numbers of bird species drop below 25 for three consecutive months. |

**Table 6.6:** Ecological Specifications and TPC for the Wildevoelvlei Estuary

| Component | Ecological specification | Threshold of potential concern |
|---|---|---|
| Microalgae | • Improvement from current hypereutrophic state where toxic cyanobacteria are common and flow to the sea. | • Phytoplankton biomass / water column chlorophyll-a greater than 100 µg/ℓ for 50% of the year in the vleis.<br>• Microcystin concentration greater than 1 µg/ℓ for 50% of the year in the vleis. |
| Macrophytes | • Maintain diversity of macrophyte habitats and species richness.<br>• Maintain the fringing vegetation around the vleis as this is important for bank stabilisation and nutrient uptake.<br>• Improve connectivity between the sea, channel and lower vlei.<br>• Control the spread of invasive floating aquatic macrophyte species present in the vleis e.g. water fern. | • Loss of salt tolerant macrophyte species in the lower reaches (e.g. succulents, grasses such as Sarcocornia and Sporobolus).<br>• Greater than 10 % change in the area covered by riparian vegetation in the lower and upper vlei.<br>• Overgrown vegetated channel, no visible water in the channel between the lower estuary reaches and lower vlei.<br>• Invasive aquatic plants cover greater than 10% of the total water surface area. |

| Component | Ecological specification | Threshold of potential concern |
|---|---|---|
| Invertebrates | • Move from a D category to a C category. The estuary should have a viable population of Callichirus kraussi in the backwater lagoon (10/$m^2$). In addition, the invertebrate community should include 2 other estuarine species in the canal. At least three marine invertebrate species present near the mouth. | • Loss of Callichirus kraussi populations from the mouth region (currently populations are of low density). Number of estuarine species drop to less than 2 in the canal (estimated current situation). Less than three marine dependant species present in the backwater lagoon. |
| Fish | • Maintain fish assemblage that includes at least two species of mullet, Liza richardsonii and either/both Mugil cephalus and Pseudomyxus capensis. Substantial seasonal fluctuations in abundance of these mullet species are expected to occur, but mullet should remain more abundant than the alien freshwater species currently inhabiting the vleis. | • Mullet species absent from vleis. Fish community dominated by alien freshwater species, or no fish present in the system. |

**Table 6.7:** Ecological Specifications and TPC for the Eerste Estuary.

| Component | Ecological specification | Threshold of potential concern |
|---|---|---|
| Microalgae | • Maintain low phytoplankton biomass (chlorophyll- a < 20 µg/ℓ) and a diversity of phytoplankton groups. | • Frequent observable blooms and scums in the estuary. Consistent high phytoplankton biomass (chlorophyll- a > 20 µg/ℓ ) as a result of high nutrient inputs from the catchment and WWTW and increase in water retention. |
| Macrophytes | • Prevent the spread of reeds, rushes and sedges into the main channel<br>• Maintain the integrity of the riparian zone<br>• Prevent the spread of invasive plants in the riparian and floodplain habitat. | • Greater than 20 % increase in the area covered by these macrophytes.<br>• Development has disturbed greater than 50% of the riparian zone.<br>• Invasive plants (e.g *Acacia cyclops* and *Myoporum tenuifolium*) cover more than 20% of the riparian and floodplain habitat. |
| Invertebrates | • Move from an E category to a D category. The estuary should have a viable population of *Callichirus kraussi* at the mouth/lower reaches (minimum of 10/$m^2$). In addition the invertebrate community should include 3 other estuarine species. There should be 1 marine invertebrate species present near the mouth. | • *Callichirus kraussi* populations disappear from the mouth region (current situation). Number of estuarine species drop to less than 3 (estimated current situation). Less than one marine dependant species present. |
| Fish | • Reduce waste water flows to restore a fish assemblage that includes at least 3 estuarine breeding species (Category I) and 4 estuary dependent or associated marine species (Category II) Estuarine residents, estuary dependent marine species and marine vagrants (Category III) should all be present in the fish community and the relative abundance of estuary residents and estuary associated marine species may fluctuate but should not fall below 10% for either category. | • Proportion of either estuary residents or estuary dependent marine species drops below 10 % numerically. Decrease in average diversity of indigenous fish species to < 7 (currently only 1).<br>• Increase in proportion of alien freshwater species in the estuary (the alien sharptooth catfish are currently increasing in abundance). |
| Birds | • The estuary should contain a rich avifaunal community that includes representatives of all original groups, significant numbers of terns, a healthy population of waterfowl and migratory waders, and a healthy breeding population of resident waders. The estuary should support thousands of birds in summer and hundreds in winter. | • Numbers of terns recorded in midsummer are fewer than 500.<br>• Numbers of bird species drop below 20 for three consecutive months. |

**Table 6.8:** Ecological Specifications and TPC for the Lourens Estuary.

| Component | Ecological specification | Threshold of potential concern |
|---|---|---|
| Microalgae | • Maintain low phytoplankton biomass (chlorophyll- a < 20 µg/ℓ) and a diversity of phytoplankton groups. | • Observable blooms and scums in the estuary. Consistent high phytoplankton biomass (chlorophyll- a > 20 µg/ℓ) as a result of high nutrient inputs and increase in water retention. |
| Macrophytes | • Prevent the spread of reeds, rushes and sedges into the main channel.<br>• Improve the integrity of the riparian zone and control the spread of invasive plants. | • Greater than 20 % increase in the area covered by reeds, rushes and sedges caused by reduced flow, sedimentation and nutrient input.<br>• Invasive plants (e.g Acacia cyclops and Myoporum tenuifolium) cover more than 20% of the riparian and floodplain habitat. |
| Invertebrates | • Move from a D category to a C category? The estuary should have a viable population of Callichirus kraussi at the mouth/lower reaches (20/m2–). In addition the invertebrate community should include 4 other estuarine species. At least three marine invertebrate species present near the mouth. | • Loss of Callichirus kraussi populations from the mouth region (current situation). Number of estuarine species drop to less than 3 (estimated current situation). Less than two marine dependant species present at the mouth. |
| Fish | • Maintain fish assemblage that includes at least 2 estuarine breeding species (Category I) and 4 estuary dependent or associated marine species (Category II) Estuarine residents, estuary dependent marine species and marine vagrants (Category III) should all be present in the community and the relative abundance of estuary residents and estuary associated marine species may fluctuate but should not fall below 10% for either category. | • Proportion of either estuary residents or estuary dependent marine species drops below 10 % numerically. Decrease in average diversity of indigenous fish species to < 6. Increase in proportion of alien freshwater species in the estuary (currently absent in samples). |
| Birds | • The estuary should contain an avifaunal community that includes representatives of all original groups. Significant numbers of terns should be present, a healthy population of migratory waders, and a healthy breeding population of resident waders. The estuary should support thousands of birds in summer and hundreds in winter. | • Numbers of terns recorded in midsummer are fewer than 1000.<br>• Numbers of bird species drop below 12 for three consecutive months. |

## 7. WETLAND COMPONENT

**Table 7.1:** Summary of the PES and REC of the identified wetlands.

| Node | Quat | Description | Associated wetlands | HGM | PES | REC |
|---|---|---|---|---|---|---|
| Bvii10 | G10D | D/s of confluence Kromme, at gauging weir G1H015 | | Floodplain | C | C |
| Bvii15 | G10D | Gauge | Klein-Sand River vlei* | Floodplain | C | C |
| Bvii5 | G10D | At gauging weir G1H036 and u/s of EWR 3 - C/D | | Floodplain | C | C |
| **Bvii11** | **G10F** | **U/s of Voëlvlei canal** | | **Floodplain** | **C** | **C** |
| Biii4 | G10E | At gauging weir G1H008 | | Channelled Valley Bottom | C | C |
| | | | | Flat | C | C |
| Biv1 | G10J | U/s of confluence Klein-Berg, d/s Voëlvlei canal | Berg River | Floodplain | C | C |
| | | | | Seep | C | C |
| Bvii17 | G10J | Gauge | Berg River | Floodplain | C | C |
| | | | | Flat | C | C |
| Bvii6 | G10J | D/s of EWR 4, above Misverstand Dam G1H013 - D | Berg River | Floodplain | C | C |
| **Bvii8** | **G10J** | **U/s Misverstand reservoir, d/s confluence with Matjies** | **Berg River** | **Floodplain** | **C** | **C** |
| Bvii12 | G10K | 3.5 km d/s of Misverstand reservoir, at EWR 5 - D | | Floodplain | C | C |
| Bii1 | G10L | U/s of confluence with Berg | | Floodplain | C | C |
| | | | | Flat | C | C |
| | | | | Channelled Valley Bottom | A/B | A/B |
| | | | | Unchannelled Valley Bottom | A/B | A/B |
| Biv2 | G10L | U/s of confluence with Sout, head of estuary | | Floodplain | C | C |
| | | | | Floodplain (within G10K) | A/B | A/B |
| | | | | Flat (within G10K) | A/B | A/B |
| | | | | Channelled Valley Bottom (within G10K) | C | C |
| | | | | Hillslope seep | C | C |
| Bviii3 | G21A | Inflow to Yzerfontein salt pan | | Unchannelled Valley Bottom | A/B | A/B |
| Bviii4 | G21D | U/s of confluence with Diep | | Unchannelled Valley Bottom | C | C |
| **Bxi7** | **G21F** | **Rietvlei/Diep Estuary** | **Rietvlei#** | **Floodplain** | **C** | **C** |
| Biv9 | G22H | U/s confluence Eerste | Cape Corps* | Floodplain | - | - |
| | | | Khayelitsha pool* | Floodplain | C/D | C/D |
| | | | Nooiensfontein# | Floodplain | E | D |
| Bviii3 | G21A | Inflow to Yzerfontein salt pan | Yzerontein Salt Pan | Depression | A/B | A/B |
| Bvii5 | | | Blouvlei# | Depression | B | B |
| Bvii7 | G22D | At EWR site | Princessvlei* | Depression | C | C |
| **Bxi20** | **G22D** | **Zeekoe Estuary** | **Zeekoevlei*** | **Depression** | **E** | **D** |
| | | | **Rondevlei*** | **Depression** | **B** | **B** |
| **Bxi14** | **G22A** | **Wildvoelvlei estuary** | **Noordhoek Salt Pan*** | **Depression** | - | **-** |
| | | | **Pick n Pay Reedbeds#** | **Depression** | **B** | **B** |
| **Bxi4** | **G22J** | **Lourens Estuary** | **Paardevlei*** | **Seep** | **-** | - |

Source: EGI, Malan and CCT.
EGI = Electrical Grid Infrastructure Data. * Western Cape Wetlands Directory.