DEPARTMENT OF WATER AND SANITATION

NO. 189 **02 MARCH 2018**

NATIONAL WATER ACT, 1998
(ACT NO.36 OF 1998)

RESERVE DETERMINATION OF WATER RESOURCES FOR THE OLIFANTS-DOORN CATCHMENTS

I, Sifiso Mkhize, in my capacity as the Acting Director-General of the Department of Water and Sanitation, having complied with section 13 of the National Water Act, (Act No. 36 of 1998) ("the Act") and Regulation 3 of the Regulations for the establishment of Water Resource Classification System (No. R. 810 Government Gazette No. 33541, 17 September 2010), and duly authorised in terms of sections 16(1) and 63(1)(a) of the Act, after having complied with section 16(2) and (3) of the Act, hereby publish the Reserve Determination of water resources for the Olifants-Doorn catchments.

Director: Reserve Determination
Attention: Mr Yakeen Atwaru
Department of Water and Sanitation
Ndinaye Building 5084
178 Francis Baard Street
Private Bag X313
Pretoria
0001

Email: atwaruy@dws.gov.za

MR. SIFISO MKHIZE
DIRECTOR-GENERAL (ACTING)
DATE: 13/12/2017

RESERVE DETERMINATION OF WATER RESOURCES FOR THE CATCHMENTS OF THE OLIFANTS-DOORN IN TERMS OF SECTION 16(1) AND (2) OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

SCHEDULE

1. DESCRIPTION OF WATER RESOURCE

1.1 The Reserve is determined for all or part of every significant water resource within the catchments of the Olifants-Doorn as set out below:

Water Management Area:	Berg-Olifants
Catchment:	Olifants-Doorn
Drainage Regions:	E Primary Drainage Region
Rivers:	Olifants-Doorn River System
Estuary:	Olifants
Catchments excluded:	Entire Berg catchment and parts of Olifants catchment (i.e. G30 catchment and F60 catchment)

1.2 The Minister has in terms of section 16 of the National Water Act, 1998 (Act No.36 of 1998) ("the Act"), prescribed a system for classifying water resources by issuing Government Notice No. R. 810, published in Government *Gazette* No. 33541 dated 17 September 2010. In terms of section 16(1) of the Act, the Minister must, as soon as reasonably practicable after the class of all or part of a water resource has been determined, by Notice in the *Gazette*, determine the Reserve for all or part of that water resource.

1.3 The Minister, in terms of section 16(1) and (2) of the Act, declares, the following Reserve for the catchments of the Olifants-Doorn.

2. RESERVE DERMINATION AS REQUIRED IN TERMS OF SECTION 16(1) AND (2) ACT

2.1 A selected list of Acronyms and definitions in Item 3.

2.2 A summary of the quantity component for the Rivers which include the EWR and the BHN in terms of section 16(1) of the Act for the Olifants-Doorn catchments is set out in Table 4.1.

2.3 A summary of the quality component for the Rivers at EWR sites in terms of section 16(1) of the Act for the Olifants-Doorn catchments is set out in Table 5.1 - 5.6.

2.4 A summary of the EWR based on the natural flow contribution of the catchments upstream Olifants River Estuary in terms of section 16(1) of the Act for the Olifants-Doorn catchments is set out in Table 6.1 - 6.3.

2.5 A summary of the groundwater contribution to the Reserve for Water Quantity & Quality in terms of section 16(1) of the Act for the Olifants-Doorn is set out in Table 7.1 - 8.3.

2.6 The Reserve will apply from the date signed off as determined in terms of Section 16(1) of the Act, unless otherwise specified by the Minister.

3. ACRONYMS AND DEFINITIONS

3.1 Acronyms

BHN	Basic Human Needs
EcoSpecs	Ecological Specifications
EIS	Estuarine Importance Score
EWR	Ecological Water Requirement
GRA II	Groundwater Resource Assessment Phase II
GRDM	Groundwater Reserve Determination Methodology
GRUs	Groundwater Resource Units
MAR	Mean Annual Runoff
MCM	Million Cubic Metres
MAR	Mean Annual Runoff
PES	Present Ecological Status
REC	Recommended Ecological Category
TEC	Target Ecological Category
TPCs	Thresholds of Potential Concern

3.2 Definitions

Baseflow is a sustained low flow in rivers during dry or fair weather conditions, but not necessarily all contributed by groundwater; includes contribution from delayed interflow and groundwater discharge.

EWR refers to the flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition.

Recharge is the addition of water to the zone of saturation, either by downward percolation of precipitation or surface water and/ or the lateral migration of groundwater from adjacent aquifers.

Reserve is the quantity and quality of the water required to satisfy the basic human needs by securing a basic water supply and to protect the aquatic ecosystem in order to secure ecologically sustainable development and use of the relevant water resource.

4. SURFACE-WATER - QUANTITY COMPONENT FOR RIVERS

The results for the Reserve determination and ecological categorisation for the Olifants/Doring River System, where the Reserve amounts are expressed as a percentage of the MAR for the respective catchments (cumulative) in terms of section 16(1) of the Act.

Table 4.1: Summary of the quantity component for the Rivers which include the EWR & BHN.

Quaternary catchment	Water Resource	PES	EIS	REC	Ecological reserve (Cumulative) (% MAR)	Basic human needs Reserve (% MAR)	MAR (MCM)	Total Reserve (%MAR)
E10A	Olifants	C	High	C	43.58	0.00	60.475	43.58
E10B	Olifants	C	High	C	44.26	0.01	129.003	44.27
E10C	Olifants	B	Very high	B	51.09	0.00	182.405	51.09
E10D	Olifants	C	Moderate	D	52.38	0.00	233.767	52.38
E10E	Olifants	C	Moderate	D	37.77	0.4	293.467	38.17
E10F (EWR 1)	Olifants	D	Moderate	D	37.77	0.03	355.557	37.8
E10G	Olifants	C	Moderate	D	26.59	0.03	437.273	26.62
E10G (EWR 3)	Rondegat	B	Moderate	B	42.75	0.03	7.411	42.78
E10H	Jan Dissels	D	Moderate	C	19.70	0.00	44.686	19.70
E10J& E10J (Q7)	Olifants	D	Moderate	D	14.90*	0.154	46.205*	15.054
E10K (EWR 2)**	Olifants	E	Moderate	E	9.32	0.00	505.716	9.32
E21A	Kruis	E	Low	C	41.98	0.07	39.425	42.05
E21B	Welgemoed	D	Low	D	23.56	0.161	1.230	23.72
E21C	Winkelhaak	D	Low	C	19.48	0.00	41.939	19.48
E21D	Houdenbeks	D	Low	D	27.72	0.092	50.217	27.81
E21E	Riet	B	Low	B	29.13	0.008	93.772	29.14
E21F	Riet	A/B	Low	B	21.72	0.00	95.862	21.72
E21G	Groot/ Leeu	D	Low	D	38.55	0.04	55.220	38.59
E21H	Twee	A/B	Low	B	70.21*	0.00	55.055*	70.21
E21H	Leeu	A/B	Low	B	64.3	0.00	138.715	64.3
E21J (EWR 6)	Groot	B	Low	B	50.65	0.00	140.463	50.65
E21K	Maatjies	B	Low	B	62.86	0.00	1.819	68.86
E21L	Groot	B	Low	B	50.02	0.00	239.220	50.02
E22A	Doring	A/B	Low	B	47.5	0.012	4.138	47.512
E22B	Doring	B	Low	B	43.1	0.002	7.66	43.10
E22C	Tankwa	C	Low	A/B	47.47	0.984	2.704	48.45
E22D	Tankwa	A/B	Low	A/B	31.93	0.027	5.44	31.957
E22E	Doring	B	Low	B	43.11	0.0004	18.688	43.11
E22F	Doring	B	Low	B	43.11	0.00	20.894	43.11
E22G	Doring	B	Very high	B	50.42	0.00	266.606	50.42
E23A	Tankwa	A/B	Low	A/B	32.42	0.00	8.001	32.42
E23B	Tankwa	A/B	Low	A/B	32.42	0.00	15.403	32.42
E23C	Tankwa	A/B	Low	A/B	32.42	0.00	3.339	32.42
E23D	Tankwa	A/B	Low	A/B	32.42	0.00	26.617	32.24
E23E	Tankwa	A/B	Low	A/B	32.42	0.00	5.922	32.24

Quaternary catchment	Water Resource	PES	EIS	REC	Ecological reserve (Cumulative) (% MAR)	Basic human needs Reserve (% MAR)	MAR (MCM)	Total Reserve (%MAR)
E23F	Tankwa	C	Low	B	26.38	0.00	37.503	26.38
E23G	Ongeluks	A/B	Low	A/B	32.42	0.018	7.844	32.44
E23H	Ongeluks	A/B	Low	A/B	32.42	0.00	69.30	32.42
E23J	Ongeluks	A/B	Low	A/B	32.42	0.00	61.673	32.42
E23K	Tankwa	B	Low	B	26.38	0.00	105.182	26.38
E24A	Tra-tra	B	Low	B	73.6	0.316	4.523	73.92
E24B	Tra-tra	B	Low	B	63.19	0.0324	12.803	63.22
E24C	Bos	B	Low	C	32.55	0.00	13.855	32.55
E24D	Bos	C	Low	C	17.71	0.00	31.475	17.71
E24E	Wolf	A/B	Low	A/B	32.54	0.00	11.855	32.54
E24F	Wolf	A/B	Low	A/B	32.54	0.00	22.140	32.54
E24G	Wolf	A/B	Low	A/B	32.54	0.00	33.327	32.54
E24H (EWR 4)	Doring	A/B	High	B	44.99	0.0098	420.425	44.99
E24J	Doring	B	High	B	48.47	0.00	439.475	48.47
E24K(EWR 5)	Doring	A/B	High	B	48.47	0.00	450.996	48.47
E24L	Brandewyn (Doringmain stem)	B	High	B	50.29	0.00	508.227	50.29
E24M	Doring	B	High	B	50.33	0.00	517.577	50.33
E31A-Q2	Sa raip se Laagte	B	Moderate	B	26.12	0.00	3.091	26.12
E31B	Kromme	B	Moderate	B	25.66	0.00	0.978	25.66
E31C	Kromme	B	Moderate	B	25.66	0.00	2.012	25.66
E31D	Kromme	B	Moderate	B	25.66	0.00	2.556	25.66
E31E	Kromme	B	Moderate	B	25.66	0.00	2.880	25.66
E31F	Hantams	B	Moderate	B	25.62	7.654	0.324	33.27
E31G	Kromme	B	Moderate	B	25.65	0.00	0.814	25.65
E31H	Hantams	B	Moderate	B	25.65	0.00	4.506	25.65
E32A	Kromme	B	Moderate	B	17.30	0.00	0.681	17.30
E32B	Hantams	B	Moderate	B	26.23	0.00	7.018	26.23
E32C	Hantams	B	Moderate	B	26.23	0.00	9.320	26.23
E32D	Hantams	B	Moderate	B	26.22	0.00	11.544	26.22
E32E	Hantams	B	Moderate	B	26.22	0.00	15.148	26.22
E33A	Sout	B	Moderate	C	26.03	0.017	20.579	26.05
E33B	Sout	C	Moderate	C	17.40	0.00	21.273	17.40
E33C	Vars	D	Moderate	C	17.04	0.327	1.009	17.37
E33D	Geelbek	C	Moderate	C	17.09	0.00	1.590	17.09
E33E	Sout	C	Moderate	C	17.39	0.023	25.197	17.413
E33F-Q1	Troe-troe	D	Moderate	D	11.22	1.366	4.530	12.586
E33G	Olifants	D	Moderate	D	12.14	0.032	1028.771	12.172
E33H	Olifants	D	Moderate	D	12.97	0.0102	1054.724	12.98

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Quaternary catchment	Water Resource	PES	EIS	REC	Ecological reserve (Cumulative) (% MAR)	Basic human needs Reserve (% MAR)	MAR (MCM)	Total Reserve (%MAR)
E40A	Oorlogskloof	C	Moderate	C	41.51	0.00	16.631	41.51
E40B	Oorlogskloof	C	Moderate	C	41.53	0.387	29.125	41.92
E40C	Oorlogskloof	C	High	C	51.84	0.042	38.491	51.882
E40D	Koebee	C	High	B	56.69	0.00	48.104	56.69

Where: MAR is the Mean Annual Runoff
MCM is million cubic metres
*incremental ecological requirement
**In terms of the RDM guidelines the Ecostatus Category should not be less than D (DWAF 1999)

5. SURFACE-WATER - QUALITY COMPONENT FOR RIVERS

Summary of the Quality component at EWR sites

Table 5.1. Ecospecs and TPCs for RU4-Olifants, as represented by **EWR Site 1** (RU 4: CITRUSDAL TO CLANWILLIAM DAM)

DESCRIPTORS USED FOR ECOSPECS	TPCs
Water Quality	
Salts	
$MgSO_4$ (mg/l)	>37
Na_2SO_4 (mg/l)	>51
$MgCl_2$ (mg/l)	>51
$CaCl_2$	>105
NaCl (mg/l)	>389
Water temperature	Not specified.
pH	<6.5 – >9.0
EC (mS/m)	>15
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	>0.007
Nutrients	
Nitrates as N (mg/l)	>0.100
Phosphorous as PO_4-P(mg/l)	>0.020
Aquatic Invertebrates	
SASS5 Score	<100
ASPT	<7.5
Ephemeroptera: Baetidae	Fewer than 4 species present overall at site
Ephemeroptera: Leptophlebiidae	Absent from > 50% of samples
Ephemeroptera: Heptageniidae	Absent from SIC/SOC biotope in summer
Coleoptera and Trichoptera	Fewer than 3 families present
Odonata	Fewer than 1 family present in any sample
Plecoptera: Notonemouridae	Absent from > 50% of samples in SIC
Aquatic vegetation and SIC	Absent

Table 5.2. Ecospecs and TPCs for RU6-Olifants, as represented by **EWR Site 2 (**RU 6: BULSHOEK BARRAGE TO THE CONFLUENCE WITH THE DORING RIVER)

DESCRIPTORS USED FOR ECOSPECS	TPCs
Water Quality	
Salts	
$MgSO_4$ (mg/l)	>37
Na_2SO_4 (mg/l)	>51
$MgCl_2$ (mg/l)	>51
$CaCl_2$	>105
NaCl (mg/l)	>389
Water temperature	Not specified
pH	<6.5 – >9.0
EC (mS/m)	>25
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	>0.007
Nutrients	
Nitrates as N (mg/l)	>0.100
Phosphorous as PO_4-P(mg/l)	>0.015
Aquatic Invertebrates	
SASS5 Score	< 30
ASPT	< 4.5
Ephemeroptera: Baetidae	Absent from > 50% of samples
Hemiptera and Odonata	Fewer than two families from each order

Table 5.3. RONDEGAT RIVER - **EWR SITE 3.**

DESCRIPTORS USED FOR ECOSPECS	TPCs
Water Quality	
Salts	
$MgSO_4$ (mg/l)	>23
Na_2SO_4 (mg/l)	>33
$MgCl_2$ (mg/l)	>30
$CaCl_2$	>57
NaCl (mg/l)	>191
Water temperature	Not specified (no identified temperature dependencies for biota in this reach)
pH	<5.2 or >7.0
EC (mS/m)	>10
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	>0.007
Nutrients	
Nitrates as N (mg/l)	>0.020
Phosphorous as PO_4-P (mg/l)	>0.010
Aquatic Invertebrates	
SASS5 Score	< 170
ASPT	< 7.5
Ephemeroptera: Baetidae	Fewer than 7 species present overall at site (all biotopes combined)
Demoreptus capensis	Absent in summer
Trichoptera	Fewer than 5 species present overall at site, representing at least two of the following families: Barbarochthonidae, Leptoceridae, Petrothrincidae, Sericostomatidae
Ephemeroptera: Leptophlebiidae	Present in less than 80% of samples (cumulative for site, taken over time)
Ephemeroptera: Heptageniidae	Fewer than Baetidae in summer samples
Coleoptera	Fewer than 3 families present
Blephariceridae and Notonemouridae	Absent in winter
Aquatic Vegetation (in and out of current); Submerged Vegetation; SIC	Habitats absent

Table 5.4. Ecospecs and TPCs for the RU4-Doring River, as represented by **EWR Site 4**. (RU 4: TANKWA/DORING RIVER CONFLUENCE TO DORINGBOS)

DESCRIPTORS USED FOR ECOSPECS	TPCs
Water Quality	
Salts	
$MgSO_4$ (mg/l)	<23
Na_2SO_4 (mg/l)	<33
$MgCl_2$ (mg/l)	<30
$CaCl_2$	<57
NaCl (mg/l)	<191
Water temperature	Adult fish: maximum daily mean = 40 °C (all year). Spawning: Minimum = 19 °C, ideal = 25-28 °C (November to January).
pH	6.5 – 8.5
EC (mS/m)	<20
DO (mg/l)	> 6.0
Toxics	
Ammonia as NH_3 (mg/l)	<0.007
Nutrients	
Nitrates as N (mg/l)	<0.020
Phosphorous as PO_4-P (mg/l)	<0.020
Aquatic Invertebrates	
SASS5 Score	< 125
ASPT	< 6
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Fewer than two taxa present
Ephemeroptera: Leptophlebiidae	Absent from > 20% of samples
Diptera: Simuliidae	Absent from > 50% of SIC samples
Aquatic Vegetation (out of current); Submerged Vegetation; SIC	Absent

Table 5.5. Ecospecs and TPCs for the RU5-Doring River, as represented by **EWR Site 5**. (RU 5: DORINGBOS TO OLIFANTS/DORING CONFLUENCE)

DESCRIPTORS USED FOR ECOSPECS	TPCs
Water Quality	
Salts	
$MgSO_4$ (mg/l)	> 23
Na_2SO_4 (mg/l)	> 33
$MgCl_2$ (mg/l)	> 30
$CaCl_2$	> 57
NaCl (mg/l)	> 191
Water temperature	Adult fish: maximum daily mean = 40 °C (all year). Spawning: Minimum = 19 °C, ideal = 25-28 °C (November to January).
pH	< 6.5 or > 8.5
EC (mS/m)	> 50
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	> 0.007
Nutrients	
Nitrates as N (mg/l)	> 0.020
Phosphorous as PO_4-P (mg/l)	> 0.020
Aquatic Invertebrates	
SASS5 Score	< 125
ASPT	< 6
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Fewer than two taxa present
Ephemeroptera: Leptophlebiidae	Absent from > 20% of samples (cumulative for site, taken over time)
Diptera: Simuliidae	Absent from > 50% of SIC samples
Aquatic Vegetation (out of current); Submerged Vegetation; SIC	Habitats absent

Table 5.6. Ecospecs and TPCs for the RU2-Groot River, as represented by **EWR Site 6.** (RU 2: GROOT RIVER GORGE)

DESCRIPTORS USED FOR ECOSPECS	TPCs
Water Quality	
Salts	
$MgSO_4$ (mg/l)	> 23
Na_2SO_4 (mg/l)	> 33
$MgCl_2$ (mg/l)	> 30
$CaCl_2$	> 57
NaCl (mg/l)	> 191
Water temperature	Adult fish: maximum daily mean = 40 °C (all year). Spawning: Minimum = 19 °C, ideal = 25-28 °C (November to January).
pH	< 6.5 OR > 8.5
EC (mg/l)	> 20
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	> 0.007
Nutrients	
Nitrates as N (mg/l)	> 0.020
Phosphorous as PO_4-P (mg/l)	> 0.020
Aquatic Invertebrates	
SASS5 Score	< 170
ASPT	< 7.5
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	At least 3 families of cased caddis present overall at site, with at least two of the following families: - Ecnomidae - Leptoceridae - Philopotamidae - Sericostomatidae
Ephemeroptera: Leptophlebiidae	Absent from > 10% of samples
Ephemeroptera: Heptageniidae	Absent from > 20% of samples
Megaloptera: Corydalidae	Absent from > 40% of samples
Coleoptera	< 3 families
Stones-in-current, including fast-flowing, turbulent riffle and run	Absent

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6. Estuary component

Geographical boundaries of the Olifants Estuary

Downstream boundary: Estuary mouth (31° 42.00'S; 18°11.34'E).
Upstream boundary: Extent of tidal influence, i.e. the causeway at Lutzville - about 36 km from the mouth (31°33.80'S; 18°19.78'E).
Lateral boundaries: 5 m contour above Mean Sea Level (MSL) along each bank.

Table 6.1. The ecological water requirements of the Olifants Estuary.

Quaternary catchment	Water Resource	PES	EIS	REC	Ecological reserve (% MAR)	MAR (MCM)	Total Reserve (%MAR)
E33H Estuary	Olifants	C	Very high	B	56	1055	56

QUANTIFICATION OF ESTUARINE ECOLOGICAL RESERVE

RECOMMENDED ECOLOGICAL FLOW REQUIREMENT

The Olifants Estuary has been targeted as a Desired Protected Area (DWAF, 2004). According to the guidelines for assigning a recommended REC the estuary, therefore needs to be in a Category A or the Best Attainable State (BAS). However, with large dam developments already existing in the catchment (e.g. Clanwilliam Dam) it will be difficult to improve the Olifants Estuary to a Category of A. It is therefore recommended that the Olifants Estuary be improved to the minimum REC for a 'Highly Important estuary', namely a **Category B**. **Scenario 2**, i.e. the Present inflow scenario plus the Ecological Water Requirement releases of the River (MAR = 800.3 x 10^6 m^3) is selected as the recommended Ecological Flow Requirement Scenario for the Olifants Estuary. The flow distributions are summarised below:

Table 6.2. Flow distribution for Scenario 2.

Percentiles	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
99%ile	48.13	32.08	21.50	37.21	24.46	7.77	96.73	194.20	550.92	472.06	230.02	153.70
90%ile	28.90	9.60	7.24	3.64	3.76	3.85	9.62	80.90	151.71	159.08	126.25	65.58
80%ile	16.05	4.30	2.06	1.75	1.68	2.21	4.85	22.01	93.83	104.19	79.44	48.08
70%ile	12.84	2.93	1.68	1.55	1.38	1.81	3.07	11.18	57.99	78.10	66.22	34.22
60%ile	11.49	2.93	1.51	1.51	1.37	1.46	2.88	8.24	42.45	58.26	50.45	25.66
50%ile	10.11	2.93	1.50	1.51	1.34	1.42	2.84	6.19	37.99	51.82	47.54	22.18
40%ile	9.01	2.49	1.50	1.51	1.34	1.42	2.49	3.57	36.22	39.92	44.77	16.34
30%ile	8.32	1.51	1.50	1.51	1.34	1.42	1.76	3.42	24.20	30.79	33.23	14.73
20%ile	6.36	1.43	1.18	1.51	0.91	1.11	1.41	2.05	15.78	21.17	28.07	11.21
10%ile	4.02	0.83	0.58	0.99	0.85	1.00	1.28	1.15	7.44	9.49	17.41	9.66
1%ile	1.01	0.15	0.00	0.99	0.34	0.00	0.04	0.29	0.82	2.07	5.35	4.04

ECOLOGICAL SPECIFICATIONS

Ecological Specifications are clear and measurable specifications of ecological attributes (in the case of estuaries - hydrodynamics, sediment dynamics, water quality and different biotic components) that define a specific ecological reserve category, in the case of the Olifants Estuary for a **Category B.** 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.

Table 6.3. The ecological specifications and associated TPCs

COMPONENT	ECOLOGICAL SPECIFICATION/	THRESHOLD OF POTENTIAL CONCERN
Birds	Retain the species richness, abundance and diversity of the bird community, representative of resident and migrant waders, wading birds and water fowl as under the Present State, except for that there would be an higher abundance of water fowl (increasing by about 10% from Present State numbers)	1.1 Community composition or bird numbers deviates by more than 50% of average seasonal baseline counts for two consecutive summer or winter seasons, focusing on waders, wading birds, terns & water fowl (summer and winter), and specifically red data species which are supported by the system (e.g. Pelican, Oyster catchers, Chestnut banded plover) 1.2 In the case of water fowl densities decline by 20% of average seasonal baseline counts for two consecutive summer or winter seasons
Fish	Retain the following fish assemblages in the estuary: estuarine species (35%), partially estuarine dependent species (50-60%), obligate estuarine dependent (e.g. white steenbras) (>1%) and indigenous freshwater species (>1%). Exotic freshwater species (<0.5%)	2.1 Level of estuarine species drop below 30% of total abundance 2.2 Levels of obligate estuarine dependent species drop below 1% of total abundance 2.3 Levels of partially estuarine dependent species drop below 50% or above 60% of total abundance 2.4 Levels of exotic freshwater species above 0.5% (e.g. Mozambique tilapia out-competing resident species) 2.5 Benthic dwellers species drop below 2% of total abundance in estuary above 18 km from the mouth
	Maintain recruitment of adult and juvenile fish at Reference Condition 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.	2.6 There are a missing year class within a species

COMPONENT	ECOLOGICAL SPECIFICATION/	THRESHOLD OF POTENTIAL CONCERN
Invertebrates	Retain Present State species richness and mix (low species abundance, high dominance). However, under the present state one or two species are always present at high densities compared to others (e.g *Pseudodiaptomus hessei* & *Ceratonereis keiskama*). For a B Category the higher densities need to be more variable in abundance during the year.	3.1 Species richness is greater than 30 for zooplankton and macroinvertebrates respectively (50% increase)
	Indicator species such as Capitella capitata, should not dominate benthic species at any site	3.2 *Capitella capitata* exceeds 50% abundance of benthic species at any site
	Calianassa and Upogebia distribution patterns as under Present State	3.3 Abundance levels or areas of distribution decreases by more than 50% (mainly lower sandy reaches)
Macrophytes	Maintain the present distribution (summer 2004) and abundance of the different plant community types (*Zostera capensis* (48 ha), intertidal salt marsh (92 ha), supratidal salt marsh (143 ha), floodplain salt marsh (797 ha), reeds and sedges (60 ha)	4.1 Greater than 20% change in the area covered by different plant community types
	Reduce the areas covered by water weeds in the upper reaches by 50% compared to the Present State (summer 2004). Therefore area covered by invasive waterweeds (*Azolla filiculoides*), nuisance filamentous algae (e.g. *Enteromorpha*, *Ulva*, *Cladophora*) and pondweed (*Potamogeton pectinatus*) should be 30 ha (half of channel)	4.2 Upper 15 km of estuary with greater than 50% of estuary water channel covered by invasive waterweeds (*Azolla filiculoides*), nuisance filamentous algae (e.g. *Enteromorpha*, *Ulva*, *Cladophora*) and pondweed (*Potamogeton pectinatus*).
	Control the spread of invasive aliens in the riparian zone (e.g. *Sesbania punicea* and *Eucalyptus* spp.).	4.3 Greater than 20 % increase in area covered by invasive plants.
	Maintain reed and sedge areas (60 ha) and brackish salt marsh (~10 ha) as for the Present State (summer 2004) (by preventing salinity of 20 ppt to move further upstream than 8.5 km and remain there for greater than 3 months).	4.4 Dieback of reeds and brackish salt marsh at 8.5 km and further upstream from the mouth.
	Prevent an increase in bareground in the floodplain salt marsh by maintaining groundwater salinity at <70 ppt and depth to the water table at < 1.5 m	4.5 Greater than 20% increase in bare ground in salt marsh.

COMPONENT	ECOLOGICAL SPECIFICATION/	THRESHOLD OF POTENTIAL CONCERN
Microalgae	Maintain a low phytoplankton biomass with a small REI (i.e. 10 ppt to river +1 ppt) zone	5.1 Phytoplankton biomass exceeds 15 µg/l chlorophyll a in summer and 10 ug/l chlorophyll a in winter 5.2 Blue-green algae exceeds 10% of phytoplankton cell counts
	Maintain microalgal group diversity as measured under Present State (2004)	5.3 Flagellates cease to be the dominant group and diatoms become less diverse (<10 taxa per site)
	Maintain intertidal and subtidal microphytobenthic biomass as measured under Present State (2004).	5.4 Benthic microphytobenthic biomass exceeds 40 mg/m^2 chlorophyll a
	Maintain a low frequency of dinoflagellates	5.5 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)	6.1 Salinity greater than 20 ppt for greater than 3 months at 7 km upstream from the mouth (brackish saltmarsh, reeds and sedges & invertebrates) 6.2 Salinity of groundwater increases to 50 ppt and depth to water table to 1 m. (flood plain salt marsh) 6.3 Total dissolved solids (measure of 'salinity') of river inflow exceeds 3500 mg/l (phytoplankton) 6.4 Salinity in estuary exceeds 35 ppt (prevent hyper-salinity) (for phytoplankton) 6.5 Salinity greater than 10 ppt occurs above 16 km upstream of the mouth (for fish)
	System variables (Temperature, pH, turbidity, dissolved oxygen, and suspended solids) not to cause exceedence of TPCs for biota (see above)	6.6 River inflow: Summer temp < 20°C pH < 6.5 'Turbid' river inflow (to be determined) Dissolved oxygen < 4 mg/l
		6.7 Secchi disc reading above 8 km from the mouth is greater than 1 m (used as a proxy for turbidity concentrations in estuary)
		6.8 pH > 8.5 or < 6.5 in river inflow or in estuary
		6.9 Water column DO drops below 4 mg/l (1 m above bottom except in deep holes) (need to investigate DO level at night in dense macrophyte beds)

COMPONENT	ECOLOGICAL SPECIFICATION/	THRESHOLD OF POTENTIAL CONCERN
	Inorganic nutrient concentrations not to cause exceedance of TPCs for macrophytes and microalgae (see above).	6.10 When average river inflow is less than 5 m^3/s and average DIN concentrations exceed 100 µg/l in river inflow and average DIN concentrations in the upper reaches of the estuary (above 16 km from mouth) exceed 100 µg/l.
		6.11 During high flow season (flows > 20 m^3/s) average DIN concentrations exceed 500 µg/l in river inflow and average DIN concentrations in the upper reaches of the estuary (above 16 km from mouth) exceed 500 µg/l
		6.12 Average DRP concentrations exceed 100 µg/l in river inflow and average DRP concentrations in the upper reaches of the estuary (above 16 km from mouth) exceed 100 µg/l.
	Presence of toxic substances not to cause exceedence of TPCs for biota (see above).	6.13 For pesticides/herbicides baseline studies still need to be undertaken before TPCs can be set (special concern in upper reaches with extensive agricultural activities along banks of estuary)
Hydrodynamics	Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality	7.1 River inflow distribution patterns differ by more than 5% from that of Scenario 2 (i.e. recommended flow scenario for the Olifants)
		7.2 River inflow decreases to below 1.5 m^3/s at any time
		7.3 River inflow below 2 m^3/s persists for longer than 4 months
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota (see above)	8.1 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)
		8.2 Suspended sediment concentration from river inflow deviates by more than 10% of the sediment load discharge relationship to be determine as part of baseline studies (Present State 2004)
	Changes in sediment grain size distribution patterns not to cause exceedance of TPCs in benthic invertebrates (see above).	8.3 The median bed sediment diameter deviates by more than a factor of two from levels to be determined as part of baseline studies (Present State).
		8.4 Sand/mud distribution in middle reaches (8-20 km) change by more than 20% from Present State (2004)
		8.5 Changes in the channel bathymetry in the upper reaches (above 20 km upstream of the mouth) change by more than 20% from Present State (2004)
		8.6 Changes in tidal amplitude below the Lutzville causeway of more than 20% from Present State (2004)

7. GROUNDWATER - QUANTITY COMPONENT

Groundwater recharge is an important component of hydrogeological characterisation as it has a major influence on groundwater quantity (especially if aquifer transmissivity and storage is favourable) and groundwater quality. Across the Olifants-Doorn WMA groundwater recharge ranges from 0 mm/a to 245 mm/a. The highest groundwater recharge occurs in the Upper Olifants sub-area, especially in the Winterhoek mountain area. Significant recharge also occurs in the Koue Bokkeveld, eastern Doring, and eastern Sandveld sub-areas. For the remaining areas groundwater recharge is quite limited.

The basic human needs Reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, food preparation and for personal hygiene. A life-line amount of 25 litres per person per day was used. A summary of the groundwater quantity aspects in terms of BHN and EWR per quaternary is provided in **Table 7.1**.

Table 7.1: Groundwater Reserve Determination Results – Quantity Component.

Quat. catchment	Area (km^2)	Recharge (Mm^3/a)[1)]	Population[2)]	EWR (Mm^3/a)	BHN (Mm^3/a)	Total Reserve (Mm^3/a)
E10A	134	30.12	0	5.44	0	5.44
E10B	202	37.17	1523	6.78	0.013	6.79
E10C	192	24.79	0	5.66	0	5.66
E10D	235	24.35	0	5.74	0	5.74
E10E	366	30.67	15 627	7.35	0.143	7.49
E10F	386	28.28	1184	5.13	0.011	5.14
E10G	508	26.88	1799	4.21	0.016	4.23
E10H	162	9.62	0	1.51	0	1.51
E10J	468	19.32	7797	1.63	0.071	1.70
E10K	235	6.67	0	0.36	0.0	0.36
E21A	190	14.14	2818	1.48	0.026	1.51
E21B	223	8.87	217	0.01	0.002	0.01
E21C	233	8.7	0	0.07	0	0.07
E21D	242	18.21	5024	1.88	0.046	1.93
E21E	293	8.44	797	0.09	0.007	0.10
E21F	379	8.76	0	0.15	0	0.15
E21G	266	18.95	2458	2.07	0.022	2.09
E21H	404	31.2	0	16.66	0	16.66
E21J	317	16.07	0	0.32	0	0.32
E21K	330	11.62	0	0.18	0	0.18
E21L	195	2.53	0	0.14	0	0.14
E22A	750	7.53	553	0.39	0.005	0.40
E22B	638	6.33	86	0.43	0.001	0.43
E22C	490	4.43	2919	0.33	0.027	0.36
E22D	496	4.21	16	0.26	0	0.26
E22E	1013	9.85	8	1.78	0	1.78
E22F	400	1.3	0	0.21	0	0.21
E22G	367	1.27	0	0.43	0	0.43
E23A	762	5.81	0	1.05	0	1.05
E23B	705	5.08	0	0.97	0	0.97
E23C	318	2.03	0	0.44	0	0.44
E23D	750	3.29	0	1.03	0	1.03

Quat. catchment	Area (km^2)	Recharge (Mm^3/a)[1)]	Population[2)]	EWR (Mm^3/a)	BHN (Mm^3/a)	Total Reserve (Mm^3/a)
E23E	564	2.99	0	0.6	0	0.60
E23F	473	0.95	0	0.51	0	0.51
E23G	747	2.84	152	0.8	0.001	0.80
E23H	660	2.71	0	0.91	0	0.91
E23J	895	1.87	0	0.96	0	0.96
E23K	572	1.08	0	0.61	0	0.61
E24A	255	6.01	1568	0.47	0.014	0.48
E24B	468	5.09	455	0.86	0.004	0.86
E24C	784	3.68	0	0.75	0	0.75
E24D	997	1.77	0	0.96	0	0.96
E24E	671	2.74	0	1.58	0	1.58
E24F	582	2.23	0	1.07	0	1.07
E24G	633	2.2	0	1.16	0	1.16
E24H	483	0.92	0	0.56	0.004	0.56
E24J	1078	5.13	0	1.24	0	1.24
E24K	652	3.22	0	0.75	0	0.75
E24L	516	9.01	0	1.01	0	1.01
E24M	529	8.41	0	0.71	0	0.71
E31A	2865	1.2	0	0.02	0	0.02
E31B	1476	2.23	0	0.09	0	0.09
E31C	1572	0.89	0	0.09	0	0.09
E31D	839	0.48	0	0.05	0	0.05
E31E	478	0.38	0	0.03	0	0.03
E31F	525	0.92	2716	0.03	0.025	0.05
E31G	1238	0.68	0	0.07	0	0.07
E31H	726	1.09	0	0.04	0	0.04
E32A	1118	4.63	0	0.4	0	0.40
E32B	828	1.52	0	0.3	0	0.30
E32C	638	2.9	0	0.23	0	0.23
E32D	616	1.08	0	0.22	0	0.22
E32E	1001	3.86	0	0.36	0	0.36
E33A	1355	1.84	394	0.08	0.004	0.08
E33B	702	0.8	0	0.06	0.0	0.06
E33C	980	1.37	366	0	0.003	0.00
E33D	1559	2.04	0	0.14	0	0.14
E33E	1282	1.59	632	0.06	0.006	0.07
E33F	725	15.87	7573	0.05	0.069	0.12
E33G	894	7.19	35 929	0	0.328	0.33
E33H	719	3.05	11 768	0.01	0.107	0.12
E40A	941	4.44	0	0.9	0	0.90
E40B	707	3.41	12 350	0.68	0.113	0.79
E40C	530	3.02	1771	0.11	0.016	0.13
E40D	544	3.09	0	1	0	1.00

1) Recharge is extracted from The Classification of Significant Water Resources in the Olifants-Doorn Water Management Area Final Technical Report.

2) Population data estimated from 2011 Census.

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8. GROUNDWATER - QUALITY COMPONENT

The ambient groundwater quality was compared to the Class 1 recommended value (DWAF, 1996). The lowest or more conservative value of the two is selected. In instances where the ambient value is selected, it is increased by 10 per cent. In instances where the ambient quality, of geological origin exceeds the recommended value, the ambient water quality is used. These poor water quality areas will become exclusion zones in determining the Basic Human Needs Reserve Requirement. The groundwater quality must comply with the target water quality ranges as shown in **Table 8.1. Table 8.2** shows a summary of the results for the quality aspects at quaternary level in terms of the BHN. **Table 8.3** illustrates the groundwater quality class and parameters of concern for each quaternary catchment. Parameters of concern in this case refer to those with elevated concentrations when compared to the drinking water quality standards.

Table 8.1: Classification for the assessment of the suitability of borehole water for potable use.

Constituent/Parameter	Target Water Quality Ranges[1]				
	Units	Class 0	Class I	Class II	Class III
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
Flouride as F	mg/l	0 - 1	1 - 1.5	1.5 - 3.5	> 3.5
Faecal coliforms	counts/100ml	0	0 - 1	1 - 10	> 10
pH (pH Units)		6 - 9	5 - 6 & 9 - 9.5	4 - 5&> 9.5 - 10	< 4 or > 10
Total Dissolved Solids	mg/l	0 - 450	450 - 1000	1000 - 2450	> 2450
Electrical Conductivity	mS/m	0 - 70	70 - 150	150 - 300	> 370

1) Ref: South African Water Quality Guidelines, Volume 1: Domestic Water Use, 2nd Ed. 1996. Department of Water Affairs and Forestry. Pretoria, South Africa.

NOTE:

Class 0 This is ideal water quality, suitable for lifetime use, with no adverse health effects on the user. This class is essentially the same as the target water quality range in the 2nd edition of the *South African Water Quality Guidelines for Domestic Use* (DWAF, 1996).

Class I Water in this class is safe for lifetime use, but falls short of the ideal water quality in that there may be instances of adverse health effects, but these are usually mild, and overt health effects are almost sub-clinical and difficult to demonstrate. Water in Class I does not cause health effects under normal circumstances. Aesthetic effects may, however, be apparent.

Class II Water in this class is defined as that where adverse health effects are unusual for limited short-term use. Adverse health effects may become more common particularly with prolonged use over many years, or with lifetime use. This class represents water suitable for short-term or emergency use only, but not necessarily suitable for continuous use over a lifetime.

Class III This water has constituents in a concentration range where serious health effects might be anticipated, particularly in infants or elderly people with short-term use, and even more so with longer term use. The water in this class is not suitable for use as drinking water without adequate treatment to shift the water into a lower and safer class.

Table 8.2: The results of the Groundwater Component – Quality Aspects

Chemical Parameter	Unit	Quaternary Catchments E10A and E10B			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		8	7.57	5.0 – 9.5	8.33
Electrical Conductivity	mS/m	8	20.2	<150	22.22
Calcium as Ca	mg/l	8	13.15	<150	14.47
Magnesium as Mg	mg/l	8	4.7	<100	5.17
Sodium as Na	mg/l	8	10.55	<200	11.61
Total Alkalinity as $CaCO_3$	mg/l	8	33.65	N/A	37
Chloride as Cl	mg/l	8	17.8	<200	19.58
Sulphate as SO_4	mg/l	8	6.55	<400	7.21
Nitrate as NO_x-N	mg/l	8	0.04	<10	0.04
Fluoride as F	Mg/l	8	0.14	<1.0	0.15
Chemical Parameter	**Unit**	**Quaternary Catchment E10C**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		8	5.16	5.0 – 9.5	5.68
Electrical Conductivity	mS/m	8	7.15	<150	7.87
Calcium as Ca	mg/l	8	1.25	<150	1.38
Magnesium as Mg	mg/l	8	1.24	<100	1.36
Sodium as Na	mg/l	8	5.97	<200	6.57
Total Alkalinity as $CaCO_3$	mg/l	8	4	N/A	4.4
Chloride as Cl	mg/l	8	14.5	<200	15.95
Sulphate as SO_4	mg/l	8	3.25	<400	3.58
Nitrate as NO_x-N	mg/l	8	0.7	<10	0.77
Fluoride as F	Mg/l	8	0.05	<1.0	0.05

Chemical Parameter	Unit	Quaternary Catchment E10D			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		100	6.87	5.0 – 9.5	7.56
Electrical Conductivity	mS/m	100	9	<150	9.9
Calcium as Ca	mg/l	97	2.4	<150	2.64
Magnesium as Mg	mg/l	97	1.96	<100	2.16
Sodium as Na	mg/l	95	8.22	<200	9.04
Total Alkalinity as $CaCO_3$	mg/l	97	10.55	N/A	11.61
Chloride as Cl	mg/l	96	16.44	<200	18.08
Sulphate as SO_4	mg/l	97	2	<400	2.2
Nitrate as NO_x-N	mg/l	96	0.24	<10	0.26
Fluoride as F	Mg/l	94	0.11	<1.0	0.12
Chemical Parameter	**Unit**	**Quaternary Catchment E10E**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		153	6.23	5.0 – 9.5	6.85
Electrical Conductivity	mS/m	152	11.32	<150	12.45
Calcium as Ca	mg/l	153	1.41	<150	1.55
Magnesium as Mg	mg/l	153	1.9	<100	2.09
Sodium as Na	mg/l	146	12.35	<200	13.58
Total Alkalinity as $CaCO_3$	mg/l	153	5	N/A	5.5
Chloride as Cl	mg/l	153	23.7	<200	26.07
Sulphate as SO_4	mg/l	153	2	<400	2.2
Nitrate as NO_x-N	mg/l	153	0.34	<10	0.37
Fluoride as F	Mg/l	148	0.05	<1.0	0.05

Chemical Parameter	Unit	Quaternary Catchment E10F			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		92	6.73	5.0 – 9.5	7.4
Electrical Conductivity	mS/m	92	16.01	<150	17.61
Calcium as Ca	mg/l	92	4.76	<150	5.24
Magnesium as Mg	mg/l	92	2.85	<100	3.14
Sodium as Na	mg/l	88	14	<200	15.4
Total Alkalinity as $CaCO_3$	mg/l	92	15.58	N/A	17.14
Chloride as Cl	mg/l	92	27.31	<200	30.04
Sulphate as SO_4	mg/l	92	4.31	<400	4.74
Nitrate as NO_x-N	mg/l	92	0.41	<10	0.45
Fluoride as F	Mg/l	90	0.1	<1.0	0.11
Chemical Parameter	**Unit**	**Quaternary Catchment E10G**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		107	6.27	5.0 – 9.5	6.9
Electrical Conductivity	mS/m	105	16.9	<150	18.59
Calcium as Ca	mg/l	102	1.68	<150	1.85
Magnesium as Mg	mg/l	103	2.87	<100	3.16
Sodium as Na	mg/l	100	16.2	<200	17.82
Total Alkalinity as $CaCO_3$	mg/l	103	4	N/A	4.4
Chloride as Cl	mg/l	104	28.95	<200	31.85
Sulphate as SO_4	mg/l	104	2	<400	2.2
Nitrate as NO_x-N	mg/l	102	0.88	<10	0.97
Fluoride as F	Mg/l	99	0.05	<1.0	0.05

Chemical Parameter	Unit	Quaternary Catchment E10H			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		7	6.56	5.0 – 9.5	7.22
Electrical Conductivity	mS/m	7	19.6	<150	21.56
Calcium as Ca	mg/l	7	2.79	<150	3.07
Magnesium as Mg	mg/l	7	3.73	<100	4.1
Sodium as Na	mg/l	7	11.6	<200	12.76
Total Alkalinity as $CaCO_3$	mg/l	7	4	N/A	4.4
Chloride as Cl	mg/l	7	47.22	<200	51.94
Sulphate as SO_4	mg/l	7	2	<400	2.2
Nitrate as NO_x-N	mg/l	7	0.04	<10	0.04
Fluoride as F	Mg/l	7	0.05	<1.0	0.05
Chemical Parameter	**Unit**	**Quaternary Catchment E10J**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		71	6.4	5.0 – 9.5	7.04
Electrical Conductivity	mS/m	71	50.4	<150	55.44
Calcium as Ca	mg/l	65	6.49	<150	7.14
Magnesium as Mg	mg/l	65	8.85	<100	9.74
Sodium as Na	mg/l	65	63	<200	69.3
Total Alkalinity as $CaCO_3$	mg/l	67	6.2	N/A	6.82
Chloride as Cl	mg/l	66	112.96	<200	124.26
Sulphate as SO_4	mg/l	66	13.95	<400	15.95
Nitrate as NO_x-N	mg/l	68	2.6	<10	2.86
Fluoride as F	Mg/l	64	0.15	<1.0	0.17

Chemical Parameter	Unit	Quaternary Catchment E10K			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		5	6.74	5.0 – 9.5	7.41
Electrical Conductivity	mS/m	5	**175**	<150	**175**
Calcium as Ca	mg/l	5	13.9	<150	15.29
Magnesium as Mg	mg/l	5	55.6	<100	61.16
Sodium as Na	mg/l	5	**207**	<200	**207**
Total Alkalinity as $CaCO_3$	mg/l	5	2	N/A	2.2
Chloride as Cl	mg/l	5	**471**	<200	**471**
Sulphate as SO_4	mg/l	5	30.3	<400	33.33
Nitrate as NO_x-N	mg/l	5	2.4	<10	2.64
Fluoride as F	Mg/l	5	0.14	<1.0	0.15
Chemical Parameter	**Unit**	**Quaternary Catchment E21A**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		50	7.63	5.0 – 9.5	8.39
Electrical Conductivity	mS/m	50	24.1	<150	26.51
Calcium as Ca	mg/l	50	13.3	<150	14.63
Magnesium as Mg	mg/l	50	5.65	<100	6.22
Sodium as Na	mg/l	50	18.2	<200	20.02
Total Alkalinity as $CaCO_3$	mg/l	50	35.6	N/A	39.16
Chloride as Cl	mg/l	50	37.25	<200	41
Sulphate as SO_4	mg/l	50	12.25	<400	13.48
Nitrate as NO_x-N	mg/l	50	0.02	<10	0.02
Fluoride as F	Mg/l	50	0.11	<1.0	0.12

Chemical Parameter	Unit	Quaternary Catchment E21B			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		17	7.5	5.0 – 9.5	8.25
Electrical Conductivity	mS/m	17	89.2	<150	98.12
Calcium as Ca	mg/l	17	65.6	<150	72.16
Magnesium as Mg	mg/l	17	27	<100	29.7
Sodium as Na	mg/l	17	64.6	<200	71.06
Total Alkalinity as $CaCO_3$	mg/l	17	76	N/A	83.6
Chloride as Cl	mg/l	17	150.3	<200	165.33
Sulphate as SO_4	mg/l	17	99.1	<400	109.01
Nitrate as NO_x-N	mg/l	17	0.11	<10	0.12
Fluoride as F	Mg/l	17	0.22	<1.0	0.24
Chemical Parameter	**Unit**	**Quaternary Catchment E21C**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		9	7.45	5.0 – 9.5	8.19
Electrical Conductivity	mS/m	9	13.7	<150	15.07
Calcium as Ca	mg/l	9	4.9	<150	5.39
Magnesium as Mg	mg/l	9	5	<100	5.5
Sodium as Na	mg/l	9	10	<200	11
Total Alkalinity as $CaCO_3$	mg/l	9	15.3	N/A	16.83
Chloride as Cl	mg/l	9	23.3	<200	25.63
Sulphate as SO_4	mg/l	9	6.7	<400	7.37
Nitrate as NO_x-N	mg/l	9	0.02	<10	0.02
Fluoride as F	Mg/l	9	0.1	<1.0	0.11

Chemical Parameter	Unit	Quaternary Catchment E21D			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		38	7.53	5.0 – 9.5	8.28
Electrical Conductivity	mS/m	38	21.85	<150	24.04
Calcium as Ca	mg/l	38	11.75	<150	12.93
Magnesium as Mg	mg/l	38	4.05	<100	4.46
Sodium as Na	mg/l	38	15.28	<200	16.08
Total Alkalinity as $CaCO_3$	mg/l	38	31.75	N/A	34.93
Chloride as Cl	mg/l	38	26.08	<200	28.69
Sulphate as SO_4	mg/l	38	5.8	<400	6.38
Nitrate as NO_x-N	mg/l	38	0.1	<10	0.11
Fluoride as F	Mg/l	38	0.05	<1.0	0.05
Chemical Parameter	**Unit**	**Quaternary Catchments E21E,E21F,E21L & E22F**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		10	6.93	5.0 – 9.5	7.62
Electrical Conductivity	mS/m	10	12.5	<150	13.75
Calcium as Ca	mg/l	10	2.35	<150	2.59
Magnesium as Mg	mg/l	10	2.8	<100	3.08
Sodium as Na	mg/l	10	10.5	<200	11.55
Total Alkalinity as $CaCO_3$	mg/l	10	7.55	N/A	8.31
Chloride as Cl	mg/l	10	16.95	<200	18.65
Sulphate as SO_4	mg/l	10	6.3	<400	6.93
Nitrate as NO_x-N	mg/l	9	0.07	<10	0.07
Fluoride as F	Mg/l	10	0.15	<1.0	0.16

Chemical Parameter	Unit	Quaternary Catchment E21G			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		44	6.59	5.0 – 9.5	7.25
Electrical Conductivity	mS/m	43	104	<150	114.4
Calcium as Ca	mg/l	44	2.76	<150	3.04
Magnesium as Mg	mg/l	44	2.39	<100	2.63
Sodium as Na	mg/l	42	8.76	<200	9.64
Total Alkalinity as $CaCO_3$	mg/l	44	8.64	N/A	9.5
Chloride as Cl	mg/l	44	14.64	<200	16.11
Sulphate as SO_4	mg/l	44	6.06	<400	6.67
Nitrate as NO_x-N	mg/l	44	0.6	<10	0.66
Fluoride as F	Mg/l	42	0.1	<1.0	0.11
Chemical Parameter	**Unit**	**Quaternary Catchment E21H**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		29	5.82	5.0 – 9.5	6.4
Electrical Conductivity	mS/m	29	3.1	<150	3.41
Calcium as Ca	mg/l	29	0.5	<150	0.55
Magnesium as Mg	mg/l	29	0.75	<100	0.83
Sodium as Na	mg/l	27	2.72	<200	3
Total Alkalinity as $CaCO_3$	mg/l	29	4	N/A	4.4
Chloride as Cl	mg/l	27	5	<200	5.5
Sulphate as SO_4	mg/l	29	2	<400	2.2
Nitrate as NO_x-N	mg/l	29	0.1	<10	0.11
Fluoride as F	Mg/l	27	0.05	<1.0	0.05

Chemical Parameter	Unit	Quaternary Catchment E21J			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		22	7.47	5.0 – 9.5	8.22
Electrical Conductivity	mS/m	22	18.19	<150	20
Calcium as Ca	mg/l	22	8.99	<150	9.9
Magnesium as Mg	mg/l	22	3.6	<100	3.96
Sodium as Na	mg/l	22	16.8	<200	17.93
Total Alkalinity as $CaCO_3$	mg/l	22	26.86	N/A	29.55
Chloride as Cl	mg/l	22	30.59	<200	33.65
Sulphate as SO_4	mg/l	22	9.78	<400	10.76
Nitrate as NO_x-N	mg/l	22	0.25	<10	0.28
Fluoride as F	Mg/l	21	0.12	<1.0	0.13
Chemical Parameter	**Unit**	**Quaternary Catchment E21K**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		10	7.6	5.0 – 9.5	8.36
Electrical Conductivity	mS/m	10	20.15	<150	22.17
Calcium as Ca	mg/l	10	20.22	<150	22.24
Magnesium as Mg	mg/l	10	1.3	<100	1.43
Sodium as Na	mg/l	10	11.91	<200	13.1
Total Alkalinity as $CaCO_3$	mg/l	10	80.86	N/A	88.95
Chloride as Cl	mg/l	10	6.5	<200	7.15
Sulphate as SO_4	mg/l	10	4.7	<400	5.17
Nitrate as NO_x-N	mg/l	10	0.05	<10	0.05
Fluoride as F	Mg/l	10	0.17	<1.0	0.18

Chemical Parameter	Unit	Quaternary Catchment E22A			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		13	8.12	5.0 – 9.5	8.93
Electrical Conductivity	mS/m	13	**171**	**<150**	**171**
Calcium as Ca	mg/l	13	78.4	<150	86.24
Magnesium as Mg	mg/l	13	46.8	<100	51.48
Sodium as Na	mg/l	13	**198.1**	**<200**	**198.1**
Total Alkalinity as $CaCO_3$	mg/l	13	271.4	N/A	271.4
Chloride as Cl	mg/l	13	**345.1**	**<200**	**345.1**
Sulphate as SO_4	mg/l	13	109.5	<400	120.45
Nitrate as NO_x-N	mg/l	13	0.29	<10	0.32
Fluoride as F	Mg/l	13	**0.98**	**<1.0**	**0.98**
Chemical Parameter	**Unit**	**Quaternary Catchment E22B**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		10	7.82	5.0 – 9.5	8.6
Electrical Conductivity	mS/m	10	**278.7**	<150	**278.7**
Calcium as Ca	mg/l	10	127	<150	136.7
Magnesium as Mg	mg/l	10	67.9	<100	74.69
Sodium as Na	mg/l	10	**271.8**	<200	**271.8**
Total Alkalinity as $CaCO_3$	mg/l	10	225.35	N/A	225.35
Chloride as Cl	mg/l	10	**614.55**	<200	**614.55**
Sulphate as SO_4	mg/l	10	197.75	<400	217.53
Nitrate as NO_x-N	mg/l	10	0.6	<10	0.66
Fluoride as F	Mg/l	10	0.9	<1.0	0.9

Chemical Parameter	Unit	Quaternary Catchment E22C			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		13	7.69	5.0 – 9.5	8.46
Electrical Conductivity	mS/m	13	64.9	<150	71.39
Calcium as Ca	mg/l	13	39	<150	42.9
Magnesium as Mg	mg/l	13	15	<100	16.5
Sodium as Na	mg/l	13	50.3	<200	55.33
Total Alkalinity as $CaCO_3$	mg/l	13	93.6	N/A	102.96
Chloride as Cl	mg/l	13	77.2	<200	84.92
Sulphate as SO_4	mg/l	13	42.1	<400	46.31
Nitrate as NO_x-N	mg/l	13	0.08	<10	0.08
Fluoride as F	Mg/l	13	0.2	<1.0	0.22
Chemical Parameter	**Unit**	**Quaternary Catchment E22D**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		6	7.97	5.0 – 9.5	8.77
Electrical Conductivity	mS/m	6	**548**	<150	**548**
Calcium as Ca	mg/l	6	**161.05**	<150	**161.05**
Magnesium as Mg	mg/l	6	**203.55**	<100	**203.55**
Sodium as Na	mg/l	6	**634.9**	<200	**634.9**
Total Alkalinity as $CaCO_3$	mg/l	6	186.3	N/A	186.3
Chloride as Cl	mg/l	6	**1624.45**	<200	**1624.45**
Sulphate as SO_4	mg/l	6	**437.9**	<400	**437.9**
Nitrate as NO_x-N	mg/l	6	1.13	<10	1.24
Fluoride as F	Mg/l	6	**1**	<1.0	**1**

Chemical Parameter	Unit	Quaternary Catchments E22E, E22G & E23A-E23D			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		12	7.92	5.0 – 9.5	8.71
Electrical Conductivity	mS/m	12	129.15	<150	142.07
Calcium as Ca	mg/l	12	61.8	<150	67.98
Magnesium as Mg	mg/l	12	23.65	<100	26.02
Sodium as Na	mg/l	12	**186.53**	<200	**186.53**
Total Alkalinity as $CaCO_3$	mg/l	12	170	N/A	187
Chloride as Cl	mg/l	12	**299.95**	<200	**299.95**
Sulphate as SO_4	mg/l	12	49.1	<400	54.01
Nitrate as NO_x-N	mg/l	12	0.05	<10	0.05
Fluoride as F	Mg/l	12	0.63	<1.0	0.69
Chemical Parameter	**Unit**	**Quaternary Catchment E23E-E23H, E23J**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		3	8.37	5.0 – 9.5	9.21
Electrical Conductivity	mS/m	3	**185.00**	<150	185.00
Calcium as Ca	mg/l	3	25.90	<150	28.49
Magnesium as Mg	mg/l	3	4.80	<100	5.28
Sodium as Na	**mg/l**	**3**	**414.10**	**<200**	**414.10**
Total Alkalinity as $CaCO_3$	mg/l	3	285.60	N/A	314.16
Chloride as Cl	**mg/l**	**3**	**344.70**	**<200**	**344.70**
Sulphate as SO_4	mg/l	3	88.80	<400	97.68
Nitrate as NO_x-N	mg/l	3	0.02	<10	0.02
Fluoride as F	mg/l	3	2.77	<1.0	3.05

Chemical Parameter	Unit	Quaternary Catchment E23K			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		14	8.55	5.0 – 9.5	9.40
Electrical Conductivity	mS/m	14	**177.50**	<150	**177.50**
Calcium as Ca	mg/l	14	9.70	<150	10.67
Magnesium as Mg	mg/l	14	4.75	<100	5.23
Sodium as Na	mg/l	14	**357.00**	<200	357.00
Total Alkalinity as $CaCO_3$	mg/l	14	220.35	N/A	242.39
Chloride as Cl	mg/l	14	**416.75**	<200	**416.75**
Sulphate as SO_4	mg/l	14	28.80	<400	31.68
Nitrate as NO_x-N	mg/l	14	0.11	<10	0.12
Fluoride as F	mg/l	14	1.04	<1.0	1.04
Chemical Parameter	**Unit**	**Quaternary Catchments E24C-E24D**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		7	8.19	5.0 – 9.5	9.01
Electrical Conductivity	mS/m	7	96.00	<150	105.60
Calcium as Ca	mg/l	7	7.00	<150	7.70
Magnesium as Mg	mg/l	7	2.00	<100	2.20
Sodium as Na	mg/l	7	**240.30**	<200	**240.30**
Total Alkalinity as $CaCO_3$	mg/l	7	331.60	N/A	364.76
Chloride as Cl	mg/l	7	129.00	<200	141.90
Sulphate as SO_4	mg/l	7	11.97	<400	13.17
Nitrate as NO_x-N	mg/l	7	0.04	<10	0.04
Fluoride as F	mg/l	7	**2.98**	<1.0	**2.98**

Chemical Parameter	Unit	Quaternary Catchment E24E			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		8	7.99	5.0 – 9.5	8.78
Electrical Conductivity	mS/m	8	**227.65**	<150	**227.65**
Calcium as Ca	mg/l	8	143.25	<150	157.58
Magnesium as Mg	mg/l	8	**106.05**	<100	106.05
Sodium as Na	mg/l	8	**201.55**	<200	201.55
Total Alkalinity as $CaCO_3$	mg/l	8	191.65	N/A	210.82
Chloride as Cl	mg/l	8	**268.40**	<200	**268.40**
Sulphate as SO_4	mg/l	8	**554.50**	<400	**554.50**
Nitrate as NO_x-N	mg/l	8	3.22	<10	3.54
Fluoride as F	mg/l	8	0.85	<1.0	0.94
Chemical Parameter	**Unit**	**Quaternary Catchment E24F**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		3	7.90	5.0 – 9.5	8.69
Electrical Conductivity	**mS/m**	**3**	**275.20**	**<150**	**275.20**
Calcium as Ca	mg/l	3	110.80	<150	121.88
Magnesium as Mg	mg/l	3	94.40	<100	103.84
Sodium as Na	mg/l	3	**361.40**	**<200**	**361.40**
Total Alkalinity as $CaCO_3$	mg/l	3	213.90	N/A	235.29
Chloride as Cl	**mg/l**	**3**	**543.90**	**<200**	**543.90**
Sulphate as SO_4	mg/l	3	378.40	<400	416.24
Nitrate as NO_x-N	mg/l	3	3.28	<10	3.61
Fluoride as F	mg/l	3	0.92	<1.0	1.01

Chemical Parameter	Unit	Quaternary Catchments E24G-E24H			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		6	7.95	5.0 – 9.5	8.75
Electrical Conductivity	**mS/m**	**6**	**320.00**	**<150**	**320.00**
Calcium as Ca	mg/l	6	116.00	<150	127.60
Magnesium as Mg	mg/l	6	84.25	<100	92.68
Sodium as Na	**mg/l**	**6**	**446.00**	**<200**	**446.00**
Total Alkalinity as $CaCO_3$	mg/l	6	213.55	N/A	234.91
Chloride as Cl	**mg/l**	**6**	**795.40**	**<200**	**795.40**
Sulphate as SO_4	mg/l	6	174.10	<400	191.51
Nitrate as NO_x-N	mg/l	6	1.11	<10	1.22
Fluoride as F	mg/l	6	0.82	<1.0	0.90
Chemical Parameter	**Unit**	**Quaternary Catchments E24J**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		56	7.31	5.0 – 9.5	8.04
Electrical Conductivity	mS/m	56	138.50	<150	152.35
Calcium as Ca	mg/l	56	46.30	<150	50.93
Magnesium as Mg	mg/l	56	30.50	<100	33.55
Sodium as Na	mg/l	54	166.55	<200	183.21
Total Alkalinity as $CaCO_3$	mg/l	56	92.05	N/A	101.26
Chloride as Cl	**mg/l**	**56**	**311.85**	**<200**	**311.85**
Sulphate as SO_4	mg/l	56	63.60	<400	69.96
Nitrate as NO_x-N	mg/l	56	0.06	<10	0.06
Fluoride as F	mg/l	54	0.23	<1.0	0.26

Chemical Parameter	Unit	Quaternary Catchment E24K			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		6	7.85	5.0 – 9.5	8.64
Electrical Conductivity	**mS/m**	**6**	**324.50**	**<150**	**356.95**
Calcium as Ca	**mg/l**	**6**	**172.25**	**<150**	**189.48**
Magnesium as Mg	**mg/l**	**6**	**110.75**	**<100**	**121.83**
Sodium as Na	**mg/l**	**6**	**269.35**	**<200**	**296.29**
Total Alkalinity as $CaCO_3$	mg/l	6	188.55	N/A	207.41
Chloride as Cl	**mg/l**	**6**	**801.65**	**<200**	**881.82**
Sulphate as SO_4	mg/l	6	206.95	<400	227.65
Nitrate as NO_x-N	mg/l	6	5.54	<10	6.09
Fluoride as F	mg/l	6	0.52	<1.0	0.57
Chemical Parameter	**Unit**	**Quaternary Catchments E24L**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		40	5.52	5.0 – 9.5	6.07
Electrical Conductivity	mS/m	40	14.55	<150	16.01
Calcium as Ca	mg/l	40	3.35	<150	3.69
Magnesium as Mg	mg/l	40	2.80	<100	3.08
Sodium as Na	mg/l	40	16.00	<200	17.60
Total Alkalinity as $CaCO_3$	mg/l	40	3.00	N/A	3.30
Chloride as Cl	mg/l	40	29.60	<200	32.56
Sulphate as SO_4	mg/l	40	6.45	<400	7.10
Nitrate as NO_x-N	mg/l	40	1.20	<10	1.32
Fluoride as F	mg/l	40	0.11	<1.0	0.12

Chemical Parameter	Unit	Quaternary Catchment E24M			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		25	6.67	5.0 – 9.5	7.34
Electrical Conductivity	mS/m	25	**165.00**	<150	**165.00**
Calcium as Ca	mg/l	22	19.65	<150	21.62
Magnesium as Mg	mg/l	22	44.15	<100	48.57
Sodium as Na	mg/l	22	207.70	<200	207.70
Total Alkalinity as $CaCO_3$	mg/l	25	9.50	N/A	10.45
Chloride as Cl	mg/l	22	**436.60**	<200	**436.60**
Sulphate as SO_4	mg/l	22	50.25	<400	55.28
Nitrate as NO_x-N	mg/l	25	3.61	<10	3.97
Fluoride as F	mg/l	22	0.17	<1.0	0.19
Chemical Parameter	**Unit**	**Quaternary Catchments E31E**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		6	8.16	5.0 – 9.5	8.98
Electrical Conductivity	mS/m	6	**430.50**	<150	**430.50**
Calcium as Ca	mg/l	6	148.12	<150	162.93
Magnesium as Mg	mg/l	6	95.09	<100	104.59
Sodium as Na	mg/l	6	**605.64**	<200	605.64
Total Alkalinity as $CaCO_3$	mg/l	6	301.77	N/A	331.94
Chloride as Cl	mg/l	6	**1124.69**	<200	**1124.69**
Sulphate as SO_4	mg/l	6	329.66	<400	362.62
Nitrate as NO_x-N	mg/l	6	2.55	<10	2.80
Fluoride as F	mg/l	6	1.47	<1.0	1.62

Chemical Parameter	Unit	Quaternary Catchment E31F			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		67	8.05	5.0 – 9.5	8.86
Electrical Conductivity	mS/m	67	**190.00**	<150	**190.00**
Calcium as Ca	mg/l	64	84.20	<150	92.62
Magnesium as Mg	mg/l	64	61.67	<100	67.83
Sodium as Na	mg/l	63	**209.10**	<200	**209.10**
Total Alkalinity as $CaCO_3$	mg/l	64	250.25	N/A	275.28
Chloride as Cl	mg/l	65	**295.30**	<200	**295.30**
Sulphate as SO_4	mg/l	65	221.90	<400	244.09
Nitrate as NO_x-N	mg/l	65	0.15	<10	0.16
Fluoride as F	mg/l	62	**1.29**	<1.0	**1.29**
Chemical Parameter	**Unit**	**Quaternary Catchments E31G**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		12	8.10	5.0 – 9.5	8.91
Electrical Conductivity	mS/m	12	**436.45**	<150	**436.45**
Calcium as Ca	mg/l	11	**163.80**	<150	**163.80**
Magnesium as Mg	mg/l	11	**147.20**	<100	**147.20**
Sodium as Na	mg/l	11	**584.30**	<200	**584.30**
Total Alkalinity as $CaCO_3$	mg/l	12	211.75	N/A	232.93
Chloride as Cl	mg/l	11	**1161.90**	<200	**1161.90**
Sulphate as SO_4	mg/l	11	364.50	<400	364.50
Nitrate as NO_x-N	mg/l	12	4.46	<10	4.91
Fluoride as F	Mg/l	11	**1.92**	<1.0	**1.92**

Chemical Parameter	Unit	Quaternary Catchment E31H			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		8	7.98	5.0 – 9.5	8.77
Electrical Conductivity	mS/m	8	**438.00**	<150	**438.00**
Calcium as Ca	mg/l	8	87.55	<150	96.31
Magnesium as Mg	mg/l	8	**107.10**	<100	**107.10**
Sodium as Na	mg/l	8	**611.10**	<200	**611.10**
Total Alkalinity as $CaCO_3$	mg/l	8	198.55	N/A	218.41
Chloride as Cl	mg/l	8	**1159.35**	<200	**1159.35**
Sulphate as SO_4	mg/l	8	349.00	<400	383.90
Nitrate as NO_x-N	mg/l	8	6.09	<10	6.69
Fluoride as F	Mg/l	8	**2.10**	<1.0	**2.10**
Chemical Parameter	**Unit**	**Quaternary Catchment E32A**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		6	7.88	5.0 – 9.5	8.67
Electrical Conductivity	mS/m	6	77.40	<150	85.14
Calcium as Ca	mg/l	6	50.50	<150	55.55
Magnesium as Mg	mg/l	6	26.20	<100	28.82
Sodium as Na	mg/l	6	83.85	<200	92.24
Total Alkalinity as $CaCO_3$	mg/l	6	204.65	N/A	225.12
Chloride as Cl	mg/l	6	83.15	<200	91.47
Sulphate as SO_4	mg/l	6	44.20	<400	48.62
Nitrate as NO_x-N	mg/l	6	0.22	<10	0.24
Fluoride as F	Mg/l	6	0.74	<1.0	0.81

Chemical Parameter	Unit	Quaternary Catchment E32B			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		14	7.74	5.0 – 9.5	8.51
Electrical Conductivity	mS/m	14	**181.60**	<150	**181.60**
Calcium as Ca	mg/l	14	109.95	<150	120.95
Magnesium as Mg	mg/l	14	74.95	<100	82.45
Sodium as Na	mg/l	14	150.65	<200	165.72
Total Alkalinity as $CaCO_3$	mg/l	14	192.10	N/A	211.31
Chloride as Cl	mg/l	14	**295.15**	<200	**295.15**
Sulphate as SO_4	mg/l	14	278.75	<400	306.63
Nitrate as NO_x-N	mg/l	14	1.76	<10	1.93
Fluoride as F	Mg/l	14	0.84	<1.0	0.92
Chemical Parameter	**Unit**	**Quaternary Catchment E32C**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		15	7.75	5.0 – 9.5	8.53
Electrical Conductivity	mS/m	15	**162.70**	<150	**162.70**
Calcium as Ca	mg/l	15	80.20	<150	88.22
Magnesium as Mg	mg/l	15	60.80	<100	66.88
Sodium as Na	mg/l	15	185.10	<200	185.10
Total Alkalinity as $CaCO_3$	mg/l	15	211.40	N/A	232.54
Chloride as Cl	mg/l	15	**203.00**	<200	**203.00**
Sulphate as SO_4	mg/l	15	303.30	<400	333.63
Nitrate as NO_x-N	mg/l	15	2.32	<10	2.55
Fluoride as F	Mg/l	15	0.96	<1.0	0.96

Chemical Parameter	Unit	Quaternary Catchment E32D			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		25	7.75	5.0 – 9.5	8.53
Electrical Conductivity	mS/m	25	**170.80**	<150	**170.80**
Calcium as Ca	mg/l	25	101.90	<150	112.09
Magnesium as Mg	mg/l	25	57.30	<100	63.03
Sodium as Na	mg/l	25	**201.40**	<200	**201.40**
Total Alkalinity as $CaCO_3$	mg/l	25	192.90	N/A	212.19
Chloride as Cl	mg/l	25	**239.40**	<200	**239.40**
Sulphate as SO_4	mg/l	25	256.30	<400	281.93
Nitrate as NO_x-N	mg/l	25	0.49	<10	0.54
Fluoride as F	Mg/l	25	**1.33**	<1.0	**1.33**
Chemical Parameter	**Unit**	**Quaternary Catchment E32E**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		15	7.80	5.0 – 9.5	8.58
Electrical Conductivity	mS/m	15	**273.00**	<150	**273.00**
Calcium as Ca	mg/l	15	106.30	<150	116.93
Magnesium as Mg	mg/l	15	88.50	<100	97.35
Sodium as Na	mg/l	15	**303.10**	<200	**303.10**
Total Alkalinity as $CaCO_3$	mg/l	15	188.00	N/A	206.80
Chloride as Cl	mg/l	15	**748.30**	<200	**748.30**
Sulphate as SO_4	mg/l	15	137.20	<400	150.92
Nitrate as NO_x-N	mg/l	15	2.23	<10	2.45
Fluoride as F	Mg/l	15	0.82	<1.0	0.90

Chemical Parameter	Unit	Quaternary Catchment E33A			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		10	8.10	5.0 – 9.5	8.90
Electrical Conductivity	mS/m	10	**433.00**	<150	**433.00**
Calcium as Ca	mg/l	10	**155.85**	<150	**155.85**
Magnesium as Mg	mg/l	10	**118.55**	<100	**118.55**
Sodium as Na	mg/l	10	**659.45**	<200	**659.45**
Total Alkalinity as $CaCO_3$	mg/l	10	178.25	N/A	196.08
Chloride as Cl	mg/l	10	**1327.85**	<200	**1327.85**
Sulphate as SO_4	mg/l	10	305.25	<400	335.78
Nitrate as NO_x-N	mg/l	10	5.42	<10	5.96
Fluoride as F	Mg/l	10	**2.14**	<1.0	**2.14**
Chemical Parameter	**Unit**	**Quaternary Catchment E33B**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		6	8.18	5.0 – 9.5	8.99
Electrical Conductivity	mS/m	6	**998.20**	<150	**998.20**
Calcium as Ca	mg/l	6	**232.15**	<150	**232.15**
Magnesium as Mg	mg/l	6	**240.60**	<100	**240.60**
Sodium as Na	mg/l	6	**1780.80**	<200	**1780.80**
Total Alkalinity as $CaCO_3$	mg/l	6	250.95	N/A	276.05
Chloride as Cl	mg/l	6	**3063.90**	<200	**3063.90**
Sulphate as SO_4	mg/l	6	**717.85**	<400	**717.85**
Nitrate as NO_x-N	mg/l	6	4.51	<10	4.96
Fluoride as F	Mg/l	6	**1.77**	<1.0	**1.77**

Chemical Parameter	Unit	Quaternary Catchment E33C			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		11	8.23	5.0 – 9.5	9.05
Electrical Conductivity	mS/m	11	**482.00**	<150	**482.00**
Calcium as Ca	mg/l	11	76.10	<150	83.71
Magnesium as Mg	mg/l	11	**131.70**	<100	**131.70**
Sodium as Na	mg/l	11	**674.60**	<200	**674.60**
Total Alkalinity as $CaCO_3$	mg/l	11	260.80	N/A	286.88
Chloride as Cl	mg/l	11	**1472.40**	<200	**1472.40**
Sulphate as SO_4	mg/l	11	215.50	<400	237.05
Nitrate as NO_x-N	mg/l	11	1.76	<10	1.94
Fluoride as F	Mg/l	11	**1.49**	<1.0	**1.49**
Chemical Parameter	**Unit**	**Quaternary Catchment E33D**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		149	7.79	5.0 – 9.5	8.57
Electrical Conductivity	mS/m	149	**636.10**	<150	**636.10**
Calcium as Ca	mg/l	143	111.54	<150	122.69
Magnesium as Mg	mg/l	143	**121.40**	<100	**121.40**
Sodium as Na	mg/l	143	**1055.72**	<200	**1055.72**
Total Alkalinity as $CaCO_3$	mg/l	144	180.56	N/A	198.62
Chloride as Cl	mg/l	144	**1799.25**	<200	**1799.25**
Sulphate as SO_4	mg/l	144	357.20	<400	392.92
Nitrate as NO_x-N	mg/l	143	0.24	<10	0.26
Fluoride as F	Mg/l	143	**1.84**	<1.0	**1.84**

Chemical Parameter	Unit	Quaternary Catchment E33E			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		32	7.65	5.0 – 9.5	8.41
Electrical Conductivity	mS/m	32	**585.60**	<150	**585.60**
Calcium as Ca	mg/l	32	**142.45**	<150	**142.45**
Magnesium as Mg	mg/l	32	**168.40**	<100	**168.40**
Sodium as Na	mg/l	32	**857.70**	<200	**857.70**
Total Alkalinity as $CaCO_3$	mg/l	32	155.10	N/A	170.61
Chloride as Cl	mg/l	32	**1712.00**	<200	**1712.00**
Sulphate as SO_4	mg/l	32	301.65	<400	331.82
Nitrate as NO_x-N	mg/l	32	1.50	<10	1.64
Fluoride as F	Mg/l	32	**2.18**	<1.0	**2.18**
Chemical Parameter	**Unit**	**Quaternary Catchment E33F**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		672	8.00	5.0 – 9.5	8.80
Electrical Conductivity	mS/m	672	**185.80**	<150	**185.80**
Calcium as Ca	mg/l	667	102.50	<150	112.75
Magnesium as Mg	mg/l	666	45.27	<100	49.80
Sodium as Na	mg/l	627	**183.38**	<200	**183.38**
Total Alkalinity as $CaCO_3$	mg/l	669	165.69	N/A	182.26
Chloride as Cl	mg/l	665	**402.61**	<200	**402.61**
Sulphate as SO_4	mg/l	647	96.46	<400	106.10
Nitrate as NO_x-N	mg/l	671	1.06	<10	1.17
Fluoride as F	Mg/l	626	0.27	<1.0	0.30

Chemical Parameter	Unit	Quaternary Catchment E33G			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		75	8.13	5.0 – 9.5	8.95
Electrical Conductivity	mS/m	75	**160.00**	<150	**160.00**
Calcium as Ca	mg/l	74	87.31	<150	96.04
Magnesium as Mg	mg/l	74	40.51	<100	44.56
Sodium as Na	mg/l	69	170.39	<200	187.43
Total Alkalinity as $CaCO_3$	mg/l	75	226.57	N/A	249.22
Chloride as Cl	mg/l	74	**323.58**	<200	**323.58**
Sulphate as SO_4	mg/l	70	101.70	<400	111.87
Nitrate as NO_x-N	mg/l	75	0.63	<10	0.69
Fluoride as F	Mg/l	68	0.45	<1.0	0.49
Chemical Parameter	**Unit**	**Quaternary Catchment E33H**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		10	7.78	5.0 – 9.5	8.55
Electrical Conductivity	mS/m	10	**372.80**	<150	**372.80**
Calcium as Ca	mg/l	10	51.85	<150	57.04
Magnesium as Mg	mg/l	10	80.00	<100	88.00
Sodium as Na	mg/l	10	**551.25**	<200	**551.25**
Total Alkalinity as $CaCO_3$	mg/l	10	150.50	N/A	165.55
Chloride as Cl	mg/l	10	**1015.30**	<200	**1015.30**
Sulphate as SO_4	mg/l	10	133.65	<400	147.02
Nitrate as NO_x-N	mg/l	10	0.67	<10	0.74
Fluoride as F	Mg/l	10	0.72	<1.0	0.79

Chemical Parameter	Unit	Quaternary Catchment E40A			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		132	7.99	5.0 – 9.5	8.79
Electrical Conductivity	mS/m	132	**183.10**	<150	**183.10**
Calcium as Ca	mg/l	132	91.90	<150	101.09
Magnesium as Mg	mg/l	132	68.60	<100	75.46
Sodium as Na	mg/l	132	**235.60**	<200	**235.60**
Total Alkalinity as $CaCO_3$	mg/l	132	219.90	N/A	241.89
Chloride as Cl	mg/l	132	**333.30**	<200	**333.30**
Sulphate as SO_4	mg/l	132	165.25	<400	181.78
Nitrate as NO_x-N	mg/l	132	0.34	<10	0.38
Fluoride as F	Mg/l	132	**1.10**	<1.0	**1.10**
Chemical Parameter	**Unit**	**Quaternary Catchment E40B**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		123	7.87	5.0 – 9.5	8.66
Electrical Conductivity	mS/m	123	**200.50**	<150	**200.50**
Calcium as Ca	mg/l	120	100.30	<150	110.33
Magnesium as Mg	mg/l	119	58.40	<100	64.24
Sodium as Na	mg/l	119	181.60	<200	199.76
Total Alkalinity as $CaCO_3$	mg/l	120	208.25	N/A	229.08
Chloride as Cl	mg/l	122	**358.00**	<200	**358.00**
Sulphate as SO_4	mg/l	122	141.86	<400	156.04
Nitrate as NO_x-N	mg/l	122	0.70	<10	0.77
Fluoride as F	Mg/l	119	0.64	<1.0	0.70

Chemical Parameter	Unit	Quaternary Catchment E40C			
		No. of Samples	Ambient GW quality or median	BHN Reserve	Groundwater Quality Reserve
pH		6	7.57	5.0 – 9.5	8.32
Electrical Conductivity	mS/m	6	91.05	<150	100.16
Calcium as Ca	mg/l	6	24.35	<150	26.79
Magnesium as Mg	mg/l	6	8.55	<100	9.41
Sodium as Na	mg/l	6	112.20	<200	123.42
Total Alkalinity as $CaCO_3$	mg/l	6	110.60	N/A	121.66
Chloride as Cl	mg/l	6	**193.30**	<200	**193.30**
Sulphate as SO_4	mg/l	6	11.30	<400	12.43
Nitrate as NO_x-N	mg/l	6	0.34	<10	0.38
Fluoride as F	Mg/l	6	0.28	<1.0	0.31
Chemical Parameter	**Unit**	**Quaternary Catchment E40D**			
		No. of Samples	**Ambient GW quality or median**	**BHN Reserve**	**Groundwater Quality Reserve**
pH		8	7.23	5.0 – 9.5	7.95
Electrical Conductivity	mS/m	8	17.60	<150	19.36
Calcium as Ca	mg/l	8	3.35	<150	3.69
Magnesium as Mg	mg/l	8	4.10	<100	4.51
Sodium as Na	mg/l	8	28.45	<200	31.30
Total Alkalinity as $CaCO_3$	mg/l	8	17.85	N/A	19.64
Chloride as Cl	mg/l	8	40.40	<200	44.44
Sulphate as SO_4	mg/l	8	7.75	<400	8.53
Nitrate as NO_x-N	mg/l	8	1.55	<10	1.70
Fluoride as F	Mg/l	8	0.23	<1.0	0.25

Table 8.3: A summary of the groundwater quality class and parameters of concern

Catchment	Area (km²)	Water Quality Class (DWAF, 1996)	Water Quality parameters of concern
E10A	134	0	
E10B	202	0	
E10C	192	I	pH
E10D	235	0	
E10E	366	0	
E10F	386	0	
E10G	508	0	
E10H	162	0	
E10J	468	0	
E10K	235	II	Cl, Na, EC
E21A	190	0	
E21B	223	I	EC
E21C	233	0	
E21D	242	0	
E21E	293	0	
E21F	379	0	
E21G	266	I	EC
E21H	404	I	pH
E21J	317	0	
E21K	330	0	
E21L	195	0	
E22A	750	II	EC, Cl
E22B	638	III	Cl
E22C	490	0	
E22D	496	III	Cl, Na, Mg
E22E	1013	II	Cl
E22F	400	0	
E22G	367	II	Cl
E23A	762	II	Cl
E23B	705	II	Cl
E23C	318	II	Cl
E23D	750	II	Cl
E23E	564	III	Na
E23F	473	III	Na
E23G	747	III	Na
E23H	660	III	Na
E23J	895	III	Na
E23K	572	II	F, Na

Catchment	Area (km²)	Water Quality Class (DWAF, 1996)	Water Quality parameters of concern
E24A	255	III	Cl, Na
E24B	468	III	Cl, Na
E24C	784	II	F, Na
E24D	997	II	F, Na
E24E	671	III	Mg
E24F	582	II	Cl, Na, EC
E24G	633	III	Cl, Na
E24H	483	III	Cl, Na
E24J	1078	II	Cl
E24K	652	III	Cl, Mg
E24L	516	I	pH
E24M	529	II	Cl, Na, EC
E31A	2865	III	Ca, Cl, Na, EC, NO_3, Mg
E31B	1476	III	Cl, Na, EC, SO_4
E31C	1572	III	Cl, Na, EC, Mg
E31D	839	III	Cl, Na, EC, Mg
E31E	478	III	Cl, Na, EC
E31F	525	II	Cl, Na, EC
E31G	1238	III	Cl, Na, EC
E31H	726	III	Cl, Na, EC
E32A	1118	I	EC,F
E32B	828	II	Cl, EC
E32C	638	II	Cl, EC
E32D	616	II	Cl, EC, Na, F
E32E	1001	III	Cl
E33A	1355	III	Cl, EC, Na
E33B	702	III	Cl, EC, Na, Mg, SO_4
E33C	980	III	Cl, EC, Na
E33D	1559	III	Cl, EC
E33E	1282	III	Cl, EC, Na
E33F	725	III	Cl
E33G	894	II	Cl, EC
E33H	719	III	Cl, EC, Na
E40A	941	II	Cl, EC, Na, F
E40B	707	II	Cl, EC
E40C	530	I	Cl, EC, Na
E40D	544	0	

DEPARTEMENT VAN WATER EN SANITASIE

NO. 189 **02 MAART 2018**

NASIONALE WATERWET, 1998
(WET NO. 36 VAN 1998)

BEPALING VAN RESERWE VAN WATERHULPBRONNE VIR DIE OLIFANTS-DOORN-OPVANGGEBIEDE

Ek, Sifiso Mkhize, in my hoedanigheid as die Waarnemende Direkteur-Generaal van die Departement van Water en Sanitasie, publiseer hierby, ná nakoming van artikel 13 en 16(2) en (3) van die Nasionale Waterwet, 1998 (Wet No. 36 van 1998) ("die Wet"), en Regulasie 3 van die "Regulations for the Establishment of the Classification System" (Goewermentskennisgewing No. R. 810 in *Staatskoerant* No. 33541 van 17 September 2010), en behoorlik daartoe gemagtig ingevolge artikel 16(1) van die Wet, die bepaling van die Reserwe van die waterhulpbronne vir die Olifants-Doorn-opvanggebiede.

Direkteur: Bepaling van Reserwe
Aandag: Mnr. Yakeen Atwaru
Departement van Water en Sanitasie
Ndinayegebou, 5084
178 Francis Baardstraat
Privaat Sak X313
Pretoria
0001

E-pos: atwaruy@dws.gov.za

MNR. SIFISO MKHIZE
DIREKTEUR-GENERAAL (WAARNEMEND)
DATUM: 13/12/2017

BEPALING VAN RESERWE VAN WATERHULPBRONNE VIR DIE OLIFANTS-DOORN-OPVANGGEBIEDE INGEVOLGE ARTIKEL 16(1) EN (2) VAN DIE NASIONALE WATERWET, 1998 (WET NO. 36 OF 1998)

BYLAE

1. BESKRYWING VAN WATERHULPBRON

1.1 Die Reserwe vir die geheel of 'n gedeelte van elke betekenisvolle waterhulpbron binne die Olifants-Doorn-opvanggebiede word bepaal soos hieronder uiteengesit:

Waterbestuursgebied:	Berg-Olifants
Opvanggebiede:	Olifants-Doorn
Dreineringstreke:	Primêre dreineringstreek E
Riviere:	Olifants-Doorn-riviersisteem
Riviermonding:	Olifants
Opvanggebiede uitgesluit:	Die geheel van die Berg-opvanggebied en gedeeltes van die Olifants-opvanggebied (d.i. die opvanggebiede G30 en F60)

1.2 Die Minister het ingevolge artikel 16 van die Nasionale Waterwet, 1998 (Wet No. 36 van 1998) ("die Wet"), 'n stelsel bepaal vir die klassifisering van waterhulpbronne deur Goewermentskennisgewing No. R. 810, gepubliseer in *Staatskoerant* No. 33541 gedateer 17 September 2010, uit te reik. Ingevolge artikel 16(1) van die Wet moet die Minister so spoedig redelik doenlik nadat die klas van die geheel of 'n gedeelte van 'n waterhulpbron bepaal is, by kennisgewing in die *Staatskoerant*, die Reserwe vir die geheel of 'n gedeelte van daardie waterhulpbron bepaal.

1.3 Die Minister verklaar, ingevolge artikel 16(1) en (2) van die Wet, die volgende as Reserwe vir die Olifants-Doorn-opvanggebiede.

2. BEPALING VAN RESERWE SOOS VEREIS BY ARTIKEL 16(1) EN (2) VAN DIE WET

2.1 Geselekteerde afkortings en akronieme en die woordomskrywing word in paragraaf 3 gemeld.

2.2 'n Opsomming van die hoeveelheidskomponent vir die riviere wat, ingevolge artikel 16(1) van die Wet, die ekologiese watervereiste (EWV) en die basiese menslike behoeftes (BMB) vir die Olifants-Doorn-opvanggebiede insluit, word in Tabel 4.1 uiteengesit.

2.3 'n Opsomming van die gehaltekomponent vir die riviere by die EWV-terreine vir die Olifants-Doorn-opvanggebiede word, ingevolge artikel 16(1) van die Wet, in Tabel 5.1 tot 5.6 uiteengesit.

2.4 'n Opsomming van die EWV op grond van die natuurlikevloeibydrae stroomop van die Olifantsriviermonding vir die Olifants-Doorn-opvanggebiede word, ingevolge artikel 16(1) van die Wet, in Tabel 6.1 tot 6.3 uiteengesit.

2.5 'n Opsomming van die grondwaterbydrae tot die Reserwe, ten opsigte van die hoeveelheid en die gehalte van die water vir die Olifants-Doorn-opvanggebiede, word, ingevolge artikel 16(1) van die Wet, in Tabel 7.1 tot 8.3 uiteengesit.

2.6 Die Reserwe is van toepassing vanaf die datum gepubliseer in die *Staatskoerant*, ingevolge artikel 16(1) van die Wet, tensy anders deur die Minister bepaal.

3. AFKORTINGS EN WOORDOMSKRYWING

3.1 Afkortings

AEK	Aanbevole Ekologiese Kategorie
BMB	Basiese Menslike Behoeftes
DPB	Drempel van Potensiële Besorgdheid
ERK	Ekologiese Reserwe (Kumulatief)
ETB	Estuariese Telling van Betekenisvolheid
EWV	Ekologiese Watervereiste
GJA	Gemiddelde Jaarlikse Afloop
HE	Hulpbroneenheid
HES	Huidige Ekologiese Status
MKM	Miljoen Kubieke Meter

3.2 Woordomskrywing

Aanvulling is die toevoeging van water tot die versadigingsone deur afwaartse deursyfering van óf neerslag óf oppervlakwater en/of die sywaartse migrasie van grondwater uit aanliggende waterdraers.

EWV behels die vloeipatrone (omvang, tydbepaling en duur) en watergehalte wat nodig is om 'n rivier-en-oewer-ekosisteem in 'n besondere toestand te hou.

Reserwe is die hoeveelheid en gehalte van water wat nodig is om aan die BMB te voldoen deur die versekering van 'n basiese watervoorsiening en die beskerming van die water-ekosisteem ten einde ekologies volhoubare ontwikkeling en die gebruik van die betrokke waterhulpbron te verseker.

4. OPPERVLAKWATER - HOEVEELHEIDSKOMPONENT VIR RIVIERE

Die resultate vir die bepaling van die Reserwe en die ekologiese kategorisering vir die Olifants/Doorn-riviersisteem, waar die Reserwehoeveelhede uitgedruk word as 'n persentasie van die gemiddelde jaarlikse afloop (GJA) vir die onderskeie opvanggebiede (kumulatief), ingevolge artikel 16(1) van die Wet:

Tabel 4.1: Opsomming van die hoeveelheidskomponent vir die riviere, wat die EWV en die BMB insluit

Kwaternêre opvanggebied	Waterhulpbron	Huidige Ekologiese Status (HES)	Estuariese Telling van Betekenisvolheid (ETB)	Aanbevole Ekologiese Kategorie (AEK)	Ekologiese Reserwe (Kumulatief) (% ERK)	BMB-reserwe (% GJA)	GJA (MKM)	Totale Reserwe (% GJA)
E10A	Olifants	C	Hoog	C	43.58	0.00	60.475	43.58
E10B	Olifants	C	Hoog	C	44.26	0.01	129.003	44.27
E10C	Olifants	B	Baie Hoog	B	51.09	0.00	182.405	51.09
E10D	Olifants	C	Gemiddeld	D	52.38	0.00	233.767	52.38
E10E	Olifants	C	Gemiddeld	D	37.77	0.4	293.467	38.17
E10F (EWV 1)	Olifants	D	Gemiddeld	D	37.77	0.03	355.557	37.8
E10G	Olifants	C	Gemiddeld	D	26.59	0.03	437.273	26.62
E10G (EWV 3)	Rondegat	B	Gemiddeld	B	42.75	0.03	7.411	42.78
E10H	Jan Dissels	D	Gemiddeld	C	19.70	0.00	44.686	19.70
E10J & E10J (Q7)	Olifants	D	Gemiddeld	D	14.90*	0.154	46.205*	15.054
E10K (EWV 2)**	Olifants	E	Gemiddeld	E	9.32	0.00	505.716	9.32
E21A	Kruis	E	Laag	C	41.98	0.07	39.425	42.05
E21B	Welgemoed	D	Laag	D	23.56	0.161	1.230	23.72
E21C	Winkelhaak	D	Laag	C	19.48	0.00	41.939	19.48
E21D	Houdenbek	D	Laag	D	27.72	0.092	50.217	27.81
E21E	Riet	B	Laag	B	29.13	0.008	93.772	29.14
E21F	Riet	A/B	Laag	B	21.72	0.00	95.862	21.72
E21G	Groot/Leeu	D	Laag	D	38.55	0.04	55.220	38.59
E21H	Twee	A/B	Laag	B	70.21*	0.00	55.055*	70.21
E21H	Leeu	A/B	Laag	B	64.3	0.00	138.715	64.3
E21J (EWV 6)	Groot	B	Laag	B	50.65	0.00	140.463	50.65
E21K	Matjies	B	Laag	B	62.86	0.00	1.819	68.86
E21L	Groot	B	Laag	B	50.02	0.00	239.220	50.02
E22A	Doring	A/B	Laag	B	47.5	0.012	4.138	47.512
E22B	Doring	B	Laag	B	43.1	0.002	7.66	43.10
E22C	Tankwa	C	Laag	A/B	47.47	0.984	2.704	48.45
E22D	Tankwa	A/B	Laag	A/B	31.93	0.027	5.44	31.957
E22E	Doring	B	Laag	B	43.11	0.0004	18.688	43.11
E22F	Doring	B	Laag	B	43.11	0.00	20.894	43.11
E22G	Doring	B	Baie Hoog	B	50.42	0.00	266.606	50.42
E23A	Tankwa	A/B	Laag	A/B	32.42	0.00	8.001	32.42
E23B	Tankwa	A/B	Laag	A/B	32.42	0.00	15.403	32.42
E23C	Tankwa	A/B	Laag	A/B	32.42	0.00	3.339	32.42
E23D	Tankwa	A/B	Laag	A/B	32.42	0.00	26.617	32.24
E23E	Tankwa	A/B	Laag	A/B	32.42	0.00	5.922	32.24
E23F	Tankwa	C	Laag	B	26.38	0.00	37.503	26.38
E23G	Ongeluks	A/B	Laag	A/B	32.42	0.018	7.844	32.44

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Kwaternêre opvanggebied	Waterhulpbron	Huidige Ekologiese Status (HES)	Estuariese Telling van Betekenisvolheid (ETB)	Aanbevole Ekologiese Kategorie (AEK)	Ekologiese Reserwe (Kumulatief) (% ERK)	BMB-reserwe (% GJA)	GJA (MKM)	Totale Reserwe (% GJA)
E23H	Ongeluks	A/B	Laag	A/B	32.42	0.00	69.30	32.42
E23J	Ongeluks	A/B	Laag	A/B	32.42	0.00	61.673	32.42
E23K	Tankwa	B	Laag	B	26.38	0.00	105.182	26.38
E24A	Tra-Tra	B	Laag	B	73.60	0.316	4.523	73.92
E24B	Tra-Tra	B	Laag	B	63.19	0.0324	12.803	63.22
E24C	Bos	B	Laag	C	32.55	0.00	13.855	32.55
E24D	Bos	C	Laag	C	17.71	0.00	31.475	17.71
E24E	Wolf	A/B	Laag	A/B	32.54	0.00	11.855	32.54
E24F	Wolf	A/B	Laag	A/B	32.54	0.00	22.140	32.54
E24G	Wolf	A/B	Laag	A/B	32.54	0.00	33.327	32.54
E24H (EWV 4)	Doring	A/B	Hoog	B	44.99	0.0098	420.425	44.99
E24J	Doring	B	Hoog	B	48.47	0.00	439.475	48.47
E24K(EWV 5)	Doring	A/B	Hoog	B	48.47	0.00	450.996	48.47
E24L	Brandewyn (sytak van Doring)	B	Hoog	B	50.29	0.00	508.227	50.29
E24M	Doring	B	Hoog	B	50.33	0.00	517.577	50.33
E31A-Q2	Saraip se Laagte	B	Gemiddeld	B	26.12	0.00	3.091	26.12
E31B	Kromme	B	Gemiddeld	B	25.66	0.00	0.978	25.66
E31C	Kromme	B	Gemiddeld	B	25.66	0.00	2.012	25.66
E31D	Kromme	B	Gemiddeld	B	25.66	0.00	2.556	25.66
E31E	Kromme	B	Gemiddeld	B	25.66	0.00	2.880	25.66
E31F	Hantams	B	Gemiddeld	B	25.62	7.654	0.324	33.27
E31G	Kromme	B	Gemiddeld	B	25.65	0.00	0.814	25.65
E31H	Hantams	B	Gemiddeld	B	25.65	0.00	4.506	25.65
E32A	Kromme	B	Gemiddeld	B	17.30	0.00	0.681	17.30
E32B	Hantams	B	Gemiddeld	B	26.23	0.00	7.018	26.23
E32C	Hantams	B	Gemiddeld	B	26.23	0.00	9.320	26.23
E32D	Hantams	B	Gemiddeld	B	26.22	0.00	11.544	26.22
E32E	Hantams	B	Gemiddeld	B	26.22	0.00	15.148	26.22
E33A	Sout	B	Gemiddeld	C	26.03	0.017	20.579	26.05
E33B	Sout	C	Gemiddeld	C	17.40	0.00	21.273	17.40
E33C	Vars	D	Gemiddeld	C	17.04	0.327	1.009	17.37
E33D	Geelbek	C	Gemiddeld	C	17.09	0.00	1.590	17.09
E33E	Sout	C	Gemiddeld	C	17.39	0.023	25.197	17.413
E33F-Q1	Troe-Troe	D	Gemiddeld	D	11.22	1.366	4.530	12.586
E33G	Olifants	D	Gemiddeld	D	12.14	0.032	1028.771	12.172

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Kwaternêre opvanggebied	Waterhulpbron	Huidige Ekologiese Status (HES)	Estuariese Telling van Betekenisvolheid (ETB)	Aanbevole Ekologiese Kategorie (AEK)	Ekologiese Reserwe (Kumulatief) (% ERK)	BMB-reserwe (% GJA)	GJA (MKM)	Totale Reserwe (% GJA)
E33H	Olifants	D	Gemiddeld	D	12.97	0.0102	1054.724	12.98
E40A	Oorlogskloof	C	Gemiddeld	C	41.51	0.00	16.631	41.51
E40B	Oorlogskloof	C	Gemiddeld	C	41.53	0.387	29.125	41.92
E40C	Oorlogskloof	C	Hoog	C	51.84	0.042	38.491	51.882
E40D	Koebee	C	Hoog	B	56.69	0.00	48.104	56.69

Waar: GJA die gemiddelde jaarlikse afloop is, is MKM miljoen kubieke meter.
*Inkrementele ekologiese vereiste
**Ingevolge die riglyne vir hulpbrongerigte metings (HGM-riglyne), moet die EkoStatus-kategorie nie minder wees as D nie (DWAF 1999)

5. OPPERVLAKWATER - GEHALTEKOMPONENT VIR RIVIERE

Opsomming van die gehaltekomponent by EWV-terreine

Tabel 5.1: Ekologiese spesifikasies en drempels van potensiële besorgdheid (DPB's) vir Hulpbroneenheid 4 (HE4): Olifants, soos verteenwoordig op **EWV-terrein 1** (HE 4: Citrusdal tot Clanwilliamdam)

BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	DPB's
Watergehalte	
Soute	
$MgSO_4$ (mg/L)	> 37
Na_2SO_4 (mg/L)	> 51
$MgCl_2$ (mg/L)	> 51
$CaCl_2$	> 105
NaCl (mg/L)	> 389
Watertemperatuur	Nie vermeld nie
pH	< 6.5 – >9.0
EG (mS/m)	> 15
OS (mg/L)	< 6.0
Gifstowwe	
Ammoniak as NH_3 (mg/L)	> 0.007
Voedingstowwe	
Nitrate as N (mg/L)	> 0.100
Fosfor as PO_4-P(mg/L)	> 0.020
Akwatiese invertebrate (ongewerwelde diere)	
SASS5-telling	< 100
ASPT	< 7.5
Ephemeroptera: Baetidae	Minder as 4 spesies aanwesig op hele terrein
Ephemeroptera: Leptophlebiidae	Afwesig in > 50% van monsters
Ephemeroptera: Heptageniidae	Afwesig in klippe-in- en klippe-buite-stroom-biotope in somer
Coleoptera en Trichoptera	Minder as 3 families aanwesig
Odonata	Minder as 1 familie aanwesig in 'n monster
Plecoptera: Notonemouridae	Afwesig in > 50% van monsters van klippe-in-stroom-biotoop
Akwatiese plantegroei en klippe-in-stroom	Afwesig

ASPT = Gemiddelde Waarde per Takson ("Average Score per Taxon")
EG = elektriese geleiding

mS/m = milliSiemens/meter
OS = opgeloste suurstof
SASS5 = "South African Scoring System" – Weergawe 5
SIC = klippe-in-stroom-biotoop
SOC = klippe-buite-stroom-biotoop

Tabel 5.2: Ekologiese spesifikasies en DPB's vir HE6: Olifants, soos verteenwoordig op **EWV-terrein 2** (HE 6: Bulshoekstuwal tot by samevloeiing met die Doringrivier)

BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	**DPB's**
Watergehalte	
Soute	
$MgSO_4$ (mg/L)	> 37
Na_2SO_4 (mg/L)	> 51
$MgCl_2$ (mg/L)	> 51
$CaCl_2$	> 105
NaCl (mg/L)	> 389
Watertemperatuur	Nie vermeld nie
pH	< 6.5 – > 9.0
EG (mS/m)	> 25
OS (mg/L)	< 6.0
Gifstowwe	
Ammoniak as NH_3 (mg/L)	> 0.007
Voedingstowwe	
Nitrate as N (mg/L)	> 0.100
Fosfor as PO_4-P(mg/L)	> 0.015
Akwatiese invertebrate	
SASS5-telling	< 30
ASPT	< 4.5
Ephemeroptera: Baetidae	Afwesig in > 50% van monsters
Hemiptera en Odonata	Minder as twee families van elke orde

Tabel 5.3: Rondegatrivier – **EWV-terrein 3**

BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	**DPB's**
Watergehalte	
Soute	
$MgSO_4$ (mg/L)	> 23
Na_2SO_4 (mg/L)	> 33
$MgCl_2$ (mg/L)	> 30
$CaCl_2$	> 57
NaCl (mg/L)	> 191
Watertemperatuur	Nie vermeld nie (geen geïdentifiseerde temperatuur-afhanklikhede vir biota in hierdie loop)
pH	< 5.2 of > 7.0
EG (mS/m)	> 10
OS (mg/L)	< 6.0
Gifstowwe	
Ammoniak as NH_3 (mg/L)	> 0.007
Voedingstowwe	
Nitrate as N (mg/L)	> 0.020
Fosfor as PO_4-P(mg/L)	> 0.010

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Akwatiese invertebrate	
SASS5-telling	< 170
ASPT	< 7.5
Ephemeroptera: Baetidae	Minder as 7 spesies aanwesig op hele terrein (alle biotope gekombineer)
Demoreptus capensis	Afwesig in somer
Trichoptera	Minder as 5 spesies aanwesig op hele terrein; verteenwoordig minstens twee van die volgende families: Barbarochthonidae, Leptoceridae, Petrothrincidae, Sericostomatidae
Ephemeroptera: Leptophlebiidae	Aanwesig in minder as 80% van monsters (kumulatief vir terrein, geneem oor 'n tydperk)
Ephemeroptera: Heptageniidae	Minder as Baetidae in somermonsters
Coleoptera	Minder as 3 families aanwesig
Blephariceridae en Notonemouridae	Afwesig in winter
Akwatiese plantegroei (in en buite stroom); onderwaterplante; klippe-in-stroom	Habitatte afwesig

Tabel 5.4: Ekologiese spesifikasies en DPB's vir HE4: Doringrivier, soos verteenwoordig op **EWV-terrein 4** (HE4: Tankwa/Doringriviersamevloeiing tot by Doringbos)

BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	**DPB's**
Watergehalte	
Soute	
$MgSO_4$ (mg/L)	< 23
Na_2SO_4 (mg/L)	< 33
$MgCl_2$ (mg/L)	< 30
$CaCl_2$	< 57
NaCl (mg/L)	< 191
Watertemperatuur	Volwasse vis: maksimum daaglikse gemiddelde = 40°C (heeljaar) Broeityd: Minimum = 19°C, ideaal = 25-28°C (November tot Januarie)
pH	6.5 – 8.5
EG (mS/m)	< 20
OS (mg/L)	> 6.0
Gifstowwe	
Ammoniak as NH_3 (mg/L)	< 0.007
Voedingstowwe	
Nitrate as N (mg/L)	< 0.020
Fosfor as PO_4-P(mg/L)	< 0.020
Akwatiese invertebrate	
SASS5-telling	< 125
ASPT	< 6
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Minder as twee taksa aanwesig
Ephemeroptera: Leptophlebiidae	Afwesig in > 20% van monsters
Diptera: Simuliidae	Afwesig in > 50% van klippe-in-stroom-monsters
Akwatiese plantegroei (buite stroom); onderwaterplante; klippe-in-stroom	Afwesig

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Tabel 5.5: Ekologiese spesifikasies en DPB's vir HE5: Doringrivier, soos verteenwoordig op **EWV-terrein 5** (HE5: Doringbos tot die Olifants/Doring-samevloeiing)

BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	**DPB's**
Watergehalte	
Soute	
$MgSO_4$ (mg/L)	> 23
Na_2SO_4 (mg/L)	> 33
$MgCl_2$ (mg/L)	> 30
$CaCl_2$	> 57
NaCl (mg/L)	> 191
Watertemperatuur	Volwasse vis: maksimum daaglikse gemiddelde = 40°C (heeljaar) Broeityd: Minimum = 19°C, ideaal = 25-28°C (November tot Januarie)
pH	< 6.5 of > 8.5
EG (mS/m)	> 50
OS (mg/L)	< 6.0
Gifstowwe	
Ammoniak as NH_3 (mg/L)	> 0.007
Voedingstowwe	
Nitrate as N (mg/L)	> 0.020
Fosfor as PO_4-P(mg/L)	> 0.020
Akwatiese invertebrate	
SASS5-telling	< 125
ASPT	< 6
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Minder as twee taksa aanwesig
Ephemeroptera: Leptophlebiidae	Afwesig in > 20% van monsters (kumulatief vir terrein, oor 'n tydperk geneem)
Diptera: Simuliidae	Afwesig in > 50% van klippe-in-stroom-monsters
Akwatiese plantegroei (buite stroom); onderwaterplante; klippe-in-stroom	Habitatte afwesig

Tabel 5.6: Ekologiese spesifikasies en DPB's vir HE2: Grootrivier, soos verteenwoordig op **EWV-terrein 6** (HE2: Grootrivierkloof)

BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	**DPB's**
Watergehalte	
Soute	
$MgSO_4$ (mg/L)	> 23
Na_2SO_4 (mg/L)	> 33
$MgCl_2$ (mg/L)	> 30
$CaCl_2$	> 57
NaCl (mg/L)	> 191
Watertemperatuur	Volwasse vis: maksimum daaglikse gemiddelde = 40°C (heeljaar) Broeityd: Minimum = 19°C, ideaal = 25-28°C (November tot Januarie)
pH	< 6.5 of > 8.5
EG (mS/m)	> 20
OS (mg/L)	< 6.0
Gifstowwe	
Ammoniak as NH_3 (mg/L)	> 0.007

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BESKRYWERS GEBRUIK VIR EKOLOGIESE SPESIFIKASIES	DPB's
Voedingstowwe	
Nitrate as N (mg/L)	> 0.020
Fosfor as PO_4-P(mg/L)	> 0.020
Akwatiese invertebrate	
SASS5-telling	< 170
ASPT	< 7.5
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Minstens 3 families van kokerjuffers (Caddis) is aanwesig op die hele terrein, met minstens twee van die volgende families: - Ecnomidae - Leptoceridae - Philopotamidae - Sericostomatidae
Ephemeroptera: Leptophlebiidae	Afwesig in > 10% van monsters
Ephemeroptera: Heptageniidae	Afwesig in > 20% van monsters
Megaloptera: Corydalidae	Afwesig in > 40% van monsters
Coleoptera	< 3 families
Klippe-in-stroom: in beide vinnig vloeiende, onstuimige stroomversnellings en strome	Afwesig

6. Estuariese komponent

Geografiese grense van die Olifantsriviermonding:

Grens stroomafwaarts: Riviermonding (31° 42.00'S; 18°11.34'E).
Grens stroomopwaarts: Reikwydte van getyinvloed, d.i. die laagwaterbrug by Lutzville - ongeveer 36 km van die mond (31°33.80'S; 18°19.78'E).
Laterale grense: 5 m kontoer bo gemiddelde seevlak met elke oewer langs.

Tabel 6.1: EWV van die Olifantsriviermonding

Kwaternêre opvang-gebied	Water-hulpbron	Huidige ekologiese status (HES)	Estuariese telling van betekenis-volheid (ETB)	Aanbevole ekologiese kategorie (AEK)	Ekologiese Reserwe (% GJA)	GJA (MKM)	Totale Reserwe (% GJA)
E33H Riviermonding	Olifants	C	Baie Hoog	B	56	1055	56

KWANTIFISERING VAN EKOLOGIESE RESERWE VIR RIVIERMONDING

AANBEVOLE EKOLOGIESE VLOEIVEREISTE

Die Olifantsriviermonding is aangewys as 'n gewenste beskermde gebied (DWAF, 2004). Die riviermonding moet, ooreenkomstig die riglyne vir die aanwysing van 'n AEK, in Kategorie A of die bes bereikbare toestand wees. Weens groot damontwikkelings wat reeds in die opvanggebied bestaan (bv. die Clanwilliamdam), is dit moeilik om die Olifantsriviermonding tot 'n Kategorie A te verbeter. Daar word dus aanbeveel dat die Olifantsriviermonding verbeter word tot die minimum AEK vir 'n "hoogs betekenisvolle riviermonding", naamlik 'n **Kategorie B. Scenario 2**, d.i. die huidige invloeiscenario plus die EWV-uitvloeiings van die rivier (GJA = 800.3 x $10^6 m^3$) word gekies as die aanbevole ekologiese vloeivereiste-scenario vir die Olifantsriviermonding. Die vloeiverspreidings word hieronder opgesom:

Tabel 6.2: Vloeiverspreiding vir Scenario 2

Persentiele	OKT	NOV	DES	JAN	FEB	MRT	APR	MEI	JUN	JUL	AUG	SEP
99%iel	48.13	32.08	21.50	37.21	24.46	7.77	96.73	194.20	550.92	472.06	230.02	153.70
90%iel	28.90	9.60	7.24	3.64	3.76	3.85	9.62	80.90	151.71	159.08	126.25	65.58
80%iel	16.05	4.30	2.06	1.75	1.68	2.21	4.85	22.01	93.83	104.19	79.44	48.08
70%iel	12.84	2.93	1.68	1.55	1.38	1.81	3.07	11.18	57.99	78.10	66.22	34.22
60%iel	11.49	2.93	1.51	1.51	1.37	1.46	2.88	8.24	42.45	58.26	50.45	25.66
50%iel	10.11	2.93	1.50	1.51	1.34	1.42	2.84	6.19	37.99	51.82	47.54	22.18
40%iel	9.01	2.49	1.50	1.51	1.34	1.42	2.49	3.57	36.22	39.92	44.77	16.34
30%iel	8.32	1.51	1.50	1.51	1.34	1.42	1.76	3.42	24.20	30.79	33.23	14.73
20%iel	6.36	1.43	1.18	1.51	0.91	1.11	1.41	2.05	15.78	21.17	28.07	11.21
10%iel	4.02	0.83	0.58	0.99	0.85	1.00	1.28	1.15	7.44	9.49	17.41	9.66
1%iel	1.01	0.15	0.00	0.99	0.34	0.00	0.04	0.29	0.82	2.07	5.35	4.04

EKOLOGIESE SPESIFIKASIES

Ekologiese spesifikasies is duidelike en meetbare spesifikasies van ekologiese attribute (in die geval van riviermondings – hidrodinamika, sedimentdinamika, watergehalte en verskillende biotiese komponente) wat 'n besondere ekologiese Reserwekategorie omskryf – in die geval van die Olifantsriviermonding, 'n **Kategorie B**. Drempels van potensiële besorgdheid (DPB's) word omskryf as meetbare eindpunte wat betrekking het op besondere abiotiese of biotiese aanwysers wat, indien bereik (of wanneer modellering voorspel dat sodanige punte bereik sal word), bestuursoptrede vereis.

Tabel 6.3: Ekologiese spesifikasies en geassosieerde DPB's

KOMPONENT	EKOLOGIESE SPESIFIKASIE	DREMPEL VAN POTENSIËLE BESORGDHEID (DPB)
Voëls	Behou die spesierykheid, volopheid en verskeidenheid van die voëlgemeenskap, verteenwoordigend van stand- en trekvoëls (waad-, moeras- en watervoëls), soos in die huidige situasie, behalwe dat daar meer watervoëls sal wees (10%-toename in huidige getalle).	1.1 Die voëlgemeenskapsamestelling of voëlgetalle wyk af met meer as 50% van die gemiddelde seisoenale basislyntellings vir twee opeenvolgende somer- of winterseisoene, met toespitsing op waad- en moerasvoëls, sterretjies en watervoëls (somer en winter), en in die besonder rooilysspesies wat deur die sisteem ondersteun word (bv. pelikane, swarttobies en die rooibandstrandkiewiet). 1.2 Watervoëldigthede neem af met 20% van die gemiddelde seisoenale basislyntellings vir twee opeenvolgende somer- of winterseisoene.

KOMPONENT	EKOLOGIESE SPESIFIKASIE	DREMPEL VAN POTENSIËLE BESORGDHEID (DPB)
Visse	Behou die volgende vissamestelling in die riviermonding: estuariese spesies (35%); gedeeltelik estuaries-afhanklike spesies (50-60%); obligate estuaries-afhanklike spesies (bv. witsteenbras) (> 1%); inheemse varswaterspesies (> 1%); en uitheemse varswaterspesies (< 0.5%).	2.1 Vlak van estuariese spesies daal tot onder 30% van totale visgemeenskap. 2.2 Vlakke van obligate estuaries-afhanklike spesies daal tot onder 1% of totale visgemeenskap. 2.3 Vlakke van gedeeltelik estuaries-afhanklike spesies daal tot onder 50% of styg tot bo 60% van totale visgemeenskap. 2.4 Vlakke van uitheemse varswaterspesies styg tot bo 0.5% van totale visgemeenskap (bv. die Mosambiekse *Tilapia* verdring standspesies). 2.5 Bentiese standspesies daal tot onder 2% van totale visgemeenskap in die riviermonding 18+ km van die mond.
	Behou aanwas van jong en volwasse visse op die genoemde verwysingsvlakke. Dit vereis die instandhouding van voldoende vloei vir varswaterpluim (temperatuur, soutgehalte en olfaktoriese gradiënt) wat die see binnegaan. Dit beteken 'n beduidende getal visse van 0-1 jaar en geen afwesige jaarklasse.	2.6 'n Jaarklas is afwesig in 'n spesie.
Invertebrate	Behou spesierykheid en spesiesamestelling soos in die huidige situasie (lae spesierykheid; hoë dominansie). In die huidige situasie is een of twee spesies altyd aanwesig in hoë digthede in vergelyking met ander spesies (bv. *Pseudodiaptomus hessei* en *Ceratonereis keiskama*). Vir 'n B-kategorie moet die hoër digthede gedurende die jaar veranderlik wees wat talrykheid betref.	3.1 Spesierykheid is groter as 30% vir onderskeidelik soöplankton en makro-invertebrate ('n 50%-toename).
	Aanwyserspesies soos *Capitella capitata* moet bentiese spesies nie op enige terrein oorheers nie.	3.2 *Capitella capitata* oorskry 50%-bentiese-spesierykheid op enige terrein.
	Calianassa- en *Upogebia-*verspreidingspatrone soos in die huidige situasie.	3.3 Talrykheidsvlakke of verspreidingsgebiede verminder met meer as 50% (hoofsaaklik laer sanderige lope).
Makrofiete	Handhaaf die huidige verspreiding en rykheid van die verskillende tipe plantgemeenskappe (somer van 2004): *Zostera capensis* (48 ha); tussengetysoutvleiland (92 ha); bogetysoutvleiland (143 ha); vloedvlaktesoutvleiland (797 ha); riete en watergras (60 ha).	4.1 'n Verandering groter as 20% in die gebied gedek deur die verskillende tipe plantgemeenskappe.

KOMPONENT	EKOLOGIESE SPESIFIKASIE	DREMPEL VAN POTENSIËLE BESORGDHEID (DPB)
	Verminder die gebiede in die bolope gedek deur akwatiese onkruid met 50% in vergelyking met die huidige situasie (somer van 2004). Die gebied gedek deur indringer- akwatiese onkruid (*Azolla filiculoides*), lastige draderige alge (bv. *Enteromorpha* en *Ulva*, *Cladophora*) en fonteinkruid (*Potamogeton pectinatus*) moet 30 ha (die helfte van die kanaal) of minder beslaan.	4.2 Meer as 50% van die estuariese waterkanaal in die boonste 15 km van die riviermonding bedek deur indringer- akwatiese onkruid (*Azolla filiculoides*), lastige draderige alge (bv. *Enteromorpha*, *Ulva* en *Cladophora*) en fonteinkruid (*Potamogeton pectinatus*).
	Beheer die verspreiding van uitheemse indringerplante (bv. *Sesbania punicea* en *Eucalyptus* spp.) in die oewersone.	4.3 'n Toename in die gebied gedek deur indringerplante van meer as 20%.
	Behou die riet- en watergrasgebiede (60 ha) en die soutvleilandgebiede (~ 10 ha) soos in die huidige situasie (somer van 2004) (deur te voorkom dat 'n soutgehalte van 20 ppt verder as 8.5 km stroomopwaarts beweeg en langer as drie maande voorkom).	4.4 Die afsterwing van riete en die voorkoms van soutvleilandgebiede 8.5 km en verder stroomopwaarts van die riviermonding.
	Voorkom 'n toename van kaal grond op die vloedvlaktesoutvleiland deur die grondwatersoutgehalte op < 70 ppt en die diepte tot die watertafel op < 1.5 m te behou.	4.5 'n Toename van meer as 20% in kaal grond op die soutvleiland.
Mikroalge	Behou 'n lae fitoplanktonbiomassa met 'n klein rivier-estuarium-skeidingsone (d.i. 10 ppt tot rivier +1 ppt).	5.1 Die fitoplanktonbiomassa oorskry 15 µg/ℓ chlorofil a in die somer en 10 ug/ℓ chlorofil a in die winter. 5.2 Blougroen alge oorskry 10% van fitoplankton-seltellings.
	Behou mikroalggroepdiversiteit soos gemeet in die huidige situasie (2004).	5.3 Flagellata is nie meer die dominante groep nie en die diatome word minder divers (< 10 taksa per terrein).
	Behou die tussengety- en subgety-mikrofitobentiese biomassa soos gemeet in die huidige situasie (2004).	5.4 Mikrofitobentiese biomassa oorskry chlorofil a van 40 mg/m^2.
	Behou 'n lae hoeveelheid van dinoflagellata.	5.5 Die hoeveelheid dinoflagellata is meer as 5% van die totale fitoplanktontelling.

KOMPONENT	EKOLOGIESE SPESIFIKASIE	DREMPEL VAN POTENSIËLE BESORGDHEID (DPB)
Watergehalte	Die soutindringing moet nie oorskryding van die DPB's vir visse, invertebrate, makrofiete en mikroalge (sien hierbo) tot gevolg hê nie.	6.1 'n Soutgehalte van 20 ppt langer as drie maande 7 km stroomopwaarts van die monding (soutvleiland, riete en watergras, en invertebrate) 6.2 Die soutgehalte van die grondwater neem toe tot 50 ppt en die diepte tot die watertafel tot 1 m (vloedvlaktesoutvleiland). 6.3 Totale opgeloste vastestowwe (maat van "southeid") van rivierinvloei oorskry 3 500 mg/ℓ (fitoplankton). 6.4 Die soutgehalte in die estuarium oorskry 35 ppt (voorkom hipersoutheid) (vir fitoplankton). 6.5 'n Soutgehalte groter as 10 ppt kom voor 16+ km stroomopwaarts van die monding (vir vis).
	Sisteemveranderlikes (temperatuur, pH, troebelheid, opgeloste suurstof (OS), en gesuspendeerde stowwe) moet nie oorskryding van DPB's vir die biota (sien hierbo) tot gevolg hê nie.	6.6 Riverinvloei: Somertemp. < 20°C pH < 6.5 Troebelheid van rivierinvloei (moet nog bepaal word) Opgeloste suurstof < 4 mg/ℓ
		6.7 Secchiskyflesing meer as 8 km van die monding is groter as 1 m (gebruik as 'n aanduiding van troebelheidkonsentrasies in estuarium).
		6.8 pH > 8.5 of < 6.5 in rivierinvloei of in estuarium.
		6.9 Die waterkolom-OS daal tot onder 4 mg/ℓ (1 m bo die bodem, uitgesonderd in diep gate) (die OS-vlak in digte makrofietbeddings moet snags ondersoek word).
	Anorganiese voedingstofkonsentrasies moet nie oorskryding van die DPB's vir makrofiete en mikroalge (sien hierbo) tot gevolg hê nie.	6.10 Wanneer die gemiddelde rivierinvloei minder is as 5 m^3/s en die gemiddelde opgeloste anorganiese stikstofkonsentrasies (OAN-konsentrasies) in die rivierinvloei groter is as 100 µg/ℓ en die gemiddelde OAN-konsentrasies in die bolope van die estuarium (16+ km van die monding) 100 µg/ℓ oorskry. 6.11 In die hoëvloeiseisoen (vloei > 20 m^3/s): die gemiddelde OAN-konsentrasies in die rivierinvloei is meer as 500 µg/ℓ en die gemiddelde OAN-konsentrasies in die bolope van die estuarium (16+ km van die monding) oorskry 500 µg/ℓ. 6.12 Die gemiddelde opgeloste reaktiewe fosforkonsentrasies (ORP-konsentrasies) in die rivierinvloei oorskry 100 µg/ℓ, en die gemiddelde ORP-konsentrasies in die bolope van die estuarium (16+ km van die monding) oorskry 100 µg/ℓ.

KOMPONENT	EKOLOGIESE SPESIFIKASIE	DREMPEL VAN POTENSIËLE BESORGDHEID (DPB)
	Die aanwesigheid van toksiese stowwe moet nie die oorskryding van die DPB's vir biota (sien hierbo) tot gevolg hê nie).	6.13 Wat betref plaagdoders en onkruiddoders moet basislynstudies nog onderneem word voordat die DPB's bepaal kan word (besondere besorgdheid oor bolope weens ekstensiewe landboubedrywighede al langs die oewer van die estuarium).
Hidrodinamika	Behou 'n vloeiregime om die vereiste habitatte vir voëls, visse, makrofiete en mikroalge te skep, en hou die watergehalte in stand.	7.1 Die rivierinvloeiverspreidingspatrone verskil met meer as 5% van daardie van Scenario 2 (d.i. die aanbevole vloeiscenario vir die Olifants). 7.2 Die rivierinvloei neem te eniger tyd af tot minder as 1.5 m^3/s. 7.3 'n Rivierinvloei van minder as 2 m^3/s hou langer as vier maande aan.
Sedimentdinamika	'n Vloedregime om die sedimentverspreidingspatrone en die akwatiese habitat (die fisiese instroom-habitat) te behou ten einde nie die DPB's vir biota (sien hierbo) te oorskry nie.	8.1 Die rivierinvloeiverspreidingspatrone (vloedkomponente) verskil met meer as 10% (wat omvang, tydsberekening en veranderlikheid betref) van daardie in die huidige situasie (2004). 8.2 Die gesuspendeerde sedimentkonsentrasie weens rivierinvloei wyk af met meer as 10% van die sedimentvrag/-uitspoelverhouding wat as deel van die basislynstudies bepaal moet word (huidige situasie 2004).
	Veranderinge in sedimentkorrelgrootte-verspreidingspatrone moet nie die oorskryding van die DPB's vir bentiese invertebrate (sien hierbo) tot gevolg hê nie.	8.3 Die mediaanbeddingsedimentdeursnee wyk af met meer as 'n faktor of twee van die vlakke wat as deel van die basislynstudies bepaal moet word (Huidige Stand). 8.4 Die sand/modder-verspreiding in die midlope (8-20 km) verander met meer as 20% van die huidige situasie (2004). 8.5 Veranderinge in die kanaalbatimetrie in die bolope (meer as 20 km stroomopwaarts van die monding) van meer as 20% van die huidige situasie (2004). 8.6 Veranderinge in die getyamplitude onder die Lutzvillelaagwaterbrug van meer as 20% van die huidige situasie (2004).

7. HOEVEELHEIDSKOMPONENT VAN GRONDWATER

Grondwateraanvulling is 'n betekenisvolle komponent van die hidrogeologiese karakter omdat dit 'n groot invloed op die hoeveelheid en gehalte van grondwater het (veral as waterdraertransmissiwiteit en -berging gunstig is). Die grondwateraanvulling wissel dwarsdeur die Olifants-Doornwaterbestuursgebied (WBG) van 0 mm/a tot 245 mm/a. Die hoogste grondwateraanvulling kom voor in die Bo-Olifants-subgebied, veral in die gebied van die Winterhoekberge. Beduidende aanvulling kom ook voor in die subgebiede die Koue Bokkeveld, oostelike Doring en oostelike Sandveld. Wat die oorblywende gebiede betref is die grondwateraanvulling taamlik beperk.

Die BMB-reserwe maak voorsiening vir die wesenlike behoeftes van individue wat deur die betrokke waterhulpbron bedien word met inbegrip van water om te drink, vir voedselvoorbereiding en vir persoonlike higiëne. 'n Lewensondersteunende hoeveelheid van 25 liter per persoon per dag is gebruik. Die aspekte van grondwaterhoeveelheid, ingevolge die BMB en die EWV per kwaternêre opvanggebied, word in **Tabel 7.1** opgesom.

Tabel 7.1: Resultate van grondwaterreserwebepaling – hoeveelheidskomponent

Kwaternêre opvanggebied	Gebied (km^2)	Aanvulling (mm^3/a)[1)]	Bevolking[2)]	EWV (mm^3/a)	BMB (mm^3/a)	Totale Reserwe (mm^3/a)
E10A	134	30.12	0	5.44	0	5.44
E10B	202	37.17	1523	6.78	0.013	6.79
E10C	192	24.79	0	5.66	0	5.66
E10D	235	24.35	0	5.74	0	5.74
E10E	366	30.67	15 627	7.35	0.143	7.49
E10F	386	28.28	1184	5.13	0.011	5.14
E10G	508	26.88	1799	4.21	0.016	4.23
E10H	162	9.62	0	1.51	0	1.51
E10J	468	19.32	7797	1.63	0.071	1.70
E10K	235	6.67	0	0.36	0.0	0.36
E21A	190	14.14	2818	1.48	0.026	1.51
E21B	223	8.87	217	0.01	0.002	0.01
E21C	233	8.7	0	0.07	0	0.07
E21D	242	18.21	5024	1.88	0.046	1.93
E21E	293	8.44	797	0.09	0.007	0.10
E21F	379	8.76	0	0.15	0	0.15
E21G	266	18.95	2458	2.07	0.022	2.09
E21H	404	31.2	0	16.66	0	16.66
E21J	317	16.07	0	0.32	0	0.32
E21K	330	11.62	0	0.18	0	0.18
E21L	195	2.53	0	0.14	0	0.14
E22A	750	7.53	553	0.39	0.005	0.40
E22B	638	6.33	86	0.43	0.001	0.43
E22C	490	4.43	2919	0.33	0.027	0.36
E22D	496	4.21	16	0.26	0	0.26
E22E	1013	9.85	8	1.78	0	1.78
E22F	400	1.3	0	0.21	0	0.21
E22G	367	1.27	0	0.43	0	0.43
E23A	762	5.81	0	1.05	0	1.05
E23B	705	5.08	0	0.97	0	0.97
E23C	318	2.03	0	0.44	0	0.44
E23D	750	3.29	0	1.03	0	1.03
E23E	564	2.99	0	0.6	0	0.60
E23F	473	0.95	0	0.51	0	0.51
E23G	747	2.84	152	0.8	0.001	0.80
E23H	660	2.71	0	0.91	0	0.91
E23J	895	1.87	0	0.96	0	0.96
E23K	572	1.08	0	0.61	0	0.61

Kwaternêre opvanggebied	Gebied (km^2)	Aanvulling (mm^3/a)[1)]	Bevolking[2)]	EWV (mm^3/a)	BMB (mm^3/a)	Totale Reserwe (mm^3/a)
E24A	255	6.01	1568	0.47	0.014	0.48
E24B	468	5.09	455	0.86	0.004	0.86
E24C	784	3.68	0	0.75	0	0.75
E24D	997	1.77	0	0.96	0	0.96
E24E	671	2.74	0	1.58	0	1.58
E24F	582	2.23	0	1.07	0	1.07
E24G	633	2.2	0	1.16	0	1.16
E24H	483	0.92	0	0.56	0.004	0.56
E24J	1078	5.13	0	1.24	0	1.24
E24K	652	3.22	0	0.75	0	0.75
E24L	516	9.01	0	1.01	0	1.01
E24M	529	8.41	0	0.71	0	0.71
E31A	2865	1.2	0	0.02	0	0.02
E31B	1476	2.23	0	0.09	0	0.09
E31C	1572	0.89	0	0.09	0	0.09
E31D	839	0.48	0	0.05	0	0.05
E31E	478	0.38	0	0.03	0	0.03
E31F	525	0.92	2716	0.03	0.025	0.05
E31G	1238	0.68	0	0.07	0	0.07
E31H	726	1.09	0	0.04	0	0.04
E32A	1118	4.63	0	0.4	0	0.40
E32B	828	1.52	0	0.3	0	0.30
E32C	638	2.9	0	0.23	0	0.23
E32D	616	1.08	0	0.22	0	0.22
E32E	1001	3.86	0	0.36	0	0.36
E33A	1355	1.84	394	0.08	0.004	0.08
E33B	702	0.8	0	0.06	0.0	0.06
E33C	980	1.37	366	0	0.003	0.00
E33D	1559	2.04	0	0.14	0	0.14
E33E	1282	1.59	632	0.06	0.006	0.07
E33F	725	15.87	7573	0.05	0.069	0.12
E33G	894	7.19	35 929	0	0.328	0.33
E33H	719	3.05	11 768	0.01	0.107	0.12
E40A	941	4.44	0	0.9	0	0.90
E40B	707	3.41	12 350	0.68	0.113	0.79
E40C	530	3.02	1771	0.11	0.016	0.13
E40D	544	3.09	0	1	0	1.00

1) Die aanvulling is geëkserpeer uit "The classification of significant water resources in the Olifants-Doorn Water Management Area: Final technical report".

2) Bevolking afgelei uit 2011-sensus.

8. GEHALTEKOMPONENT VAN GRONDWATER

Die omgewingsgrondwatergehaltewaarde word met die aanbevole Klas 1-waarde vergelyk (DWAF, 1996). Die laagste of die konserwatiewer waarde van die twee word gekies. Wanneer die

omgewingswaarde gekies word, word dit met 10 persent verhoog. In gevalle waar die omgewingsgehalte van geologiese oorsprong die aanbevole waarde oorskry, word die omgewingswatergehalte gebruik. Gebiede met 'n swak watergehalte word uitsluitingsones in die bepaling van die BMB-reserwevereiste. Die grondwatergehalte moet voldoen aan die teikenwatergehalteverspreidings wat in **Tabel 8.1** aangedui word. **Tabel 8.2** toon 'n opsomming van die resultate vir die gehalteaspekte ingevolge die BMB op kwaternêre vlak. **Tabel 8.3** illustreer die grondwatergehalteklas en die parameters van besorgdheid vir elke kwaternêre opvanggebied. Parameters van besorgdheid beteken in hierdie geval daardie met verhoogde konsentrasies wanneer dit met die drinkwatergehaltestandaarde vergelyk word.

Tabel 8.1: Klassifikasie vir die beraming van die geskiktheid van boorgatwater as drinkwater

Bestanddeel/Parameter	Teikenverspreidings vir watergehalte[1]				
	Eenhede	Klas 0	Klas I	Klas II	Klas III
Kalsium as Ca	mg/L	0-80	80-150	150-300	> 300
Magnesium as Mg	mg/L	0-30	30-70	70-100	> 100
Natrium as Na	mg/L	0-100	100-200	200-400	> 400
Chloried as Cl	mg/L	0-100	100-200	200-600	> 600
Sulfate 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
Flouried as F	mg/L	0-1	1-1.5	1.5-3.5	> 3.5
Fekale koliform	tellings/100ml	0	0-1	1-10	> 10
pH (pH-eenhede)		6-9	5-6 & 9-9.5	4-5 & > 9.5-10	< 4 of > 10
Totale opgeloste vastestowwe	mg/L	0-450	450-1000	1000-2450	> 2450
Elektriese geleiding	mS/m	0-70	70-150	150-300	> 370

1) Bron: *Suid-Afrikaanse riglyne vir watergehalte, volume 1: Huishoudelike watergebruik*, 2de Uitgawe. 1996. Departement van Waterwese en Bosbou. Pretoria, Suid-Afrika.

LET WEL:

Klas 0 Hierdie is die ideale watergehalte, geskik vir lewenslange gebruik, met geen nadelige gesondheidsgevolge vir die gebruiker. Hierdie klas is wesenlik dieselfde as die teikenwatergehalteverspreiding in die tweede uitgawe van die *Suid-Afrikaanse riglyne vir watergehalte, volume 1: Huishoudelike watergebruik* (DWB, 1996).

Klas I Water in hierdie klas is veilig vir lewenslange gebruik, maar beantwoord nie aan die ideale watergehalte nie omdat daar gevalle van nadelige gesondheidsgevolge kan wees. Hierdie gevolge is gewoonlik matig, en die klaarblyklike gesondheidsgevolge is bykans subklinies en moeilik bewysbaar. Water in Klas I het in normale omstandighede geen gesondheidsgevolge nie. Die estetiese gevolge kan egter duidelik wees.

Klas II Water in hierdie klas word omskryf as water waarvan die negatiewe gesondheidsgevolge met beperkte korttermyngebruik ongewoon is. Die negatiewe gesondheidsgevolge kan veral met langdurige gebruik oor baie jare, of met lewenslange gebruik, meer algemeen word. Hierdie klas verteenwoordig water wat slegs geskik is vir gebruik oor die kort termyn of in noodsituasies, maar wat nie noodwendig vir deurlopende gebruik oor 'n leeftyd geskik is nie.

Klas III Hierdie water bevat bestanddele in 'n konsentrasieverspreiding wat met korttermyngebruik, en des te meer met langtermyngebruik, ernstige gesondheidsgevolge vir veral babas of ouer persone tot gevolg het. Die water in hierdie klas is nie sonder afdoende behandeling, wat die water in 'n laer en veiliger klas plaas, as drinkwater geskik nie.

Tabel 8.2: Resultate van aspekte van die gehaltekomponent van grondwater

Chemiese parameter	Eenheid	Kwaternêre opvanggebiede E10A en E10B			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		8	7.57	5.0 – 9.5	8.33
Elektriese geleiding	mS/m	8	20.2	< 150	22.22
Kalsium as Ca	mg/L	8	13.15	< 150	14.47
Magnesium as Mg	mg/L	8	4.7	< 100	5.17
Natrium as Na	mg/L	8	10.55	< 200	11.61
Totale alkaliniteit as $CaCO_3$	mg/L	8	33.65	NvT	37
Chloried as Cl	mg/L	8	17.8	< 200	19.58
Sulfaat as SO_4	mg/L	8	6.55	< 400	7.21
Nitraat as NO_x-N	mg/L	8	0.04	< 10	0.04
Fluoried as F	mg/L	8	0.14	< 1.0	0.15
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E10C**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		8	5.16	5.0 – 9.5	5.68
Elektriese geleiding	mS/m	8	7.15	< 150	7.87
Kalsium as Ca	mg/L	8	1.25	< 150	1.38
Magnesium as Mg	mg/L	8	1.24	< 100	1.36
Natrium as Na	mg/L	8	5.97	< 200	6.57
Totale alkaliniteit as $CaCO_3$	mg/L	8	4	NvT	4.4
Chloried as Cl	mg/L	8	14.5	< 200	15.95
Sulfaat as SO_4	mg/L	8	3.25	< 400	3.58
Nitraat as NO_x-N	mg/L	8	0.7	< 10	0.77
Fluoried as F	mg/L	8	0.05	< 1.0	0.05

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E10D			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		100	6.87	5.0 – 9.5	7.56
Elektriese geleiding	mS/m	100	9	< 150	9.9
Kalsium as Ca	mg/L	97	2.4	< 150	2.64
Magnesium as Mg	mg/L	97	1.96	< 100	2.16
Natrium as Na	mg/L	95	8.22	< 200	9.04
Totale alkaliniteit as $CaCO_3$	mg/L	97	10.55	NvT	11.61
Chloried as Cl	mg/L	96	16.44	< 200	18.08
Sulfaat as SO_4	mg/L	97	2	< 400	2.2
Nitraat as NO_x-N	mg/L	96	0.24	< 10	0.26
Fluoried as F	mg/L	94	0.11	< 1.0	0.12
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E10E**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		153	6.23	5.0 – 9.5	6.85
Elektriese geleiding	mS/m	152	11.32	< 150	12.45
Kalsium as Ca	mg/L	153	1.41	< 150	1.55
Magnesium as Mg	mg/L	153	1.9	< 100	2.09
Natrium as Na	mg/L	146	12.35	< 200	13.58
Totale alkaliniteit as $CaCO_3$	mg/L	153	5	NvT	5.5
Chloried as Cl	mg/L	153	23.7	< 200	26.07
Sulfaat as SO_4	mg/L	153	2	< 400	2.2
Nitraat as NO_x-N	mg/L	153	0.34	< 10	0.37
Fluoried as F	mg/L	148	0.05	< 1.0	0.05

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E10F			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		92	6.73	5.0 – 9.5	7.4
Elektriese geleiding	mS/m	92	16.01	< 150	17.61
Kalsium as Ca	mg/L	92	4.76	< 150	5.24
Magnesium as Mg	mg/L	92	2.85	< 100	3.14
Natrium as Na	mg/L	88	14	< 200	15.4
Totale alkaliniteit as $CaCO_3$	mg/L	92	15.58	NvT	17.14
Chloried as Cl	mg/L	92	27.31	< 200	30.04
Sulfaat as SO_4	mg/L	92	4.31	< 400	4.74
Nitraat as NO_x-N	mg/L	92	0.41	< 10	0.45
Fluoried as F	mg/L	90	0.1	< 1.0	0.11
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E10G**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		107	6.27	5.0 – 9.5	6.9
Elektriese geleiding	mS/m	105	16.9	< 150	18.59
Kalsium as Ca	mg/L	102	1.68	< 150	1.85
Magnesium as Mg	mg/L	103	2.87	< 100	3.16
Natrium as Na	mg/L	100	16.2	< 200	17.82
Totale alkaliniteit as $CaCO_3$	mg/L	103	4	NvT	4.4
Chloried as Cl	mg/L	104	28.95	< 200	31.85
Sulfaat as SO_4	mg/L	104	2	< 400	2.2
Nitraat as NO_x-N	mg/L	102	0.88	< 10	0.97
Fluoried as F	mg/L	99	0.05	< 1.0	0.05

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E10H			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		7	6.56	5.0 – 9.5	7.22
Elektriese geleiding	mS/m	7	19.6	< 150	21.56
Kalsium as Ca	mg/L	7	2.79	< 150	3.07
Magnesium as Mg	mg/L	7	3.73	< 100	4.1
Natrium as Na	mg/L	7	11.6	< 200	12.76
Totale alkaliniteit as $CaCO_3$	mg/L	7	4	NvT	4.4
Chloried as Cl	mg/L	7	47.22	< 200	51.94
Sulfaat as SO_4	mg/L	7	2	< 400	2.2
Nitraat as NO_x-N	mg/L	7	0.04	< 10	0.04
Fluoried as F	mg/L	7	0.05	< 1.0	0.05
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E10J**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		71	6.4	5.0 – 9.5	7.04
Elektriese geleiding	mS/m	71	50.4	< 150	55.44
Kalsium as Ca	mg/L	65	6.49	< 150	7.14
Magnesium as Mg	mg/L	65	8.85	< 100	9.74
Natrium as Na	mg/L	65	63	< 200	69.3
Totale alkaliniteit as $CaCO_3$	mg/L	67	6.2	NvT	6.82
Chloried as Cl	mg/L	66	112.96	< 200	124.26
Sulfaat as SO_4	mg/L	66	13.95	< 400	15.95
Nitraat as NO_x-N	mg/L	68	2.6	< 10	2.86
Fluoried as F	mg/L	64	0.15	< 1.0	0.17

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E10K			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		5	6.74	5.0 – 9.5	7.41
Elektriese geleiding	mS/m	5	**175**	< 150	**175**
Kalsium as Ca	mg/L	5	13.9	< 150	15.29
Magnesium as Mg	mg/L	5	55.6	< 100	61.16
Natrium as Na	mg/L	5	**207**	< 200	**207**
Totale alkaliniteit as $CaCO_3$	mg/L	5	2	NvT	2.2
Chloried as Cl	mg/L	5	**471**	< 200	**471**
Sulfaat as SO_4	mg/L	5	30.3	< 400	33.33
Nitraat as NO_x-N	mg/L	5	2.4	< 10	2.64
Fluoried as F	mg/L	5	0.14	< 1.0	0.15
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E21A**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		50	7.63	5.0 – 9.5	8.39
Elektriese geleiding	mS/m	50	24.1	< 150	26.51
Kalsium as Ca	mg/L	50	13.3	< 150	14.63
Magnesium as Mg	mg/L	50	5.65	< 100	6.22
Natrium as Na	mg/L	50	18.2	< 200	20.02
Totale alkaliniteit as $CaCO_3$	mg/L	50	35.6	NvT	39.16
Chloried as Cl	mg/L	50	37.25	< 200	41
Sulfaat as SO_4	mg/L	50	12.25	< 400	13.48
Nitraat as NO_x-N	mg/L	50	0.02	< 10	0.02
Fluoried as F	mg/L	50	0.11	< 1.0	0.12

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E21B			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		17	7.5	5.0 – 9.5	8.25
Elektriese geleiding	mS/m	17	89.2	< 150	98.12
Kalsium as Ca	mg/L	17	65.6	< 150	72.16
Magnesium as Mg	mg/L	17	27	< 100	29.7
Natrium as Na	mg/L	17	64.6	< 200	71.06
Totale alkaliniteit as $CaCO_3$	mg/L	17	76	NvT	83.6
Chloried as Cl	mg/L	17	150.3	< 200	165.33
Sulfaat as SO_4	mg/L	17	99.1	< 400	109.01
Nitraat as NO_x-N	mg/L	17	0.11	< 10	0.12
Fluoried as F	mg/L	17	0.22	< 1.0	0.24
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E21C**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		9	7.45	5.0 – 9.5	8.19
Elektriese geleiding	mS/m	9	13.7	< 150	15.07
Kalsium as Ca	mg/L	9	4.9	< 150	5.39
Magnesium as Mg	mg/L	9	5	< 100	5.5
Natrium as Na	mg/L	9	10	< 200	11
Totale alkaliniteit as $CaCO_3$	mg/L	9	15.3	NvT	16.83
Chloried as Cl	mg/L	9	23.3	< 200	25.63
Sulfaat as SO_4	mg/L	9	6.7	< 400	7.37
Nitraat as NO_x-N	mg/L	9	0.02	< 10	0.02
Fluoried as F	mg/L	9	0.1	< 1.0	0.11

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E21D			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		38	7.53	5.0 – 9.5	8.28
Elektriese geleiding	mS/m	38	21.85	< 150	24.04
Kalsium as Ca	mg/L	38	11.75	< 150	12.93
Magnesium as Mg	mg/L	38	4.05	< 100	4.46
Natrium as Na	mg/L	38	15.28	< 200	16.08
Totale alkaliniteit as $CaCO_3$	mg/L	38	31.75	NvT	34.93
Chloried as Cl	mg/L	38	26.08	< 200	28.69
Sulfaat as SO_4	mg/L	38	5.8	< 400	6.38
Nitraat as NO_x-N	mg/L	38	0.1	< 10	0.11
Fluoried as F	mg/L	38	0.05	< 1.0	0.05
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebiede E21E, E21F, E21L & E22F**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		10	6.93	5.0 – 9.5	7.62
Elektriese geleiding	mS/m	10	12.5	< 150	13.75
Kalsium as Ca	mg/L	10	2.35	< 150	2.59
Magnesium as Mg	mg/L	10	2.8	< 100	3.08
Natrium as Na	mg/L	10	10.5	< 200	11.55
Totale alkaliniteit as $CaCO_3$	mg/L	10	7.55	NvT	8.31
Chloried as Cl	mg/L	10	16.95	< 200	18.65
Sulfaat as SO_4	mg/L	10	6.3	< 400	6.93
Nitraat as NO_x-N	mg/L	9	0.07	< 10	0.07
Fluoried as F	mg/L	10	0.15	< 1.0	0.16

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E21G			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		44	6.59	5.0 – 9.5	7.25
Elektriese geleiding	mS/m	43	104	< 150	114.4
Kalsium as Ca	mg/L	44	2.76	< 150	3.04
Magnesium as Mg	mg/L	44	2.39	< 100	2.63
Natrium as Na	mg/L	42	8.76	< 200	9.64
Totale alkaliniteit as $CaCO_3$	mg/L	44	8.64	NvT	9.5
Chloried as Cl	mg/L	44	14.64	< 200	16.11
Sulfaat as SO_4	mg/L	44	6.06	< 400	6.67
Nitraat as NO_x-N	mg/L	44	0.6	< 10	0.66
Fluoried as F	mg/L	42	0.1	< 1.0	0.11
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E21H**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		29	5.82	5.0 – 9.5	6.4
Elektriese geleiding	mS/m	29	3.1	< 150	3.41
Kalsium as Ca	mg/L	29	0.5	< 150	0.55
Magnesium as Mg	mg/L	29	0.75	< 100	0.83
Natrium as Na	mg/L	27	2.72	< 200	3
Totale alkaliniteit as $CaCO_3$	mg/L	29	4	NvT	4.4
Chloried as Cl	mg/L	27	5	< 200	5.5
Sulfaat as SO_4	mg/L	29	2	< 400	2.2
Nitraat as NO_x-N	mg/L	29	0.1	< 10	0.11
Fluoried as F	mg/L	27	0.05	< 1.0	0.05

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E21J			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		22	7.47	5.0 – 9.5	8.22
Elektriese geleiding	mS/m	22	18.19	< 150	20
Kalsium as Ca	mg/L	22	8.99	< 150	9.9
Magnesium as Mg	mg/L	22	3.6	< 100	3.96
Natrium as Na	mg/L	22	16.8	< 200	17.93
Totale alkaliniteit as $CaCO_3$	mg/L	22	26.86	NvT	29.55
Chloried as Cl	mg/L	22	30.59	< 200	33.65
Sulfaat as SO_4	mg/L	22	9.78	< 400	10.76
Nitraat as NO_x-N	mg/L	22	0.25	< 10	0.28
Fluoried as F	mg/L	21	0.12	< 1.0	0.13
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E21K**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		10	7.6	5.0 – 9.5	8.36
Elektriese geleiding	mS/m	10	20.15	< 150	22.17
Kalsium as Ca	mg/L	10	20.22	< 150	22.24
Magnesium as Mg	mg/L	10	1.3	< 100	1.43
Natrium as Na	mg/L	10	11.91	< 200	13.1
Totale alkaliniteit as $CaCO_3$	mg/L	10	80.86	NvT	88.95
Chloried as Cl	mg/L	10	6.5	< 200	7.15
Sulfaat as SO_4	mg/L	10	4.7	< 400	5.17
Nitraat as NO_x-N	mg/L	10	0.05	< 10	0.05
Fluoried as F	mg/L	10	0.17	< 1.0	0.18

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E22A			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		13	8.12	5.0 – 9.5	8.93
Elektriese geleiding	mS/m	13	**171**	**< 150**	**171**
Kalsium as Ca	mg/L	13	78.4	< 150	86.24
Magnesium as Mg	mg/L	13	46.8	< 100	51.48
Natrium as Na	mg/L	13	**198.1**	**< 200**	**198.1**
Totale alkaliniteit as $CaCO_3$	mg/L	13	271.4	NvT	271.4
Chloried as Cl	mg/L	13	**345.1**	**< 200**	**345.1**
Sulfaat as SO_4	mg/L	13	109.5	< 400	120.45
Nitraat as NO_x-N	mg/L	13	0.29	< 10	0.32
Fluoried as F	mg/L	13	**0.98**	**< 1.0**	**0.98**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E22B**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		10	7.82	5.0 – 9.5	8.6
Elektriese geleiding	mS/m	10	**278.7**	< 150	**278.7**
Kalsium as Ca	mg/L	10	127	< 150	136.7
Magnesium as Mg	mg/L	10	67.9	< 100	74.69
Natrium as Na	mg/L	10	**271.8**	< 200	**271.8**
Totale alkaliniteit as $CaCO_3$	mg/L	10	225.35	NvT	225.35
Chloried as Cl	mg/L	10	**614.55**	< 200	**614.55**
Sulfaat as SO_4	mg/L	10	197.75	< 400	217.53
Nitraat as NO_x-N	mg/L	10	0.6	< 10	0.66
Fluoried as F	mg/L	10	0.9	< 1.0	0.9

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Government Gazette
Staatskoerant

REPUBLIC OF SOUTH AFRICA
REPUBLIEK VAN SUID AFRIKA

Vol. 633 2 March Maart 2018 No. 41473

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ISSN 1682-5843

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Chemiese parameter	Eenheid	Kwaternêre opvanggebied E22C			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		13	7.69	5.0 – 9.5	8.46
Elektriese geleiding	mS/m	13	64.9	< 150	71.39
Kalsium as Ca	mg/L	13	39	< 150	42.9
Magnesium as Mg	mg/L	13	15	< 100	16.5
Natrium as Na	mg/L	13	50.3	< 200	55.33
Totale alkaliniteit as $CaCO_3$	mg/L	13	93.6	NvT	102.96
Chloried as Cl	mg/L	13	77.2	< 200	84.92
Sulfaat as SO_4	mg/L	13	42.1	< 400	46.31
Nitraat as NO_x-N	mg/L	13	0.08	< 10	0.08
Fluoried as F	mg/L	13	0.2	< 1.0	0.22
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E22D**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		6	7.97	5.0 – 9.5	8.77
Elektriese geleiding	mS/m	6	**548**	< 150	**548**
Kalsium as Ca	mg/L	6	**161.05**	< 150	**161.05**
Magnesium as Mg	mg/L	6	**203.55**	< 100	**203.55**
Natrium as Na	mg/L	6	**634.9**	< 200	**634.9**
Totale alkaliniteit as $CaCO_3$	mg/L	6	186.3	NvT	186.3
Chloried as Cl	mg/L	6	**1624.45**	< 200	**1624.45**
Sulfaat as SO_4	mg/L	6	**437.9**	< 400	**437.9**
Nitraat as NO_x-N	mg/L	6	1.13	< 10	1.24
Fluoried as F	mg/L	6	**1**	< 1.0	**1**

Chemiese parameter	Eenheid	Kwaternêre opvanggebiede E22E, E22G & E23A-E23D			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		12	7.92	5.0 – 9.5	8.71
Elektriese geleiding	mS/m	12	129.15	< 150	142.07
Kalsium as Ca	mg/L	12	61.8	< 150	67.98
Magnesium as Mg	mg/L	12	23.65	< 100	26.02
Natrium as Na	mg/L	12	**186.53**	< 200	**186.53**
Totale alkaliniteit as $CaCO_3$	mg/L	12	170	NvT	187
Chloried as Cl	mg/L	12	**299.95**	< 200	**299.95**
Sulfaat as SO_4	mg/L	12	49.1	< 400	54.01
Nitraat as NO_x-N	mg/L	12	0.05	< 10	0.05
Fluoried as F	mg/L	12	0.63	< 1.0	0.69
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebiede E23E-E23H, E23J**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		3	8.37	5.0 – 9.5	9.21
Elektriese geleiding	mS/m	3	**185.00**	< 150	185.00
Kalsium as Ca	mg/L	3	25.90	< 150	28.49
Magnesium as Mg	mg/L	3	4.80	< 100	5.28
Natrium as Na	**mg/L**	**3**	**414.10**	**< 200**	**414.10**
Totale alkaliniteit as $CaCO_3$	mg/L	3	285.60	NvT	314.16
Chloried as Cl	**mg/L**	**3**	**344.70**	**< 200**	**344.70**
Sulfaat as SO_4	mg/L	3	88.80	< 400	97.68
Nitraat as NO_x-N	mg/L	3	0.02	< 10	0.02
Fluoried as F	mg/L	3	2.77	< 1.0	3.05

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E23K			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		14	8.55	5.0 – 9.5	9.40
Elektriese geleiding	mS/m	14	**177.50**	< 150	**177.50**
Kalsium as Ca	mg/L	14	9.70	< 150	10.67
Magnesium as Mg	mg/L	14	4.75	< 100	5.23
Natrium as Na	mg/L	14	**357.00**	< 200	357.00
Totale alkaliniteit as $CaCO_3$	mg/L	14	220.35	NvT	242.39
Chloried as Cl	mg/L	14	**416.75**	< 200	**416.75**
Sulfaat as SO_4	mg/L	14	28.80	< 400	31.68
Nitraat as NO_x-N	mg/L	14	0.11	< 10	0.12
Fluoried as F	mg/L	14	1.04	< 1.0	1.04

Chemiese parameter	Eenheid	Kwaternêre opvanggebiede E24C-E24D			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		7	8.19	5.0 – 9.5	9.01
Elektriese geleiding	mS/m	7	96.00	< 150	105.60
Kalsium as Ca	mg/L	7	7.00	< 150	7.70
Magnesium as Mg	mg/L	7	2.00	< 100	2.20
Natrium as Na	mg/L	7	**240.30**	< 200	**240.30**
Totale alkaliniteit as $CaCO_3$	mg/L	7	331.60	NvT	364.76
Chloried as Cl	mg/L	7	129.00	< 200	141.90
Sulfaat as SO_4	mg/L	7	11.97	< 400	13.17
Nitraat as NO_x-N	mg/L	7	0.04	< 10	0.04
Fluoried as F	mg/L	7	**2.98**	< 1.0	**2.98**

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E24E			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		8	7.99	5.0 – 9.5	8.78
Elektriese geleiding	mS/m	8	**227.65**	< 150	**227.65**
Kalsium as Ca	mg/L	8	143.25	< 150	157.58
Magnesium as Mg	mg/L	8	**106.05**	< 100	106.05
Natrium as Na	mg/L	8	**201.55**	< 200	201.55
Totale alkaliniteit as $CaCO_3$	mg/L	8	191.65	NvT	210.82
Chloried as Cl	mg/L	8	**268.40**	< 200	**268.40**
Sulfaat as SO_4	mg/L	8	**554.50**	< 400	**554.50**
Nitraat as NO_x-N	mg/L	8	3.22	< 10	3.54
Fluoried as F	mg/L	8	0.85	< 1.0	0.94
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E24F**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		3	7.90	5.0 – 9.5	8.69
Elektriese geleiding	**mS/m**	**3**	**275.20**	**< 150**	**275.20**
Kalsium as Ca	mg/L	3	110.80	< 150	121.88
Magnesium as Mg	mg/L	3	94.40	< 100	103.84
Natrium as Na	mg/L	3	**361.40**	**< 200**	**361.40**
Totale alkaliniteit as $CaCO_3$	mg/L	3	213.90	NvT	235.29
Chloried as Cl	**mg/L**	**3**	**543.90**	**< 200**	**543.90**
Sulfaat as SO_4	mg/L	3	378.40	< 400	416.24
Nitraat as NO_x-N	mg/L	3	3.28	< 10	3.61
Fluoried as F	mg/L	3	0.92	< 1.0	1.01

Chemiese parameter	Eenheid	Kwaternêre opvanggebiede E24G-E24H			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		6	7.95	5.0 – 9.5	8.75
Elektriese geleiding	**mS/m**	**6**	**320.00**	**< 150**	**320.00**
Kalsium as Ca	mg/L	6	116.00	< 150	127.60
Magnesium as Mg	mg/L	6	84.25	< 100	92.68
Natrium as Na	**mg/L**	**6**	**446.00**	**< 200**	**446.00**
Totale alkaliniteit as $CaCO_3$	mg/L	6	213.55	NvT	234.91
Chloried as Cl	**mg/L**	**6**	**795.40**	**< 200**	**795.40**
Sulfaat as SO_4	mg/L	6	174.10	< 400	191.51
Nitraat as NO_x-N	mg/L	6	1.11	< 10	1.22
Fluoried as F	mg/L	6	0.82	< 1.0	0.90
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E24J**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		56	7.31	5.0 – 9.5	8.04
Elektriese geleiding	mS/m	56	138.50	< 150	152.35
Kalsium as Ca	mg/L	56	46.30	< 150	50.93
Magnesium as Mg	mg/L	56	30.50	< 100	33.55
Natrium as Na	mg/L	54	166.55	< 200	183.21
Totale alkaliniteit as $CaCO_3$	mg/L	56	92.05	NvT	101.26
Chloried as Cl	**mg/L**	**56**	**311.85**	**< 200**	**311.85**
Sulfaat as SO_4	mg/L	56	63.60	< 400	69.96
Nitraat as NO_x-N	mg/L	56	0.06	< 10	0.06
Fluoried as F	mg/L	54	0.23	< 1.0	0.26

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E24K			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		6	7.85	5.0 – 9.5	8.64
Elektriese geleiding	**mS/m**	**6**	**324.50**	**< 150**	**356.95**
Kalsium as Ca	**mg/L**	**6**	**172.25**	**< 150**	**189.48**
Magnesium as Mg	**mg/L**	**6**	**110.75**	**< 100**	**121.83**
Natrium as Na	**mg/L**	**6**	**269.35**	**< 200**	**296.29**
Totale alkaliniteit as $CaCO_3$	mg/L	6	188.55	NvT	207.41
Chloried as Cl	**mg/L**	**6**	**801.65**	**< 200**	**881.82**
Sulfaat as SO_4	mg/L	6	206.95	< 400	227.65
Nitraat as NO_x-N	mg/L	6	5.54	< 10	6.09
Fluoried as F	mg/L	6	0.52	< 1.0	0.57
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E24L**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		40	5.52	5.0 – 9.5	6.07
Elektriese geleiding	mS/m	40	14.55	< 150	16.01
Kalsium as Ca	mg/L	40	3.35	< 150	3.69
Magnesium as Mg	mg/L	40	2.80	< 100	3.08
Natrium as Na	mg/L	40	16.00	< 200	17.60
Totale alkaliniteit as $CaCO_3$	mg/L	40	3.00	NvT	3.30
Chloried as Cl	mg/L	40	29.60	< 200	32.56
Sulfaat as SO_4	mg/L	40	6.45	< 400	7.10
Nitraat as NO_x-N	mg/L	40	1.20	< 10	1.32
Fluoried as F	mg/L	40	0.11	< 1.0	0.12

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E24M			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		25	6.67	5.0 – 9.5	7.34
Elektriese geleiding	mS/m	25	**165.00**	< 150	**165.00**
Kalsium as Ca	mg/L	22	19.65	< 150	21.62
Magnesium as Mg	mg/L	22	44.15	< 100	48.57
Natrium as Na	mg/L	22	207.70	< 200	207.70
Totale alkaliniteit as $CaCO_3$	mg/L	25	9.50	NvT	10.45
Chloried as Cl	mg/L	22	**436.60**	< 200	**436.60**
Sulfaat as SO_4	mg/L	22	50.25	< 400	55.28
Nitraat as NO_x-N	mg/L	25	3.61	< 10	3.97
Fluoried as F	mg/L	22	0.17	< 1.0	0.19
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E31E**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		6	8.16	5.0 – 9.5	8.98
Elektriese geleiding	mS/m	6	**430.50**	< 150	**430.50**
Kalsium as Ca	mg/L	6	148.12	< 150	162.93
Magnesium as Mg	mg/L	6	95.09	< 100	104.59
Natrium as Na	mg/L	6	**605.64**	< 200	605.64
Totale alkaliniteit as $CaCO_3$	mg/L	6	301.77	NvT	331.94
Chloried as Cl	mg/L	6	**1124.69**	< 200	**1124.69**
Sulfaat as SO_4	mg/L	6	329.66	< 400	362.62
Nitraat as NO_x-N	mg/L	6	2.55	< 10	2.80
Fluoried as F	mg/L	6	1.47	< 1.0	1.62

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E31F			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		67	8.05	5.0 – 9.5	8.86
Elektriese geleiding	mS/m	67	**190.00**	< 150	**190.00**
Kalsium as Ca	mg/L	64	84.20	< 150	92.62
Magnesium as Mg	mg/L	64	61.67	< 100	67.83
Natrium as Na	mg/L	63	**209.10**	< 200	**209.10**
Totale alkaliniteit as $CaCO_3$	mg/L	64	250.25	NvT	275.28
Chloried as Cl	mg/L	65	**295.30**	< 200	**295.30**
Sulfaat as SO_4	mg/L	65	221.90	< 400	244.09
Nitraat as NO_x-N	mg/L	65	0.15	< 10	0.16
Fluoried as F	mg/L	62	**1.29**	< 1.0	**1.29**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E31G**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		12	8.10	5.0 – 9.5	8.91
Elektriese geleiding	mS/m	12	**436.45**	< 150	**436.45**
Kalsium as Ca	mg/L	11	**163.80**	< 150	**163.80**
Magnesium as Mg	mg/L	11	**147.20**	< 100	**147.20**
Natrium as Na	mg/L	11	**584.30**	< 200	**584.30**
Totale alkaliniteit as $CaCO_3$	mg/L	12	211.75	NvT	232.93
Chloried as Cl	mg/L	11	**1161.90**	< 200	**1161.90**
Sulfaat as SO_4	mg/L	11	364.50	< 400	364.50
Nitraat as NO_x-N	mg/L	12	4.46	< 10	4.91
Fluoried as F	mg/L	11	**1.92**	< 1.0	**1.92**

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E31H			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		8	7.98	5.0 – 9.5	8.77
Elektriese geleiding	mS/m	8	**438.00**	< 150	**438.00**
Kalsium as Ca	mg/L	8	87.55	< 150	96.31
Magnesium as Mg	mg/L	8	**107.10**	< 100	**107.10**
Natrium as Na	mg/L	8	**611.10**	< 200	**611.10**
Totale alkaliniteit as $CaCO_3$	mg/L	8	198.55	NvT	218.41
Chloried as Cl	mg/L	8	**1159.35**	< 200	**1159.35**
Sulfaat as SO_4	mg/L	8	349.00	< 400	383.90
Nitraat as NO_x-N	mg/L	8	6.09	< 10	6.69
Fluoried as F	mg/L	8	**2.10**	< 1.0	**2.10**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E32A**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		6	7.88	5.0 – 9.5	8.67
Elektriese geleiding	mS/m	6	77.40	< 150	85.14
Kalsium as Ca	mg/L	6	50.50	< 150	55.55
Magnesium as Mg	mg/L	6	26.20	< 100	28.82
Natrium as Na	mg/L	6	83.85	< 200	92.24
Totale alkaliniteit as $CaCO_3$	mg/L	6	204.65	NvT	225.12
Chloried as Cl	mg/L	6	83.15	< 200	91.47
Sulfaat as SO_4	mg/L	6	44.20	< 400	48.62
Nitraat as NO_x-N	mg/L	6	0.22	< 10	**0.24**
Fluoried as F	mg/L	6	0.74	< 1.0	**0.81**

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E32B			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		14	7.74	5.0 – 9.5	8.51
Elektriese geleiding	mS/m	14	**181.60**	< 150	**181.60**
Kalsium as Ca	mg/L	14	109.95	< 150	120.95
Magnesium as Mg	mg/L	14	74.95	< 100	82.45
Natrium as Na	mg/L	14	150.65	< 200	165.72
Totale alkaliniteit as $CaCO_3$	mg/L	14	192.10	NvT	211.31
Chloried as Cl	mg/L	14	**295.15**	< 200	**295.15**
Sulfaat as SO_4	mg/L	14	278.75	< 400	306.63
Nitraat as NO_x-N	mg/L	14	1.76	< 10	1.93
Fluoried as F	mg/L	14	0.84	< 1.0	0.92
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E32C**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		15	7.75	5.0 – 9.5	8.53
Elektriese geleiding	mS/m	15	**162.70**	< 150	**162.70**
Kalsium as Ca	mg/L	15	80.20	< 150	88.22
Magnesium as Mg	mg/L	15	60.80	< 100	66.88
Natrium as Na	mg/L	15	185.10	< 200	185.10
Totale alkaliniteit as $CaCO_3$	mg/L	15	211.40	NvT	232.54
Chloried as Cl	mg/L	15	**203.00**	< 200	**203.00**
Sulfaat as SO_4	mg/L	15	303.30	< 400	333.63
Nitraat as NO_x-N	mg/L	15	2.32	< 10	2.55
Fluoried as F	mg/L	15	0.96	< 1.0	0.96

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E32D			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		25	7.75	5.0 – 9.5	8.53
Elektriese geleiding	mS/m	25	**170.80**	< 150	**170.80**
Kalsium as Ca	mg/L	25	101.90	< 150	112.09
Magnesium as Mg	mg/L	25	57.30	< 100	63.03
Natrium as Na	mg/L	25	**201.40**	< 200	**201.40**
Totale alkaliniteit as $CaCO_3$	mg/L	25	192.90	NvT	212.19
Chloried as Cl	mg/L	25	**239.40**	< 200	**239.40**
Sulfaat as SO_4	mg/L	25	256.30	< 400	281.93
Nitraat as NO_x-N	mg/L	25	0.49	< 10	0.54
Fluoried as F	mg/L	25	**1.33**	< 1.0	**1.33**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E32E**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		15	7.80	5.0 – 9.5	8.58
Elektriese geleiding	mS/m	15	**273.00**	< 150	**273.00**
Kalsium as Ca	mg/L	15	106.30	< 150	116.93
Magnesium as Mg	mg/L	15	88.50	< 100	97.35
Natrium as Na	mg/L	15	**303.10**	< 200	**303.10**
Totale alkaliniteit as $CaCO_3$	mg/L	15	188.00	NvT	206.80
Chloried as Cl	mg/L	15	**748.30**	< 200	**748.30**
Sulfaat as SO_4	mg/L	15	137.20	< 400	150.92
Nitraat as NO_x-N	mg/L	15	2.23	< 10	2.45
Fluoried as F	mg/L	15	0.82	< 1.0	0.90

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E33A			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		10	8.10	5.0 – 9.5	8.90
Elektriese geleiding	mS/m	10	**433.00**	< 150	**433.00**
Kalsium as Ca	mg/L	10	**155.85**	< 150	**155.85**
Magnesium as Mg	mg/L	10	**118.55**	< 100	**118.55**
Natrium as Na	mg/L	10	**659.45**	< 200	**659.45**
Totale alkaliniteit as $CaCO_3$	mg/L	10	178.25	NvT	196.08
Chloried as Cl	mg/L	10	**1327.85**	< 200	**1327.85**
Sulfaat as SO_4	mg/L	10	305.25	< 400	335.78
Nitraat as NO_x-N	mg/L	10	5.42	< 10	5.96
Fluoried as F	mg/L	10	**2.14**	< 1.0	**2.14**

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E33B			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		6	8.18	5.0 – 9.5	8.99
Elektriese geleiding	mS/m	6	**998.20**	< 150	**998.20**
Kalsium as Ca	mg/L	6	**232.15**	< 150	**232.15**
Magnesium as Mg	mg/L	6	**240.60**	< 100	**240.60**
Natrium as Na	mg/L	6	**1780.80**	< 200	**1780.80**
Totale alkaliniteit as $CaCO_3$	mg/L	6	250.95	NvT	276.05
Chloried as Cl	mg/L	6	**3063.90**	< 200	**3063.90**
Sulfaat as SO_4	mg/L	6	**717.85**	< 400	**717.85**
Nitraat as NO_x-N	mg/L	6	4.51	< 10	4.96
Fluoried as F	mg/L	6	**1.77**	< 1.0	**1.77**

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E33C			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		11	8.23	5.0 – 9.5	9.05
Elektriese geleiding	mS/m	11	**482.00**	< 150	**482.00**
Kalsium as Ca	mg/L	11	76.10	< 150	83.71
Magnesium as Mg	mg/L	11	**131.70**	< 100	**131.70**
Natrium as Na	mg/L	11	**674.60**	< 200	**674.60**
Totale alkaliniteit as $CaCO_3$	mg/L	11	260.80	NvT	286.88
Chloried as Cl	mg/L	11	**1472.40**	< 200	**1472.40**
Sulfaat as SO_4	mg/L	11	215.50	< 400	237.05
Nitraat as NO_x-N	mg/L	11	1.76	< 10	1.94
Fluoried as F	mg/L	11	**1.49**	< 1.0	**1.49**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E33D**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		149	7.79	5.0 – 9.5	8.57
Elektriese geleiding	mS/m	149	**636.10**	< 150	**636.10**
Kalsium as Ca	mg/L	143	111.54	< 150	122.69
Magnesium as Mg	mg/L	143	**121.40**	< 100	**121.40**
Natrium as Na	mg/L	143	**1055.72**	< 200	**1055.72**
Totale alkaliniteit as $CaCO_3$	mg/L	144	180.56	NvT	198.62
Chloried as Cl	mg/L	144	**1799.25**	< 200	**1799.25**
Sulfaat as SO_4	mg/L	144	357.20	< 400	392.92
Nitraat as NO_x-N	mg/L	143	0.24	< 10	0.26
Fluoried as F	mg/L	143	**1.84**	< 1.0	**1.84**

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E33E			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		32	7.65	5.0 – 9.5	8.41
Elektriese geleiding	mS/m	32	**585.60**	< 150	**585.60**
Kalsium as Ca	mg/L	32	**142.45**	< 150	**142.45**
Magnesium as Mg	mg/L	32	**168.40**	< 100	**168.40**
Natrium as Na	mg/L	32	**857.70**	< 200	**857.70**
Totale alkaliniteit as $CaCO_3$	mg/L	32	155.10	NvT	170.61
Chloried as Cl	mg/L	32	**1712.00**	< 200	**1712.00**
Sulfaat as SO_4	mg/L	32	301.65	< 400	331.82
Nitraat as NO_x-N	mg/L	32	1.50	< 10	1.64
Fluoried as F	mg/L	32	**2.18**	< 1.0	**2.18**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E33F**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		672	8.00	5.0 – 9.5	8.80
Elektriese geleiding	mS/m	672	**185.80**	< 150	**185.80**
Kalsium as Ca	mg/L	667	102.50	< 150	112.75
Magnesium as Mg	mg/L	666	45.27	< 100	49.80
Natrium as Na	mg/L	627	**183.38**	< 200	**183.38**
Totale alkaliniteit as $CaCO_3$	mg/L	669	165.69	NvT	182.26
Chloried as Cl	mg/L	665	**402.61**	< 200	**402.61**
Sulfaat as SO_4	mg/L	647	96.46	< 400	106.10
Nitraat as NO_x-N	mg/L	671	1.06	< 10	1.17
Fluoried as F	mg/L	626	0.27	< 1.0	0.30

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E33G			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		75	8.13	5.0 – 9.5	8.95
Elektriese geleiding	mS/m	75	**160.00**	< 150	**160.00**
Kalsium as Ca	mg/L	74	87.31	< 150	96.04
Magnesium as Mg	mg/L	74	40.51	< 100	44.56
Natrium as Na	mg/L	69	170.39	< 200	187.43
Totale alkaliniteit as $CaCO_3$	mg/L	75	226.57	NvT	249.22
Chloried as Cl	mg/L	74	**323.58**	< 200	**323.58**
Sulfaat as SO_4	mg/L	70	101.70	< 400	111.87
Nitraat as NO_x-N	mg/L	75	0.63	< 10	0.69
Fluoried as F	mg/L	68	0.45	< 1.0	0.49
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E33H**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		10	7.78	5.0 – 9.5	8.55
Elektriese geleiding	mS/m	10	**372.80**	< 150	**372.80**
Kalsium as Ca	mg/L	10	51.85	< 150	57.04
Magnesium as Mg	mg/L	10	80.00	< 100	88.00
Natrium as Na	mg/L	10	**551.25**	< 200	**551.25**
Totale alkaliniteit as $CaCO_3$	mg/L	10	150.50	NvT	165.55
Chloried as Cl	mg/L	10	**1015.30**	< 200	**1015.30**
Sulfaat as SO_4	mg/L	10	133.65	< 400	147.02
Nitraat as NO_x-N	mg/L	10	0.67	< 10	0.74
Fluoried as F	mg/L	10	0.72	< 1.0	0.79

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E40A			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		132	7.99	5.0 – 9.5	8.79
Elektriese geleiding	mS/m	132	**183.10**	< 150	**183.10**
Kalsium as Ca	mg/L	132	91.90	< 150	101.09
Magnesium as Mg	mg/L	132	68.60	< 100	75.46
Natrium as Na	mg/L	132	**235.60**	< 200	**235.60**
Totale alkaliniteit as $CaCO_3$	mg/L	132	219.90	NvT	241.89
Chloried as Cl	mg/L	132	**333.30**	< 200	**333.30**
Sulfaat as SO_4	mg/L	132	165.25	< 400	181.78
Nitraat as NO_x-N	mg/L	132	0.34	< 10	0.38
Fluoried as F	mg/L	132	**1.10**	< 1.0	**1.10**
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E40B**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		123	7.87	5.0 – 9.5	8.66
Elektriese geleiding	mS/m	123	**200.50**	< 150	**200.50**
Kalsium as Ca	mg/L	120	100.30	< 150	110.33
Magnesium as Mg	mg/L	119	58.40	< 100	64.24
Natrium as Na	mg/L	119	181.60	< 200	199.76
Totale alkaliniteit as $CaCO_3$	mg/L	120	208.25	NvT	229.08
Chloried as Cl	mg/L	122	**358.00**	< 200	**358.00**
Sulfaat as SO_4	mg/L	122	141.86	< 400	156.04
Nitraat as NO_x-N	mg/L	122	0.70	< 10	0.77
Fluoried as F	mg/L	119	0.64	< 1.0	0.70

Chemiese parameter	Eenheid	Kwaternêre opvanggebied E40C			
		Getal monsters	Omgewings-grondwater-gehalte of -mediaan	BMB-reserwe	Grondwatergehalte-reserwe
pH		6	7.57	5.0 – 9.5	8.32
Elektriese geleiding	mS/m	6	91.05	< 150	100.16
Kalsium as Ca	mg/L	6	24.35	< 150	26.79
Magnesium as Mg	mg/L	6	8.55	< 100	9.41
Natrium as Na	mg/L	6	112.20	< 200	123.42
Totale alkaliniteit as $CaCO_3$	mg/L	6	110.60	NvT	121.66
Chloried as Cl	mg/L	6	**193.30**	< 200	**193.30**
Sulfaat as SO_4	mg/L	6	11.30	< 400	12.43
Nitraat as NO_x-N	mg/L	6	0.34	< 10	0.38
Fluoried as F	mg/L	6	0.28	< 1.0	0.31
Chemiese parameter	**Eenheid**	**Kwaternêre opvanggebied E40D**			
		Getal monsters	**Omgewings-grondwater-gehalte of -mediaan**	**BMB-reserwe**	**Grondwatergehalte-reserwe**
pH		8	7.23	5.0 – 9.5	7.95
Elektriese geleiding	mS/m	8	17.60	< 150	19.36
Kalsium as Ca	mg/L	8	3.35	< 150	3.69
Magnesium as Mg	mg/L	8	4.10	< 100	4.51
Natrium as Na	mg/L	8	28.45	< 200	31.30
Totale alkaliniteit as $CaCO_3$	mg/L	8	17.85	NvT	19.64
Chloried as Cl	mg/L	8	40.40	< 200	44.44
Sulfaat as SO_4	mg/L	8	7.75	< 400	8.53
Nitraat as NO_x-N	mg/L	8	1.55	< 10	1.70
Fluoried as F	mg/L	8	0.23	< 1.0	0.25

Tabel 8.3: Opsomming van die grondwatergehalteklas en die parameters van besorgdheid

Opvanggebied	Gebied (km²)	Watergehalteklas (DWAF, 1996)	Watergehalteparameters van besorgdheid
E10A	134	0	
E10B	202	0	
E10C	192	I	pH
E10D	235	0	
E10E	366	0	
E10F	386	0	
E10G	508	0	
E10H	162	0	
E10J	468	0	
E10K	235	II	Cl, Na, EG
E21A	190	0	
E21B	223	I	EG
E21C	233	0	
E21D	242	0	
E21E	293	0	
E21F	379	0	
E21G	266	I	EG
E21H	404	I	pH
E21J	317	0	
E21K	330	0	
E21L	195	0	
E22A	750	II	EG, Cl
E22B	638	III	Cl
E22C	490	0	
E22D	496	III	Cl, Na, Mg
E22E	1013	II	Cl
E22F	400	0	
E22G	367	II	Cl
E23A	762	II	Cl
E23B	705	II	Cl
E23C	318	II	Cl
E23D	750	II	Cl
E23E	564	III	Na
E23F	473	III	Na
E23G	747	III	Na
E23H	660	III	Na
E23J	895	III	Na
E23K	572	II	F, Na

Opvanggebied	Gebied (km²)	Watergehalteklas (DWAF, 1996)	Watergehalteparameters van besorgdheid
E24A	255	III	Cl, Na
E24B	468	III	Cl, Na
E24C	784	II	F, Na
E24D	997	II	F, Na
E24E	671	III	Mg
E24F	582	II	Cl, Na, EG
E24G	633	III	Cl, Na
E24H	483	III	Cl, Na
E24J	1078	II	Cl
E24K	652	III	Cl, Mg
E24L	516	I	pH
E24M	529	II	Cl, Na, EG
E31A	2865	III	Ca, Cl, Na, EG, NO_3, Mg
E31B	1476	III	Cl, Na, EG, SO_4
E31C	1572	III	Cl, Na, EG, Mg
E31D	839	III	Cl, Na, EG, Mg
E31E	478	III	Cl, Na, EG
E31F	525	II	Cl, Na, EG
E31G	1238	III	Cl, Na, EG
E31H	726	III	Cl, Na, EG
E32A	1118	I	EG,F
E32B	828	II	Cl, EG
E32C	638	II	Cl, EG
E32D	616	II	Cl, EG, Na, F
E32E	1001	III	Cl
E33A	1355	III	Cl, EG, Na
E33B	702	III	Cl, EG, Na, Mg, SO_4
E33C	980	III	Cl, EG, Na
E33D	1559	III	Cl, EG
E33E	1282	III	Cl, EG, Na
E33F	725	III	Cl
E33G	894	II	Cl, EG
E33H	719	III	Cl, EG, Na
E40A	941	II	Cl, EG, Na, F
E40B	707	II	Cl, EG
E40C	530	I	Cl, EG, Na
E40D	544	0	

ISAZISO SIKARHULUMENTE

R. SIKA2017

ISEBE LEMICIMBI YEZAMANZI NOGUTYULO LOKUNGCOLA NELINDLE

UMTHETHO WAMANZI WESIZWE , KA1998

(UMTHETHO WAMA-36 KA-1998)

ISIGQIBO MALUNGA NOHLELO LWEMIJELO YAMANZI KUMMANDLA WOLAWULO LWAMANZI I- DOORN

Mna, Sifiso Mkhize, uMphathi-jikelele oBambeleyo weSebe leMicimbi yezaManzi noGutyulo lweLindle, ndigunyaziswa nguMqathango-13 woMthetho waManzi weSizwe, (uMthetho wama-36 ka-1998), neSolotya-3 loMthetho malunga nokuyilwa kweNdlela yokuHlela iMijelo yaManzi ngokweeNdidi njengoko kuxeliwe kuMmiselo-810 weSaziso sikaRhulumente esinguNombolo-33541, esakhutshwa ngoMhla we-17 kuSeptemba ka-2010, nesasigunyaziswa yimiqathango -16(1) no-63(1)(a) yoMthetho, ukuba ndibhengeze iSigqibo ngokuhlelwa kweMijelo yaManzi kuMmandla woBoniselo ngaManzi i-Olifants-Doorn.

Imibuzo malunga nesi sigqibo mayithunyelwe ku:
UMphathi weCandelo leZigqibo zoHlelo lweMijelo yaManzi
Mnu Yakeen Atwaru
ISebe lezaManzi noGutyulo
Ndinaye Building 185 Francis Baard Street
Private Bag X313
Pretoria
0001

i-Email: atwaruy@dws.gov.za

MNU. SIFISO MKHIZE

UMPHATHISWA-JIKELELE (OBAMBELEYO)
UMHLA: 13/12/2017

ISIGQIBO MALUNGA NOHLELO LWEMIJELO YAMANZI KUMMANDLA WOLAWULO LWAMANZI I- DOORN NGOKWEMIQATHANGO YESIQENDU 16(1) NO-(2) SOMTHETHO WAMANZI WESIZWE (UMTHETHO WAMA-36, KA1998)

ULUDWE LWENKQUBO

1. SIWUCHAZA NJANI UMJELO WAMANZI

1.1 UHlelo luchaphazela yonke imijelo yamanzi ephantsi kommandla wolawulo lwamanzi i-Olifants-Doorn, njengoko kubonisiwe apha ngezantsi:

UMmandla woLawulo lwaManzi:	yi-Berg-Olifants-Doorn
Ingingqi yoFunxo:	yi-Primary Drainage
Imilambo:	yonke imilambo ephantsi kwe-Olifants-Doorn
Ichweba lomlambo:	yi-Olifants
Imimandla engeyonxalenye:	wonke ummandla ophantsi kommandla wolawulo i-Berg, neendawana nje zommandla wolawulo i-Olifants catchment (umzekelo u-G30 no-F60)

1.2 UMphathiswa, ngokwemiqathango yesiqendu-16 soMthetho, ka1998 (uMthetho wama-36 ka1998) ("uMthetho"), ukhuphe ingxelo malunga nendlela yokuhlela imijelo yamanzi kwiSaziso sikaRhulumente esingNombolo-810, esipapashwe kuXwebhu lweZaziso zikaRhulumente olunguNombolo-33541, lomhla we-17 Septemba ka-2010. Ngokwemiqathango yesiqendu-16(1) soMthetho, uMphathiswa makenze oku, futhi enze oko ngokukhupha iSaziso ngokukhawuleza emva kokuba ududu lomjelo wamanzi luxeliwe; abeke/asibhale ngokusesikweni iSigqibo soHlelo lwaloo mjelo wamanzi (uwonke okanye ezo ndawana zawo.

1.3 UMphathiswa, ngokwemiqathango yesiqendu-16 soMthetho, u-(1) no-(2), wazisa ngokusesikweni esi Sigqibo soHlelo silandelayo ngommandla wolawulo i-Olifants-Doorn.

2. ISIGQIBO SOHLELO NGEKWEMIQATHANGO YESIQENDU- 16 SOMTHETHO, U-(1) NO-(2)

2.1 Uluhlu lwezifinyezi-magama ezikhethiweyo (neenkcazo) lukwinqanaba-3.

2.2 Isishwankathelo malunga nemithamo yemilambo equka iziza i-EWR ne-BHN ngokwemiqathango yesiqendu-16(1) soMthetho ngokubhekiselele kummandla wolawulo lwamanzi i-Olifants-Doorn njengoko kubonisiwe kwiTafile-4.1.

2.3 Isishwankathelo malunga nemeko yokomelela nobuhle bemilambo kwisiza-EWR ngokwemiqathango yesiqendu-16(1) soMthetho ngokubhekiselele kummandla wolawulo lwamanzi i-Olifants-Doorn njengoko kubonisiwe kwiiTafile- 5.1 - 5.6.

2.4 Isishwankathelo sesiza-EWR malunga nezinga lokwehla kwamanzi agalela emantla kummandla wolawulo lwamanzi kuchweme lomlambo i-Olifants ngokwemiqathango yesiqendu-16(1) soMthetho ngokubhekiselele kummandla wolawulo lwamanzi i-Olifants-Doorn njengoko kubonisiwe kwiiTafile-6.1 - 6.3.

2.5 Isishwankathelo segalelo lamanzi angaphezu komhlaba kuHlelo malunga nomthamo ndawonye nokomelela kwemijelo yamanzi ngokwemiqathango yesiqendu-16(1) soMthetho ngokubhekiselele kummandla wolawulo lwamanzi i-Olifants-Doorn njengoko kubonisiwe kwiiTafile-7.1 - 8.3.

2.6 ISigqibo malunga neHlelo siza kusetyenziswa ukusukela kumhla esityikitywe ngawo ngokwemiqathango yesiqendu-16(1) soMthetho, ngaphandle kokuba umphathiswa ugqibe ngolunye uhlobo.

3. IZISHUNQULELI-MAGAMA NEENKCAZO

3.1 Izishunquleli-magama

BHN	Iimfuno zoluntu ezisisiseko
EcoSpecs	Izinto ezikhethekileyo ngendawo ethile
EIS	Inqaku elibonisa ukubaluleka kochweme lomlambo Estuarine
EWR	Iimfuno zamanzi zechweme lomlambo
GRA II	IBakala lesi-II lohlolo lwemijelo yamanzi angaphezu komhlaba
GRDM	Indlela yokwenza isiGqibo ngehlelo/hlobo lomjelo wamanzi angaphezu komhlaba
GRUs	AmaBakala emijelo yamanzi angaphantsi komhlaba
MAR	Ubuncikane bamanzi emvula (ngonyaka)
MCM	Ii-Metre zobalo-mthamo lwamanzi
MAR	Ubuncikane bamanzi emvula (ngonyaka)
PES	Ubume bangoku bendawo
REC	IBakala lendawo elivunyiweyo
TEC	IBakala lendawo echongiweyo
TPCs	Imiyinge malunga nenqanaba omawuqale ngalo ukukrokra

3.2 Iinkcazo

Isichenene amanzana asoloko ebonakala (emilanjeni) ngamaxesha embalela futhi ingekuba sisuka kumanzi angaphezu komhlaba includes contribution from delayed interflow and groundwater discharge.

i-EWR ibhekisa kuhlobo olunye lokunkcenkceza kwamanzi (kujongwe kwisixa, ixesha, nethuba ankcenkceza ngalo) nemiba yomthamo wamanzi owamkelekileyo khunukuze izilwanyana zasemanzini zikwazi ukuphila kwiimeko ezithile.

Ukuvuselela Le yimeko yokumana kugalelwa/kunkinkishwa amanzi kwindawo atshe kuyo, mhlawumbi ngokuncitshiswa kokunyuka komphunga wamanzi okanye amanzi asemhlabeni, okanye ke kususwe/kuthuthwe amanzi kwindawo yogcino lwawo esisiwa kwenye ngenxa yemeko ethile (umzekelo ngexesha leempuphuma).

UHlelo Libhekisa kumthamo nobumnandi/coceko lwamanzi afunekayo khonukuze abe anele okanye alungele ukusetyenziswa ngabantu. Le nto yenziwa ngokuthi kubekwe mbinana ethile asisiseko eya kwanelisa imfuno yabantu, kwandule kukhuselwe loo ndawo ithile yogcino lwamanzi ukuqinisekisa ukuba izilwanyana zasemanzini zisoloko zinawo amanzi ukuze ziphile, futhi loo manzi abe anele rhoqo kuza kusetyenziswa loo mjelo uthile wamanzi.

4. AMANZI ANGAPHEZU KOMHLABA- UMTHAMO WAMANZI EMILAMBO

Iziphumo zeSigqibo soHlelo lwemijelo yamanzi kwimilambo ephantsi kommandla wolawulo lwamanzi i-Olifants/Doring. Amanani-miyinge oHlelo aboniswe ngeepesenti ze-MAR kuyo yonke imamandla yolawulo lwamanzi ngokwemiqathango yesiqendu-16(1) soMthetho.

Itafile-4.1: Isishwankathelo malunga nemithamo yemilambo, oko kuquka iziza- EWR no-BHN.

Ummandla wolawulo lwamanzi	Umjelo wamanzi	i-PES	i-EIS	i-REC	Umjelo wezilwanyana eziphila emanzini (uyaguqu-guquka) (% MAR)	Umjelo weemfuno zamanzi zoluntu (% MAR)	i-MAR (MCM)	UHlelo lulonke (%MAR)
E10A	Olifants	C	Phezulu	C	43.58	0.00	60.475	43.58
E10B	Olifants	C	Phezulu	C	44.26	0.01	129.003	44.27
E10C	Olifants	B	Phezulu	B	51.09	0.00	182.405	51.09
E10D	Olifants	C	Phakathi	D	52.38	0.00	233.767	52.38
E10E	Olifants	C	Phakathi	D	37.77	0.4	293.467	38.17
E10F (EWR 1)	Olifants	D	Phakathi	D	37.77	0.03	355.557	37.8
E10G	Olifants	C	Phakathi	D	26.59	0.03	437.273	26.62
E10G (EWR 3)	Rondegat	B	Phakathi	B	42.75	0.03	7.411	42.78
E10H	Jan Dissels	D	Phakathi	C	19.70	0.00	44.686	19.70
E10J& E10J (Q7)	Olifants	D	Phakathi	D	14.90*	0.154	46.205*	15.054
E10K (EWR 2)**	Olifants	E	Phakathi	E	9.32	0.00	505.716	9.32
E21A	Kruis	E	Phantsi	C	41.98	0.07	39.425	42.05
E21B	Welgemoed	D	Phantsi	D	23.56	0.161	1.230	23.72
E21C	Winkelhaak	D	Phantsi	C	19.48	0.00	41.939	19.48
E21D	Houdenbeks	D	Phantsi	D	27.72	0.092	50.217	27.81
E21E	Riet	B	Phantsi	B	29.13	0.008	93.772	29.14
E21F	Riet	A/B	Phantsi	B	21.72	0.00	95.862	21.72
E21G	Groot/ Leeu	D	Phantsi	D	38.55	0.04	55.220	38.59
E21H	Twee	A/B	Phantsi	B	70.21*	0.00	55.055*	70.21
E21H	Leeu	A/B	Phantsi	B	64.3	0.00	138.715	64.3
E21J (EWR 6)	Groot	B	Phantsi	B	50.65	0.00	140.463	50.65
E21K	Maatjies	B	Phantsi	B	62.86	0.00	1.819	68.86
E21L	Groot	B	Phantsi	B	50.02	0.00	239.220	50.02
E22A	Doring	A/B	Phantsi	B	47.5	0.012	4.138	47.512
E22B	Doring	B	Phantsi	B	43.1	0.002	7.66	43.10
E22C	Tankwa	C	Phantsi	A/B	47.47	0.984	2.704	48.45
E22D	Tankwa	A/B	Phantsi	A/B	31.93	0.027	5.44	31.957
E22E	Doring	B	Phantsi	B	43.11	0.0004	18.688	43.11
E22F	Doring	B	Phantsi	B	43.11	0.00	20.894	43.11
E22G	Doring	B	Phezulu	B	50.42	0.00	266.606	50.42
E23A	Tankwa	A/B	Phantsi	A/B	32.42	0.00	8.001	32.42
E23B	Tankwa	A/B	Phantsi	A/B	32.42	0.00	15.403	32.42
E23C	Tankwa	A/B	Phantsi	A/B	32.42	0.00	3.339	32.42
Low	Tankwa	A/B	Phantsi	A/B	32.42	0.00	26.617	32.24

Ummandla wolawulo lwamanzi	Umjelo wamanzi	i-PES	i-EIS	i-REC	Umjelo wezilwanyan a eziphila emanzini (uyaguqu-guquka) (% MAR)	Umjelo weemfuno zamanzi zoluntu (% MAR)	i-MAR (MCM)	UHlelo lulonke (%MAR)
Low	Tankwa	A/B	Phantsi	A/B	32.42	0.00	5.922	32.24
Low	Tankwa	C	Phantsi	B	26.38	0.00	37.503	26.38
Low	Ongeluks	A/B	Phantsi	A/B	32.42	0.018	7.844	32.44
Low	Ongeluks	A/B	Phantsi	A/B	32.42	0.00	69.30	32.42
Low	Ongeluks	A/B	Phantsi	A/B	32.42	0.00	61.673	32.42
Low	Tankwa	B	Phantsi	B	26.38	0.00	105.182	26.38
Low	Tra-tra	B	Phantsi	B	73.6	0.316	4.523	73.92
Low	Tra-tra	B	Phantsi	B	63.19	0.0324	12.803	63.22
Low	Bos	B	Phantsi	C	32.55	0.00	13.855	32.55
Low	Bos	C	Phantsi	C	17.71	0.00	31.475	17.71
Low	Wolf	A/B	Phantsi	A/B	32.54	0.00	11.855	32.54
Low	Wolf	A/B	Phantsi	A/B	32.54	0.00	22.140	32.54
E24G	Wolf	A/B	Phantsi	A/B	32.54	0.00	33.327	32.54
E24H (EWR 4)	Doring	A/B	Phezulu	B	44.99	0.0098	420.425	44.99
E24J	Doring	B	Phezulu	B	48.47	0.00	439.475	48.47
E24K(EWR 5)	Doring	A/B	Phezulu	B	48.47	0.00	450.996	48.47
E24L	Brandewyn (Doringmain stem)	B	Phezulu	B	50.29	0.00	508.227	50.29
E24M	Doring	B	Phezulu	B	50.33	0.00	517.577	50.33
E31A-Q2	Sa raip se Laagte	B	Phakathi	B	26.12	0.00	3.091	26.12
E31B	Kromme	B	Phakathi	B	25.66	0.00	0.978	25.66
E31C	Kromme	B	Phakathi	B	25.66	0.00	2.012	25.66
E31D	Kromme	B	Phakathi	B	25.66	0.00	2.556	25.66
E31E	Kromme	B	Phakathi	B	25.66	0.00	2.880	25.66
E31F	Hantams	B	Phakathi	B	25.62	7.654	0.324	33.27
E31G	Kromme	B	Phakathi	B	25.65	0.00	0.814	25.65
E31H	Hantams	B	Phakathi	B	25.65	0.00	4.506	25.65
E32A	Kromme	B	Phakathi	B	17.30	0.00	0.681	17.30
E32B	Hantams	B	Phakathi	B	26.23	0.00	7.018	26.23
E32C	Hantams	B	Phakathi	B	26.23	0.00	9.320	26.23
E32D	Hantams	B	Phakathi	B	26.22	0.00	11.544	26.22
E32E	Hantams	B	Phakathi	B	26.22	0.00	15.148	26.22
E33A	Sout	B	Phakathi	C	26.03	0.017	20.579	26.05
E33B	Sout	C	Phakathi	C	17.40	0.00	21.273	17.40
E33C	Vars	D	Phakathi	C	17.04	0.327	1.009	17.37
E33D	Geelbek	C	Phakathi	C	17.09	0.00	1.590	17.09
E33E	Sout	C	Phakathi	C	17.39	0.023	25.197	17.413

Ummandla wolawulo lwamanzi	Umjelo wamanzi	i-PES	i-EIS	i-REC	Umjelo wezilwanyana eziphila emanzini (uyaguqu-guquka) (% MAR)	Umjelo weemfuno zamanzi zoluntu (% MAR)	i-MAR (MCM)	UHlelo lulonke (%MAR)
E33F-Q1	Troe-troe	D	Phakathi	D	11.22	1.366	4.530	12.586
E33G	Olifants	D	Phakathi	D	12.14	0.032	1028.771	12.172
E33H	Olifants	D	Phakathi	D	12.97	0.0102	1054.724	12.98
E40A	Oorlogskloof	C	Phakathi	C	41.51	0.00	16.631	41.51
E40B	Oorlogskloof	C	Phakathi	C	41.53	0.387	29.125	41.92
E40C	Oorlogskloof	C	Phezulu	C	51.84	0.042	38.491	51.882
E40D	Koebee	C	Phezulu	B	56.69	0.00	48.104	56.69

Ingcaciso:MAR – ubuncikane bamanzi emvula ngonyaka
MCM- Imetre ezibonisa umyinge wamanzi
*Imfuneko (enyukelayo) kumjelo onezilwanyana eziphila kuwo
**Ngokwemiqathango ye-RDM inqanaba elibonisa impilo-ntle yezilwanyana kuloo mjelo uthile mayingabi ngaphantsi ko-D (DWAF 1999)

5. AMANZI ANGAPHEZU KOMHLABA- UBUHLE NOCOCEKO LWEMILAMBO (Isishwankathelo sobuhle, ucoceko nokomelela kwisiza-EWR

Itafile-5.1. Imiqathango ngendawo yezilwanyana zasemanzini (Ecospecs) nee-TPC zesiza-RU4-Olifants, njengoko zimelwe sisiza -**EWR (1)**: UKUSUKA ECITRUSDAL UKUYA KWIDAMA I-CLANWILLIAM)

IINKCAZO NGEZI NDAWO	II-TPC
Ubuhle nococeko lwamanzi	
iityuwa	
$MgSO_4$ (mg/l)	>37
Na_2SO_4 (mg/l)	>51
$MgCl_2$ (mg/l)	>51
$CaCl_2$	>105
NaCl (mg/l)	>389
Ubushushu bamanzi	Abuxelwanga
pH	<6.5 – >9.0
EC (mS/m)	>15
DO (mg/l)	< 6.0
ityhefu	
Ammonia as NH_3 (mg/l)	>0.007
Nutrients	
Nitrates as N (mg/l)	>0.100
Phosphorous as PO_4-P(mg/l)	>0.020
Izilwanyana zasemanzini ezingenamqolo	
Amanqaku e-SASS5	<100
ASPT	<7.5
Ephemeroptera: Baetidae	Zingaphantsi kwe- 4 iindidi eziphila kwesi siza
Ephemeroptera: Leptophlebiidae	Ezingekhoyo ukusukela kwi > 50% yeesampulu
Ephemeroptera: Heptageniidae	Ezingekhoyo ukusukela kwi-SIC/SOC biotope ehlotyeni
Coleoptera and Trichoptera	Lungaphantsi kwe-3 usapho olukhoyo
Odonata	Lungaphantsi ko-1 usapho olukhoyo nakuyiphi na isampulu
Plecoptera: Notonemouridae	Ezingekhoyo ukusukela kwi > 50% yeesampulu kwi-SIC
Izityalo zasemanzini ne-SIC	Azikho

Table 5.2. Imiqathango yomjelo ohlala izilwanyana nee-TPCs kwisiza-RU6-Olifants, ezimelwe sisiza- **EWR Site 2 (UKUSUKELA KU-**RU 6: BULSHOEK BARRAGE IYOQHINA EKUDIBANENI NOMLAMBO I-DORING)

IINKCAZO NGEZI NDAWO	II-TPC
Ubuhle nococeko lwamanzi	

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lityuwa	
$MgSO_4$ (mg/l)	>37
Na_2SO_4 (mg/l)	>51
$MgCl_2$ (mg/l)	>51
$CaCl_2$	>105
NaCl (mg/l)	>389
Ubushushu bamanzi	Abuxelwanga
pH	<6.5 – >9.0
EC (mS/m)	>25
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	>0.007
Nutrients	
Nitrates as N (mg/l)	>0.100
Phosphorous as PO_4-P(mg/l)	>0.015
Izilwanyana zasemanzini ezingenamqolo	
SASS5 Score	< 30
ASPT	< 4.5
Ephemeroptera: Baetidae	Ezingekhoyo ukusukela kwi-50% yeesampulu
Hemiptera and Odonata	Ezingaphantsi kwe-2 sosapho kudidi ngalunye

Itafile-5.3. UMLAMBO I-RONDEGAT NESIZA- **EWR 3.**

IINKCAZO NGEZI NDAWO	**II-TPC**
Ubuhle nococeko	
lityuwa	
$MgSO_4$ (mg/l)	>23
Na_2SO_4 (mg/l)	>33
$MgCl_2$ (mg/l)	>30
$CaCl_2$	>57
NaCl (mg/l)	>191
Ubushushu bamanzi	Abuxelwanga (akukho kuxhomekeka bushushwini buxeliweyo)
pH	<5.2 or >7.0
EC (mS/m)	>10
DO (mg/l)	< 6.0
lityhefu	
Ammonia as NH_3 (mg/l)	>0.007
Nutrients	
Nitrates as N (mg/l)	>0.020
Phosphorous as PO_4-P (mg/l)	>0.010
Izilwanyana zesemanzini ezingenamqolo	
SASS5 Score	< 170
ASPT	< 7.5
Ephemeroptera: Baetidae	Zingaphantsi kwe-7 iindidi ezikhoyo kwisiza siphela
Demoreptus capensis	Azibikho ehlotyeni
Trichoptera	Zingaphantsi kwe-5 iindidi ezikhoyo kwisiza siphela Fewer than 5 species present overall at site, zimele ezi ntsapho zine zilandelayo : Barbarochthonidae, Leptoceridae, Petrothrincidae, Sericostomatidae
Ephemeroptera: Leptophlebiidae	Zikhona kodwa ngaphantsi kwe-80% yeesampulu (ziyaguquguquka ngesi siza, zithathwa ekuhambeni kwexesha)
Ephemeroptera: Heptageniidae	Zimbalwa kunee-Baetidae kwiisampulu zasehlotyeni
Coleoptera	Zingaphantsi kwi-3 yeentsapho ezikhoyo
Blephariceridae and Notonemouridae	Azibikho ebusika
Utyani/Izityalo zasemanzini (ezingaphandle kwamaza); utyani oluxutyiweyo; i-SIC	Azikho ezindawo

Itafile-5.4. Imiqathango yemjelo ehlala izilwanyana nee-TPC zomlambo i-RU4-Doring, ezimelwe sisiza-**EWR Site 4.**
(UKUSUKA KUMLAMBO I-RU 4: TANKWA/DORING
UKUYA KUQHINA EKUDIBANENI NE-DORINGBOS)

IINKCAZO NGEZI NDAWO	**II-TPC**
Ubuhle noococeko lwamanzi	
lityuwa	
$MgSO_4$ (mg/l)	<23
Na_2SO_4 (mg/l)	<33
$MgCl_2$ (mg/l)	<30
$CaCl_2$	<57
NaCl (mg/l)	<191
Ubushushu bamanzi	Iintlanzi ezindala : ubuncikane bazo mihla le = kangange-40 °C (unyaka wonke). Ubuncikane bokuzala kwazo= kangange-19 °C, iqondo lozalo eliyimfuneko = 25-28 °C (Novemba ukuya ku-Janyuwar).
pH	6.5 – 8.5
EC (mS/m)	<20
DO (mg/l)	> 6.0
Toxics	
Ammonia as NH_3 (mg/l)	<0.007
Nutrients	
Nitrates as N (mg/l)	<0.020
Phosphorous as PO_4-P (mg/l)	<0.020
Aquatic Invertebrates	
Amanqaku e-SASS5	< 125
ASPT	< 6
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Ngaphantsi kwe-2 seendidi ezikhoyo
Ephemeroptera: Leptophlebiidae	Ezingekhoyo ukusukela kwi > 20% yeesampulu
Diptera: Simuliidae	Ezingekhoyo ukusukela kwi > 50% yeesampulu ze-SIC
Utyani/izityalo zasemanzini (ezingaphandle kwamaza); utyani oluxutyiweyo; i-SIC	Azikho

Itafile-5.5. Imiqathango yemjelo ehlala izilwanyana nee-TPC zomlambo i-RU4-Doring, ezimelwe sisiza-**EWR Site 5.**
(UKUSUKA KUMLAMBO I-RU 5: DORINGBOS
UKUYA KUQHINA EKUDIBANENI NE-OLIFANTS/DORING)

IINKCAZO NGEZI NDAWO	**II-TPC**
Ubuhle noceceko lwamanzi	
lityuwa	
$MgSO_4$ (mg/l)	> 23
Na_2SO_4 (mg/l)	> 33
$MgCl_2$ (mg/l)	> 30
$CaCl_2$	> 57
NaCl (mg/l)	> 191
Ubushushu bamanzi	Iintlanzi ezindala : ubukhulu bazo mihla le = kangange-40 °C (unyaka wonke). Ubuncikane bokuzala kwazo= kangange-19 °C, iqondo lozalo eliyimfuneko = 25-28 °C ((ukusukela kuNovemba ukuya kuJanyuwari).
pH	< 6.5 or > 8.5
EC (mS/m)	> 50
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	> 0.007
Izondlo	
Nitrates as N (mg/l)	> 0.020

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Phosphorous as PO_4-P (mg/l)	> 0.020
Izilwanyana zasemanzini ezingenamqolo	
SASS5 Score	< 125
ASPT	< 6
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Zingaphantsi kweendidi ezikhoyo
Ephemeroptera: Leptophlebiidae	Azikho ukususka kwi> 20% yeesampulu (ziyaguquguquka ngesiza, zithathwa ekuhambeni kwexesha)
Diptera: Simuliidae	Azikho ukususka kwi> 50% yeesampulu ze-SIC
Utyani/izityalo zasemanzini (ezingaphandle kwamaza); utyani oluxutyiweyo; i-SIC	Azikho ezi ndawo

Itafile-5.6. Imiqathango yemijelo ehlala izilwanyana nee-TPC zomlambo i-RU4-Grootng, ezimelwe sisiza-**EWR Site 6.** (UKUSUKA KUMLAMBO I-RU 2: GROOT UKUYA E-GEORGE KUQHINA EKUDIBANENI NE-OLIFANTS/DORING)

IINKCAZO NGEZI NDAWO	**II-TPC**
Ubuhle nococeko lwamanzi	
lityuwa	
$MgSO_4$ (mg/l)	> 23
Na_2SO_4 (mg/l)	> 33
$MgCl_2$ (mg/l)	> 30
$CaCl_2$	> 57
NaCl (mg/l)	> 191
Ubushushu bamanzi	Iintlanzi ezindala : ubukhulu bazo mihla le = kangange-40 °C (unyaka wonke). Ubuncikane bokuzala kwazo= kangange-19 °C, iqondo lozalo eliyimfuneko = 25-28 °C ((ukusukela kuNovemba ukuya kuJanyuwari).
pH	< 6.5 OR > 8.5
EC (mg/l)	> 20
DO (mg/l)	< 6.0
Toxics	
Ammonia as NH_3 (mg/l)	> 0.007
Izondlo	
Nitrates as N (mg/l)	> 0.020
Phosphorous as PO_4-P (mg/l)	> 0.020
Izilwanyana zasemanzini ezingenamqolo	
Amanquaku e-SASS5	< 170
ASPT	< 7.5
Trichoptera: Ecnomidae, Philopotamidae (winter), Hydropsychidae, Hydroptilidae	Ubuncikane ziintsapho ezi-3 zeecaddis ezivalelwe kwizindlwana ezikhoyo kwisiza siphela, nobuncikane bezi ntsapho zi4 zilandelayo: - Ecnomidae,Leptoceridae,- Philopotamidae , Sericostomatidae
Ephemeroptera: Leptophlebiidae	Absent from > 10% of samples
Ephemeroptera: Heptageniidae	Absent from > 20% of samples
Megaloptera: Corydalidae	Absent from > 40% of samples
Coleoptera	< 3 families
Stones-in-current, including fast-flowing, turbulent riffle and run	

6. Uchweme lomlambo

Imida yobume bomhlaba kwichweme lomlambo i-Olifants

Umda osemazantsi omlambo: emlonyeni wechweme (31° 42.00'S; 18°11.34'E).
Umda osemantla omlambo: Umgangatho wefuthe lweliza, oko kukuthi umcangcatho e-Lutzville – kangangee-km ezingama-36 km ukususka emlonyeni wochweme (31°33.80'S; 18°19.78'E).
Umda osemacaleni omlambo: iimitha ezi-5 zeengxondorha ezingaphezu komgangatho wolwandle kunxweme ngalunye.

Itafile-6.1. iimfuno/umyinge wamanzi ofunekayo kumjelo wamanzi ngamnye ophantsi kochweme lwe-Olifants Estuary.

Ummandla wolawulo lwamanzi	Umjelo wamanzi	i-PES	i-EIS	i-REC	Uhlelo lomjelo wamanzi ohlala izilwanyana (% MAR)	i-MAR (MCM)	Lulonke uhlelo (%MAR)
Uchweme-E33H	Olifants	C	Phezulu kakhulu	B	56	1055	56

UHLELO LWEMIJELO EHLALA IZILWANYANA NGOKUMETA IMITHAMO YAWO

UMYINGE OVUNYIWEYO WOKUHAMBA KWAMANZI

Uchweme lwe-Olifants luxelwe njengeyona ndawo emelwe kukhuselwa (DWAF, 2004). Ngokwemiqathango yesikhokelo yokuxela umyinge ovunyiweyo wokuhamba kwamanzi (i-REC) uchweme olo malube kwiBakala-A kungenjalo lube kweyona meko intle yaziwayo (kwinqanaba i-BAS) noko kunjalo, kuba uphuhliso lwamadama amakhulu sele luqhubeka kulo mmandla wolawulo lwamanzi (umzekelo idama i-Clanwilliam) kuza kuba nzima ukuphuhlisa i-Olifants ide ifikelele kwiBakala-A. Kungoko sicebisa ukuba uchweme lomlambo i-Olifants luphuhliswe ukuya kufikelela kuphela kubuncikane be- REC emiselwe "amachweme abaluleke kakhulu", abizwa ngokuba ngamachweme eBakala-**Category B, uMboniso**-2, oko kukuthi umboniso wohambo lwamanzi okhoyo nomyinge wokuhamba kwamanzi ovunyiweyo kwimijelo yamanzi ehlala izilwanyana. (I-MAR = 800.3 x 10^6 m^3) ngumyinge ovunyiweyo wokuhamba kwamanzi kuchweme lomlambo i-Olifants. Imiyinge yokuhamba kwamanzi eyabelwe olu chweme ibonisiwe apha ngezantsi:

Itafile-6.2. Umyinge owabelwe uMboniso-2.

iiPercentile	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
99%ile	48.13	32.08	21.50	37.21	24.46	7.77	96.73	194.20	550.92	472.06	230.02	153.70
90%ile	28.90	9.60	7.24	3.64	3.76	3.85	9.62	80.90	151.71	159.08	126.25	65.58
80%ile	16.05	4.30	2.06	1.75	1.68	2.21	4.85	22.01	93.83	104.19	79.44	48.08
70%ile	12.84	2.93	1.68	1.55	1.38	1.81	3.07	11.18	57.99	78.10	66.22	34.22
60%ile	11.49	2.93	1.51	1.51	1.37	1.46	2.88	8.24	42.45	58.26	50.45	25.66
50%ile	10.11	2.93	1.50	1.51	1.34	1.42	2.84	6.19	37.99	51.82	47.54	22.18
40%ile	9.01	2.49	1.50	1.51	1.34	1.42	2.49	3.57	36.22	39.92	44.77	16.34
30%ile	8.32	1.51	1.50	1.51	1.34	1.42	1.76	3.42	24.20	30.79	33.23	14.73
20%ile	6.36	1.43	1.18	1.51	0.91	1.11	1.41	2.05	15.78	21.17	28.07	11.21
10%ile	4.02	0.83	0.58	0.99	0.85	1.00	1.28	1.15	7.44	9.49	17.41	9.66
1%ile	1.01	0.15	0.00	0.99	0.34	0.00	0.04	0.29	0.82	2.07	5.35	4.04

IMIQATHANGO NGEMIJELO EHLALA IZILWANYANA

Le yimiqathango ecace gca nekulula ukuyihlola xa kujongisiwa iimpawu zemijelo ehlala izilwanyana. Xa sibhekiselele kumachweme omlambo sithetha ngokuhlola uguquguquko lwamaza, ubuhle nococeko lwamanzi nezinye iimpawu ezahlukayo kuba ezi nkcukacha zibonisa iBakala elithile ekulo imijelo ehlala izilwanyana (**iBakala-B** xa sibhekiselele kuchweme lomlambo i-Olifant). Impawu ezibonisa ukuba kukho ingxaki zichazwa njengezalathisi ezihlolekayo ezithi ukuba ude wafikelela kuzo xa usenza uhlolo kunyanzeleke ukuba uqalise ukuza nesisombululo sengxaki leyo.

Itafile-6.3. imiqathango ngemijelo ehlala izilwanyana nee-TPC ezibandakanyekayo

UDIDI LWESILWANYANA	IMIQATHANGO YOMJELO	UPHAWU OLUBONISA UBUKHO BENGXAKI
Iintaka	Umjelo mawugcine: ubuhle bodidi (lweentaka), ubuninzi neentlobo-ntlobo zeentaka, umele ezo zihlalayo nezo zifudukayo, eziphumayo neziphila emanzini kuphela ngokwemeko yelo xesha (ngaphandle kwamaxa zixhaphakile ezi ziphila emanzini kuphela (xa zisanda kangange-10% kunamanani esiqhelo)	1.1 Amanani eentaka aguquguquka kangangee-50% nangaphezulu xa kuthelekiswa nesimo esiqhelekileyo ngamaxesha athile omnyaka, mhlawumbi de ibe yiminyaka emibini elandelelanayo isenzeka lee nto (ehlotyeni okanye ebusika) 1.2 Xa ubunzulu bamanzi busehla kangange-20% xa kuthelekiswa nesimo esiqhelekileyo de ibe yiminyaka emibini elandelelanayo isenzeka lee nto (ehlotyeni okanye ebusika) de ibe yiminyaka emibini elandelelanayo isenzeka lee nto (ehlotyeni okanye ebusika)
Iintlanzi	Ugcine ezi ntlobo zentlanzi: ezihlala ngqo/oko eluchwemeni lomlambo (35%), zihlala zimana ziphumaphuma eluchwemeni lomlambo (50-60%), ezinyanzelisayo ukuhlala eluchwemeni (>1%), ezikholwa kukuhlala emanzini amnandi nacocekileyo (>1%). Ezizingcayo ngokuhlala emanzini amnandi nacocekileyo (<0.5%)	2.1 Xa ibakala leendidi zeentlanzi eziphila eluchwemeni lisehla kangangee-30% kunenani elikhulu lesiqhelo 2.2 Xa ibakala leentlanzi ezinyanzelekileyo ukuba zihlale eluchwemeni lisehla kangange-1% kunenani elikhulu lesiqhelo 2.3 Xa ibakala leentlanzi ezihlalayo ze zimana ziphumaphuma eluchwemeni lomlambo lisehla kangange- 50% okanye 60% kunenani elikhulu lesiqhelo 2.4 Xa ibakala leentlanzi ezizingcayo ngokuhlala emanzini amnandi nacocekileyo lingaphezu kwe-0.5% 2.5 Xa ibakala leentlanzi ezihlala kwi-Benthic lisihla nge-2% kunenani elikhulu lesiqhelo kuchweme olungaphezulu kwee-km ezili-18 ukusuka emlonyeni wochweme

UDIDI LWESILWANYANA	IMIQATHANGO YOMJELO	UPHAWU OLUBONISA UBUKHO BENGXAKI
	Ukhuthaze ukumenywa kweentlanzi ezindala nezincinane kumabakala eemeko ngeemeko (lo mqathango ufuna ugcine amanzi ahambayo/nangena ngokwaneleyo elwandle khonukuze ahlale epholile emnandi (ngokobushushu nangokobukho betyuwa) . Le nto ithetha ukuthi mazibe ninzi iintlanzi ezineminyaka e: 0 -1 ziphila.	2.6 Xa kukho ezo zifuduka zimke kangangonyaka kwiindidi ezithile zentlanzi
Ezingenamqolo	Ugcine ubuhle bodidi lwezi zilwanyana, zihlale zixubile (ezininzi nezimbalwa). Kodwa ngokwemeko yangoku lubakho olo didi luninzi ukwedlula olunye. NgeBakala-B ezo zongameleyo mazibe ziintlobontlo ezininzi phakathi enyakeni.	3.1 Ubuhle bodidi lwezi zilwanyana bungaphezu kwe 30% ne50% nge-zooplankton ne-macroinvertebrates ngokulandelelanayo
	Ugcine Udidi oluyi- Capitella capitate malungabi luninzi ukwedlula olwe-benthic	3.2 i-*Capitella capitata* idlula i-benthic nge-50%
	Ugcine ipethini yokuhanjiswa kodidi i-Calianassa nodidi i-Upogebia, njengoko isimo sangoku sibonisa	3.3 amabakala obuninzi okanye iindawo ezithuthelwa kuzo ehla kangange-50% (isikakhulu ezo zihlala ezantsi esantini)
Ii-Macrophytes	Ugcine isimo sangoku sokuhanjiswa (uhlobo luka2004) nobuninzi bezityalo eziziintlobo ngeentlobo (umzekelo ii-*Zostera capensis* (48 ha), intertidal salt marsh (92 ha), supratidal salt marsh (143 ha), floodplain salt marsh (797 ha), reeds and sedges (60 ha)	4.1 lungaphezulu kwe-20% utshintsho kwindawo ethiwe jize/egqunywe ziintlobo ngeentlobo zezityalo
	Unciphise indawo egqunywe lukhula kumphezulu wochweme kangange- 50% xa uthelekisa nemeko yangoku (uhlobo luka2004). Ngoko ke indawo egqunywe ngamakhula (afana nala:*Azolla filiculoides*, nuisance filamentous algae, *Enteromorpha*, *Ulva*, *Cladophora* nepondweed (*Potamogeton pectinatus*) ube yi-30 ha	4.2 i-15 km kumphezulu wochweme kummandla i-50% kwindlela yamanzi ochweme olugqunywe lukhula (i-*Azolla filiculoides*), i-nuisance filamentous algae (umzekelo i- *Enteromorpha*, *Ulva*, *Cladophora*) nepondweed (*Potamogeton pectinatus*).
	Ulawule ukusasazeka kwamakhula atshabalalisayo ngengala: *i-Sesbania punicea* ne-*Eucalyptus* spp.	4.3 anyuke ngaphezulu kwe- 20 %
	Ugcine indawo yeengcongolo nenqoboka (60 ha) netyuwa engange(~10 ha) ngokwesimo sangoku (uhlobo luka2004) (ngokunqanda amanzi anetywa eninzi)	4.4 iingcongolo neetyuwa kumgama i- 8.5 km ukuya kutsho phaya emantla ukusuka emlonyeni wochweme.

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UDIDI LWESILWANYANA	IMIQATHANGO YOMJELO	UPHAWU OLUBONISA UBUKHO BENGXAKI
	Unqande ukwanda komhlaba oze ngokugcina ubutyuwa bamanzi angaphezulu komhlaba buyi- <70 nobunzulu ukuya kwitafile yamanzi buyi- < 1.5 m	4.5 bunyuke ngaphezulu kwe-20% kwindawo eze yeetyuwa
ii-Microalgae	Ugcine i-phytoplankton biomass iphantsi kangange-REI (10 ppt to +1 ppt)	5.1 Ubunzima be-Phytoplankt budlula obohlaza kangange-15 µg/l ehlotyeni, kangange-10 ug/l ebusika 5.2 I-Blue-green algae yodlula i-phytoplankton kangange-10% cell counts
	Ugcine iqela le-microalgal lahlukile njengoko kuthathwe umlinganiselo wayo kwisimi sangoku (ku2004)	5.3 ii-Flagellates ziyayeka ukongamela ze zona ii-diatoms zihle ngokwahlukahluka (kangange<10 taxa kwisiza ngasinye)
	Ugcina ubunzima be-intertidal ne-subtidal microphytobenthic njengoko kuthathwe umlinganiselo wayo kwisimi sangoku (ku2004)	5.4 Ubunzima be-Benthic microphytobenthic bodlula uhlaza kangange-40 mg/m^2
	Ugcine ubukho bee-dinoflagellates busezantsi	5.5 Ubukho be-dinoflagellates bodlula obe-phytoplankton kangange-5% counts
Ubuhle nococeko lwamanzi	Ukungenelela kwetyuwa mabungabangeli ukuwanda ngokugqithileyo kwe- TPCs yeentlanzi, yezilwanyana ezingenamqolo, yee- macrophytes nee-microalgae (njengoko kubonisiwe ngentla	6.1 Ubutyuwa emanzini ungaphezulu kwe-20 kwisithuba esingaphezulu kweenyanga ezi- 3 months, kubude obungange- 7 km ukuya emantla ukusukela emlonyeni wochweme 6.2 Ubutyuwa emanzini angaphezulu komhlaba bunyuka nge- 50 ppt ze ubunzulu bube - 1 m ukuya kwitafile yamanzi 6.3 Zizonke iziqina ezinyibilikisiweyo zinyuka nge 3500 mg/l (i-phytoplankton) 6.4 Ubutyuwa bamanzi kuchweme lomlambo budlula kanga nge- 35 ppt (prevent hyper- salinity) (for phytoplankton) 6.5 Ubutyuwa bamanzi obungaphezulu kwe-10 ppt buyavakala kubude obuyi- 16 km emantla ukuya emlonyeni wochweme lomlambo.
	Ukwahluka (ngokobushushu, i-, pH, ubukho bodaka emanzini, i-oksijini enyibilikisiweyo, neziqini ezirhoxisiweyo (yiya phaya phezulu)	6.6 Okungena emlanjeni: Ubushushu ehlotyeni < 20°C i-pH < 6.5 'udaka' olungena emlanjeni (luseza kuqikelelwa) i-oksijini enyibilikayo < 4 mg/l
		6.7 umbhalo we-Secchi disc ongaphezu ngee-8 km ukusuka emlonyeni ungaphezulu kwe 1 m (esetyenziswa njengendlela yokuthatha umlinganiselo wobukho bodaka kuchweme lomlambo)

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UDIDI LWESILWANYANA	IMIQATHANGO YOMJELO	UPHAWU OLUBONISA UBUKHO BENGXAKI
		6.8 i-pH > 8.5 okanye < 6.5 koko kungena emlanjeni okanye eluchwemeni
		6.9 Amathontsi i-DO angaphantsi kwe- 4 mg/l (i-1 m ngaphezu ezantsi, ngaphandle kwakwimingxunya enzulu. (imfuneko yokuba kuphandwe ukuba lingakanani inqanaba le-DO ebusuku
	Imixube yezondlo ezingaphiliyo mazingabangeli ii-TPC ezidluleleyo kwii- macrophytes nee-microalgae (yiya phaya phezulu).	6.10 Xa amanzi angena emlanjeni engaphantsi kwe- 5 m^3/s ze imixube ye-DIN yesiqhelo ibethe ngaphaya kwe-100 µg/l kumanzi angena emlanjeni ze imixube ye-DIN yesiqhelo ibethe ngaphaya kwe-100 µg/l kumantla ochweme lomlambo (ngaphezu kwe-16 km ukusuka emlonyeni wochweme).
		6.11 Ngamanxa amanzi agalela emlanjeni emaninzi kakhulu (kangange- > 20 m^3/s) ze imixube ye-DIN yesiqhelo ibethe ngaphaya kwe-500 µg/l kumanzi angena emlanjeni ze imixube ye-DIN yesiqhelo ibethe ngaphaya kwe-500 µg/l kumantla ochweme lomlambo (ngaphezu kwe-16 km ukusuka emlonyeni wochweme).
		6.12 Xa imixube ye-DRP yesiqhelo ibethe ngaphaya kwe-100 µg/l kumanzi angena emlanjeni ze imixube ye-DRP yesiqhelo ibethe ngaphaya kwe-100 µg/l kumantla ochweme lomlambo (ngaphezu kwe-16 km ukusuka emlonyeni wochwemeAverage
	Ubukho bezinto eziyityhefu mabungabangeli ii-TPC ezidluleleyo nge-biota (yiya phaya phezulu).	6.13 Xa ufundo ngeerhorhwana zasemanzini lwenziwe kuqala nangaphambi kokuba ii- TPCs zixelwe (yeyona ngxaki ke le phaya emantla apho imisebenzi yolimo yenziwa kakhulu phaya kunxweme lochweme.
Uguquguquko lwasemanzini	Ugcine uhlobo olunye lokuhamba kwamanzi khonukuze kubekho indawo yokuhlala efanele iintaka, iintlanzi, ii-macrophytes, ii-microalgae nococeko lwamanzi	7.1 Xa iipethini zokuhamba kwamanzi angena emlanjeni esahluka nge- 5% kulawo axeliweyo kumboniso 2 (umboniso ovunyelwe i- Olifants)
		7.2 Xa amanzi agalela emlanjeni esihla de abe ngaphantsi kwe 1.5 m^3/s, nangaliphi na ixesha
		7.3 Xa amanzi agalela emlanjeni esihla de abe ngaphantsi kwe2 m^3/s, ze aqhube njalo de kuphele iinyanga ezi-4 nangaphezulu
Uguquguquko lwentlenge	Ubukho beempuphuma bugcine iipethini zokuthuthwa kwentlenge neendawo zokuhlala emanzini ukuze bungabikho ngapahya kwee- TPC nge biota (yiya phezulu)	8.1 Xa iiphethini zamanzi agalela emlanjeni (iimpuphuma) zisahluka ngaphaya kwe-10% (xa ujonge ubuninzi, ixesha, noguquguquko) kulawo esimo sangoku (ku2004)
		8.2 Xa umxube wentlenge erhoxisiweyo (kuloo manzi agalelayo emlanjeni) uguquka nge-10 kwiintlenge yesiqhelo ze oko kusetyenziswe njengenxalenye yezifundo ezikumila kunje (isimo sangoku 2004)

UDIDI LWESILWANYANA	IMIQATHANGO YOMJELO	UPHAWU OLUBONISA UBUKHO BENGXAKI
	Ugugugugugo lweepethini zothutho lwentlenge mazingabangeli ii-TPCs ezedluleleyo kwizilwanyana ezingenamqolo kwi- benthic (Jonga phaya phezulu).	8.3 Ububanzi bombindi webhedi yamanzi ugugugugugka kabini nangaphezulu kumanqanaba aseza kuxelwa njengenxalenye yamaqalela ezifundo ngophando lwamanzi (IMeko yaNgoku). 8.4 Isanti/udaka olusembinini (umgama ogu-8-20 km) lugugugugugka kangangee-20% kwiMeko yaNgoku (2004) 8.5 linguqu kumjelokazi i-bathymetry esemantla omlomo wochweme (umgama ongaphezu kwe-20 km) zingaphezu kwee-20% kwiMeko yaNgoku (2004) 8.6 linguqu kubukhulu beliza ngaphantsi kwejelo i-Lutzville zingaphezu kwee-20% kwiMeko yaNgoku (2004)

7. AMANZI ANGAPHEZU KOMHLABA – UMTHAMO WOMJELO

Ukuvuselelwa kwemijelo yamanzi angaphezulu komhlaba yinto ebaluleke kakhulu ekuchazweni kwemo yamanzi kuba lunefuthe kumthamo wamanzi angaphezulu komhlaba (ngakumbi ukuba iindawo zogcino lwamanzi nendlela aphethwe ngayo amanzi kwezi ndawo zisoloko zikwimeko entle. Kuwo wonke ummandla wolawulo lwamanzi i-Doorn amanzi avuselelwa kangange- 0 mm/a to 245 mm/a. uvuselelo lwamanzi oluthe kratya lwenzeka emantla omlambo i-Olifants, ngakumbi kummandla wentaba i-Winterhoek. Uvuselelo olubaluleke kakhulu lwenzeka kwimimandla i-Koue Bokkeveld, iMpuma-Doring, eMpuma-Sandveld. Kwezinye nje iindawo ezingaxelwanga uvuselelo lwamanzi alululninzanga kuyaphi.

UHlelo malunga neemfuno ezisisiseko zamanzi luzithathela ingqalelo iimfuno zoluntu ezibalulekleyo ngomjelo ngamnye futhi ziquka amanzi okusela, okwenza ukutya nokuzigcina usempilweni. Kusetyenziswa isikhokelo esiziilitre ezingama-25 ngomntu ngamnye njengemfuno esisiseko. Isishwankathelo malunga neenkcukacha zamanzi angaphezu komhlaba ngokubhekiselele kwi-BHN ne-EWR kummandla ngamnye wolawulo lwamanzi sibonisiwe kwitafile-**7.1** apha ngezantsi.

Itafile- 7.1: Iziphumo zophando malunga noHlelo lwamanzi angaphantsi komhlaba – Umthamo womjelo

Ummandla wolawulo lwamanzi	Indawo (km^2)	Ukuvuselela (Mm^3/a)[1)]	Abemi[2)]	i-EWR (Mm^3/a)	i-BHN (Mm^3/a)	Lulonke uHlelo lReserve (Mm^3/a)
E10A	134	30.12	0	5.44	0	5.44
E10B	202	37.17	1523	6.78	0.013	6.79
E10C	192	24.79	0	5.66	0	5.66
E10D	235	24.35	0	5.74	0	5.74
E10E	366	30.67	15 627	7.35	0.143	7.49
E10F	386	28.28	1184	5.13	0.011	5.14
E10G	508	26.88	1799	4.21	0.016	4.23
E10H	162	9.62	0	1.51	0	1.51
E10J	468	19.32	7797	1.63	0.071	1.70
E10K	235	6.67	0	0.36	0.0	0.36
E21A	190	14.14	2818	1.48	0.026	1.51
E21B	223	8.87	217	0.01	0.002	0.01

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Ummandla wolawulo lwamanzi	Indawo (km^2)	Ukuvuselela (Mm^3/a)[1]	Abemi[2]	i-EWR (Mm^3/a)	i-BHN (Mm^3/a)	Lulonke uHlelo iReserve (Mm^3/a)
E21C	233	8.7	0	0.07	0	0.07
E21D	242	18.21	5024	1.88	0.046	1.93
E21E	293	8.44	797	0.09	0.007	0.10
E21F	379	8.76	0	0.15	0	0.15
E21G	266	18.95	2458	2.07	0.022	2.09
E21H	404	31.2	0	16.66	0	16.66
E21J	317	16.07	0	0.32	0	0.32
E21K	330	11.62	0	0.18	0	0.18
E21L	195	2.53	0	0.14	0	0.14
E22A	750	7.53	553	0.39	0.005	0.40
E22B	638	6.33	86	0.43	0.001	0.43
E22C	490	4.43	2919	0.33	0.027	0.36
E22D	496	4.21	16	0.26	0	0.26
E22E	1013	9.85	8	1.78	0	1.78
E22F	400	1.3	0	0.21	0	0.21
E22G	367	1.27	0	0.43	0	0.43
E23A	762	5.81	0	1.05	0	1.05
E23B	705	5.08	0	0.97	0	0.97
E23C	318	2.03	0	0.44	0	0.44
E23D	750	3.29	0	1.03	0	1.03
E23E	564	2.99	0	0.6	0	0.60
E23F	473	0.95	0	0.51	0	0.51
E23G	747	2.84	152	0.8	0.001	0.80
E23H	660	2.71	0	0.91	0	0.91
E23J	895	1.87	0	0.96	0	0.96
E23K	572	1.08	0	0.61	0	0.61
E24A	255	6.01	1568	0.47	0.014	0.48
E24B	468	5.09	455	0.86	0.004	0.86
E24C	784	3.68	0	0.75	0	0.75
E24D	997	1.77	0	0.96	0	0.96
E24E	671	2.74	0	1.58	0	1.58
E24F	582	2.23	0	1.07	0	1.07
E24G	633	2.2	0	1.16	0	1.16
E24H	483	0.92	0	0.56	0.004	0.56
E24J	1078	5.13	0	1.24	0	1.24
E24K	652	3.22	0	0.75	0	0.75
E24L	516	9.01	0	1.01	0	1.01
E24M	529	8.41	0	0.71	0	0.71
E31A	2865	1.2	0	0.02	0	0.02
E31B	1476	2.23	0	0.09	0	0.09
E31C	1572	0.89	0	0.09	0	0.09
E31D	839	0.48	0	0.05	0	0.05
E31E	478	0.38	0	0.03	0	0.03
E31F	525	0.92	2716	0.03	0.025	0.05
E31G	1238	0.68	0	0.07	0	0.07

Ummandla wolawulo lwamanzi	Indawo (km^2)	Ukuvuselela (Mm^3/a)[1)]	Abemi[2)]	i-EWR (Mm^3/a)	i-BHN (Mm^3/a)	Lulonke uHlelo iReserve (Mm^3/a)
E31H	726	1.09	0	0.04	0	0.04
E32A	1118	4.63	0	0.4	0	0.40
E32B	828	1.52	0	0.3	0	0.30
E32C	638	2.9	0	0.23	0	0.23
E32D	616	1.08	0	0.22	0	0.22
E32E	1001	3.86	0	0.36	0	0.36
E33A	1355	1.84	394	0.08	0.004	0.08
E33B	702	0.8	0	0.06	0.0	0.06
E33C	980	1.37	366	0	0.003	0.00
E33D	1559	2.04	0	0.14	0	0.14
E33E	1282	1.59	632	0.06	0.006	0.07
E33F	725	15.87	7573	0.05	0.069	0.12
E33G	894	7.19	35 929	0	0.328	0.33
E33H	719	3.05	11 768	0.01	0.107	0.12
E40A	941	4.44	0	0.9	0	0.90
E40B	707	3.41	12 350	0.68	0.113	0.79
E40C	530	3.02	1771	0.11	0.016	0.13
E40D	544	3.09	0	1	0	1.00

1) Uhlelo malunga namanzi ovuselelo luthatyathelwe kwimijelo yamanzi ephambili yommandla wolawulo lwamanzi i-Olifants-Doorn (INgxelo yoBugcisa yokugqibela.

2) Inkcazo ngabemi etyatyathelwe kuBalo luka2011.

8. AMANZI ANGAPHEZULU KOMHLABA – UBUHLE NOCOCEKO

Ucoceko lwamanzi angaphezulu komhlaba luthelekiswe nexabiso elivunyiweyo leHlelo1 (DWAF, 1996). Kukhethwe elona xabiso lisezantsi nelingundoqo phakathi kwalawo mabini. Kwiimeko apho kuye kukhethwe ixabiso elingundoqo liye linyuswe kangangeepesenti ezili- 10. Kwiimeko apho ucoceko lwamanzi luye lubethe ngaphaya kwexabiso elivunyiweyo kuye kusetyenziswe yona loo nkcukacha. Iindawo ezinamanzi amtyuba ziye zixelwe njengeemimandla engenakusetyenziswa njengemfuneko yoHlelo olumalunga neemfuno zabantu ezisisiseko. Isimo sococeko lwamanzi angaphezulu komhlaba masiyilandele imiqathango yococeko lwamanzi elindelekileyo njenoko kubonisiwe kwitafile-**8.1. Itafile-8.2** ibonisa isishwankathelo seziphumo malunga nemiba yococeko lwamanzi kummandla othile wolawulo lwamanzi ngokwemiqathango ye-BHN. Itafile-**8.3** ibonisa ihlelo lococeko lwamanzi angaphezulu komhlaba nemida/iindawana ezibonisa ingxaki yamanzi kuloo mmandla wolawulo lwamanzi uthile. Xa kuthethwa ngeendawana eziyingxaki kubhekiswa kuloo manzi abonisa ubukho bemixube ethile xa kuthelekiswa nemiqathango elindelekileyo ngamanzi aselekayo.

Itafile-8.1: Uhlelo/iziphumo zohlolo lwemingxunya-sitsala-manzi ukujonga ukuba ikulungele na ukugcina amanzi anokusetyenziswa luluntu.

Ummandla /Ubunjani bento	Amabakala ococeko lwamanzi ajongiweyo [1]				
	Imivo	Ihlelo 0	Ihlelo I	Ihlelo II	Ihlelo III
Calcium as Ca	mg/l	0 - 80	80 - 150	150 - 300	> 300
Magnesium njenge-Mg	mg/l	0 - 30	30 - 70	70 - 100	> 100
Sodium njenge- Na	mg/l	0 - 100	100 - 200	200 - 400	> 400
Chloride njenge-Cl	mg/l	0 - 100	100 - 200	200 - 600	> 600

Sulphate njenge-SO_4	mg/l	0 - 200	200 - 400	400 - 600	> 600
Nitrate njenge-NO_x- N	mg/l	0 - 6	6 - 10	10 - 20	> 20
Flouride njenge- F	mg/l	0 - 1	1 - 1.5	1.5 - 3.5	> 3.5
Ubukho bekaka emanzini	counts/100ml	0	0 - 1	1 - 10	> 10
i-pH (Imivo ye-pH)		6 - 9	5 - 6 & 9 - 9.5	4 - 5&> 9.5 - 10	< 4 or > 10
Iziqiniezinyibilikisiweyo zonke	mg/l	0 - 450	450 - 1000	1000 - 2450	> 2450
Ukuthwala umbane	mS/m	0 - 70	70 - 150	150 - 300	> 370

1) Ngokubhekiselele: KwiMiqathango yoCoceko lwaManzi eMzantsi Afrika (iSouth African Water Quality Guidelines, Volume 1: Domestic Water Use, 2nd Ed. 1996). ISebe leMicimbi yezaManzi naMahlathi (Department of Water Affairs and Forestry. Pretoria, South Africa).

QAPHELA:

IHlelo-0 Olu lucoceko lwamanzi olufunekayo, lukulungele ukusetyenziswa ubomi bonke, alunamakhwiniba ngokubhekiselele kwimpilo yomntu. Olu hlelo luyafana nebakala elilindelekileyo lococeko lwamanzi ekuthethwe ngalo kuxhwebhu lwesibini olumalunga nococeko lwamanzi (i- 2nd edition of the *South African Water Quality Guidelines for Domestic Use* (DWAF, 1996).

IHlelo-I Amanzi eli hlelo ayaseleka, kodwa alide lifikelele ncam kucoceko lwamanzi olufunekayo kuba asenokuba nobungozi empilweni yomntu: kodwa ubungozi obo abuxhalabisi futhi amakhwiniba avelayo ayanyangeka kwaye akaziveli ngendlela embi. Amanzi eHlelo-1 kahlekahle akanabo ubungozi empilweni yomntu xa sele sithetha, noxa zisenobakho nje ezo mpawu zalatha ingxaki.

Class II Amanzi eli hlelo singawachaza ngokuba zibakho iingxaki (abakho amaxesha o-) zobungozi okwexeshana. Kodwa ubungozi bawo bona buba nefuthe ixesha elide empilweni yomntu, ngakumbi xa liza kuman'ukufika elo xeshana lubungozi bawo minyaka le. Singathi eli hlelo lamanzi limele kusetyenziswa nje okwethutyana, okanye ngaloo maxesha kaXakeka, hayi ubomi bonke.

Class III **Amanzi eli hlelo anemixube emininzi kuwo futhi anobungozi kakhulu, ngakumbi ebantwaneni nabantu abadala. Amanzi anje akamele ze asetyenziselwe ukusela engakhange acocwe khonukuze ahlele kwinqanaba elisezantsi nelikhuselekileyo.**

Table 8.2: Iziphumo zamanzi angaphezulu komhlaba– imiba yococeko

Ubunjani bekhemikhali	**Umvo**	**Imimandla yolawulo lwamanzi u-E10A no-E10B**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		8	7.57	5.0 – 9.5	8.33
Ukuthwala umbane	mS/m	8	20.2	<150	22.22
Calcium njenge- Ca	mg/l	8	13.15	<150	14.47
Magnesium njenge- Mg	mg/l	8	4.7	<100	5.17
Sodium njenge- Na	mg/l	8	10.55	<200	11.61
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	8	33.65	N/A	37
Chloride njenge- Cl	mg/l	8	17.8	<200	19.58

Sulphate njenge- SO_4	mg/l	8	6.55	<400	7.21
Nitrate njenge- NO_x-N	mg/l	8	0.04	<10	0.04
Fluoride njenge- F	Mg/l	8	0.14	<1.0	0.15
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u-E10C**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		8	5.16	5.0 – 9.5	5.68
Ukuthwala umbane	mS/m	8	7.15	<150	7.87
Calcium njenge- Ca	mg/l	8	1.25	<150	1.38
Magnesium njenge- Mg	mg/l	8	1.24	<100	1.36
Sodium njenge- Na	mg/l	8	5.97	<200	6.57
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	8	4	N/A	4.4
Chloride njenge- Cl	mg/l	8	14.5	<200	15.95
Sulphate njenge- SO_4	mg/l	8	3.25	<400	3.58
Nitrate njenge- NO_x-N	mg/l	8	0.7	<10	0.77
Fluoride njenge- F	Mg/l	8	0.05	<1.0	0.05

Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u-E10D**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		100	6.87	5.0 – 9.5	7.56
Ukuthwala umbane	mS/m	100	9	<150	9.9
Calcium njenge- Ca	mg/l	97	2.4	<150	2.64
Magnesium njenge- Mg	mg/l	97	1.96	<100	2.16
Sodium njenge- Na	mg/l	95	8.22	<200	9.04
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	97	10.55	N/A	11.61

Chloride njenge- Cl	mg/l	96	16.44	<200	18.08
Sulphate njenge- SO_4	mg/l	97	2	<400	2.2
Nitrate njenge- NO_x-N	mg/l	96	0.24	<10	0.26
Fluoride njenge- F	Mg/l	94	0.11	<1.0	0.12
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u-E10E**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		153	6.23	5.0 – 9.5	6.85
Ukuthwala umbane	mS/m	152	11.32	<150	12.45
Calcium njenge- Ca	mg/l	153	1.41	<150	1.55
Magnesium njenge- Mg	mg/l	153	1.9	<100	2.09
Sodium njenge- Na	mg/l	146	12.35	<200	13.58
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	153	5	N/A	5.5
Chloride njenge- Cl	mg/l	153	23.7	<200	26.07
Sulphate njenge- SO_4	mg/l	153	2	<400	2.2
Nitrate njenge- NO_x-N	mg/l	153	0.34	<10	0.37
Fluoride njenge- F	Mg/l	148	0.05	<1.0	0.05

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u-E10F			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		92	6.73	5.0 – 9.5	7.4
Ukuthwala umbane	mS/m	92	16.01	<150	17.61
Calcium njenge- Ca	mg/l	92	4.76	<150	5.24
Magnesium njenge- Mg	mg/l	92	2.85	<100	3.14
Sodium njenge- Na	mg/l	88	14	<200	15.4
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	92	15.58	N/A	17.14
Chloride njenge- Cl	mg/l	92	27.31	<200	30.04
Sulphate njenge- SO_4	mg/l	92	4.31	<400	4.74
Nitrate njenge- NO_x-N	mg/l	92	0.41	<10	0.45
Fluoride njenge- F	Mg/l	90	0.1	<1.0	0.11
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u-E10G**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		107	6.27	5.0 – 9.5	6.9
Ukuthwala umbane	mS/m	105	16.9	<150	18.59
Calcium njenge- Ca	mg/l	102	1.68	<150	1.85
Magnesium njenge- Mg	mg/l	103	2.87	<100	3.16
Sodium njenge- Na	mg/l	100	16.2	<200	17.82
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	103	4	N/A	4.4
Chloride njenge- Cl	mg/l	104	28.95	<200	31.85
Sulphate njenge- SO_4	mg/l	104	2	<400	2.2
Nitrate njenge- NO_x-N	mg/l	102	0.88	<10	0.97
Fluoride njenge- F	Mg/l	99	0.05	<1.0	0.05

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u-E10H			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		7	6.56	5.0 – 9.5	7.22
Ukuthwala umbane	mS/m	7	19.6	<150	21.56
Calcium njenge- Ca	mg/l	7	2.79	<150	3.07
Magnesium njenge- Mg	mg/l	7	3.73	<100	4.1
Sodium njenge- Na	mg/l	7	11.6	<200	12.76
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	7	4	N/A	4.4
Chloride njenge- Cl	mg/l	7	47.22	<200	51.94
Sulphate njenge- SO_4	mg/l	7	2	<400	2.2
Nitrate njenge- NO_x-N	mg/l	7	0.04	<10	0.04
Fluoride njenge- F	Mg/l	7	0.05	<1.0	0.05
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E10J**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		71	6.4	5.0 – 9.5	7.04
Ukuthwala umbane	mS/m	71	50.4	<150	55.44
Calcium njenge- Ca	mg/l	65	6.49	<150	7.14
Magnesium njenge- Mg	mg/l	65	8.85	<100	9.74
Sodium njenge- Na	mg/l	65	63	<200	69.3
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	67	6.2	N/A	6.82
Chloride njenge- Cl	mg/l	66	112.96	<200	124.26
Sulphate njenge- SO_4	mg/l	66	13.95	<400	15.95
Nitrate njenge- NO_x-N	mg/l	68	2.6	<10	2.86
Fluoride njenge- F	Mg/l	64	0.15	<1.0	0.17

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E10K			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		5	6.74	5.0 – 9.5	7.41
Ukuthwala umbane	mS/m	5	**175**	<150	**175**
Calcium njenge- Ca	mg/l	5	13.9	<150	15.29
Magnesium njenge- Mg	mg/l	5	55.6	<100	61.16
Sodium njenge- Na	mg/l	5	**207**	<200	**207**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	5	2	N/A	2.2
Chloride njenge- Cl	mg/l	5	**471**	<200	**471**
Sulphate njenge- SO_4	mg/l	5	30.3	<400	33.33
Nitrate njenge- NO_x-N	mg/l	5	2.4	<10	2.64
Fluoride njenge- F	Mg/l	5	0.14	<1.0	0.15
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E21A**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		50	7.63	5.0 – 9.5	8.39
Ukuthwala umbane	mS/m	50	24.1	<150	26.51
Calcium njenge- Ca	mg/l	50	13.3	<150	14.63
Magnesium njenge- Mg	mg/l	50	5.65	<100	6.22
Sodium njenge- Na	mg/l	50	18.2	<200	20.02
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	50	35.6	N/A	39.16
Chloride njenge- Cl	mg/l	50	37.25	<200	41
Sulphate njenge- SO_4	mg/l	50	12.25	<400	13.48
Nitrate njenge- NO_x-N	mg/l	50	0.02	<10	0.02
Fluoride njenge- F	Mg/l	50	0.11	<1.0	0.12

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E21B			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		17	7.5	5.0 – 9.5	8.25
Ukuthwala umbane	mS/m	17	89.2	<150	98.12
Calcium njenge- Ca	mg/l	17	65.6	<150	72.16
Magnesium njenge- Mg	mg/l	17	27	<100	29.7
Sodium njenge- Na	mg/l	17	64.6	<200	71.06
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	17	76	N/A	83.6
Chloride njenge- Cl	mg/l	17	150.3	<200	165.33
Sulphate njenge- SO_4	mg/l	17	99.1	<400	109.01
Nitrate njenge- NO_x-N	mg/l	17	0.11	<10	0.12
Fluoride njenge- F	Mg/l	17	0.22	<1.0	0.24
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u-E21C**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		9	7.45	5.0 – 9.5	8.19
Ukuthwala umbane	mS/m	9	13.7	<150	15.07
Calcium njenge- Ca	mg/l	9	4.9	<150	5.39
Magnesium njenge- Mg	mg/l	9	5	<100	5.5
Sodium njenge- Na	mg/l	9	10	<200	11
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	9	15.3	N/A	16.83
Chloride njenge- Cl	mg/l	9	23.3	<200	25.63
Sulphate njenge- SO_4	mg/l	9	6.7	<400	7.37
Nitrate njenge- NO_x-N	mg/l	9	0.02	<10	0.02
Fluoride njenge- F	Mg/l	9	0.1	<1.0	0.11

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E21D			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		38	7.53	5.0 – 9.5	8.28
Ukuthwala umbane	mS/m	38	21.85	<150	24.04
Calcium njenge- Ca	mg/l	38	11.75	<150	12.93
Magnesium njenge- Mg	mg/l	38	4.05	<100	4.46
Sodium njenge- Na	mg/l	38	15.28	<200	16.08
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	38	31.75	N/A	34.93
Chloride njenge- Cl	mg/l	38	26.08	<200	28.69
Sulphate njenge- SO_4	mg/l	38	5.8	<400	6.38
Nitrate njenge- NO_x-N	mg/l	38	0.1	<10	0.11
Fluoride njenge- F	Mg/l	38	0.05	<1.0	0.05
Ubunjani bekhemikhali	**Umvo**	**Imimandla yolawulo lwamanzi-E21E,E21F,E21L NO-E22F**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		10	6.93	5.0 – 9.5	7.62
Ukuthwala umbane	mS/m	10	12.5	<150	13.75
Calcium njenge- Ca	mg/l	10	2.35	<150	2.59
Magnesium njenge- Mg	mg/l	10	2.8	<100	3.08
Sodium njenge- Na	mg/l	10	10.5	<200	11.55
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	10	7.55	N/A	8.31
Chloride njenge- Cl	mg/l	10	16.95	<200	18.65
Sulphate njenge- SO_4	mg/l	10	6.3	<400	6.93
Nitrate njenge- NO_x-N	mg/l	9	0.07	<10	0.07
Fluoride njenge- F	Mg/l	10	0.15	<1.0	0.16

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E21G			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		44	6.59	5.0 – 9.5	7.25
Ukuthwala umbane	mS/m	43	104	<150	114.4
Calcium njenge- Ca	mg/l	44	2.76	<150	3.04
Magnesium njenge- Mg	mg/l	44	2.39	<100	2.63
Sodium njenge- Na	mg/l	42	8.76	<200	9.64
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	44	8.64	N/A	9.5
Chloride njenge- Cl	mg/l	44	14.64	<200	16.11
Sulphate njenge- SO_4	mg/l	44	6.06	<400	6.67
Nitrate njenge- NO_x-N	mg/l	44	0.6	<10	0.66
Fluoride njenge- F	Mg/l	42	0.1	<1.0	0.11
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E21H**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		29	5.82	5.0 – 9.5	6.4
Ukuthwala umbane	mS/m	29	3.1	<150	3.41
Calcium njenge- Ca	mg/l	29	0.5	<150	0.55
Magnesium njenge- Mg	mg/l	29	0.75	<100	0.83
Sodium njenge- Na	mg/l	27	2.72	<200	3
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	29	4	N/A	4.4
Chloride njenge- Cl	mg/l	27	5	<200	5.5
Sulphate njenge- SO_4	mg/l	29	2	<400	2.2
Nitrate njenge- NO_x-N	mg/l	29	0.1	<10	0.11
Fluoride njenge- F	Mg/l	27	0.05	<1.0	0.05

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E21J			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		22	7.47	5.0 – 9.5	8.22
Ukuthwala umbane	mS/m	22	18.19	<150	20
Calcium njenge- Ca	mg/l	22	8.99	<150	9.9
Magnesium njenge- Mg	mg/l	22	3.6	<100	3.96
Sodium njenge- Na	mg/l	22	16.8	<200	17.93
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	22	26.86	N/A	29.55
Chloride njenge- Cl	mg/l	22	30.59	<200	33.65
Sulphate njenge- SO_4	mg/l	22	9.78	<400	10.76
Nitrate njenge- NO_x-N	mg/l	22	0.25	<10	0.28
Fluoride njenge- F	Mg/l	21	0.12	<1.0	0.13
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E21K**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		10	7.6	5.0 – 9.5	8.36
Ukuthwala umbane	mS/m	10	20.15	<150	22.17
Calcium njenge- Ca	mg/l	10	20.22	<150	22.24
Magnesium njenge- Mg	mg/l	10	1.3	<100	1.43
Sodium njenge- Na	mg/l	10	11.91	<200	13.1
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	10	80.86	N/A	88.95
Chloride njenge- Cl	mg/l	10	6.5	<200	7.15
Sulphate njenge- SO_4	mg/l	10	4.7	<400	5.17
Nitrate njenge- NO_x-N	mg/l	10	0.05	<10	0.05
Fluoride njenge- F	Mg/l	10	0.17	<1.0	0.18

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E22A			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		13	8.12	5.0 – 9.5	8.93
Ukuthwala umbane	mS/m	13	**171**	**<150**	**171**
Calcium njenge- Ca	mg/l	13	78.4	<150	86.24
Magnesium njenge- Mg	mg/l	13	46.8	<100	51.48
Sodium njenge- Na	mg/l	13	**198.1**	**<200**	**198.1**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	13	271.4	N/A	271.4
Chloride njenge- Cl	mg/l	13	**345.1**	**<200**	**345.1**
Sulphate njenge- SO_4	mg/l	13	109.5	<400	120.45
Nitrate njenge- NO_x-N	mg/l	13	0.29	<10	0.32
Fluoride njenge- F	Mg/l	13	**0.98**	**<1.0**	**0.98**
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E22B**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
pH		10	7.82	5.0 – 9.5	8.6
Electrical Conductivity	mS/m	10	**278.7**	<150	**278.7**
Calcium as Ca	mg/l	10	127	<150	136.7
Magnesium as Mg	mg/l	10	67.9	<100	74.69
Sodium as Na	mg/l	10	**271.8**	<200	**271.8**
Total Alkalinity as $CaCO_3$	mg/l	10	225.35	N/A	225.35
Chloride as Cl	mg/l	10	**614.55**	<200	**614.55**
Sulphate as SO_4	mg/l	10	197.75	<400	217.53
Nitrate as NO_x-N	mg/l	10	0.6	<10	0.66
Fluoride as F	Mg/l	10	0.9	<1.0	0.9

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E22C			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		13	7.69	5.0 – 9.5	8.46
Ukuthwala umbane	mS/m	13	64.9	<150	71.39
Calcium njenge- Ca	mg/l	13	39	<150	42.9
Magnesium njenge- Mg	mg/l	13	15	<100	16.5
Sodium njenge- Na	mg/l	13	50.3	<200	55.33
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	13	93.6	N/A	102.96
Chloride njenge- Cl	mg/l	13	77.2	<200	84.92
Sulphate njenge- SO_4	mg/l	13	42.1	<400	46.31
Nitrate njenge- NO_x-N	mg/l	13	0.08	<10	0.08
Fluoride njenge- F	Mg/l	13	0.2	<1.0	0.22
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E22D**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		6	7.97	5.0 – 9.5	8.77
Ukuthwala umbane	mS/m	6	**548**	<150	**548**
Calcium njenge- Ca	mg/l	6	**161.05**	<150	**161.05**
Magnesium njenge- Mg	mg/l	6	**203.55**	<100	**203.55**
Sodium njenge- Na	mg/l	6	**634.9**	<200	**634.9**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	186.3	N/A	186.3
Chloride njenge- Cl	mg/l	6	**1624.45**	<200	**1624.45**
Sulphate njenge- SO_4	mg/l	6	**437.9**	<400	**437.9**
Nitrate njenge- NO_x-N	mg/l	6	1.13	<10	1.24
Fluoride njenge- F	Mg/l	6	**1**	<1.0	**1**

Ubunjani bekhemikhali	Umvo	imimandla yolawulo lwamanzi u- E22E, E22G no-E23A-E23D			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		12	7.92	5.0 – 9.5	8.71
Ukuthwala umbane	mS/m	12	129.15	<150	142.07
Calcium njenge- Ca	mg/l	12	61.8	<150	67.98
Magnesium njenge- Mg	mg/l	12	23.65	<100	26.02
Sodium njenge- Na	mg/l	12	**186.53**	<200	**186.53**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	12	170	N/A	187
Chloride njenge- Cl	mg/l	12	**299.95**	<200	**299.95**
Sulphate njenge- SO_4	mg/l	12	49.1	<400	54.01
Nitrate njenge- NO_x-N	mg/l	12	0.05	<10	0.05
Fluoride njenge- F	Mg/l	12	0.63	<1.0	0.69

Ubunjani bekhemikhali	Umvo	imimandla yolawulo lwamanzi u- E23E-E23H, E23J			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		3	8.37	5.0 – 9.5	9.21
Ukuthwala umbane	mS/m	3	**185.00**	<150	185.00
Calcium njenge- Ca	mg/l	3	25.90	<150	28.49
Magnesium njenge- Mg	mg/l	3	4.80	<100	5.28
Sodium njenge- Na	**mg/l**	**3**	**414.10**	**<200**	**414.10**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	3	285.60	N/A	314.16
Chloride njenge- Cl	**mg/l**	**3**	**344.70**	**<200**	**344.70**
Sulphate njenge- SO_4	mg/l	3	88.80	<400	97.68
Nitrate njenge- NO_x-N	mg/l	3	0.02	<10	0.02
Fluoride njenge- F	mg/l	3	2.77	<1.0	3.05

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E23K			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		14	8.55	5.0 – 9.5	9.40
Ukuthwala umbane	mS/m	14	**177.50**	<150	**177.50**
Calcium njenge- Ca	mg/l	14	9.70	<150	10.67
Magnesium njenge- Mg	mg/l	14	4.75	<100	5.23
Sodium njenge- Na	mg/l	14	**357.00**	<200	357.00
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	14	220.35	N/A	242.39
Chloride njenge- Cl	mg/l	14	**416.75**	<200	**416.75**
Sulphate njenge- SO_4	mg/l	14	28.80	<400	31.68
Nitrate njenge- NO_x-N	mg/l	14	0.11	<10	0.12
Fluoride njenge- F	mg/l	14	1.04	<1.0	1.04
Ubunjani bekhemikhali	**Umvo**	**imimandla yolawulo lwamanzi u- E24C-E24D**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		7	8.19	5.0 – 9.5	9.01
Ukuthwala umbane	mS/m	7	96.00	<150	105.60
Calcium njenge- Ca	mg/l	7	7.00	<150	7.70
Magnesium njenge- Mg	mg/l	7	2.00	<100	2.20
Sodium njenge- Na	mg/l	7	**240.30**	<200	**240.30**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	7	331.60	N/A	364.76
Chloride njenge- Cl	mg/l	7	129.00	<200	141.90
Sulphate njenge- SO_4	mg/l	7	11.97	<400	13.17
Nitrate njenge- NO_x-N	mg/l	7	0.04	<10	0.04
Fluoride njenge- F	mg/l	7	**2.98**	<1.0	**2.98**

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E24E			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		8	7.99	5.0 – 9.5	8.78
Ukuthwala umbane	mS/m	8	**227.65**	<150	**227.65**
Calcium njenge- Ca	mg/l	8	143.25	<150	157.58
Magnesium njenge- Mg	mg/l	8	**106.05**	<100	106.05
Sodium njenge- Na	mg/l	8	**201.55**	<200	201.55
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	8	191.65	N/A	210.82
Chloride njenge- Cl	mg/l	8	**268.40**	<200	**268.40**
Sulphate njenge- SO_4	mg/l	8	**554.50**	<400	**554.50**
Nitrate njenge- NO_x-N	mg/l	8	3.22	<10	3.54
Fluoride njenge- F	mg/l	8	0.85	<1.0	0.94
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E24F**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		3	7.90	5.0 – 9.5	8.69
Ukuthwala umbane	**mS/m**	**3**	**275.20**	**<150**	**275.20**
Calcium njenge- Ca	mg/l	3	110.80	<150	121.88
Magnesium njenge- Mg	mg/l	3	94.40	<100	103.84
Sodium njenge- Na	mg/l	3	**361.40**	**<200**	**361.40**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	3	213.90	N/A	235.29
Chloride njenge- Cl	**mg/l**	**3**	**543.90**	**<200**	**543.90**
Sulphate njenge- SO_4	mg/l	3	378.40	<400	416.24
Nitrate njenge- NO_x-N	mg/l	3	3.28	<10	3.61
Fluoride njenge- F	mg/l	3	0.92	<1.0	1.01

Ubunjani bekhemikhali	Umvo	imimandla yolawulo lwamanzi u- E24G-E24H			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		6	7.95	5.0 – 9.5	8.75
Ukuthwala umbane	**mS/m**	**6**	**320.00**	**<150**	**320.00**
Calcium njenge- Ca	mg/l	6	116.00	<150	127.60
Magnesium njenge- Mg	mg/l	6	84.25	<100	92.68
Sodium njenge- Na	**mg/l**	**6**	**446.00**	**<200**	**446.00**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	213.55	N/A	234.91
Chloride njenge- Cl	**mg/l**	**6**	**795.40**	**<200**	**795.40**
Sulphate njenge- SO_4	mg/l	6	174.10	<400	191.51
Nitrate njenge- NO_x-N	mg/l	6	1.11	<10	1.22
Fluoride njenge- F	mg/l	6	0.82	<1.0	0.90
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E24J**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		56	7.31	5.0 – 9.5	8.04
Ukuthwala umbane	mS/m	56	138.50	<150	152.35
Calcium njenge- Ca	mg/l	56	46.30	<150	50.93
Magnesium njenge- Mg	mg/l	56	30.50	<100	33.55
Sodium njenge- Na	mg/l	54	166.55	<200	183.21
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	56	92.05	N/A	101.26
Chloride njenge- Cl	**mg/l**	**56**	**311.85**	**<200**	**311.85**
Sulphate njenge- SO_4	mg/l	56	63.60	<400	69.96
Nitrate njenge- NO_x-N	mg/l	56	0.06	<10	0.06
Fluoride njenge- F	mg/l	54	0.23	<1.0	0.26

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E24K			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		6	7.85	5.0 – 9.5	8.64
Ukuthwala umbane	mS/m	6	324.50	<150	356.95
Calcium njenge- Ca	mg/l	6	172.25	<150	189.48
Magnesium njenge- Mg	mg/l	6	110.75	<100	121.83
Sodium njenge- Na	mg/l	6	269.35	<200	296.29
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	188.55	N/A	207.41
Chloride njenge- Cl	mg/l	6	801.65	<200	881.82
Sulphate njenge- SO_4	mg/l	6	206.95	<400	227.65
Nitrate njenge- NO_x-N	mg/l	6	5.54	<10	6.09
Fluoride njenge- F	mg/l	6	0.52	<1.0	0.57
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E24L**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		40	5.52	5.0 – 9.5	6.07
Ukuthwala umbane	mS/m	40	14.55	<150	16.01
Calcium njenge- Ca	mg/l	40	3.35	<150	3.69
Magnesium njenge- Mg	mg/l	40	2.80	<100	3.08
Sodium njenge- Na	mg/l	40	16.00	<200	17.60
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	40	3.00	N/A	3.30
Chloride njenge- Cl	mg/l	40	29.60	<200	32.56
Sulphate njenge- SO_4	mg/l	40	6.45	<400	7.10
Nitrate njenge- NO_x-N	mg/l	40	1.20	<10	1.32
Fluoride njenge- F	mg/l	40	0.11	<1.0	0.12

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E24M			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		25	6.67	5.0 – 9.5	7.34
Ukuthwala umbane	mS/m	25	**165.00**	<150	**165.00**
Calcium njenge- Ca	mg/l	22	19.65	<150	21.62
Magnesium njenge- Mg	mg/l	22	44.15	<100	48.57
Sodium njenge- Na	mg/l	22	207.70	<200	207.70
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	25	9.50	N/A	10.45
Chloride njenge- Cl	mg/l	22	**436.60**	<200	**436.60**
Sulphate njenge- SO_4	mg/l	22	50.25	<400	55.28
Nitrate njenge- NO_x-N	mg/l	25	3.61	<10	3.97
Fluoride njenge- F	mg/l	22	0.17	<1.0	0.19
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E31E**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		6	8.16	5.0 – 9.5	8.98
Ukuthwala umbane	mS/m	6	**430.50**	<150	**430.50**
Calcium njenge- Ca	mg/l	6	148.12	<150	162.93
Magnesium njenge- Mg	mg/l	6	95.09	<100	104.59
Sodium njenge- Na	mg/l	6	**605.64**	<200	605.64
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	301.77	N/A	331.94
Chloride njenge- Cl	mg/l	6	**1124.69**	<200	**1124.69**
Sulphate njenge- SO_4	mg/l	6	329.66	<400	362.62
Nitrate njenge- NO_x-N	mg/l	6	2.55	<10	2.80
Fluoride njenge- F	mg/l	6	1.47	<1.0	1.62

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u-			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		67	8.05	5.0 – 9.5	8.86
Ukuthwala umbane	mS/m	67	**190.00**	<150	**190.00**
Calcium njenge- Ca	mg/l	64	84.20	<150	92.62
Magnesium njenge- Mg	mg/l	64	61.67	<100	67.83
Sodium njenge- Na	mg/l	63	**209.10**	<200	**209.10**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	64	250.25	N/A	275.28
Chloride njenge- Cl	mg/l	65	**295.30**	<200	**295.30**
Sulphate njenge- SO_4	mg/l	65	221.90	<400	244.09
Nitrate njenge- NO_x-N	mg/l	65	0.15	<10	0.16
Fluoride njenge- F	mg/l	62	**1.29**	<1.0	**1.29**

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E31G			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		12	8.10	5.0 – 9.5	8.91
Ukuthwala umbane	mS/m	12	**436.45**	<150	**436.45**
Calcium njenge- Ca	mg/l	11	**163.80**	<150	**163.80**
Magnesium njenge- Mg	mg/l	11	**147.20**	<100	**147.20**
Sodium njenge- Na	mg/l	11	**584.30**	<200	**584.30**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	12	211.75	N/A	232.93
Chloride njenge- Cl	mg/l	11	**1161.90**	<200	**1161.90**
Sulphate njenge- SO_4	mg/l	11	364.50	<400	364.50
Nitrate njenge- NO_x-N	mg/l	12	4.46	<10	4.91
Fluoride njenge- F	Mg/l	11	**1.92**	<1.0	**1.92**

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E31H			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		8	7.98	5.0 – 9.5	8.77
Ukuthwala umbane	mS/m	8	**438.00**	<150	**438.00**
Calcium njenge- Ca	mg/l	8	87.55	<150	96.31
Magnesium njenge- Mg	mg/l	8	**107.10**	<100	**107.10**
Sodium njenge- Na	mg/l	8	**611.10**	<200	**611.10**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	8	198.55	N/A	218.41
Chloride njenge- Cl	mg/l	8	**1159.35**	<200	**1159.35**
Sulphate njenge- SO_4	mg/l	8	349.00	<400	383.90
Nitrate njenge- NO_x-N	mg/l	8	6.09	<10	6.69
Fluoride njenge- F	Mg/l	8	**2.10**	<1.0	**2.10**

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E32A			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		6	7.88	5.0 – 9.5	8.67
Ukuthwala umbane	mS/m	6	77.40	<150	85.14
Calcium njenge- Ca	mg/l	6	50.50	<150	55.55
Magnesium njenge- Mg	mg/l	6	26.20	<100	28.82
Sodium njenge- Na	mg/l	6	83.85	<200	92.24
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	204.65	N/A	225.12
Chloride njenge- Cl	mg/l	6	83.15	<200	91.47
Sulphate njenge- SO_4	mg/l	6	44.20	<400	48.62
Nitrate njenge- NO_x-N	mg/l	6	0.22	<10	0.24
Fluoride njenge- F	Mg/l	6	0.74	<1.0	0.81

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E32B			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		14	7.74	5.0 – 9.5	8.51
Ukuthwala umbane	mS/m	14	**181.60**	<150	**181.60**
Calcium njenge- Ca	mg/l	14	109.95	<150	120.95
Magnesium njenge- Mg	mg/l	14	74.95	<100	82.45
Sodium njenge- Na	mg/l	14	150.65	<200	165.72
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	14	192.10	N/A	211.31
Chloride njenge- Cl	mg/l	14	**295.15**	<200	**295.15**
Sulphate njenge- SO_4	mg/l	14	278.75	<400	306.63
Nitrate njenge- NO_x-N	mg/l	14	1.76	<10	1.93
Fluoride njenge- F	Mg/l	14	0.84	<1.0	0.92
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E32C**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		15	7.75	5.0 – 9.5	8.53
Ukuthwala umbane	mS/m	15	**162.70**	<150	**162.70**
Calcium njenge- Ca	mg/l	15	80.20	<150	88.22
Magnesium njenge- Mg	mg/l	15	60.80	<100	66.88
Sodium njenge- Na	mg/l	15	185.10	<200	185.10
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	15	211.40	N/A	232.54
Chloride njenge- Cl	mg/l	15	**203.00**	<200	**203.00**
Sulphate njenge- SO_4	mg/l	15	303.30	<400	333.63
Nitrate njenge- NO_x-N	mg/l	15	2.32	<10	2.55
Fluoride njenge- F	Mg/l	15	0.96	<1.0	0.96

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E32D			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		25	7.75	5.0 – 9.5	8.53
Ukuthwala umbane	mS/m	25	**170.80**	<150	**170.80**
Calcium njenge- Ca	mg/l	25	101.90	<150	112.09
Magnesium njenge- Mg	mg/l	25	57.30	<100	63.03
Sodium njenge- Na	mg/l	25	**201.40**	<200	**201.40**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	25	192.90	N/A	212.19
Chloride njenge- Cl	mg/l	25	**239.40**	<200	**239.40**
Sulphate njenge- SO_4	mg/l	25	256.30	<400	281.93
Nitrate njenge- NO_x-N	mg/l	25	0.49	<10	0.54
Fluoride njenge- F	Mg/l	25	**1.33**	<1.0	**1.33**
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E32E**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		15	7.80	5.0 – 9.5	8.58
Ukuthwala umbane	mS/m	15	**273.00**	<150	**273.00**
Calcium njenge- Ca	mg/l	15	106.30	<150	116.93
Magnesium njenge- Mg	mg/l	15	88.50	<100	97.35
Sodium njenge- Na	mg/l	15	**303.10**	<200	**303.10**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	15	188.00	N/A	206.80
Chloride njenge- Cl	mg/l	15	**748.30**	<200	**748.30**
Sulphate njenge- SO_4	mg/l	15	137.20	<400	150.92
Nitrate njenge- NO_x-N	mg/l	15	2.23	<10	2.45
Fluoride njenge- F	Mg/l	15	0.82	<1.0	0.90

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E33A			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		10	8.10	5.0 – 9.5	8.90
Ukuthwala umbane	mS/m	10	**433.00**	<150	**433.00**
Calcium njenge- Ca	mg/l	10	**155.85**	<150	**155.85**
Magnesium njenge- Mg	mg/l	10	**118.55**	<100	**118.55**
Sodium njenge- Na	mg/l	10	**659.45**	<200	**659.45**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	10	178.25	N/A	196.08
Chloride njenge- Cl	mg/l	10	**1327.85**	<200	**1327.85**
Sulphate njenge- SO_4	mg/l	10	305.25	<400	335.78
Nitrate njenge- NO_x-N	mg/l	10	5.42	<10	5.96
Fluoride njenge- F	Mg/l	10	**2.14**	<1.0	**2.14**
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E33B**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		6	8.18	5.0 – 9.5	8.99
Ukuthwala umbane	mS/m	6	**998.20**	<150	**998.20**
Calcium njenge- Ca	mg/l	6	**232.15**	<150	**232.15**
Magnesium njenge- Mg	mg/l	6	**240.60**	<100	**240.60**
Sodium njenge- Na	mg/l	6	**1780.80**	<200	**1780.80**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	250.95	N/A	276.05
Chloride njenge- Cl	mg/l	6	**3063.90**	<200	**3063.90**
Sulphate njenge- SO_4	mg/l	6	**717.85**	<400	**717.85**
Nitrate njenge- NO_x-N	mg/l	6	4.51	<10	4.96
Fluoride njenge- F	Mg/l	6	**1.77**	<1.0	**1.77**

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E33C			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		11	8.23	5.0 – 9.5	9.05
Ukuthwala umbane	mS/m	11	**482.00**	<150	**482.00**
Calcium njenge- Ca	mg/l	11	76.10	<150	83.71
Magnesium njenge- Mg	mg/l	11	**131.70**	<100	**131.70**
Sodium njenge- Na	mg/l	11	**674.60**	<200	**674.60**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	11	260.80	N/A	286.88
Chloride njenge- Cl	mg/l	11	**1472.40**	<200	**1472.40**
Sulphate njenge- SO_4	mg/l	11	215.50	<400	237.05
Nitrate njenge- NO_x-N	mg/l	11	1.76	<10	1.94
Fluoride njenge- F	Mg/l	11	**1.49**	<1.0	**1.49**
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E33D**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		149	7.79	5.0 – 9.5	8.57
Ukuthwala umbane	mS/m	149	**636.10**	<150	**636.10**
Calcium njenge- Ca	mg/l	143	111.54	<150	122.69
Magnesium njenge- Mg	mg/l	143	**121.40**	<100	**121.40**
Sodium njenge- Na	mg/l	143	**1055.72**	<200	**1055.72**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	144	180.56	N/A	198.62
Chloride njenge- Cl	mg/l	144	**1799.25**	<200	**1799.25**
Sulphate njenge- SO_4	mg/l	144	357.20	<400	392.92
Nitrate njenge- NO_x-N	mg/l	143	0.24	<10	0.26
Fluoride njenge- F	Mg/l	143	**1.84**	<1.0	**1.84**

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Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E33E			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		32	7.65	5.0 – 9.5	8.41
Ukuthwala umbane	mS/m	32	**585.60**	<150	**585.60**
Calcium njenge- Ca	mg/l	32	**142.45**	<150	**142.45**
Magnesium njenge- Mg	mg/l	32	**168.40**	<100	**168.40**
Sodium njenge- Na	mg/l	32	**857.70**	<200	**857.70**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	32	155.10	N/A	170.61
Chloride njenge- Cl	mg/l	32	**1712.00**	<200	**1712.00**
Sulphate njenge- SO_4	mg/l	32	301.65	<400	331.82
Nitrate njenge- NO_x-N	mg/l	32	1.50	<10	1.64
Fluoride njenge- F	Mg/l	32	**2.18**	<1.0	**2.18**

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E33F			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		672	8.00	5.0 – 9.5	8.80
Ukuthwala umbane	mS/m	672	**185.80**	<150	**185.80**
Calcium njenge- Ca	mg/l	667	102.50	<150	112.75
Magnesium njenge- Mg	mg/l	666	45.27	<100	49.80
Sodium njenge- Na	mg/l	627	**183.38**	<200	**183.38**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	669	165.69	N/A	182.26
Chloride njenge- Cl	mg/l	665	**402.61**	<200	**402.61**
Sulphate njenge- SO_4	mg/l	647	96.46	<400	106.10
Nitrate njenge- NO_x-N	mg/l	671	1.06	<10	1.17
Fluoride njenge- F	Mg/l	626	0.27	<1.0	0.30

Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E33G**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		75	8.13	5.0 – 9.5	8.95
Ukuthwala umbane	mS/m	75	**160.00**	<150	**160.00**
Calcium njenge- Ca	mg/l	74	87.31	<150	96.04
Magnesium njenge- Mg	mg/l	74	40.51	<100	44.56
Sodium njenge- Na	mg/l	69	170.39	<200	187.43
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	75	226.57	N/A	249.22
Chloride njenge- Cl	mg/l	74	**323.58**	<200	**323.58**
Sulphate njenge- SO_4	mg/l	70	101.70	<400	111.87
Nitrate njenge- NO_x-N	mg/l	75	0.63	<10	0.69
Fluoride njenge- F	Mg/l	68	0.45	<1.0	0.49
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E33H**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe-GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		10	7.78	5.0 – 9.5	8.55
Ukuthwala umbane	mS/m	10	**372.80**	<150	**372.80**
Calcium njenge- Ca	mg/l	10	51.85	<150	57.04
Magnesium njenge- Mg	mg/l	10	80.00	<100	88.00
Sodium njenge- Na	mg/l	10	**551.25**	<200	**551.25**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	10	150.50	N/A	165.55
Chloride njenge- Cl	mg/l	10	**1015.30**	<200	**1015.30**
Sulphate njenge- SO_4	mg/l	10	133.65	<400	147.02
Nitrate njenge- NO_x-N	mg/l	10	0.67	<10	0.74
Fluoride njenge- F	Mg/l	10	0.72	<1.0	0.79

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E40A			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		132	7.99	5.0 – 9.5	8.79
Ukuthwala umbane	mS/m	132	**183.10**	<150	**183.10**
Calcium njenge- Ca	mg/l	132	91.90	<150	101.09
Magnesium njenge- Mg	mg/l	132	68.60	<100	75.46
Sodium njenge- Na	mg/l	132	**235.60**	<200	**235.60**
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	132	219.90	N/A	241.89
Chloride njenge- Cl	mg/l	132	**333.30**	<200	**333.30**
Sulphate njenge- SO_4	mg/l	132	165.25	<400	181.78
Nitrate njenge- NO_x-N	mg/l	132	0.34	<10	0.38
Fluoride njenge- F	Mg/l	132	**1.10**	<1.0	**1.10**
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E40B**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		123	7.87	5.0 – 9.5	8.66
Ukuthwala umbane	mS/m	123	**200.50**	<150	**200.50**
Calcium njenge- Ca	mg/l	120	100.30	<150	110.33
Magnesium njenge- Mg	mg/l	119	58.40	<100	64.24
Sodium njenge- Na	mg/l	119	181.60	<200	199.76
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	120	208.25	N/A	229.08
Chloride njenge- Cl	mg/l	122	**358.00**	<200	**358.00**
Sulphate njenge- SO_4	mg/l	122	141.86	<400	156.04
Nitrate njenge- NO_x-N	mg/l	122	0.70	<10	0.77
Fluoride njenge- F	Mg/l	119	0.64	<1.0	0.70

Ubunjani bekhemikhali	Umvo	ummandla wolawulo lwamanzi u- E40C			
		Inani leesampulu	Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW	UHlelo i-BHN Reserve	Uhlelo malunga nococeko lwamanzi angaphezu komhlaba
I-pH		6	7.57	5.0 – 9.5	8.32
Ukuthwala umbane	mS/m	6	91.05	<150	100.16
Calcium njenge- Ca	mg/l	6	24.35	<150	26.79
Magnesium njenge- Mg	mg/l	6	8.55	<100	9.41
Sodium njenge- Na	mg/l	6	112.20	<200	123.42
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	6	110.60	N/A	121.66
Chloride njenge- Cl	mg/l	6	**193.30**	<200	**193.30**
Sulphate njenge- SO_4	mg/l	6	11.30	<400	12.43
Nitrate njenge- NO_x-N	mg/l	6	0.34	<10	0.38
Fluoride njenge- F	Mg/l	6	0.28	<1.0	0.31
Ubunjani bekhemikhali	**Umvo**	**ummandla wolawulo lwamanzi u- E40D**			
		Inani leesampulu	**Ucoceko okanye umbindi ozolileyo wohlobo lwe- GW**	**UHlelo i-BHN Reserve**	**Uhlelo malunga nococeko lwamanzi angaphezu komhlaba**
I-pH		8	7.23	5.0 – 9.5	7.95
Ukuthwala umbane	mS/m	8	17.60	<150	19.36
Calcium njenge- Ca	mg/l	8	3.35	<150	3.69
Magnesium njenge- Mg	mg/l	8	4.10	<100	4.51
Sodium njenge- Na	mg/l	8	28.45	<200	31.30
Ubualkhalini xa bubonke njenge-$CaCO_3$	mg/l	8	17.85	N/A	19.64
Chloride njenge- Cl	mg/l	8	40.40	<200	44.44
Sulphate njenge- SO_4	mg/l	8	7.75	<400	8.53
Nitrate njenge- NO_x-N	mg/l	8	1.55	<10	1.70
Fluoride njenge- F	Mg/l	8	0.23	<1.0	0.25

Itafile-8.3 Isishwankathelo sococeko lwamanzi angaphezulu komhlaba nemida/neendawana zobungozi

Ummandla wolawulo lwamanzi	Ummandla (km²)	Ihlelo lococeko lwamanzi (DWAF, 1996)	Iindawana ezibonisa iingxaki ngococeko
E10A	134	0	
E10B	202	0	
E10C	192	I	pH
E10D	235	0	
E10E	366	0	
E10F	386	0	
E10G	508	0	
E10H	162	0	
E10J	468	0	
E10K	235	II	Cl, Na, EC
E21A	190	0	
E21B	223	I	EC
E21C	233	0	
E21D	242	0	
E21E	293	0	
E21F	379	0	
E21G	266	I	EC
E21H	404	I	pH
E21J	317	0	
E21K	330	0	
E21L	195	0	
E22A	750	II	EC, Cl
E22B	638	III	Cl
E22C	490	0	
E22D	496	III	Cl, Na, Mg
E22E	1013	II	Cl
E22F	400	0	
E22G	367	II	Cl
E23A	762	II	Cl
E23B	705	II	Cl
E23C	318	II	Cl
E23D	750	II	Cl
E23E	564	III	Na
E23F	473	III	Na
E23G	747	III	Na
E23H	660	III	Na

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Ummandla wolawulo lwamanzi	Ummandla (km^2)	Ihlelo lococeko lwamanzi (DWAF, 1996)	Iindawana ezibonisa iingxaki ngococeko
E23J	895	III	Na
E23K	572	II	F, Na
E24A	255	III	Cl, Na
E24B	468	III	Cl, Na
E24C	784	II	F, Na
E24D	997	II	F, Na
E24E	671	III	Mg
E24F	582	II	Cl, Na, EC
E24G	633	III	Cl, Na
E24H	483	III	Cl, Na
E24J	1078	II	Cl
E24K	652	III	Cl, Mg
E24L	516	I	pH
E24M	529	II	Cl, Na, EC
E31A	2865	III	Ca, Cl, Na, EC, NO_3, Mg
E31B	1476	III	Cl, Na, EC, SO_4
E31C	1572	III	Cl, Na, EC, Mg
E31D	839	III	Cl, Na, EC, Mg
E31E	478	III	Cl, Na, EC
E31F	525	II	Cl, Na, EC
E31G	1238	III	Cl, Na, EC
E31H	726	III	Cl, Na, EC
E32A	1118	I	EC,F
E32B	828	II	Cl, EC
E32C	638	II	Cl, EC
E32D	616	II	Cl, EC, Na, F
E32E	1001	III	Cl
E33A	1355	III	Cl, EC, Na
E33B	702	III	Cl, EC, Na, Mg, SO_4
E33C	980	III	Cl, EC, Na
E33D	1559	III	Cl, EC
E33E	1282	III	Cl, EC, Na
E33F	725	III	Cl
E33G	894	II	Cl, EC
E33H	719	III	Cl, EC, Na
E40A	941	II	Cl, EC, Na, F
E40B	707	II	Cl, EC
E40C	530	I	Cl, EC, Na
E40D	544	0	