



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

**DETERMINATION OF WATER RESOURCE CLASSES, RESERVE AND
RESOURCE QUALITY OBJECTIVES STUDY FOR SECONDARY
CATCHMENTS A5 – A9 WITHIN THE LIMPOPO WATER MANAGEMENT
AREA (WMA 1) AND SECONDARY CATCHMENT B9 IN THE OLIFANTS
WATER MANAGEMENT AREA (WMA 2)**

PROGRESS REPORT: BASIC HUMAN NEEDS REPORT

FINAL

DECEMBER 2023

WP 11352

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**FINAL
DECEMBER 2023**

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PROGRESS REPORT - BASIC HUMAN NEEDS REPORT

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TERMINOLOGY AND ABBREVIATIONS

ACRONYMS	DESCRIPTION
BHN	Basic human needs
BHNR	Basic human needs reserve
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
GIS	Geographic Information System
IUA	Integrated units of analysis
NWA	National Water Act
RDM	Resource Directed Measures
RQOs	Resource Quality Objectives
WMA	Water Management Area
WRCS	Water Resources Classification System

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1 INTRODUCTION

1.1 Background

The Department of Water and Sanitation (DWS), Chief Directorate (CD): Water Ecosystems Management (WEM) initiated a three-year study, extended to a fourth year, to Determine Water Resource Classes, the Ecological Reserve and Resource Quality Objectives for Secondary Catchments A5-A9 in the Limpopo Water Management Area (WMA 1) and Secondary Catchment B9 in the Olifants Water Management Area (WMA 2).

The suite of Resource Directed Measures tools being implemented in these catchments aims to ensure sustainable utilisation of water resources to meet the ecological, social and economic needs of the communities dependent on them.

1.2 Objectives of the Study

The overall objective of this project is to classify and determine the Reserve and Resource Quality Objectives for all significant water resources in the Secondary catchments (A5-A9) of the Limpopo WMA and B9 in the Olifants WMA.

The Scope of Work as stipulated in the Terms of Reference calls for the following:

- Coordinate the implementation of the Water Resources Classification System (WRCS), as required in Regulation 810 in Government Gazette 33541, by classifying all significant water resources in the Limpopo WMA (secondary catchments A5-A9) and Olifants WMA (secondary catchment B9).
- Determine the water quantity and quality components of the groundwater and surface water (rivers and wetlands) Reserve.
- Determine Resource Quality Objectives (RQOs) using the DWS Procedures to Determine and Implement RQOs.

1.3 Study area

The study area is the Secondary catchments (A5-A9) of the Limpopo WMA and B9 in the Olifants WMA (Figure 1). The study area quaternaries are divided into twelve integrated units of analysis (IUAs) as follows:

- Upper Lephalala (A50A-A50F)
- Lower Lephalala (A50G-A50H)
- Upper Nyl & Sterk (A61A-A61H, A161J)
- Mogalakwena (A62A-A62H, A62J, A63A, A63B, A63D)
- Kalkpan se Loop (A50J, A63C)
- Upper Sand (A71A-A71C, A71E, A71F)
- Lower Sand (A71D, A71G, A71H, A71J, A71K, A72A, A72B)
- Mapungubwe (A63E, A71L)
- Nzhelele/Ñwanedī (A80A-A80H, A80J)
- Upper Luvuvhu (A91A-A91G)
- Lower Luvuvhu/Mutale (A91H, A91J, A91K, A92A-A92D)
- Shingwedzi (B90A-B90H)

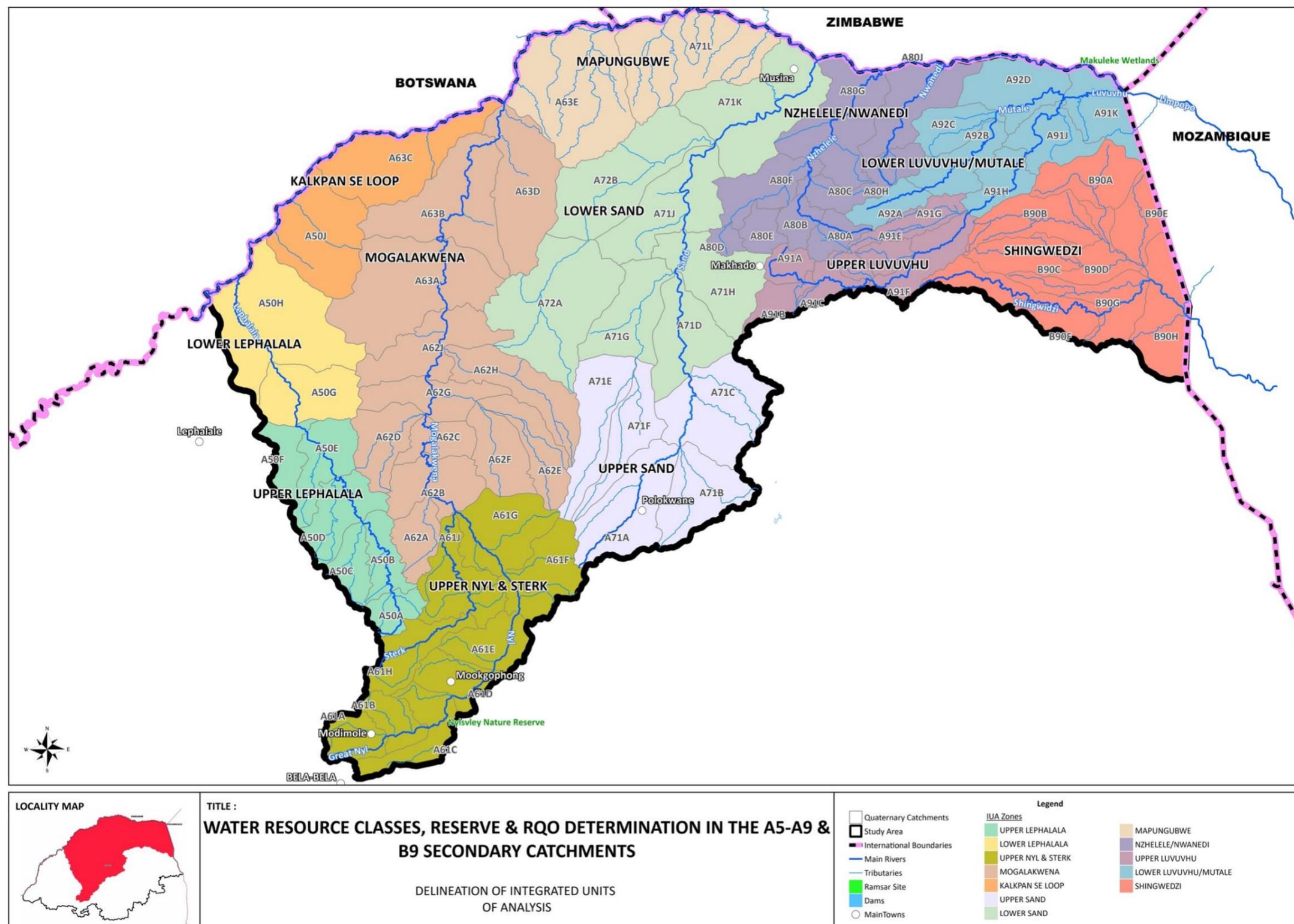


Figure 1. Locality map of the study area showing the twelve IUAs and quaternaries.

1.4 Purpose of this report

The purpose of this report is to quantify the Basic Human Needs Reserve (BHNR) as a key component of the study to Determine Water Resource Classes, the Ecological Reserve and Resource Quality Objectives for Secondary Catchments A5-A9 in the Limpopo Water Management Area (WMA 1) and Secondary Catchment B9 in the Olifants Water Management Area (WMA 2). Specifically, this report describes the BHN requirements for the study area population who rely directly on surface or groundwater ecosystems for their basic water needs, i.e., their water is not delivered to houses, yards or community standpipes from service provisioners (King & Pienaar 2011).

The concept of the right to water is deeply entrenched in the National Water Act (NWA) which gives effect to this right in the form of the BHNR (see Box 1) which is defined within the NWA as follows: “*BHNR provides for the essential needs of individuals served by the water resource in question and includes water for drinking, for food preparation and for personal hygiene.*” Thus, basic water for all includes ensuring that there is (a) enough available free basic water in formal delivery systems (through services providers) and (b) that enough is available directly in aquatic ecosystems for those who do not yet have access to formal delivery systems (King & Pienaar 2011). Note that this is over and above the Ecological Reserve which is needed to maintain the ecological integrity of South Africa’s water resources.

Box 1. Defining the Basic Human Needs Reserve within the wider context of the Reserve. Extracted from the NWA (DWA 1998), Chapter 1, section 1(1) (xviii)(a); Source: King & Pienaar (2011).

“**Reserve**” means the quantity and quality of water required:

- a. to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997), for people who are now or who will, in the reasonably near future, be:
 - i. relying upon;
 - ii. taking water from; or
 - iii. being supplied from, the relevant water resource; and
- b. to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

2 APPROACH

2.1 Determining the population reliant on informal water sources

Households reliant on the direct abstraction of water from groundwater sources (boreholes, wells and springs) and run off river and surface water sources (dam, pool, stream, river) were identified in the study area using Geographic Information System (GIS) in combination with Census 2011, Community Survey 2016 and Census 2022 datasets (Stats SA 2012, 2018, 2023). These households represent the population that do not have access to a formal water supply and are reliant on surface or groundwater aquatic ecosystems for their basic water needs. The method for determining the population reliant on ground and surface water sources within each quaternary followed the DWAF (2008) revised approach for determining the BHNR, as outlined in King & Pienaar (2011).

The 2011 Census dataset contained the most comprehensive statistics at the smallest aggregations of data at the sub-place level. Within each sub-place, population statistics are presented at the household level and include information on household access to formal and informal water supplies. This includes the number of households by water source (formal water scheme; borehole; dam, pool or stagnant water; rainwater tank; river or stream; spring; water tanker or water vendor; and other). The quaternary catchment boundaries were overlain onto the sub-places. All sub-places that were either wholly or partially within the quaternary catchments were captured, applying a proportional rule whereby if for example 50% of the sub-place fell within a quaternary catchment, then 50% of households were included. It was assumed that the households that are reliant on water resources utilise the aquatic ecosystems closest to them within the quaternary catchment linked to that sub-place. The proportion of households reliant on each type of water source was then calculated for each quaternary catchment.

Unfortunately only national and some provincial level summary statistics from the 2022 Census had been released at the time of this analysis. Therefore, the 2016 Community Survey dataset and the 2022 Census summary statistics for Limpopo (where available) were used to update the 2011 sub-place estimates using adjustment factors. Both these datasets provided information on the proportion of households with access to piped water and the proportion of households by water source. The relative change in the proportion of households relying on the different water sources was then used to compute an adjustment factor for estimating household reliance in 2022 (assuming the statistics for Limpopo are representative of the study area). The adjustment factors were used to calculate the number of households in 2022 by water source within each quaternary catchment (Table 1).

Table 1. Adjustment factors used to update household percentage reliance on ground and surface water resources in the study area in 2022.

Water source	Adjustment factor 2011 - 2022
Borehole	0.76
Spring	0.57
Dam, pool or stagnant water	0.48
River or stream	1.00

Finally, the total number of people reliant on ground and surface water sources was determined by multiplying the number of households by the average household size which in 2022 for Limpopo province was 3.6 people per household. This is lower than the 3.8 people per household in 2011 and 4.5 people per household in 2001.

2.2 Calculating the basic human needs reserve

To calculate the total amount of water for the BHNR, a daily allowance of 50 litres per person per day was used for those individuals in the population relying on ground or surface water resources, in line with international benchmarks (Gleick 1996) and World Health Organization (WHO) and United Nations guidelines which recommend a minimum of 50 litres per person per day for drinking, washing, cooking and maintaining proper hygiene. While in South Africa the standard quantum for the purposes of the BHNR has previously been 25 litres per person per day, higher allocations can be motivated for considering local climatic conditions, lifestyles, culture and conditions of access (King & Pienaar 2011). Given the relatively poor levels of service delivery and particular needs of the rural communities in the study area, a volume of 50 litres of water per person per day is considered more appropriate. However, the BHNR using a volume of 25 litres of water per person per day is also reported. The volume of water per person per day was multiplied by the total number of people reliant on ground and surface water sources in each quaternary catchment. This was then converted into an annual volume (m³/year). Note, however, that this should be translated into a constant flow allowance **per day** (the BHNR/365) to be able to meet household needs.

2.3 Calculating future requirements

Following the estimation of the BHNR for the baseline (current, 2022) population, the BHNR in the future (2032 and 2042) was projected using population trends and service delivery trends based on Census data from 1996, 2001, 2011, 2016 and 2022. The population in the Limpopo Province has increased on average at 1.4% per annum since 1996, increasing from 4.6 million people to 6.6 million people in 2022 (Figure 2). Based on this growth rate, the population is expected to grow to around 7.5 million people in 2032 and 8.6 million in 2042. This equates to a 118% increase from 2022 to 2032 and a 115% increase from 2032 to 2042.

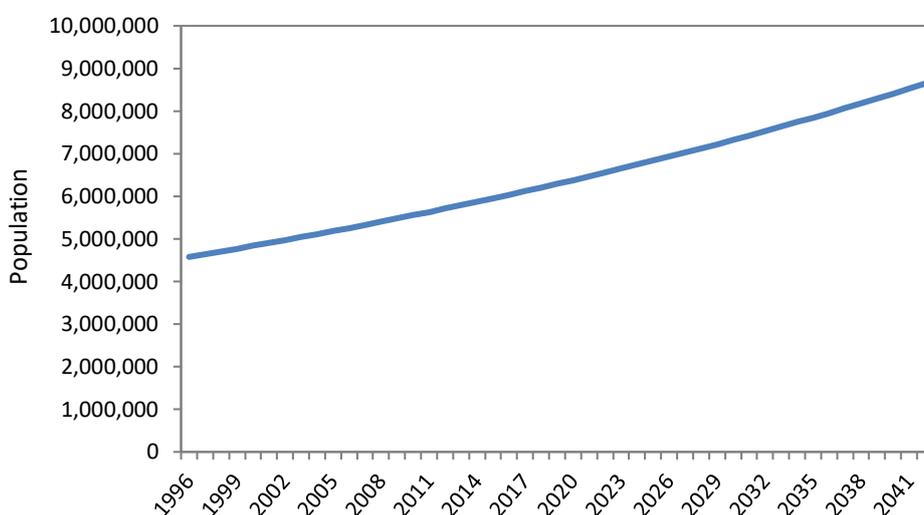


Figure 2. Forecast population growth in Limpopo Province based on past trends. Source: Census 1996, 2001, 2011, 2016, 2022.

However, while the population is expected to grow over time, access to formal water supplies is expected to improve and reliance on surface and ground water resources is expected to decline as a result. Indeed, in the study area, the percentage of households with access to a formal water supply increased from 70.2% in 2011 to 74.5% in 2016, which is in line with national trends (Figure 3). Borehole usage in the study area declined from 13.4% to 10.3% of households, whereas the reliance on rivers

and streams remained largely unchanged. Furthermore, in the Limpopo Province, the average household size declined over time from more than 5 people per household to just 3.6 people per household. Using population, water service and household size trends, a set of adjustment factors were calculated and applied to the 2022 reliance data to estimate the future BHR for 2032 and 2042 (Table 2).

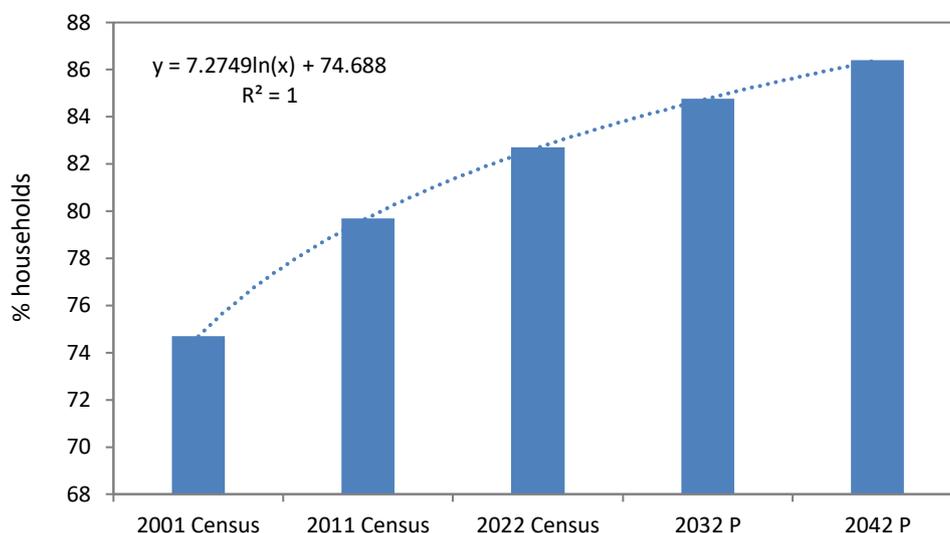


Figure 3. The percentage of households with access to formal water supply (i.e., water scheme) over time. 2001-2022 actual data, 2032 and 2042 predicted based on past trend using logarithmic relationship.

Table 2. Adjustment factors used to update household percentage reliance on ground and surface water resources in the study area in 2022.

Water source	Adjustment factor 2022 - 2032	Adjustment factor 2032 - 2042
Water scheme	1.03	1.02
Borehole	0.80	0.80
Spring	0.79	0.79
Dam, pool or stagnant water	0.79	0.48
River or stream	1.00	0.98

3 RESULTS

3.1 Baseline population and BHNR

In 2022, there were just under 851 000 households (~3 063 515 people) living in the 76 quaternary catchments that make up the study area (Table 3). Of these, just over 131 000 households were dependent on the BHNR with 11.1% reliant on groundwater resources and 4.3% reliant on surface water resources (Table 3, Appendix 1). This equates to 8.6 million m³ of water per year, with 6.2 million m³ from groundwater sources and 2.4 million m³ from surface water sources when using 50 litres per person per day (Figure 4, Figure 5). Groundwater dependence was highest in the Mogalakwena, Upper Sand and Lower Sand IUAs and surface water dependence was highest in the Upper Luvuvhu, Lower Luvuvhu/Mutale and Nzhelele/Ñwanedji IUAs (Table 3, Figure 6, Figure 7) in the east of the study area.

The results for BHNR calculated using 25 litres per person per day are shown in Table 4.

Table 3. The total number of households in each IUA and the proportion of households that are dependent on groundwater and surface water resources for their basic human needs, and the estimated BHNR per IUA in million m³ per annum (assuming 50 litres per person per day).

IUA	Total number of households 2022	Number of households dependent on groundwater	BHNR groundwater 50 L pppd (million m ³ /y)	Number of households dependent on surface water	BHNR surface water 50 L pppd (million m ³ /y)
Upper Lephalala	1 444	802	0.053	71	0.005
Lower Lephalala	18 068	2 737	0.180	583	0.038
Upper Nyl & Sterk	96 489	10 502	0.690	505	0.033
Mogalakwena	89 042	15 035	0.988	3 893	0.256
Kalkpan se Loop	1 101	658	0.043	29	0.002
Upper Sand	232 721	20 280	1.332	2 398	0.158
Lower Sand	93 722	13 907	0.914	2 791	0.183
Mapungubwe	4 586	1 605	0.105	1 324	0.087
Nzhelele/Ñwanedji	58 352	9 059	0.595	6 961	0.457
Upper Luvuvhu	157 335	11 020	0.724	9 681	0.636
Lower Luvuvhu/Mutale	50 533	5 385	0.354	7 565	0.497
Shingwedzi	47 584	3 867	0.254	387	0.025
Total	850 976	94 857	6.232	36 189	2.378

Table 4. The total number of households in each IUA and the proportion of households that are dependent on groundwater and surface water resources for their basic human needs, and the estimated BHNR per IUA in million m³ per annum (assuming 25 litres per person per day).

IUA	Total number of households 2022	Number of households dependent on groundwater	BHNR groundwater 25 L pppd (million m ³ /y)	Number of households dependent on surface water	BHNR surface water 25 L pppd (million m ³ /y)
Upper Lephalala	1 444	802	0.026	71	0.002
Lower Lephalala	18 068	2 737	0.090	583	0.019
Upper Nyl & Sterk	96 489	10 502	0.345	505	0.017
Mogalakwena	89 042	15 035	0.494	3 893	0.128
Kalkpan se Loop	1 101	658	0.022	29	0.001
Upper Sand	232 721	20 280	0.666	2 398	0.079
Lower Sand	93 722	13 907	0.457	2 791	0.092
Mapungubwe	4 586	1 605	0.053	1 324	0.044
Nzhelele/Nwanedi	58 352	9 059	0.298	6 961	0.229
Upper Luvuvhu	157 335	11 020	0.362	9 681	0.318
Lower Luvuvhu/Mutale	50 533	5 385	0.177	7 565	0.249
Shingwedzi	47 584	3 867	0.127	387	0.013
Total	850 976	94 857	3.116	36 189	1.189

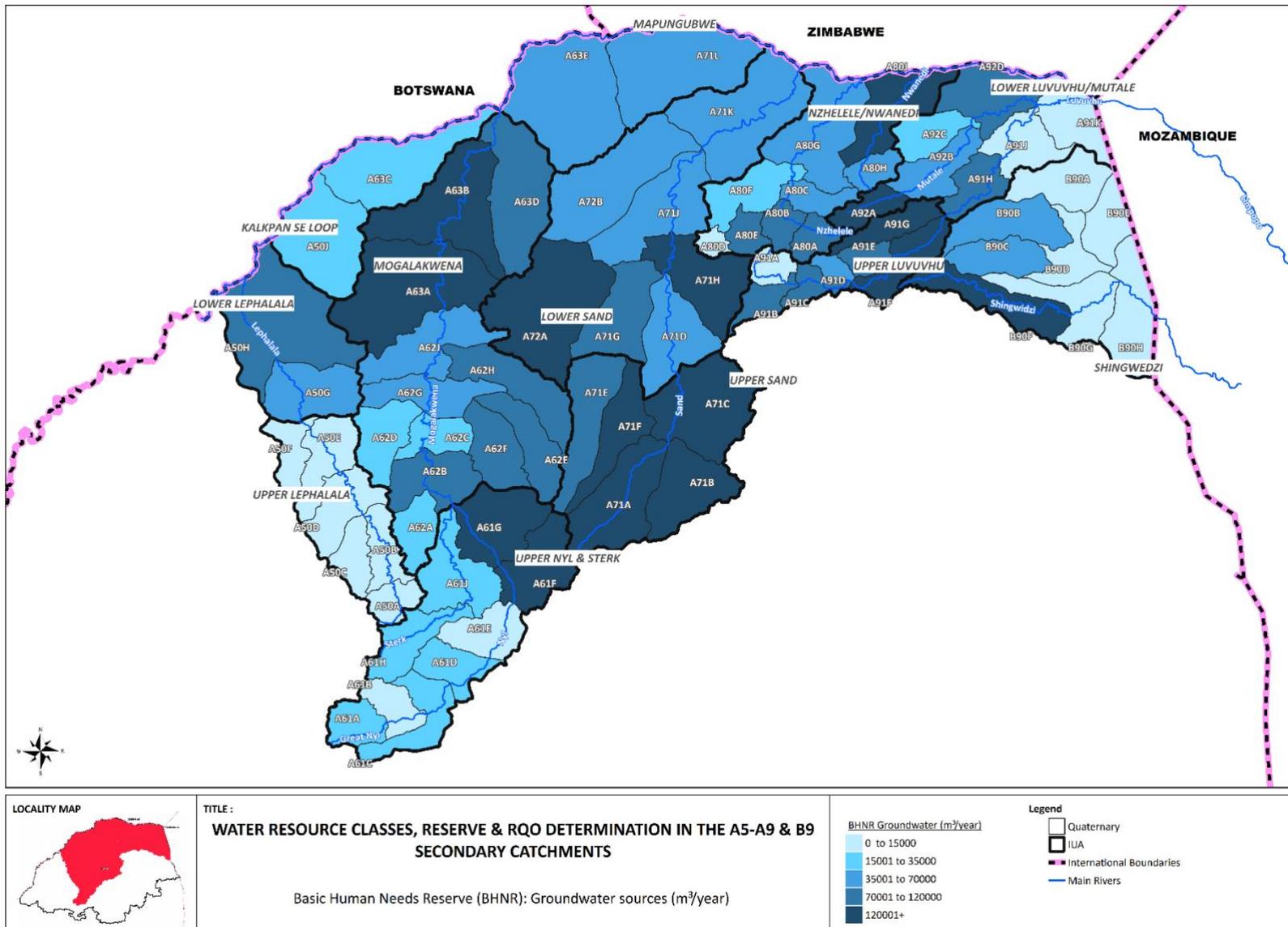


Figure 4. Estimated Basic Human Needs Reserve (BHNR) from groundwater sources (m³/year) per quaternary catchment in 2022.

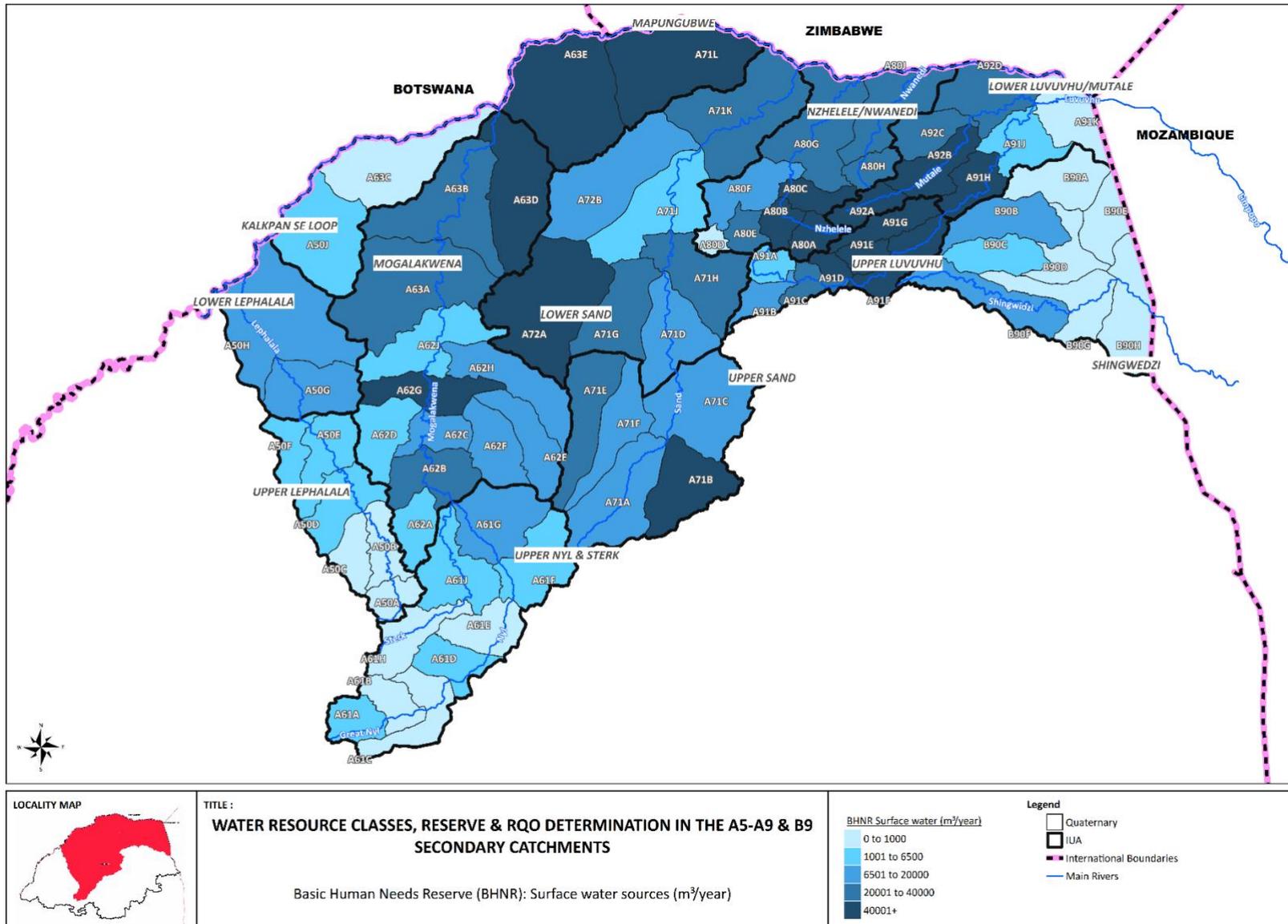


Figure 5. Estimated Basic Human Needs Reserve (BHNr) from surface water sources (m³/year) per quaternary catchment in 2022.

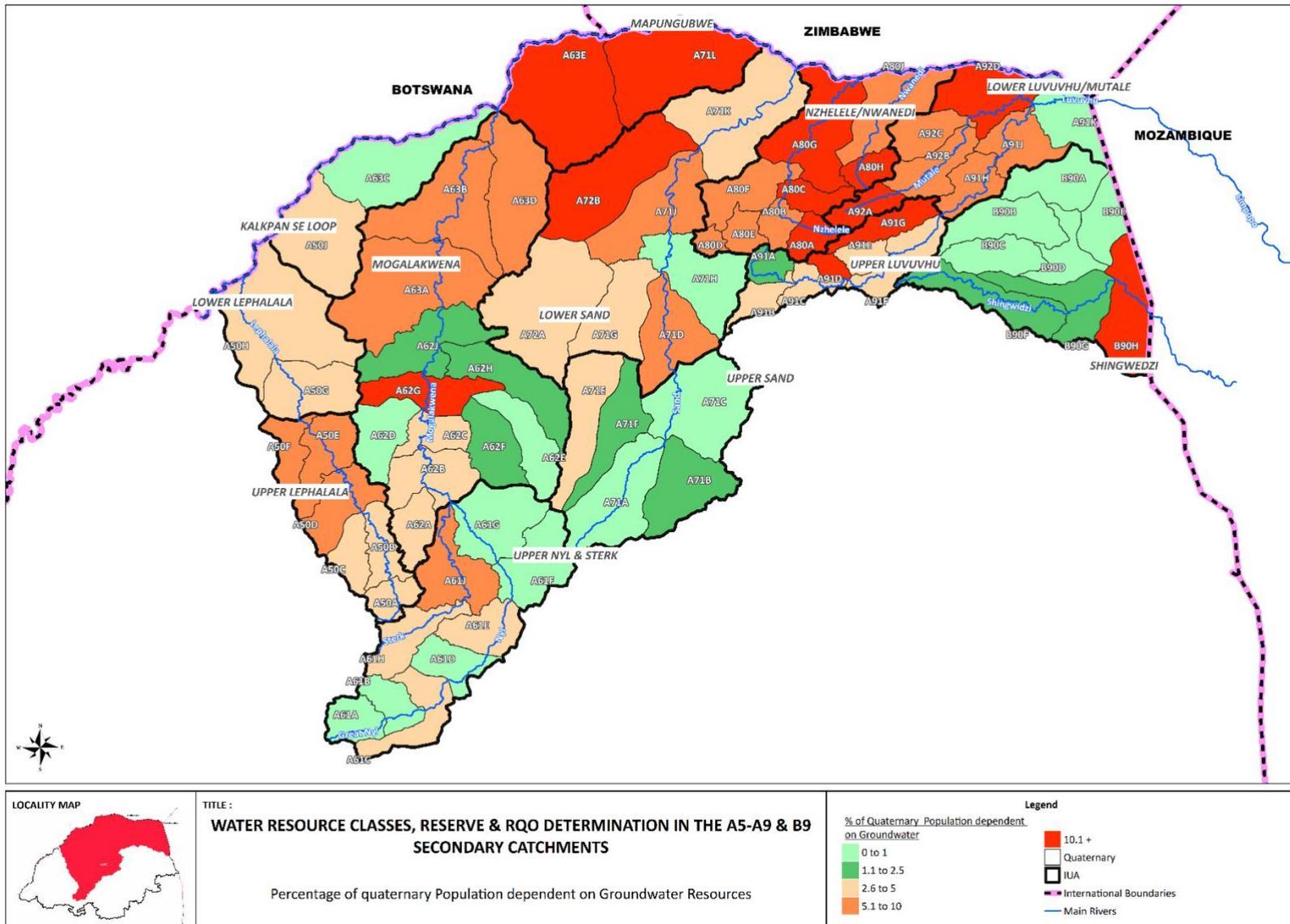


Figure 6. Percentage of the population dependent on groundwater resources for their basic needs in 2022.

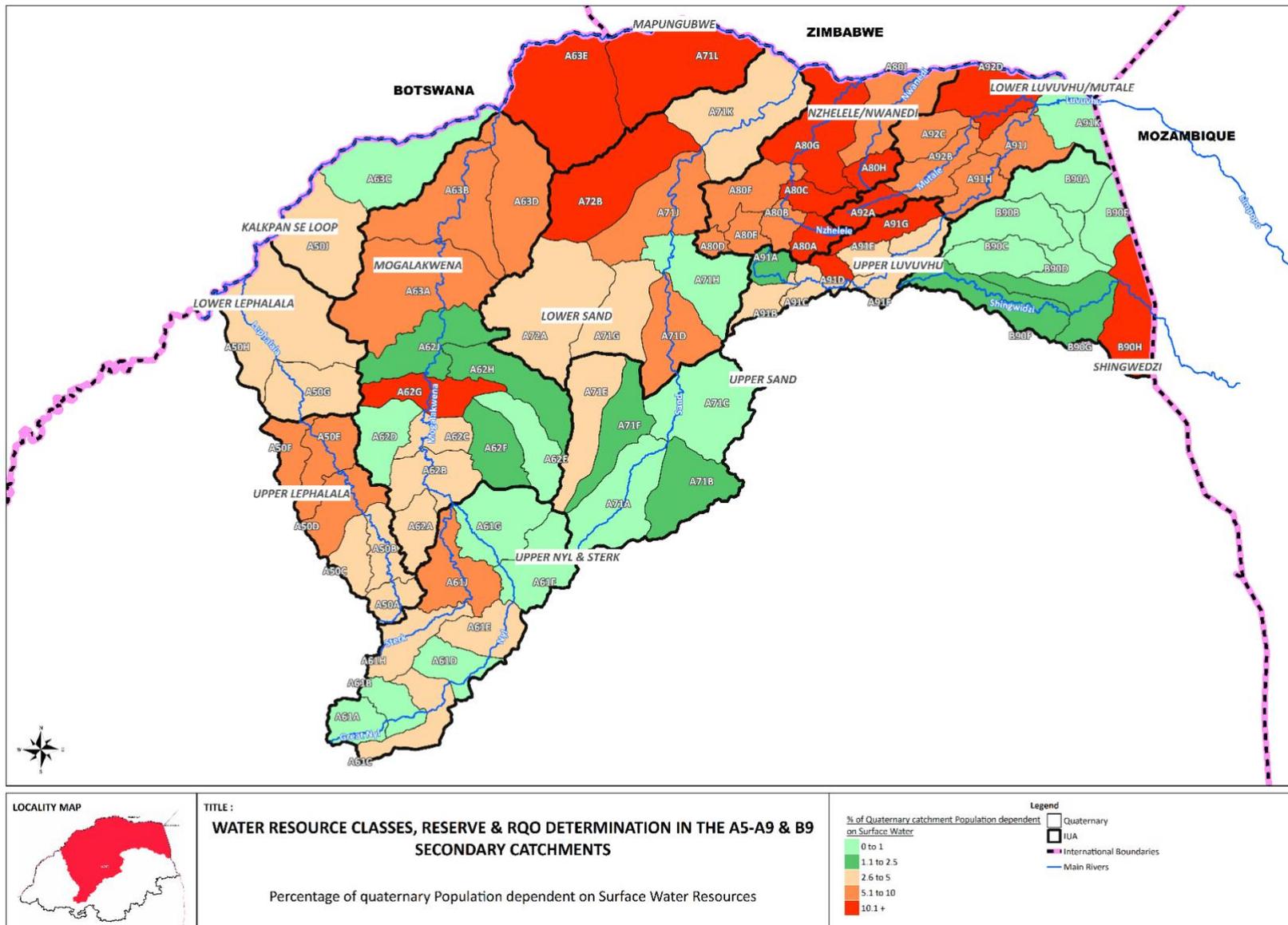


Figure 7. Percentage of the population dependent on surface water resources for their basic needs in 2022.

3.2 Future population and BHN

The total number of households in the study area is predicted to increase from just under 851 000 to just over 1 million households in 2032 and 1.2 million households in 2042 (Table 5). While the number of households is expected to increase overall, the number of households dependent on groundwater sources is expected to decline when compared to 2022 resulting in an overall decline in the total BHN over time (Table 6, Table 7). This is because the expected rate at which groundwater usage is set to decline is higher than the rate at which the population is set to increase over the same period.

Table 5. Total number of households in the study area in 2022 and projected household numbers in 2032 and 2042.

IUA	Total number of households 2022	Total number of households 2032	Total number of households 2042
Upper Lephalala	1 444	1 706	1 957
Lower Lephalala	18 068	21 341	24 483
Upper Nyl & Sterk	96 489	113 965	130 744
Mogalakwena	89 042	105 170	120 653
Kalkpan se Loop	1 101	1 300	1 491
Upper Sand	232 721	274 873	315 341
Lower Sand	93 722	110 697	126 994
Mapungubwe	4 586	5 417	6 214
Nzhelele/Nwanedi	58 352	68 921	79 068
Upper Luvuvhu	157 335	185 833	213 192
Lower Luvuvhu/Mutale	50 533	59 685	68 472
Shingwedzi	47 584	56 203	64 478
Total	850 976	1 005 111	1 153 086

Table 6. Projected number of households dependent on groundwater and surface water resources in 2032 and 2042.

IUA	Number of households dependent on groundwater 2032	Number of households dependent on surface water 2032	Number of households dependent on groundwater 2042	Number of households dependent on surface water 2042
Upper Lephalala	760	81	696	84
Lower Lephalala	2 595	634	2 374	585
Upper Nyl & Sterk	9 954	520	9 109	411
Mogalakwena	14 247	4 175	13 036	3 712
Kalkpan se Loop	624	34	571	36
Upper Sand	19 225	2 437	17 593	1 849
Lower Sand	13 175	3 028	12 053	2 777
Mapungubwe	1 521	1 536	1 392	1 639
Nzhelele/Nwanedi	8 552	7 572	7 811	6 985
Upper Luvuvhu	10 393	10 686	9 489	10 218
Lower Luvuvhu/Mutale	5 058	8 831	4 610	9 544
Shingwedzi	3 665	423	3 354	395
Total	89 769	39 959	82 088	38 235

However, it is projected that the surface water BHN increases in 2032 and 2042 compared to 2022 because the expected rate at which households depend on surface water remains relatively stable and only starts to decline at a faster rate compared to the population increase closer to 2042 (Table 7). The results for projected BHN at 25 litres per person per day is shown in Table 8.

Table 7. Projected BHNR (assuming 50 litres per person per day) per IUA in 2032 and 2042 expressed in million m³ per annum.

IUA	BHNR groundwater 2022 (million m ³ /y)	BHNR groundwater 2032 (million m ³ /y)	BHNR groundwater 2042 (million m ³ /y)	BHNR surface water 2022 (million m ³ /y)	BHNR surface water 2032 (million m ³ /y)	BHNR surface water 2042 (million m ³ /y)
Upper Lephalala	0.053	0.049	0.044	0.005	0.005	0.005
Lower Lephalala	0.180	0.167	0.150	0.038	0.041	0.037
Upper Nyl & Sterk	0.690	0.641	0.575	0.033	0.033	0.026
Mogalakwena	0.988	0.918	0.822	0.256	0.269	0.234
Kalkpan se Loop	0.043	0.040	0.036	0.002	0.002	0.002
Upper Sand	1.332	1.238	1.110	0.158	0.157	0.117
Lower Sand	0.914	0.849	0.760	0.183	0.195	0.175
Mapungubwe	0.105	0.098	0.088	0.087	0.099	0.103
Nzhelele/Nwanedji	0.595	0.551	0.493	0.457	0.488	0.441
Upper Luvuvhu	0.724	0.669	0.599	0.636	0.688	0.645
Lower Luvuvhu/Mutale	0.354	0.326	0.291	0.497	0.569	0.602
Shingwedzi	0.254	0.236	0.212	0.025	0.027	0.025
Total	6.232	5.781	5.179	2.378	2.574	2.412

Table 8. Projected BHNR (assuming 25 litres per person per day) per IUA in 2032 and 2042 expressed in million m³ per annum.

IUA	BHNR groundwater 2022 (million m ³ /y)	BHNR groundwater 2032 (million m ³ /y)	BHNR groundwater 2042 (million m ³ /y)	BHNR surface water 2022 (million m ³ /y)	BHNR surface water 2032 (million m ³ /y)	BHNR surface water 2042 (million m ³ /y)
Upper Lephalala	0.027	0.025	0.022	0.003	0.003	0.003
Lower Lephalala	0.090	0.084	0.075	0.019	0.021	0.019
Upper Nyl & Sterk	0.345	0.321	0.288	0.017	0.017	0.013
Mogalakwena	0.494	0.459	0.411	0.128	0.135	0.117
Kalkpan se Loop	0.022	0.020	0.018	0.001	0.001	0.001
Upper Sand	0.666	0.619	0.555	0.079	0.079	0.059
Lower Sand	0.457	0.425	0.380	0.092	0.098	0.088
Mapungubwe	0.053	0.049	0.044	0.044	0.050	0.052
Nzhelele/Nwanedji	0.298	0.276	0.247	0.229	0.244	0.221
Upper Luvuvhu	0.362	0.335	0.300	0.318	0.344	0.323
Lower Luvuvhu/Mutale	0.177	0.163	0.146	0.249	0.285	0.301
Shingwedzi	0.127	0.118	0.106	0.013	0.014	0.013
Total	3.116	2.891	2.590	1.189	1.287	1.206

4 CONCLUSION

The following conclusions are drawn from the BHNr analysis:

- In 2022, there were just under 851 000 households (~3 063 515 people) living in the study area and of these approximately 131 000 households were dependent on the BHNr with 11.1% reliant on groundwater resources and 4.3% reliant on surface water resources.
- This equates to an estimated 8.6 million m³ of water per year (BHNr), with 6.2 million m³ from groundwater sources and 2.4 million m³ from surface water sources (when assuming 50 litres per person per day).
- The IUA with the greatest number of households reliant on groundwater resources overall with a BHNr of 1.3 million m³ was the Upper Sand IUA, followed by the Mogalakwena and Lower Sand IUAs.
- While total groundwater usage was lowest in the Upper Lephalala, Kalkpan se Loop and Mapungubwe IUAs, a high percentage of households in these IUAs are reliant on groundwater as their main source of water.
- The IUAs with the greatest number of households reliant on surface water resources is the Upper Luvuvhu, Lower Luvuvhu/Mutale and Nzhelele/Ōwanedi IUAs accounting for two thirds of the households in the study area that are dependent on these aquatic ecosystems as their main source of water.
- In the future, it is expected that groundwater dependence and the groundwater component of the BHNr will decrease due to the expected rate of decline in the number of households that are dependent on these sources compared to the population growth rate.
- Surface water dependence in the future is expected to remain relatively stable and as a result the surface component of the BHNr is higher in 2032 and 2042 compared to 2022.

5 REFERENCES

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6 APPENDIX 1: SUMMARISED POPULATION AND BHNR PER QUATERNARY CATCHMENT

Table 9. Number of households dependant on BHNR by quaternary catchment.

Quaternary	IUA	Number of households dependent on BHNR		
		2022	2032	2042
A50A	1. Upper Lephhalala	144	138	126
A50B	1. Upper Lephhalala	145	139	127
A50C	1. Upper Lephhalala	146	139	128
A50D	1. Upper Lephhalala	172	167	156
A50E	1. Upper Lephhalala	161	156	146
A50F	1. Upper Lephhalala	104	102	97
A50G	2. Lower Lephhalala	1 298	1 293	1 241
A50H	2. Lower Lephhalala	2 022	1 933	1 718
A50J	5. Kalkpan se Loop	340	327	304
A63C	5. Kalkpan se Loop	348	330	303
A61A	3. Upper Nyl & Sterk	280	268	242
A61B	3. Upper Nyl & Sterk	182	173	158
A61C	3. Upper Nyl & Sterk	314	299	273
A61D	3. Upper Nyl & Sterk	292	279	256
A61E	3. Upper Nyl & Sterk	227	216	198
A61H	3. Upper Nyl & Sterk	265	252	230
A61J	3. Upper Nyl & Sterk	366	351	321
A61F	3. Upper Nyl & Sterk	4 720	4 482	4 107
A61G	3. Upper Nyl & Sterk	4 362	4 144	3 736
A62A	4. Mogalakwena	575	548	481
A62B	4. Mogalakwena	2 268	2 174	1 909
A62C	4. Mogalakwena	392	403	402
A62D	4. Mogalakwena	316	305	285
A62E	4. Mogalakwena	1 931	1 849	1 687
A62F	4. Mogalakwena	1 895	1 799	1 607
A62G	4. Mogalakwena	1 399	1 489	1 509
A62H	4. Mogalakwena	2 066	1 974	1 768
A62J	4. Mogalakwena	1 036	993	920
A63A	4. Mogalakwena	2 665	2 552	2 223
A63B	4. Mogalakwena	2 329	2 254	2 023
A63D	4. Mogalakwena	2 056	2 064	1 934
A63E	8. Mapungubwe	1 521	1 580	1 563
A71L	8. Mapungubwe	1 407	1 474	1 467
A71A	6. Upper Sand	6 751	6 401	5 816
A71B	6. Upper Sand	3 976	3 867	3 414
A71C	6. Upper Sand	5 265	5 000	4 546
A71D	7. Lower Sand	856	815	716
A71H	7. Lower Sand	4 856	4 612	4 145
A71E	6. Upper Sand	1 934	1 868	1 615
A71F	6. Upper Sand	4 753	4 505	4 051
A71G	7. Lower Sand	1 584	1 572	1 506
A72A	7. Lower Sand	6 003	5 787	5 209
A71J	7. Lower Sand	924	890	819
A72B	7. Lower Sand	1 092	1 074	1 010

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Quaternary	IUA	Number of households dependent on BHNR		
		2022	2032	2042
A71K	7. Lower Sand	1 382	1 437	1 423
A80A	9. Nzhelele/Nwanedi	4 462	4 608	4 130
A80B	9. Nzhelele/Nwanedi	2 361	2 274	1 849
A80C	9. Nzhelele/Nwanedi	1 655	1 736	1 763
A80D	9. Nzhelele/Nwanedi	102	97	89
A80E	9. Nzhelele/Nwanedi	1 856	1 863	1 820
A80F	9. Nzhelele/Nwanedi	621	600	526
A80G	9. Nzhelele/Nwanedi	1 407	1 424	1 376
A80H	9. Nzhelele/Nwanedi	1 144	1 171	1 124
A80J	9. Nzhelele/Nwanedi	2 412	2 337	2 119
A91A	10. Upper Luvuvhu	223	213	195
A91B	10. Upper Luvuvhu	1 391	1 366	1 282
A91C	10. Upper Luvuvhu	2 049	1 989	1 812
A91D	10. Upper Luvuvhu	1 775	1 809	1 624
A91E	10. Upper Luvuvhu	4 204	4 449	4 401
A91F	10. Upper Luvuvhu	4 081	3 936	3 271
A91G	10. Upper Luvuvhu	6 978	7 298	7 122
A91H	11. Lower Luvuvhu/Mutale	2 583	2 745	2 765
A91J	11. Lower Luvuvhu/Mutale	83	89	91
A91K	11. Lower Luvuvhu/Mutale	26	24	22
A92A	11. Lower Luvuvhu/Mutale	6 590	7 306	7 799
A92B	11. Lower Luvuvhu/Mutale	1 233	1 293	1 272
A92C	11. Lower Luvuvhu/Mutale	736	700	537
A92D	11. Lower Luvuvhu/Mutale	1 699	1 720	1 669
B90A	12. Shingwedzi	38	36	31
B90B	12. Shingwedzi	645	619	554
B90C	12. Shingwedzi	838	796	725
B90D	12. Shingwedzi	3	3	2
B90E	12. Shingwedzi	3	3	2
B90F	12. Shingwedzi	2 602	2 505	2 319
B90G	12. Shingwedzi	91	89	83
B90H	12. Shingwedzi	34	34	33
Total		131 045	129 604	120 323

Table 10. BHNR by quaternary catchment in million cubic metres per annum (assuming 50 litres per person per day).

Quaternary	IUA	BHNR (million m ³ /year)		
		2022	2032	2042
A50A	1. Upper Lephhalala	0.0095	0.0089	0.0079
A50B	1. Upper Lephhalala	0.0096	0.0089	0.0080
A50C	1. Upper Lephhalala	0.0096	0.0090	0.0081
A50D	1. Upper Lephhalala	0.0113	0.0107	0.0098
A50E	1. Upper Lephhalala	0.0106	0.0101	0.0092
A50F	1. Upper Lephhalala	0.0069	0.0066	0.0061
A50G	2. Lower Lephhalala	0.0853	0.0833	0.0783
A50H	2. Lower Lephhalala	0.1328	0.1245	0.1084
A50J	5. Kalkpan se Loop	0.0223	0.0211	0.0192
A63C	5. Kalkpan se Loop	0.0229	0.0213	0.0191
A61A	3. Upper Nyl & Sterk	0.0184	0.0172	0.0153
A61B	3. Upper Nyl & Sterk	0.0120	0.0112	0.0100
A61C	3. Upper Nyl & Sterk	0.0206	0.0192	0.0172
A61D	3. Upper Nyl & Sterk	0.0192	0.0180	0.0161
A61E	3. Upper Nyl & Sterk	0.0149	0.0139	0.0125
A61H	3. Upper Nyl & Sterk	0.0174	0.0162	0.0145
A61J	3. Upper Nyl & Sterk	0.0241	0.0226	0.0203
A61F	3. Upper Nyl & Sterk	0.3101	0.2887	0.2591
A61G	3. Upper Nyl & Sterk	0.2866	0.2669	0.2357
A62A	4. Mogalakwena	0.0378	0.0353	0.0303
A62B	4. Mogalakwena	0.1490	0.1400	0.1204
A62C	4. Mogalakwena	0.0257	0.0259	0.0254
A62D	4. Mogalakwena	0.0208	0.0196	0.0180
A62E	4. Mogalakwena	0.1269	0.1191	0.1064
A62F	4. Mogalakwena	0.1245	0.1159	0.1014
A62G	4. Mogalakwena	0.0919	0.0959	0.0952
A62H	4. Mogalakwena	0.1358	0.1271	0.1116
A62J	4. Mogalakwena	0.0681	0.0640	0.0581
A63A	4. Mogalakwena	0.1751	0.1644	0.1403
A63B	4. Mogalakwena	0.1530	0.1452	0.1276
A63D	4. Mogalakwena	0.1351	0.1329	0.1220
A63E	8. Mapungubwe	0.1000	0.1018	0.0986
A71L	8. Mapungubwe	0.0925	0.0949	0.0926
A71A	6. Upper Sand	0.4436	0.4123	0.3670
A71B	6. Upper Sand	0.2612	0.2491	0.2154
A71C	6. Upper Sand	0.3459	0.3220	0.2868
A71D	7. Lower Sand	0.0563	0.0525	0.0452
A71H	7. Lower Sand	0.3191	0.2970	0.2616
A71E	6. Upper Sand	0.1270	0.1203	0.1019
A71F	6. Upper Sand	0.3122	0.2901	0.2556
A71G	7. Lower Sand	0.1041	0.1013	0.0950

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Quaternary	IUA	BHNR (million m ³ /year)		
		2022	2032	2042
A72A	7. Lower Sand	0.3944	0.3727	0.3287
A71J	7. Lower Sand	0.0607	0.0573	0.0517
A72B	7. Lower Sand	0.0718	0.0692	0.0637
A71K	7. Lower Sand	0.0908	0.0926	0.0898
A80A	9. Nzhelele/N'wanedi	0.2931	0.2968	0.2606
A80B	9. Nzhelele/N'wanedi	0.1551	0.1464	0.1167
A80C	9. Nzhelele/N'wanedi	0.1087	0.1118	0.1113
A80D	9. Nzhelele/N'wanedi	0.0067	0.0063	0.0056
A80E	9. Nzhelele/N'wanedi	0.1220	0.1200	0.1149
A80F	9. Nzhelele/N'wanedi	0.0408	0.0386	0.0332
A80G	9. Nzhelele/N'wanedi	0.0924	0.0917	0.0868
A80H	9. Nzhelele/N'wanedi	0.0752	0.0754	0.0709
A80J	9. Nzhelele/N'wanedi	0.1585	0.1505	0.1337
A91A	10. Upper Luvuvhu	0.0147	0.0137	0.0123
A91B	10. Upper Luvuvhu	0.0914	0.0880	0.0809
A91C	10. Upper Luvuvhu	0.1346	0.1281	0.1144
A91D	10. Upper Luvuvhu	0.1166	0.1165	0.1025
A91E	10. Upper Luvuvhu	0.2762	0.2865	0.2777
A91F	10. Upper Luvuvhu	0.2681	0.2535	0.2064
A91G	10. Upper Luvuvhu	0.4584	0.4700	0.4494
A91H	11. Lower Luvuvhu/Mutale	0.1697	0.1768	0.1744
A91J	11. Lower Luvuvhu/Mutale	0.0055	0.0057	0.0057
A91K	11. Lower Luvuvhu/Mutale	0.0017	0.0016	0.0014
A92A	11. Lower Luvuvhu/Mutale	0.4330	0.4705	0.4921
A92B	11. Lower Luvuvhu/Mutale	0.0810	0.0833	0.0803
A92C	11. Lower Luvuvhu/Mutale	0.0484	0.0451	0.0339
A92D	11. Lower Luvuvhu/Mutale	0.1116	0.1108	0.1053
B90A	12. Shingwedzi	0.0025	0.0023	0.0019
B90B	12. Shingwedzi	0.0424	0.0399	0.0350
B90C	12. Shingwedzi	0.0551	0.0513	0.0457
B90D	12. Shingwedzi	0.0002	0.0002	0.0002
B90E	12. Shingwedzi	0.0002	0.0002	0.0002
B90F	12. Shingwedzi	0.1709	0.1613	0.1463
B90G	12. Shingwedzi	0.0060	0.0057	0.0053
B90H	12. Shingwedzi	0.0022	0.0022	0.0021
Total		8.6097	8.3470	7.5918

Table 11. BHNR by quaternary catchment in million cubic metres per annum (assuming 25 litres per person per day).

Quaternary	IUA	BHNR (million m ³ /year)		
		2022	2032	2042
A50A	1. Upper Lephhalala	0.0047	0.0044	0.0040
A50B	1. Upper Lephhalala	0.0048	0.0045	0.0040
A50C	1. Upper Lephhalala	0.0048	0.0045	0.0040
A50D	1. Upper Lephhalala	0.0057	0.0054	0.0049
A50E	1. Upper Lephhalala	0.0053	0.0050	0.0046
A50F	1. Upper Lephhalala	0.0034	0.0033	0.0031
A50G	2. Lower Lephhalala	0.0427	0.0416	0.0392
A50H	2. Lower Lephhalala	0.0664	0.0622	0.0542
A50J	5. Kalkpan se Loop	0.0112	0.0105	0.0096
A63C	5. Kalkpan se Loop	0.0114	0.0106	0.0095
A61A	3. Upper Nyl & Sterk	0.0092	0.0086	0.0076
A61B	3. Upper Nyl & Sterk	0.0060	0.0056	0.0050
A61C	3. Upper Nyl & Sterk	0.0103	0.0096	0.0086
A61D	3. Upper Nyl & Sterk	0.0096	0.0090	0.0081
A61E	3. Upper Nyl & Sterk	0.0075	0.0070	0.0062
A61H	3. Upper Nyl & Sterk	0.0087	0.0081	0.0073
A61J	3. Upper Nyl & Sterk	0.0120	0.0113	0.0101
A61F	3. Upper Nyl & Sterk	0.1550	0.1443	0.1296
A61G	3. Upper Nyl & Sterk	0.1433	0.1335	0.1179
A62A	4. Mogalakwena	0.0189	0.0177	0.0152
A62B	4. Mogalakwena	0.0745	0.0700	0.0602
A62C	4. Mogalakwena	0.0129	0.0130	0.0127
A62D	4. Mogalakwena	0.0104	0.0098	0.0090
A62E	4. Mogalakwena	0.0635	0.0595	0.0532
A62F	4. Mogalakwena	0.0622	0.0579	0.0507
A62G	4. Mogalakwena	0.0460	0.0479	0.0476
A62H	4. Mogalakwena	0.0679	0.0636	0.0558
A62J	4. Mogalakwena	0.0340	0.0320	0.0290
A63A	4. Mogalakwena	0.0875	0.0822	0.0701
A63B	4. Mogalakwena	0.0765	0.0726	0.0638
A63D	4. Mogalakwena	0.0676	0.0665	0.0610
A63E	8. Mapungubwe	0.0500	0.0509	0.0493
A71L	8. Mapungubwe	0.0462	0.0475	0.0463
A71A	6. Upper Sand	0.2218	0.2061	0.1835
A71B	6. Upper Sand	0.1306	0.1245	0.1077
A71C	6. Upper Sand	0.1730	0.1610	0.1434
A71D	7. Lower Sand	0.0281	0.0263	0.0226
A71H	7. Lower Sand	0.1595	0.1485	0.1308
A71E	6. Upper Sand	0.0635	0.0602	0.0510
A71F	6. Upper Sand	0.1561	0.1451	0.1278
A71G	7. Lower Sand	0.0520	0.0506	0.0475

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Quaternary	IUA	BHNR (million m ³ /year)		
		2022	2032	2042
A72A	7. Lower Sand	0.1972	0.1864	0.1643
A71J	7. Lower Sand	0.0304	0.0287	0.0258
A72B	7. Lower Sand	0.0359	0.0346	0.0319
A71K	7. Lower Sand	0.0454	0.0463	0.0449
A80A	9. Nzhelele/N'wanedi	0.1466	0.1484	0.1303
A80B	9. Nzhelele/N'wanedi	0.0775	0.0732	0.0583
A80C	9. Nzhelele/N'wanedi	0.0544	0.0559	0.0556
A80D	9. Nzhelele/N'wanedi	0.0033	0.0031	0.0028
A80E	9. Nzhelele/N'wanedi	0.0610	0.0600	0.0574
A80F	9. Nzhelele/N'wanedi	0.0204	0.0193	0.0166
A80G	9. Nzhelele/N'wanedi	0.0462	0.0459	0.0434
A80H	9. Nzhelele/N'wanedi	0.0376	0.0377	0.0354
A80J	9. Nzhelele/N'wanedi	0.0793	0.0752	0.0668
A91A	10. Upper Luvuvhu	0.0073	0.0069	0.0061
A91B	10. Upper Luvuvhu	0.0457	0.0440	0.0404
A91C	10. Upper Luvuvhu	0.0673	0.0640	0.0572
A91D	10. Upper Luvuvhu	0.0583	0.0582	0.0512
A91E	10. Upper Luvuvhu	0.1381	0.1433	0.1388
A91F	10. Upper Luvuvhu	0.1341	0.1267	0.1032
A91G	10. Upper Luvuvhu	0.2292	0.2350	0.2247
A91H	11. Lower Luvuvhu/Mutale	0.0849	0.0884	0.0872
A91J	11. Lower Luvuvhu/Mutale	0.0027	0.0029	0.0029
A91K	11. Lower Luvuvhu/Mutale	0.0008	0.0008	0.0007
A92A	11. Lower Luvuvhu/Mutale	0.2165	0.2353	0.2460
A92B	11. Lower Luvuvhu/Mutale	0.0405	0.0416	0.0401
A92C	11. Lower Luvuvhu/Mutale	0.0242	0.0225	0.0169
A92D	11. Lower Luvuvhu/Mutale	0.0558	0.0554	0.0526
B90A	12. Shingwedzi	0.0012	0.0012	0.0010
B90B	12. Shingwedzi	0.0212	0.0199	0.0175
B90C	12. Shingwedzi	0.0275	0.0256	0.0229
B90D	12. Shingwedzi	0.0001	0.0001	0.0001
B90E	12. Shingwedzi	0.0001	0.0001	0.0001
B90F	12. Shingwedzi	0.0855	0.0807	0.0732
B90G	12. Shingwedzi	0.0030	0.0029	0.0026
B90H	12. Shingwedzi	0.0011	0.0011	0.0010
Total		4.3048	4.1735	3.7959