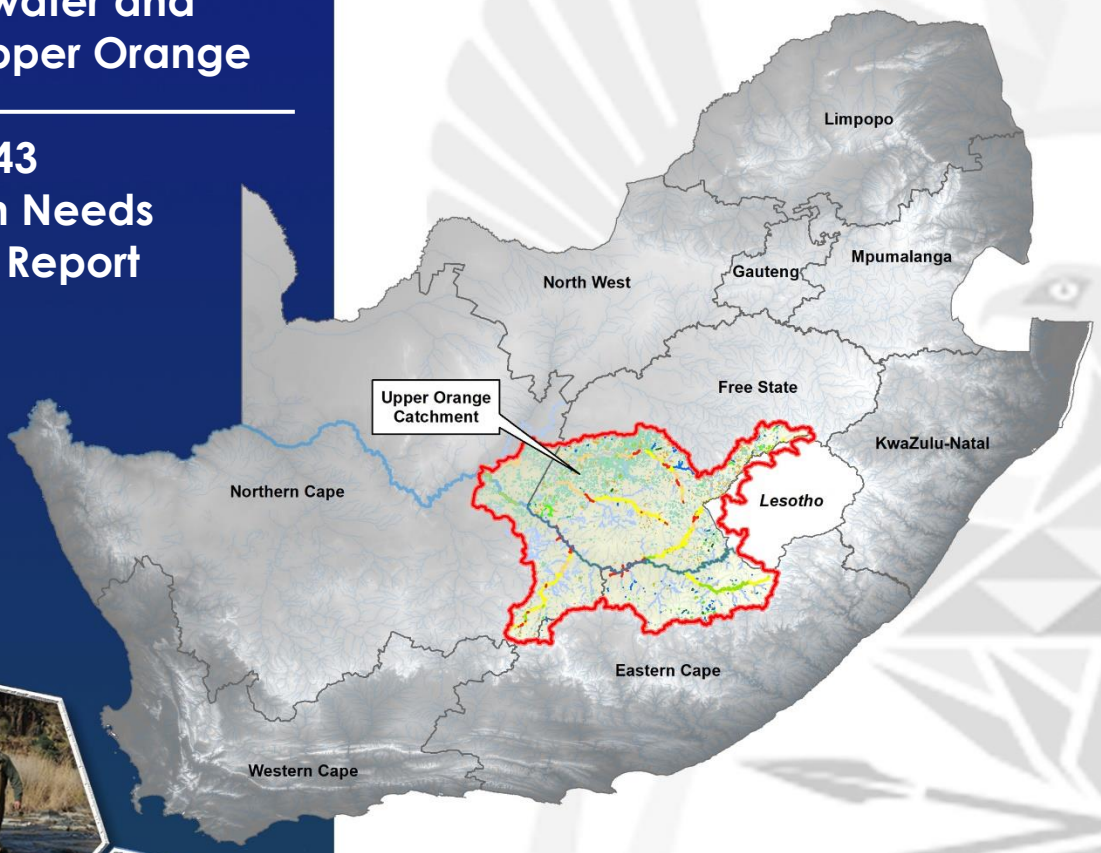
DEPARTMENT OF WATER AND SANITATION

A High Confidence Reserve Determination Study for Surface Water, Groundwater and Wetlands in the Upper Orange

WP11343
Basic Human Needs Assessment Report



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LIST OF ACRONYMS

BHN	Basic Human Needs
DM	District Municipality
DWS	Department of Water and Sanitation
EWR	Ecological Water Requirements
GW	Groundwater
IDP	Integrated Development Plan
L	Litres
LM	Local Municipality
MCM	Million Cubic Metres
MYPE	Mid-year Population Estimates
NMAR	Natural Mean Annual Runoff
NWA	National Water Act
RDM	Resource Directed Measures
WRCS	Water Resource Classification System
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Services Provider

1. INTRODUCTION

1.1 Background

The National Water Act (No. 36 of 1998) (NWA) is founded on the principle that the National Government has overall responsibility for, and authority over, water resource management for beneficial public use without seriously affecting the functioning and sustainability of water resources. Chapter 3 of the NWA enables the protection of water resources by the implementation of Resource Directed Measures (RDM). As part of the RDM process, an Ecological Reserve must be determined for a significant water resource to ensure a desired level of protection.

The Reserve is defined in terms of (i) Ecological Water Requirements (EWR) based on, the quantity and quality of water needed to protect aquatic ecosystems; water quantity, quality, habitat and biota in the desired state and (ii) Basic Human Needs (BHN), ensuring that the essential needs of individuals dependant on the water resource is provided for. These measures collectively aim to ensure that a balance is reached between the need to protect and sustain water resources while allowing economic development.

The Chief Directorate: Water Ecosystems Management (CD: WEM) of the Department of Water and Sanitation (DWS) is responsible for coordinating all Reserve Determination studies in terms of the Water Resource Classification System (WRCS). These studies include the surface water (rivers, wetlands and estuaries) and groundwater components of water resources.

The Reserve has priority over other water uses in terms of the NWA and should be determined before license applications are processed, particularly in stressed and over-utilised catchments. Accordingly, the CD: WEM identified the need to determine the Reserve for the ecosystems (rivers, wetlands and groundwater) of the Upper Orange River catchment in the Orange Water Management Area (WMA 6). The aim is to provide adequate protection for (i) possible hydraulic fracturing (HF) activities, (ii) assessment of various water use license applications, and (iii) evaluation of impacts of current and proposed developments on the availability of water for BHN and Resource Protection

1.2 Purpose of the study

The overall purpose of the study is to determine the Reserve for priority rivers, wetlands and groundwater areas at a high level of confidence in the Upper Orange Catchment. This assessment (and report) pertains specifically to the quantification of the BHN for the Upper Orange Catchment. The BHN is determined across all the quaternary catchments of the study area.

The results from the study will guide the Department to meet the objectives of maintaining, and if attainable, improving the ecological state of the water resources. The primary deliverable will be the preparation of the Reserve templates for the Upper Orange Catchment, specifying the ecological water requirements and ecological specifications/ conditions for the management of the priority rivers, wetlands and groundwater areas.

1.3 Purpose of this report

The purpose of this report is to document the approach and results of the Basic Human Needs (BHN) assessment to determine the BHN Reserve for this study. The BHN determination aims to ensure that the essential needs of individuals served by the water resources in question, rivers and groundwater, are provided for and pertains specifically to those people not linked to a formal (municipal) water supply system and directly dependent on surface water (rivers) and groundwater abstraction to meet their basic needs. The assessment covers the quaternary catchments of the study area and indicates the river/stream and groundwater BHN requirements separately.

2. OVERVIEW OF THE STUDY AREA

The study area of the Upper Orange Catchment (Figure 2-1) forms part of the Orange WMA6 and includes the main stem Orange River from the Lesotho border to the confluence with the Vaal River at Douglas. The major tributaries of the Orange River include the Kraai, Caledon and Seekoei Rivers. The Modder-Riet River drain into the Vaal River and due to their interconnectivity (i.e. water transfers) with the Upper Orange River, are included in this study. The study area can be divided into four distinct sub-areas within secondary catchments D1, D2, D3 and C5, namely:

i. The Orange River from the Lesotho Border to the Gariep Dam, including the main tributaries: Kornetspruit, Sterkspruit, Stormbergspruit and Brandwaterspruit (catchments D12, D14 and the SA part of D15 and D18);
ii. The Caledon River from its headwaters and its tributaries to the Gariep Dam (catchments D21, D22, D23, D24);
iii. The Kraai River catchment (catchment D13); and
iv. The Orange River from the Gariep Dam to Marksdrift weir (catchments D31, D33, D34 and D35), just upstream from the confluence with the Vaal River. This includes the Seekoei River (catchment D32) in the south and the Modder-Riet River (catchments C51 and C52) in the north.

Altogether, there are 130 quaternary catchments within the study area (Figure 2-1).

There are nine District Municipalities (DM), 26 Local Municipalities (LM) and 176 wards that intersect with the catchments of the study area (Table 2-1). The Mangaung Metropolitan area is the largest city in the study area with smaller towns scattered throughout the catchment. Larger towns include Herschel/Sterkspruit, Aliwal North, Burgersdorp, Ficksburg, Ladybrand, Botshabelo, Kimberley and Colesberg.

Table 2-1: District and Local Municipalities, Upper Orange study area

Province	District Municipality	Local Municipality
Eastern Cape	Chris Hani	Emalahleni
		Enoch Mgijima
		Inxuba Yethemba
		Sakhisizwe
	Joe Gqabi	Elundini
		Senqu
		Walter Sisulu
	Sarah Bartman	Dr Beyers Naude

Province	District Municipality	Local Municipality
Free State	Lejweleputswa	Masilonyana
		Tokologo
		Tswelopele
	Mangaung	Mangaung
	Thabo Mofutsanyane	Dihlabeng
		Maluti a Phofung
		Mantsopa
		Setsoto
	Xhariep	Kopanong
		Letsemeng
		Mohokare
Northern Cape	Frances Baard	Sol Plaatje
	Pixley ka Seme	Emthanjeni
		Renosterberg
		Siyancuma
		Thembelihle
		Ubuntu
		Umsobomvu

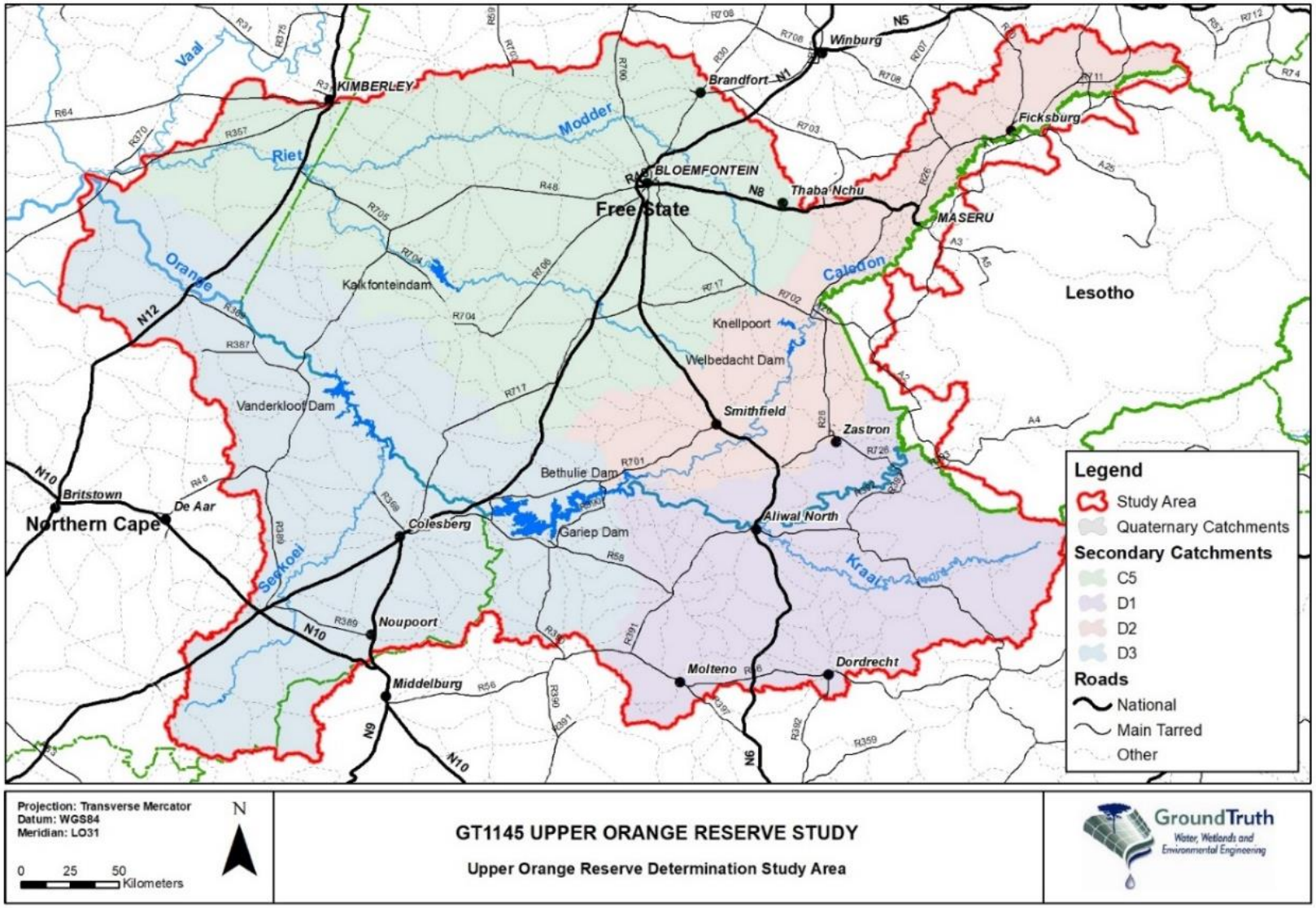

Figure 2-1: Upper Orange Reserve determination study area.

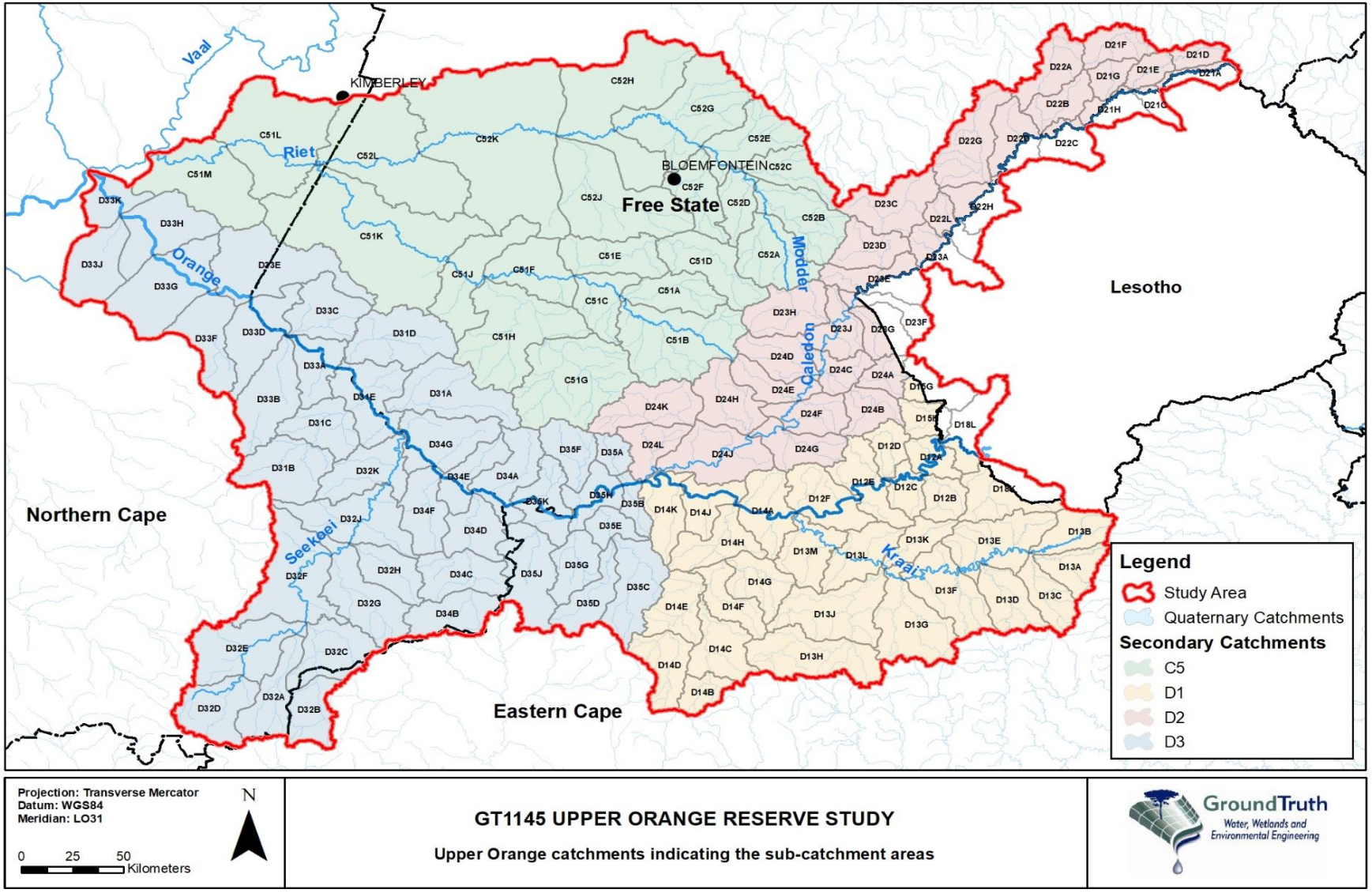

Figure 2-2: Sub-catchment areas and quaternaries of the Upper Orange study area.

3. APPROACH TO THE BASIC HUMAN NEEDS ASSESSMENT

The approach to the BHN assessment follows the Reserve determination process as outlined in the study, 'Development of Procedures to operationalise Resource Directed Measures (DWS, 2017). Furthermore, the approach that will be applied for the BHN assessment forms part of Step 4 of the 8-step process as outlined in Regulation 810 (Government Gazette 33541) dated 17 September 2010 (Figure 3-1).

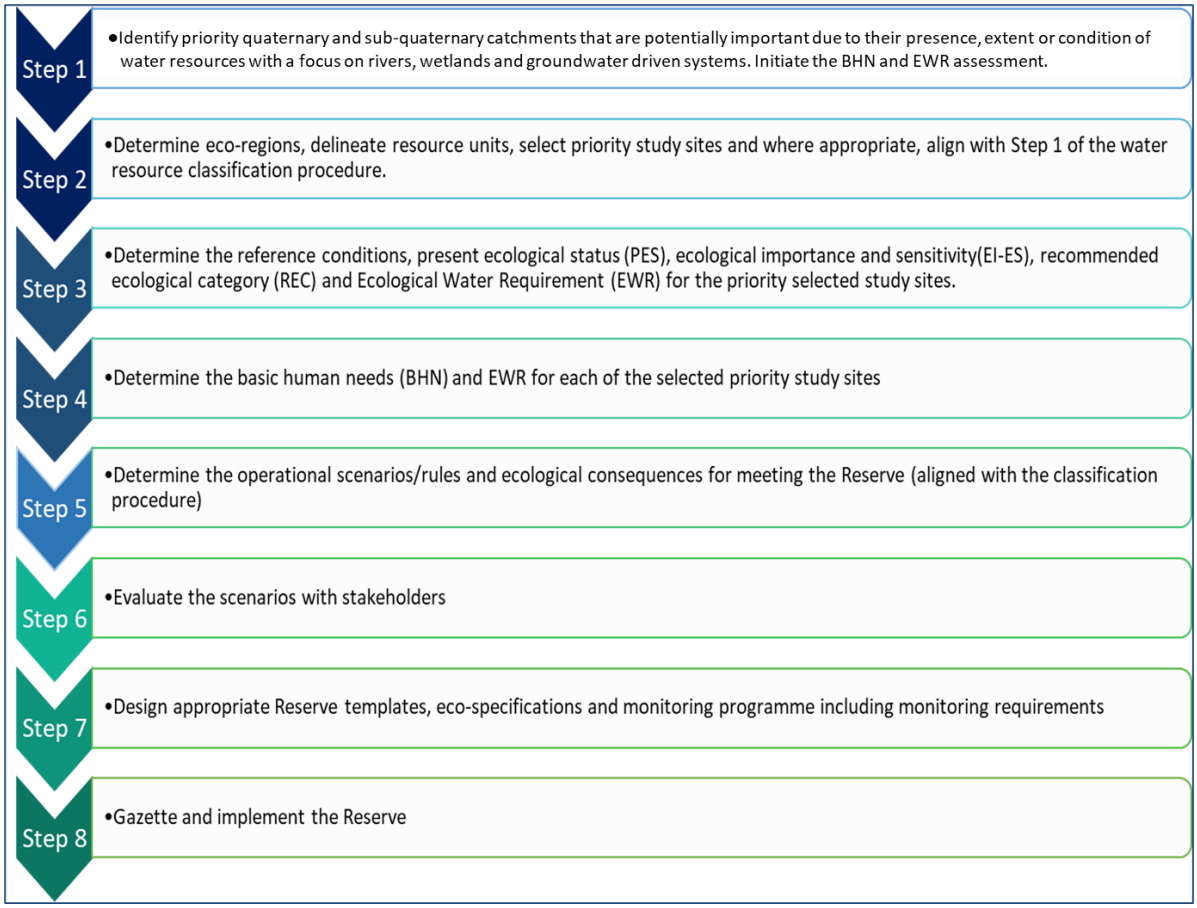

Figure 3-1: Integrated steps for the determination of the Reserve (DWS, 2017).

The assessment relates specifically to the population not linked to a formal water supply system and directly dependent on rivers and groundwater abstraction to meet their basic needs. The BHN assessment was conducted at the quaternary catchment scale, with population information derived from ward-level census data. The relevant wards were identified by overlaying ward boundaries (2016 Municipal Demarcation Board boundaries) with the quaternary catchments to identify those that fall entirely or partially within the quaternary catchments of the study area. Once the wards were identified, the steps outlined below were followed.

The following steps were applied for the BHN assessment:

Step1: Obtain data at the most refined level available

Census data were sourced from Statistics South Africa (StatsSA). While the latest South African National Census was undertaken in 2022, the data will only be available after the completion of this study. Consequently, the data from the previous census (2011) were used and adjusted for population changes using the StatsSA Mid-year Population Estimates (see section 5 for further discussion on this point).

Census 2011 data on 'main source of water for household use' were extracted from the Community Profile Databases (using the StatsSA SuperWeb application) for the 176 wards of the study area. The data were used to distinguish the population directly reliant on river and groundwater resources for basic needs. The StatsSA census resources provide ward-level data and distinguish between 11 categories of household main water source including: 'borehole', 'spring' and 'river/stream'. The categories of 'borehole' and 'spring' were combined to reflect groundwater reliance.

The StatsSA Mid-year Population Estimates (MYPE, 2011 to 2022) were used to adjust the 2011 census data to account for population changes since 2011 and better reflect population sizes for the assessment year (2022). Table 3-1 provides a summary of the population by water source for all wards of the study area, aggregated by the local municipality (population percentages are reported in Appendix A).

Step 2: Match ward-level population data to quaternary catchments

Census water source data are seldom available at a quaternary catchment scale; the census wards and quaternary catchment boundaries do not directly align. As such, the water source population data has to be manipulated to align with the quaternary catchments. This was done through a GIS analysis (DWS, 2016) to overlay the wards with the quaternary catchments and establish the proportion of each ward falling within a particular quaternary catchment. The approach assumed an equal distribution of the population across the ward. Table 3-2 provides a summary of the population by water source corresponding to the proportion of each ward intersecting the study area, aggregated by the local municipality (population percentages are reported in Appendix B).

Step 3: Generate the quantum of water based on the defined daily allocation

The BHN volume was calculated based on the lifeline amount of 25 litres per person per day (DWS, 2016). The BHN requirement for river/stream sources was then expressed as a percent of natural mean annual runoff (NMAR) per quaternary; the BHN requirement for groundwater sources was expressed as an annual volume per quaternary.

Table 3-1: Population by water source, wards of the Upper Orange study area, aggregated to local municipality

Local Municipality	Scheme	Ground-water	River/ stream	Rain-water tank	Dam pool/ stagnant water	Water vendor	Water tanker	Other	Un-specified	Not applicable	TOTAL
EC_Dr Beyers Naude	4 134	2 714	18	59	912	15	38	49	0	227	8 166
EC_Elundini	832	2 337	1 779	249	451	71	217	222	0	61	6 220
EC_Emalahleni	15 839	3 164	1 412	595	566	149	1 718	751	0	2	24 195
EC_Enoch Mgijima	18 880	4 343	153	335	495	310	466	824	0	4	25 810
EC_Inxuba Yethemba	3 997	2 704	0	10	48	29	141	120	0	1	7 050
EC_Sakhisizwe	8 701	2 472	538	98	452	48	730	217	0	0	13 257
EC_Senqu	73 218	26 471	9 889	3 087	3 941	2 288	3 187	2 971	0	235	125 287
EC_Walter Sisulu	64 191	7 393	107	232	1 274	448	1 391	854	0	99	75 988
FS_Dihlabeng	41 813	15 105	380	321	788	651	4 851	744	0	205	64 858
FS_Kopanong	40 611	7 573	65	92	180	143	646	632	0	106	50 049
FS_Letsemeng	33 098	5 144	382	128	626	92	2 494	509	0	24	42 497
FS_Maluti a Phofung	15 989	970	103	141	221	102	176	262	0	0	17 964
FS_Mangaung	805 884	23 824	318	1 097	1 668	4 118	7 514	18 053	0	1 575	864 051
FS_Mantsopa	44 597	6 743	90	197	215	222	575	647	0	191	53 476
FS_Masilonyana	18 238	2 903	12	99	215	166	400	341	0	80	22 454
FS_Mohokare	28 982	4 417	41	340	345	61	993	287	0	15	35 480
FS_Setsoto	67 276	8 867	170	338	290	1 203	2 489	835	0	273	81 740
FS_Tokologo	10 201	3 129	17	142	101	29	208	184	0	17	14 029
FS_Tswelopele	123	5 773	13	111	145	10	335	94	0	14	6 619
NC_Emthanjeni	5 045	1 262	0	6	46	49	28	28	0	46	6 510
NC_Renosterberg	10 594	1 295	120	3	272	0	436	76	0	74	12 869
NC_Siyancuma	12 252	5 171	2 616	49	425	230	1 402	407	0	0	22 552
NC_Sol Plaatje	69 992	1 454	46	35	88	142	456	864	0	238	73 315
NC_Thembelihle	14 133	3 471	514	25	122	10	145	115	0	33	18 568
NC_Ubuntu	1 591	2 964	10	46	127	3	306	37	0	35	5 119
NC_Umsobomvu	28 542	2 908	127	40	877	126	448	294	0	244	33 606

Note: Population derived from census 2011 (adjusted for population change to 2022).

Table 3-2: Population by water source corresponding to the proportion of each ward intersecting the Upper Orange study area, aggregated to the local municipality

Local Municipality	Scheme	Ground-water	River/ stream	Rain-water tank	Dam pool/ stagnant water	Water vendor	Water tanker	Other	Un-specified	Not applicable	TOTAL
EC_Dr Beyers Naude	31	20	0	0	7	0	0	0	0	2	60
EC_Elundini	3	9	7	1	2	0	1	1	0	0	23
EC_Emalahleni	4 090	279	67	112	95	28	219	66	0	0	4 957
EC_Enoch Mgijima	8 545	1 058	79	96	159	27	137	184	0	2	10 286
EC_Inxuba Yethemba	516	349	0	1	6	4	18	15	0	0	911
EC_Sakhisizwe	66	9	2	1	3	0	2	1	0	0	84
EC_Senqu	72 682	26 236	9 799	3 061	3 907	2 275	3 159	2 941	0	234	124 293
EC_Walter Sisulu	60 525	6 803	104	204	1 228	400	1 183	808	0	98	71 353
FS_Dihlabeng	24 144	4 996	172	116	474	264	2 014	494	0	117	32 791
FS_Kopanong	40 684	7 590	65	92	180	143	648	633	0	106	50 141
FS_Letsemeng	33 287	5 169	384	128	630	93	2 504	513	0	24	42 733
FS_Maluti a Phofung	818	11	0	2	17	3	1	14	0	0	866
FS_Mangaung	797 512	23 467	310	1 089	1 662	3 997	7 421	17 860	0	1 575	854 894
FS_Mantsopa	39 038	5 542	82	137	164	211	438	557	0	189	46 358
FS_Masilonyana	13 680	1 444	9	66	166	135	251	302	0	51	16 104
FS_Mohokare	28 945	4 405	41	340	344	61	991	287	0	15	35 427
FS_Setsoto	62 015	4 108	113	166	171	1 056	1 724	680	0	263	70 296
FS_Tokologo	4 912	1 519	9	67	47	14	98	87	0	9	6 761
FS_Tswelopele	6	284	1	5	7	1	16	5	0	1	325
NC_Emthanjeni	2 504	626	0	3	23	24	14	14	0	23	3 231
NC_Renosterberg	9 736	1 004	89	3	206	0	348	68	0	65	11 519
NC_Siyancuma	6 774	2 097	1 278	34	241	49	372	261	0	0	11 108
NC_Sol Plaatje	46 148	1 085	30	21	83	119	296	550	0	167	48 497
NC_Thembelihle	13 122	1 403	501	25	44	10	129	93	0	33	15 359
NC_Ubuntu	184	342	1	5	15	0	35	4	0	4	591
NC_Umsobomvu	28 532	2 900	128	40	874	127	447	293	0	242	33 582

Note: Population derived from census 2011 (adjusted for population change to 2022); discrepancies due to rounding. EC is Eastern Cape, FS is Free State and NC is Northern Cape and indicates the province of the local municipality.

4. RESULTS OF THE BHN ASSESSMENT

In total, the BHN requirements for the entire study area (130 quaternary catchments), for the year of the assessment – 2022, is estimated at 0.121 million cubic metres per annum for river/stream sources and 0.938 million cubic metres per annum for groundwater sources. This is based on the lifeline amount of 25 litres per person per day. Table 4-1 reports the BHN surface water (river/stream) Reserve required per quaternary drainage region expressed as million cubic metres per annum and as a percent of natural mean annual runoff (NMAR). Table 4-2 reports the BHN groundwater Reserve required per quaternary drainage region expressed as million cubic metres per annum.

Table 4-1: Basic human needs surface water (river/stream) Reserve required, by quaternary catchment, Upper Orange study area

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	NMAR (MCM)	Basic human needs surface water Reserve required*	
				MCM / annum	% NMAR
C51A	1	25	15.030	0.00001	0.00006
C51B	2	25	20.070	0.00002	0.00010
C51C	1	25	9.390	0.00001	0.00010
C51D	5	25	16.180	0.00004	0.00026
C51E	1	25	18.690	0.00001	0.00003
C51F	1	25	12.120	0.00001	0.00008
C51G	4	25	42.740	0.00004	0.00008
C51H	4	25	38.710	0.00003	0.00009
C51J	1	25	13.930	0.00001	0.00008
C51K	203	25	6.100	0.00185	0.03033
C51L	189	25	3.020	0.00172	0.05711
C51M	404	25	2.320	0.00368	0.15879
C52A	9	25	28.960	0.00008	0.00028
C52B	73	25	26.270	0.00066	0.00253
C52C	13	25	10.840	0.00012	0.00108
C52D	9	25	7.690	0.00008	0.00101
C52E	3	25	11.860	0.00003	0.00021
C52F	144	25	11.200	0.00131	0.01173
C52G	14	25	24.280	0.00013	0.00052
C52H	9	25	1.650	0.00008	0.00482
C52J	12	25	3.120	0.00011	0.00339
C52K	38	25	1.440	0.00035	0.02419
C52L	42	25	1.190	0.00038	0.03212
D12A	1 038	25	26.090	0.00947	0.03629
D12B	2 690	25	40.360	0.02454	0.06081
D12C	420	25	18.050	0.00383	0.02124
D12D	1	25	15.560	0.00001	0.00006
D12E	325	25	29.010	0.00297	0.01023
D12F	4	25	24.500	0.00003	0.00014
D13A	147	25	70.670	0.00134	0.00190
D13B	162	25	73.350	0.00148	0.00202
D13C	161	25	53.640	0.00147	0.00273

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	NMAR (MCM)	Basic human needs surface water Reserve required*	
				MCM / annum	% NMAR
D13D	198	25	56.110	0.00181	0.00322
D13E	346	25	127.870	0.00316	0.00247
D13F	329	25	92.530	0.00300	0.00324
D13G	275	25	54.270	0.00251	0.00462
D13H	77	25	29.990	0.00070	0.00234
D13J	6	25	32.980	0.00005	0.00016
D13K	137	25	48.750	0.00125	0.00257
D13L	149	25	26.000	0.00136	0.00525
D13M	16	25	18.020	0.00014	0.00079
D14A	29	25	21.800	0.00026	0.00121
D14B	14	25	6.290	0.00013	0.00208
D14C	28	25	14.600	0.00026	0.00178
D14D	25	25	9.090	0.00023	0.00248
D14E	5	25	7.970	0.00005	0.00062
D14F	6	25	13.220	0.00005	0.00041
D14G	8	25	14.800	0.00007	0.00050
D14H	15	25	12.810	0.00014	0.00109
D14J	6	25	9.560	0.00006	0.00059
D14K	11	25	10.940	0.00010	0.00088
D15G	1	25	44.490	0.00001	0.00002
D15H	1	25	25.670	0.00001	0.00004
D18K	1 970	25	144.510	0.01798	0.01244
D18L	1 472	25	64.340	0.01343	0.02087
D21A	9	25	65.500	0.00008	0.00012
D21C	3	25	33.620	0.00003	0.00008
D21D	24	25	22.590	0.00022	0.00099
D21E	33	25	18.600	0.00030	0.00163
D21F	55	25	33.040	0.00050	0.00151
D21G	37	25	20.970	0.00033	0.00160
D21H	5	25	41.620	0.00005	0.00012
D22A	15	25	35.970	0.00013	0.00037
D22B	10	25	32.250	0.00009	0.00028
D22C	27	25	50.260	0.00024	0.00048
D22D	28	25	37.080	0.00026	0.00070
D22G	64	25	53.300	0.00059	0.00110
D22H	24	25	36.910	0.00021	0.00058
D22L	7	25	22.140	0.00006	0.00028
D23A	7	25	36.990	0.00006	0.00017
D23C	6	25	26.190	0.00005	0.00020
D23D	10	25	21.720	0.00009	0.00043
D23E	7	25	28.290	0.00006	0.00023
D23F	1	25	19.130	0.00001	0.00004
D23G	5	25	25.460	0.00004	0.00017
D23H	7	25	26.250	0.00007	0.00025
D23J	9	25	21.180	0.00008	0.00039
D24A	3	25	14.470	0.00003	0.00020

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	NMAR (MCM)	Basic human needs surface water Reserve required*	
				MCM / annum	% NMAR
D24B	3	25	19.500	0.00002	0.00013
D24C	7	25	11.530	0.00006	0.00055
D24D	5	25	12.930	0.00005	0.00036
D24E	3	25	10.650	0.00003	0.00028
D24F	5	25	15.040	0.00004	0.00029
D24G	4	25	20.150	0.00004	0.00019
D24H	2	25	17.220	0.00002	0.00012
D24J	13	25	19.020	0.00012	0.00063
D24K	1	25	15.560	0.00001	0.00007
D24L	10	25	8.480	0.00010	0.00113
D31A	4	25	14.510	0.00004	0.00026
D31B	20	25	3.610	0.00018	0.00503
D31C	12	25	3.920	0.00011	0.00280
D31D	39	25	8.490	0.00036	0.00422
D31E	16	25	7.690	0.00015	0.00196
D32A	1	25	3.200	0.00001	0.00029
D32B	1	25	3.670	0.00001	0.00025
D32C	1	25	3.910	0.00001	0.00023
D32D	1	25	3.710	0.00000	0.00013
D32E	1	25	2.820	0.00001	0.00032
D32F	3	25	4.970	0.00002	0.00047
D32G	5	25	5.170	0.00005	0.00090
D32H	4	25	2.750	0.00003	0.00126
D32J	36	25	4.150	0.00033	0.00801
D32K	29	25	3.400	0.00027	0.00782
D33A	28	25	2.890	0.00025	0.00882
D33B	21	25	1.580	0.00019	0.01223
D33C	75	25	3.150	0.00068	0.02172
D33D	109	25	1.220	0.00100	0.08186
D33E	257	25	1.410	0.00234	0.16610
D33F	97	25	0.250	0.00088	0.35238
D33G	253	25	1.240	0.00231	0.18614
D33H	256	25	1.730	0.00233	0.13491
D33J	45	25	0.520	0.00041	0.07857
D33K	179	25	0.940	0.00163	0.17350
D34A	5	25	8.110	0.00005	0.00059
D34B	1	25	5.390	0.00001	0.00017
D34C	7	25	4.690	0.00006	0.00138
D34D	10	25	3.980	0.00009	0.00221
D34E	5	25	4.090	0.00005	0.00118
D34F	30	25	4.010	0.00027	0.00675
D34G	9	25	8.200	0.00008	0.00100
D35A	3	25	4.340	0.00003	0.00058
D35B	5	25	3.960	0.00004	0.00111
D35C	2	25	11.720	0.00002	0.00018
D35D	1	25	6.010	0.00001	0.00011

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	NMAR (MCM)	Basic human needs surface water Reserve required*	
				MCM / annum	% NMAR
D35E	1	25	3.830	0.00001	0.00024
D35F	2	25	8.520	0.00002	0.00019
D35G	0	25	5.640	0.00000	0.00000
D35H	3	25	6.030	0.00002	0.00039
D35J	1	25	8.130	0.00001	0.00013
D35K	1	25	6.890	0.00001	0.00020

*Note: *The Reserve is shown to 5 decimal points to avoid reporting zero results where there is a dependent population. NMAR is Natural Mean Annual Runoff; MCM is Million Cubic Metres.*

Table 4-2: Basic human needs groundwater Reserve required, by quaternary catchment, Upper Orange study area

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	Basic human needs ground water Reserve required (MCM / annum)
C51A	489	25	0.004
C51B	804	25	0.007
C51C	313	25	0.003
C51D	1 894	25	0.017
C51E	1 140	25	0.010
C51F	528	25	0.005
C51G	752	25	0.007
C51H	1 062	25	0.010
C51J	585	25	0.005
C51K	1 833	25	0.017
C51L	1 032	25	0.009
C51M	723	25	0.007
C52A	906	25	0.008
C52B	1 394	25	0.013
C52C	594	25	0.005
C52D	590	25	0.005
C52E	750	25	0.007
C52F	5 048	25	0.046
C52G	1 609	25	0.015
C52H	3 174	25	0.029
C52J	7 480	25	0.068
C52K	2 652	25	0.024
C52L	1 690	25	0.015
D12A	4 237	25	0.039
D12B	6 317	25	0.058
D12C	1 401	25	0.013
D12D	224	25	0.002
D12E	799	25	0.007
D12F	530	25	0.005
D13A	329	25	0.003
D13B	366	25	0.003
D13C	358	25	0.003
D13D	478	25	0.004
D13E	855	25	0.008
D13F	855	25	0.008
D13G	923	25	0.008
D13H	864	25	0.008
D13J	747	25	0.007
D13K	358	25	0.003
D13L	445	25	0.004
D13M	557	25	0.005
D14A	740	25	0.007
D14B	190	25	0.002

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	Basic human needs ground water Reserve required (MCM / annum)
D14C	446	25	0.004
D14D	383	25	0.003
D14E	425	25	0.004
D14F	302	25	0.003
D14G	373	25	0.003
D14H	487	25	0.004
D14J	285	25	0.003
D14K	319	25	0.003
D15G	76	25	0.001
D15H	209	25	0.002
D18K	4 263	25	0.039
D18L	5 401	25	0.049
D21A	280	25	0.003
D21C	76	25	0.001
D21D	795	25	0.007
D21E	929	25	0.008
D21F	1 623	25	0.015
D21G	773	25	0.007
D21H	279	25	0.003
D22A	1 223	25	0.011
D22B	997	25	0.009
D22C	223	25	0.002
D22D	1 034	25	0.009
D22G	1 651	25	0.015
D22H	612	25	0.006
D22L	551	25	0.005
D23A	622	25	0.006
D23C	1 444	25	0.013
D23D	1 218	25	0.011
D23E	639	25	0.006
D23F	56	25	0.001
D23G	224	25	0.002
D23H	507	25	0.005
D23J	468	25	0.004
D24A	236	25	0.002
D24B	268	25	0.002
D24C	322	25	0.003
D24D	195	25	0.002
D24E	151	25	0.001
D24F	166	25	0.002
D24G	314	25	0.003
D24H	305	25	0.003
D24J	569	25	0.005
D24K	364	25	0.003
D24L	167	25	0.002
D31A	439	25	0.004

Quaternary drainage region	Population (current requirement)	Per capita need (litres / day)	Basic human needs ground water Reserve required (MCM / annum)
D31B	204	25	0.002
D31C	160	25	0.001
D31D	364	25	0.003
D31E	290	25	0.003
D32A	146	25	0.001
D32B	282	25	0.003
D32C	297	25	0.003
D32D	151	25	0.001
D32E	242	25	0.002
D32F	351	25	0.003
D32G	374	25	0.003
D32H	216	25	0.002
D32J	368	25	0.003
D32K	272	25	0.002
D33A	169	25	0.002
D33B	217	25	0.002
D33C	178	25	0.002
D33D	250	25	0.002
D33E	669	25	0.006
D33F	294	25	0.003
D33G	549	25	0.005
D33H	446	25	0.004
D33J	385	25	0.004
D33K	180	25	0.002
D34A	288	25	0.003
D34B	364	25	0.003
D34C	366	25	0.003
D34D	271	25	0.002
D34E	201	25	0.002
D34F	403	25	0.004
D34G	341	25	0.003
D35A	96	25	0.001
D35B	124	25	0.001
D35C	404	25	0.004
D35D	228	25	0.002
D35E	112	25	0.001
D35F	215	25	0.002
D35G	191	25	0.002
D35H	181	25	0.002
D35J	362	25	0.003
D35K	246	25	0.002

Note: MCM is Million Cubic Metres.

5. LIMITATIONS

The BHN volumes associated with river/stream and groundwater sources were derived from the latest available census data. However, the 2011 census data are more than 10 years old and outdated in terms of population size and potentially also outdated concerning possible water infrastructure and service delivery developments. As noted in section 3, data from the 2022 census will not be available for this study.

In this assessment, the StatsSA Mid-year Population Estimates were applied to adjust the 2011 census data to account for population changes since 2011, thereby conceivably increasing the confidence in the BHN volume estimates. While the adjustment accounts for population changes since the latest available census, it does not account for any change in the distribution of the population across water sources (e.g., as a result of new water supply schemes/infrastructure shifting reliance from a river source to a municipal supply). To gain a sense of the possible effect of this data limitation on the BHN estimates, an investigation of water supply developments was undertaken for those wards where a relatively large percentage of the ward is reliant on river/stream or groundwater sources for household use and the majority of ward falls within the study area. A review of relevant municipal documentation was conducted. Key findings are summarized in Table 5-1. The municipal documentation reviewed does not indicate any significant decline in the direct reliance on river/stream and groundwater sources for household use since the 2011 census. Therefore, the 2011 population distribution across water sources can be regarded as representative of the present (2022) state for the study area.

Table 5-1: Consideration of water supply developments for certain wards within the Upper Orange study area

Ward and associated quaternaries	Comment on Water Supply Developments
EC Joe Gqabi DM, Senqu LM, Ward 1 (21402001); D12A & D18L	67% reliant on GW as main source of household water use (Census 2011). **Proportion of GW dependence unlikely to have declined, and may have increased since census 2011.** Joe Gqabi DM is the WSA and WSP. The Joe Gqabi WSDP (2014/15) references the 2011 Census and indicates that no reduction in the 'unserved' households has been made since the census. The Senqu IDP 2018/19 review recommends further use of GW schemes to address water supply backlogs. Joe Gqabi WSDP (2019/20), based on the community survey 2016 data, suggests a higher proportion of households without access to piped water in the Senqu LM since 2011.
EC Joe Gqabi DM, Senqu LM, Ward 6 (21402006); D12A, D12B, D18K, D18L	28% reliant on river/stream as main source of household water use (Census 2011). **Proportion of river/stream dependence unlikely to have declined, and may have increased since census 2011.** Joe Gqabi DM is the WSA and WSP. The Joe Gqabi WSDP (2014/15) references the 2011 Census and indicates that no reduction in the 'unserved' households has been made since the Census. The Joe Gqabi WSDP (2019/20), based on community survey 2016 data, suggests a higher proportion of households without access to piped water in the Senqu LM since 2011.
NC Pixley ka Seme DM, Siyancuma LM, Ward 6	27% reliant on river/stream as main source of household water use (Census 2011). **Possible slight decline in reliance on river water.**

Ward and associated quaternaries	Comment on Water Supply Developments
(30708006); C51K, C51L, C51M, C52L, D33E, D33G, D33H, D33K	The trend at the Siyancuma LM level is a slight decline (of 2%) in reliance on river/stream sources between 2011 and 2016 based on community survey 2016 results. The Siyancuma IDP 2020/21 references the community survey 2016 data and indicates that the majority of the population, at the LM level, have access to water inside the house. However, Ward 6 is a large, rural area with a low population density relative to the rest of the municipality.

Note: EC is Eastern Cape; NC is Northern Cape; LM is Local Municipality; DM is District Municipality; GW is Ground Water; WSDP is Water Supply Development Plan; WSA is Water Services Authority; WSP is Water Services Provider; IDP is Integrated Development Plan. 'Unserved' refers to people sourcing water from springs, rainwater tanks, streams, rivers, dams or water vendors.

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6. CONCLUSIONS

Based on the adjusted 2011 census data, it is calculated that 13 271 people (1%) rely directly on river/stream sources and 102 755 (7%) on groundwater sources for household water use within the study area. At the national level, the 2011 census data indicated that 6% of the population is reliant on river/stream sources and 8% on groundwater sources as the main source for household use. Reliance on river/stream sources for household use in the study area is lower than the national average; while reliance on groundwater sources is relatively similar to the national average.

Based on a lifeline amount of 25 litres per person per day, the BHN requirement for the Upper Orange study area, at the time of assessment (2022), is estimated at 0.121 million cubic metres per annum for river/stream sources and 0.938 million cubic metres per annum for groundwater sources.

7. REFERENCES

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Siyancuma Local Municipality. 2020. Integrated Development Plant 2020/21. Siyancuma Local Municipality, Douglas.

8. APPENDICES

Appendix A: Population percent by water source, wards of the Upper Orange study area, aggregated to the local municipality

Local Municipality	Scheme	Ground-water	River/ stream	Rain-water tank	Dam pool/ stagnant water	Water vendor	Water tanker	Other	Un-specified	Not applicable	TOTAL
EC_Dr Beyers Naude	50.62%	33.24%	0.22%	0.72%	11.16%	0.18%	0.47%	0.60%	0.00%	2.78%	100%
EC_Elundini	13.38%	37.57%	28.60%	4.00%	7.26%	1.14%	3.49%	3.58%	0.00%	0.99%	100%
EC_Emalahleni	65.46%	13.08%	5.83%	2.46%	2.34%	0.62%	7.10%	3.11%	0.00%	0.01%	100%
EC_Enoch Mgijima	73.15%	16.83%	0.59%	1.30%	1.92%	1.20%	1.81%	3.19%	0.00%	0.01%	100%
EC_Inxuba Yethemba	56.69%	38.35%	0.00%	0.15%	0.69%	0.41%	2.01%	1.70%	0.00%	0.01%	100%
EC_Sakhisizwe	65.64%	18.65%	4.06%	0.74%	3.41%	0.36%	5.50%	1.63%	0.00%	0.00%	100%
EC_Senqu	58.44%	21.13%	7.89%	2.46%	3.15%	1.83%	2.54%	2.37%	0.00%	0.19%	100%
EC_Walter Sisulu	84.48%	9.73%	0.14%	0.31%	1.68%	0.59%	1.83%	1.12%	0.00%	0.13%	100%
FS_Dihlabeng	64.47%	23.29%	0.59%	0.49%	1.21%	1.00%	7.48%	1.15%	0.00%	0.32%	100%
FS_Kopanong	81.14%	15.13%	0.13%	0.18%	0.36%	0.29%	1.29%	1.26%	0.00%	0.21%	100%
FS_Letsemeng	77.88%	12.10%	0.90%	0.30%	1.47%	0.22%	5.87%	1.20%	0.00%	0.06%	100%
FS_Maluti a Phofung	89.01%	5.40%	0.57%	0.79%	1.23%	0.57%	0.98%	1.46%	0.00%	0.00%	100%
FS_Mangaung	93.27%	2.76%	0.04%	0.13%	0.19%	0.48%	0.87%	2.09%	0.00%	0.18%	100%
FS_Mantsopa	83.40%	12.61%	0.17%	0.37%	0.40%	0.42%	1.08%	1.21%	0.00%	0.36%	100%
FS_Masilonyana	81.22%	12.93%	0.05%	0.44%	0.96%	0.74%	1.78%	1.52%	0.00%	0.35%	100%
FS_Mohokare	81.69%	12.45%	0.12%	0.96%	0.97%	0.17%	2.80%	0.81%	0.00%	0.04%	100%
FS_Setsoto	82.31%	10.85%	0.21%	0.41%	0.36%	1.47%	3.04%	1.02%	0.00%	0.33%	100%
FS_Tokologo	72.71%	22.30%	0.12%	1.01%	0.72%	0.20%	1.48%	1.31%	0.00%	0.12%	100%
FS_Tswelopele	1.86%	87.21%	0.20%	1.68%	2.20%	0.16%	5.06%	1.42%	0.00%	0.21%	100%
NC_Emthanjeni	77.50%	19.38%	0.00%	0.09%	0.71%	0.75%	0.44%	0.43%	0.00%	0.71%	100%
NC_Renosterberg	82.32%	10.06%	0.93%	0.02%	2.11%	0.00%	3.39%	0.59%	0.00%	0.57%	100%
NC_Siyancuma	54.33%	22.93%	11.60%	0.22%	1.88%	1.02%	6.22%	1.81%	0.00%	0.00%	100%
NC_Sol Plaatje	95.47%	1.98%	0.06%	0.05%	0.12%	0.19%	0.62%	1.18%	0.00%	0.32%	100%
NC_Thembelihle	76.12%	18.70%	2.77%	0.13%	0.66%	0.05%	0.78%	0.62%	0.00%	0.18%	100%
NC_Ubuntu	31.07%	57.91%	0.20%	0.91%	2.47%	0.06%	5.98%	0.73%	0.00%	0.68%	100%
NC_Umsobomvu	84.93%	8.65%	0.38%	0.12%	2.61%	0.38%	1.33%	0.87%	0.00%	0.73%	100%

Note: Population derived from census 2011 (adjusted for population change to 2022).

Appendix B: Population percent by water source corresponding to the proportion of each ward intersecting the Upper Orange study area, aggregated to the local municipality

Local Municipality	Scheme	Ground-water	River/ stream	Rain-water tank	Dam pool/ stagnant water	Water vendor	Water tanker	Other	Un-specified	Not applicable	TOTAL
EC_Dr Beyers Naude	50.62%	33.24%	0.22%	0.72%	11.16%	0.18%	0.47%	0.60%	0.00%	2.78%	100%
EC_Elundini	13.38%	37.57%	28.60%	4.00%	7.26%	1.14%	3.49%	3.58%	0.00%	0.99%	100%
EC_Emalahleni	82.52%	5.63%	1.36%	2.27%	1.91%	0.56%	4.42%	1.33%	0.00%	0.01%	100%
EC_Enoch Mgijima	83.07%	10.28%	0.77%	0.93%	1.54%	0.26%	1.33%	1.79%	0.00%	0.02%	100%
EC_Inxuba Yethemba	56.69%	38.35%	0.00%	0.15%	0.69%	0.41%	2.01%	1.70%	0.00%	0.01%	100%
EC_Sakhisizwe	78.30%	10.71%	2.52%	0.60%	3.88%	0.21%	2.40%	1.39%	0.00%	0.00%	100%
EC_Senqu	58.48%	21.11%	7.88%	2.46%	3.14%	1.83%	2.54%	2.37%	0.00%	0.19%	100%
EC_Walter Sisulu	84.82%	9.53%	0.15%	0.29%	1.72%	0.56%	1.66%	1.13%	0.00%	0.14%	100%
FS_Dihlabeng	73.63%	15.24%	0.52%	0.35%	1.44%	0.81%	6.14%	1.51%	0.00%	0.36%	100%
FS_Kopanong	81.14%	15.14%	0.13%	0.18%	0.36%	0.29%	1.29%	1.26%	0.00%	0.21%	100%
FS_Letsemeng	77.89%	12.10%	0.90%	0.30%	1.47%	0.22%	5.86%	1.20%	0.00%	0.06%	100%
FS_Maluti a Phofung	94.51%	1.32%	0.01%	0.22%	1.95%	0.31%	0.11%	1.57%	0.00%	0.00%	100%
FS_Mangaung	93.29%	2.75%	0.04%	0.13%	0.19%	0.47%	0.87%	2.09%	0.00%	0.18%	100%
FS_Mantsopa	84.21%	11.96%	0.18%	0.29%	0.35%	0.45%	0.95%	1.20%	0.00%	0.41%	100%
FS_Masilonyana	84.95%	8.96%	0.06%	0.41%	1.03%	0.84%	1.56%	1.87%	0.00%	0.32%	100%
FS_Mohokare	81.70%	12.43%	0.12%	0.96%	0.97%	0.17%	2.80%	0.81%	0.00%	0.04%	100%
FS_Setsoto	88.22%	5.84%	0.16%	0.24%	0.24%	1.50%	2.45%	0.97%	0.00%	0.37%	100%
FS_Tokologo	72.65%	22.46%	0.13%	1.00%	0.70%	0.21%	1.44%	1.28%	0.00%	0.13%	100%
FS_Tswelopele	1.86%	87.21%	0.20%	1.68%	2.20%	0.16%	5.06%	1.42%	0.00%	0.21%	100%
NC_Emthanjeni	77.50%	19.38%	0.00%	0.09%	0.71%	0.75%	0.44%	0.43%	0.00%	0.71%	100%
NC_Renosterberg	84.52%	8.72%	0.77%	0.02%	1.79%	0.00%	3.02%	0.59%	0.00%	0.56%	100%
NC_Siyancuma	60.99%	18.87%	11.51%	0.31%	2.17%	0.44%	3.35%	2.35%	0.00%	0.00%	100%
NC_Sol Plaatje	95.16%	2.24%	0.06%	0.04%	0.17%	0.24%	0.61%	1.13%	0.00%	0.34%	100%
NC_Thembelihle	85.43%	9.13%	3.26%	0.16%	0.29%	0.06%	0.84%	0.61%	0.00%	0.21%	100%
NC_Ubuntu	31.07%	57.91%	0.20%	0.91%	2.47%	0.06%	5.98%	0.73%	0.00%	0.68%	100%
NC_Umsobomvu	84.96%	8.64%	0.38%	0.12%	2.60%	0.38%	1.33%	0.87%	0.00%	0.72%	100%

Note: Population derived from census 2011 (adjusted for population change to 2022); discrepancies due to rounding.