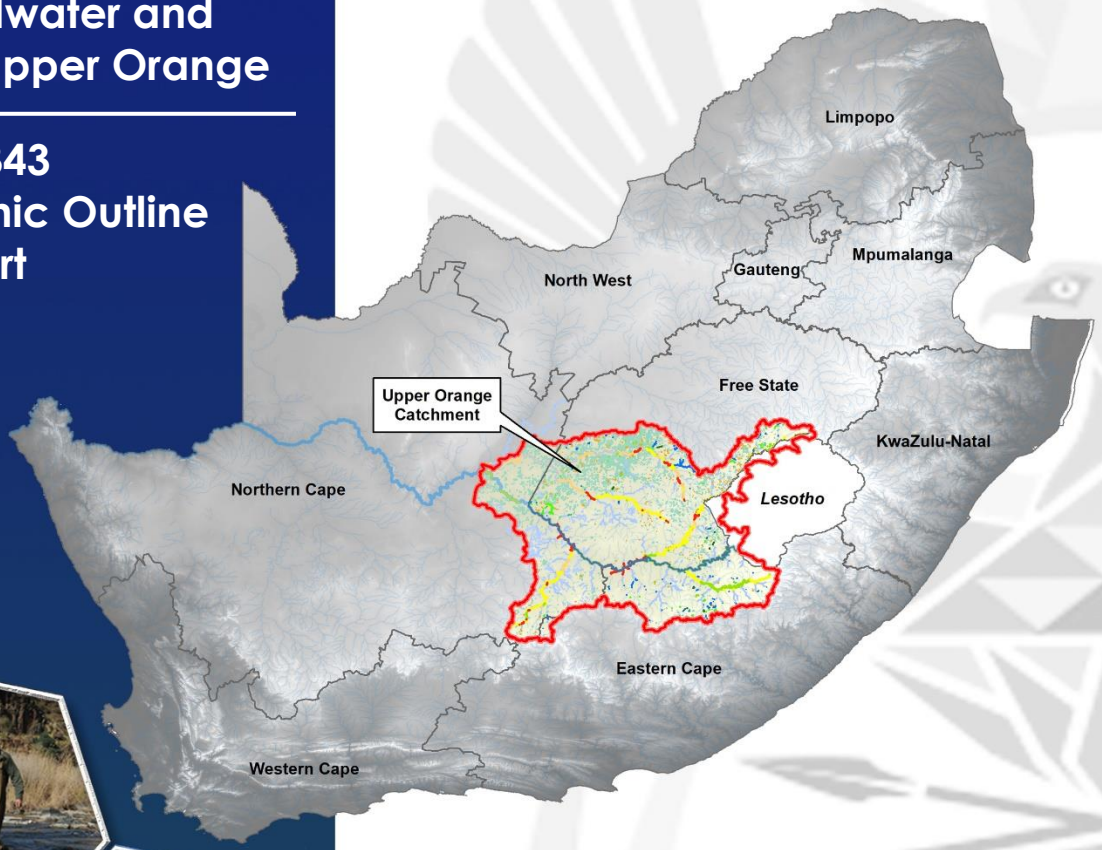
# DEPARTMENT OF WATER AND SANITATION

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

## WP11343
## Socio-Economic Outline Report

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Private Bag X313
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Tel: (012) 336 7500/ +27 12 336 7500
Fax: (012) 336 6731/ +27 12 336 6731



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*Prepared by:*

GroundTruth: Water, Wetlands and Environmental Engineering

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| **Authors:** | *M. Browne and F. Lewis* |
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**Approved for the Professional Service Provided by:**

…… …….

*Dr Mark Graham* *Date*

*Director, GroundTruth*

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**DEPARTMENT OF WATER AND SANITATION**

**Chief Directorate: Water Ecosystems Management**

**Approved for DWS by:**

…… …….

*Ndivhuwo Netshiendeulu (Project Manager)* *Kwazikwakhe Majola (Scientific Manager)*

*Date:* …….. *Date:* ……..

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*Director: Yakeen Atwaru* *Date*

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**Bold** type indicates this report

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| 2.0 | RDM/WMA13/00/CON/COMP/0221 | Stakeholder Engagement Plan |
| 3.0 | RDM/WMA13/00/CON/COMP/0321 | Gaps Analysis Report |
| 4.0 | RDM/WMA13/00/CON/COMP/0422 | Resource Units Report |
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# *LIST OF ACRONYMS AND ABBREVIATIONS*

| | |
|---|---|
| BHN | Basic Human Needs |
| CD: WEM | Chief Directorate: Water Ecosystems Management |
| CM | Cubic Metre |
| DM | District Municipality |
| DWS | Department of Water and Sanitation |
| EWR | Ecological Water Requirements |
| GDP | Gross Domestic Product |
| GVA | Gross Value Add |
| IDP | Integrated Development Plan |
| LM | Local Municipality |
| NWA | National Water Act |
| PA | Protected Area |
| RDM | Resource Directed Measures |
| SAMPI | South African Multidimensional Poverty Indicator |
| Stats SA | Statistics South Africa |
| UO | Upper Orange |
| WARMS | Water use Authorization and Registration Management System |
| WRCS | Water Resource Classification System |

# 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 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 aim of the study is to determine the Reserve for identified priority rivers, wetlands and groundwater areas at a high level of confidence in the Upper Orange Catchment. This socio-economic assessment and report pertain specifically to the socio-economic context and human water use as part of the catchment system analysis.

The results from the study will support 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 prepared 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 objective of this report is to present an overview of the socio-economic context of the study area. The report profiles the socio-economic conditions and well-being of the communities of the Upper Orange Catchment area with a particular focus on socio-economic water use and cultural importance. The socio-economic profile provides the baseline for evaluating the social consequences of potential operational flow scenarios as part of steps 5 and 6 of the Reserve Determination process 'Scenario determination, evaluation and consequences' (DWS, 2017).

# 2. OVERVIEW OF THE STUDY AREA

The study area (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 drains 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 is 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) and 26 Local Municipalities (LM) that intersect with the Upper Orange catchment 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:** Administrative divisions and respective quaternary catchments, Upper Orange (UO) study area

| Province | District municipality | Local municipality | Associated quaternary drainage regions | Percent of UO study area |
|---|---|---|---|---|
| Eastern Cape | Chris Hani | Emalahleni | D13F, D13G, D13H | 21% |
| | | Enoch Mgijima | D13H, D13J, D14B, D14C, D14D, D14E, D14F | |
| | | Inxuba Yethemba | D32A, D32B, D32C, D34B | |
| | | Sakhisizwe | D13C, D13D | |
| | Joe Gqabi | Elundini | D13A, D13B, D13C | |
| | | Senqu | D12A, D12B, D12C, D12E, D12F, D13A, D13B, D13C, D13D, D13E, D13F, D13G, D13J, D13K, D13L, D18K, D18L | |
| | Sarah Bartman | Walter Sisulu | D12E, D12F, D13G, D13H, D13J, D13K, D13L, D13M, D14A, D14C, D14D, D14E, D14F, D14G, D14H, D14J, D14K, D34A, D34B, D34C, D34D, D35B, D35C, D35D, D35E, D35G, D35H, D35J, D35K | |
| | | Dr Beyers Naude | D32A, D32B, D32D | |
| Free State | Lejweleputswa | Masilonyana | C52C, C52E, C52G, C52H | 54% |
| | | Tokologo | C52H, C52K, C52L | |
| | | Tswelopele | C52H | |
| | Mangaung | Mangaung | C51A, C51D, C51E, C52A, C52B, C52C, C52D, C52E, C52F, C52G, C52H, C52J, D15G, D23C, D23D, D23E, D23F, D23G, D23H, D23J, D24A, D24B, D24C, D24D, D24E, D24F | |
| | Thabo Mofutsanyane | Dihlabeng | D21A, D21C, D21D, D21E, D21F, D21G, D21H, D22A, D22B | |
| | | Maluti a Phofung | D21A, D21D | |
| | | Mantsopa | C52B, C52C, D22D, D22G, D22H, D22L, D23A, D23C, D23D, D23E | |
| | | Setsoto | D21H, D22A, D22B, D22C, D22D, D22G, D22H | |
| | Xhariep | Kopanong | C51A, C51B, C51C, C51D, C51E, C51F, C51G, C51H, C51J, C51K, C52J, C52K, D14J, D14K, D24J, D24K, D24L, D31A, D31D, D31E, D34A, D34E, D34F, D34G, D35A, D35B, D35F, D35H, D35K | |
| | | Letsemeng | C51F, C51H, C51J, C51K, C52H, C52J, C52K, C52L, D31D, D31E, D33A, D33B, D33C, D33D, D33E | |
| | | Mohokare | C51A, C51B, C51D, D12A, D12B, D12C, D12D, D12E, D12F, D13M, D14A, D14H, D14J, D14K, D15G, D15H, D18L, D23H, D24A, D24B, D24C, D24D, D24E, D24F, D24G, D24H, D24J, D24K, D24L | |
| Northern Cape | Frances Baard | Sol Plaatjie | C51L, C52L | 25% |
| | | Emthanjeni | D31B, D32A, D32C, D32E, D32F, D32G, D32J | |
| | | Renosterberg | D31B, D31C, D31E, D32F, D32J, D32K, D33A, D33B, D33C, D33D, D33F | |
| | Pixley ka Seme | Siyancuma | C51K, C51L, C51M, C52L, D33E, D33G, D33H, D33K | |
| | | Thembelihle | D33D, D33E, D33F, D33G, D33H, D33J, D33K | |
| | | Ubuntu | D32A, D32B, D32C, D32D, D32E | |
| | | Umsobomvu | D31C, D31E, D32A, D32C, D32F, D32G, D32H, D32J, D32K, D34A, D34B, D34C, D34D, D34E, D34F, D34G, D35J | |

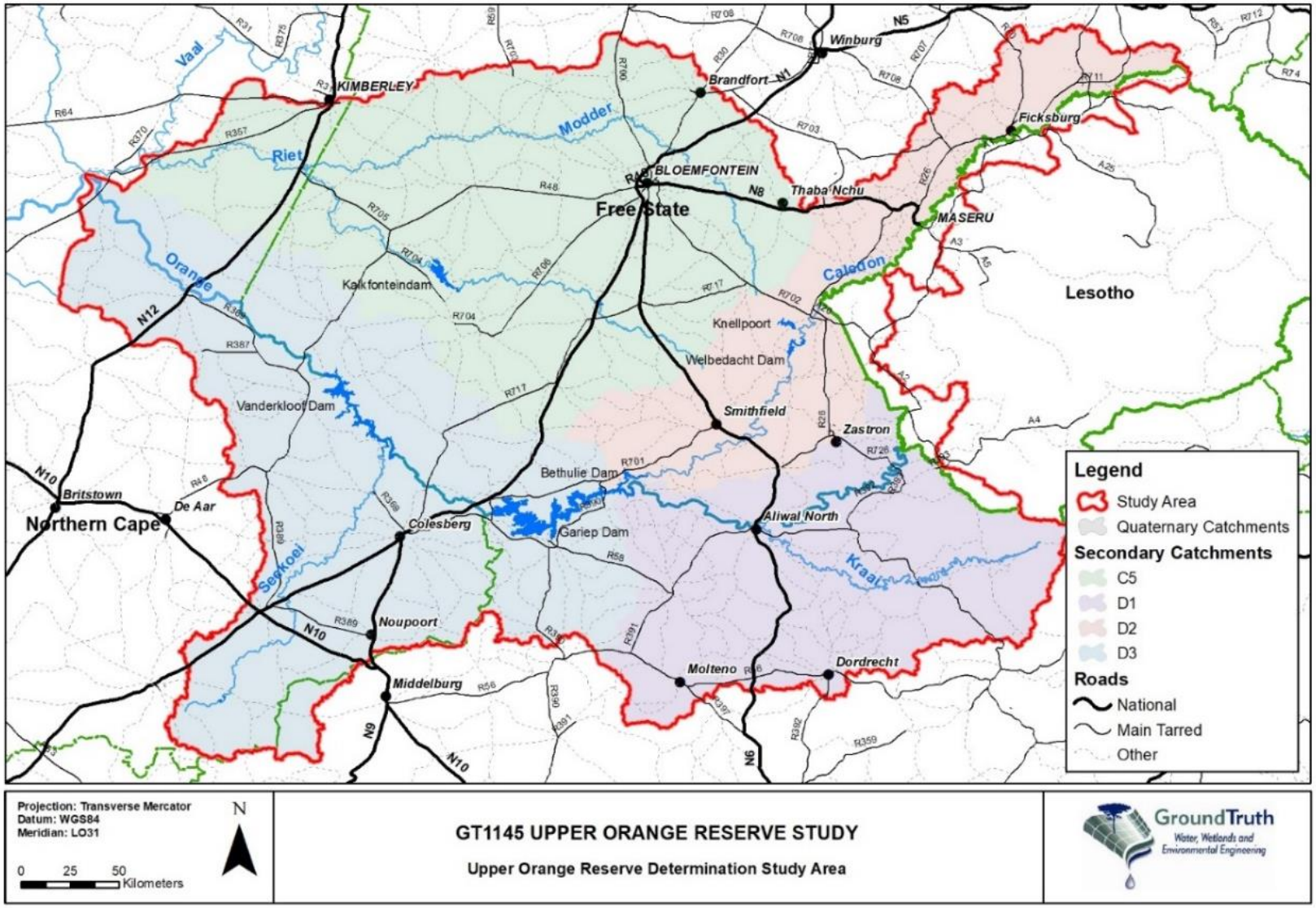


**Figure 2-1:** Upper Orange Reserve determination study area

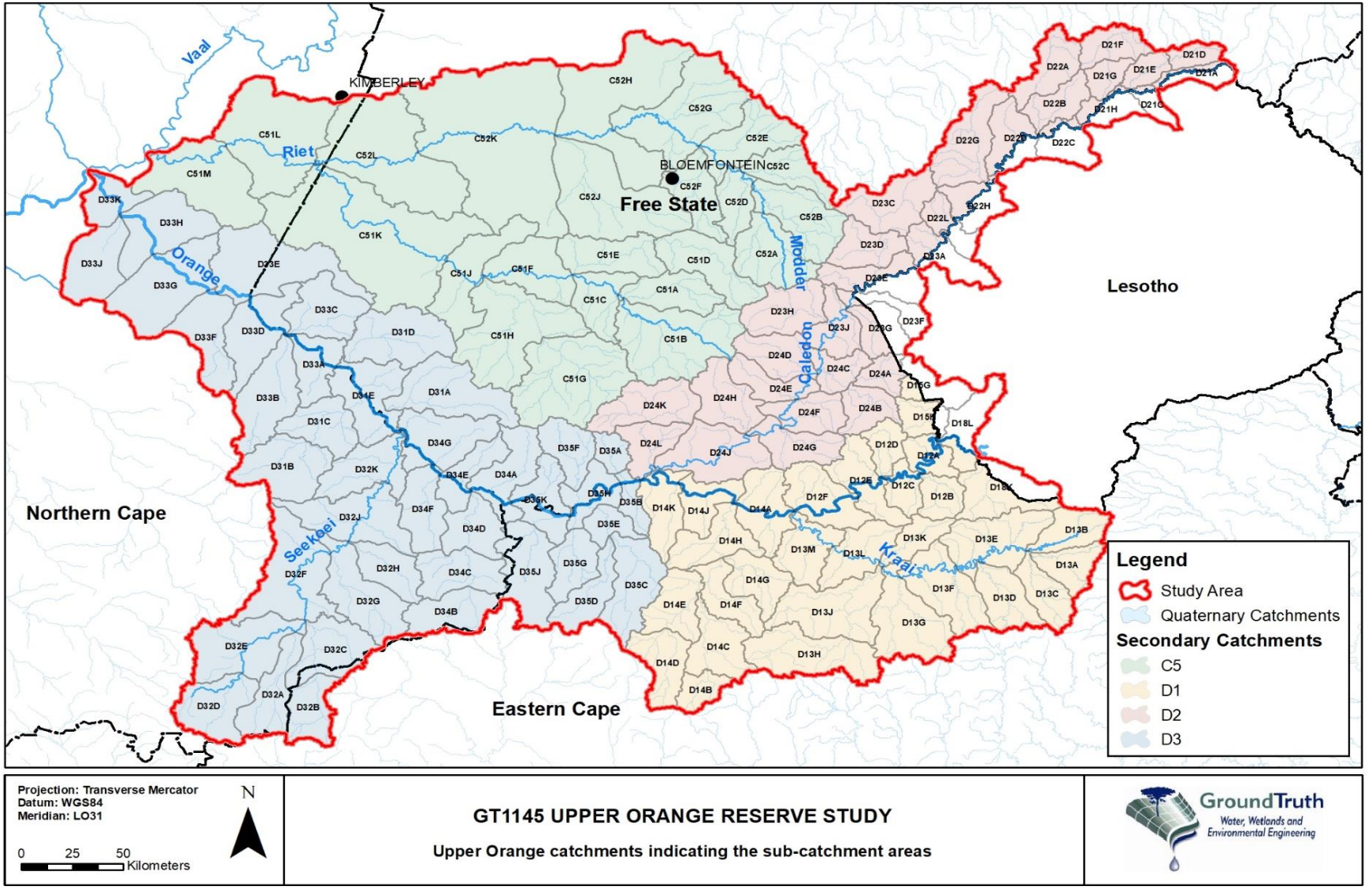


**Figure 2-2:** Sub-catchment areas and quaternaries of the Upper Orange catchment

# 3. APPROACH

The outline of the socio-economic conditions and well-being of the catchment communities contributes to steps 5 and 6 of the 8-step Reserve determination process as outlined in Regulation 810 (Government Gazette 33541) dated 17 September 2010 (Figure 3-1). The socio-economic assessment and this report, outlining the socio-economic profile of the catchment, collate and presents the information needed to evaluate the social consequences of potential operational flow scenarios.

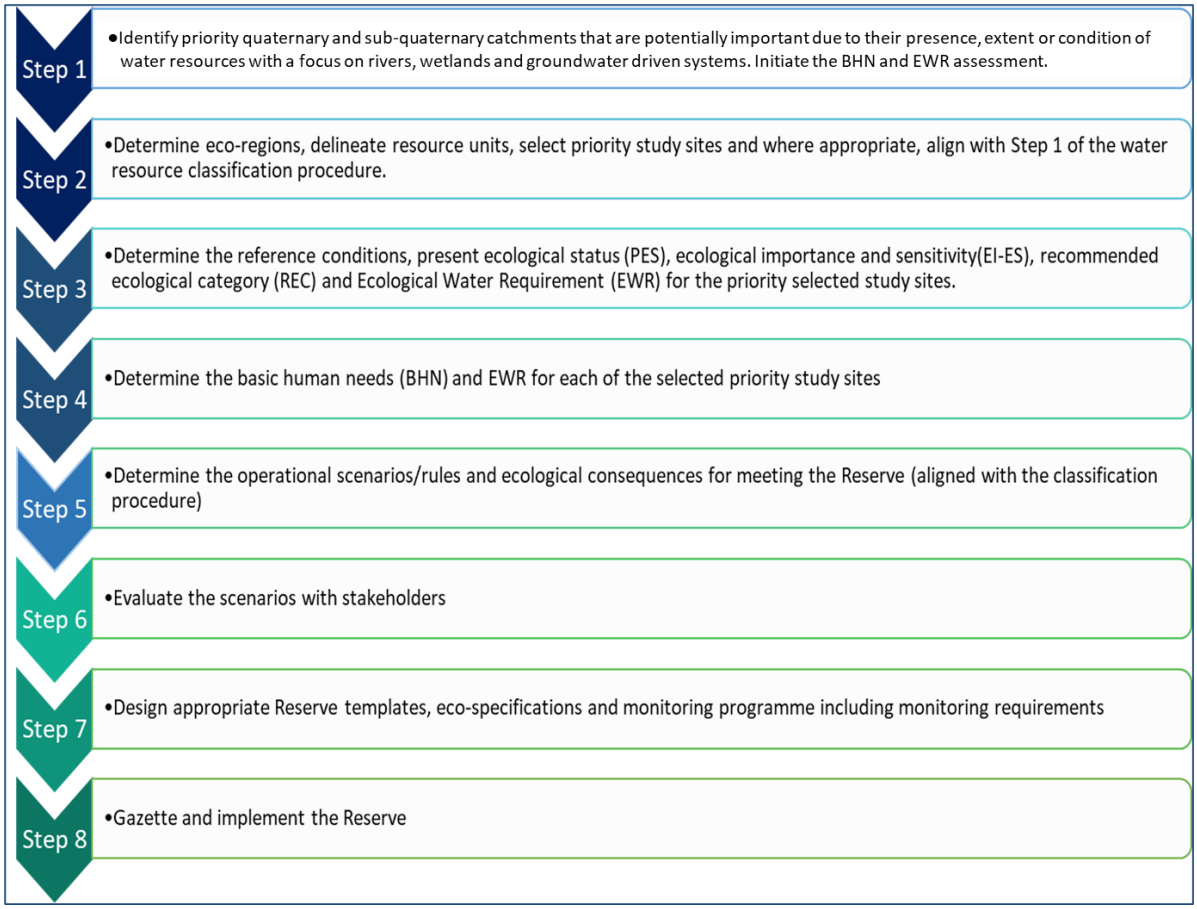


**Figure 3-1:** Integrated steps for the determination of the Reserve (DWS, 2017).

The approach to the socio-economic assessment is guided by the WRCS Socio-Economic Guidelines (DWAF, 2007) and the methods outlined in the Resource Directed Measures Socio-economics and Ecosystem services tool analysis and standardisation Report (DWS, 2016). Important to note is that these guidelines include 'methodologies required for Classification and RQO determinations', as well as for Reserve determinations. Given that this is a Reserve determination, not all methodologies and steps of the processes described in the DWS guidelines are applicable, nor is the same level of detail that would apply in a Classification study. Particularly:

- While, indicators of local economic activity have been included (Gross Domestic Product (GDP), employment, Gross Value Add (GVA) primary sector) as these reflect local livelihood

pressures, quantifying the value of market and/or commercial use of water (i.e. macro-economic modelling) is beyond the scope of the Reserve determination; and
- Similarly, the monetary valuation of ecosystem service and social benefit changes is beyond the scope of the Reserve determination.

The approach adopted in this study is aligned with the DWS methodologies and the outputs could be used/taken further in future Classification studies.

**This report specifically addresses the description of the present socio-economic status**, based on available data, with a focus on socio-economic water use and cultural importance. The assessment was undertaken at the scale of the local municipality as this is the finest scale supported by the broadest range of existing, representative, information. Maps have been used to spatially represent the socio-economic aspects/indicators. The maps provide a visual reflection of potential areas of relative greater vulnerability (i.e. 'hot spots') and the spatial data (layers) will be particularly useful in the scenario analysis for integrating ecological and socio-economic aspects to identify potential consequences.

The following aspects have been addressed:

- Demographic characteristics;
- The current wellbeing of people/communities;
- Characteristics of the economy;
- Land-use and related economic activities;
- Current water use; and
- Cultural importance (related to cultural ecosystem services, e.g., heritage, recreation, aesthetic enjoyment, spiritual experience, intellectual and knowledge development).

In this assessment, these aspects were assessed using available information. The related indicators are presented in the sub-sections of Section 4. Data and supporting information were drawn from existing sources, including Statistics South Africa (Stats SA) reports and databases, municipal reports, spatial coverages, the Water Use Authorization and Registration Management System (WARMS) (DWS, 2021) and previous studies (e.g., Huggins et al., 2010; various from DWS and ORASECOM). An explanation of each indicator assessed and the specific data source is provided in Table 3-1.

Census and Community Survey data have been used extensively. The latest available National Census is for the year 2011[1]. Where possible, the latest available Community Survey data, year 2016, have been used as a more recent indicator. The Community Survey is much smaller (number of households surveyed) than the Census and is less representative of conditions at a fine scale (e.g., ward level). There are differences between the questions of a Community Survey and a National Census and the two surveys do not cover all of the same information. Certain indicators cannot be calculated or compared for both periods. Furthermore, changes were made to certain of the questions and categories of the 2016 survey from the 2011 Census; as such, certain indicators are not directly

[1] While the national census data is over ten years old, it is the most comprehensive socio-economic dataset representative of households at the local municipal scale. The 2011 census data is currently being updated, the population survey was completed in 2022, however, the new database is expected earliest at the end of 2023, which is too late for inclusion into this study and data analysis.

comparable between years. Where appropriate, data/indicators available for multiple years have been compared. The trend (increase/decrease) between years is shown for key indicators.

**Table 3-1:** Socio-economic assessment approach: key Indicator description, data source and associated section of the report

| Indicator | Section |
|---|---|
| **Local municipality - spatial** | **4** |
| Boundaries and extent of local municipalities based on the 2016 demarcation of boundaries.<br>Data: Municipal Demarcation Board | |
| **Population** | **4.1** |
| Estimated population size<br>Data: Stats SA<br>2011 - Census 2011<br>2016 - Community Survey 2016<br>2022 - Mid-year population estimates (projected) | |
| **Population density** | **4.1** |
| Number of people per square kilometre (people/km$^2$). Calculated from LM population figures and the LM area.<br>Data: Population figures from Census 2011, Community Survey 2016, Mid-year population estimates (Stats SA). | |
| **Settlement type** | **4.1** |
| Proportion (%) of settlement within the LM according to the settlement types categorized in the Stats SA Community Profiles (2011) as:<br>Urban – includes formal and informal,<br>Tribal areas and rural informal settlements – tribal settlements are found in areas that are legally proclaimed to be under tribal authorities., and<br>Commercial farms – cultivation and/or livestock.<br>Data: Aggregated by Stats SA from Census 2011 data (not available for the Community Survey 2016). | |
| **Poverty level** | **4.2** |
| Income poverty level by local municipality based on the proportion (%) of people falling below the upper-income poverty line defined by Stats SA (R779/person/month in 2011).<br>Data: Poverty level derived by David et al. (2018) using income data from Census 2011. | |
| **SAMPI (South African Multidimensional Poverty Indicator) - Multidimensional Poverty Indicator (MPI) adapted for South Africa** | **4.2** |
| Multidimensional poverty level (score) by local municipality. The MPI captures severe deprivations concerning education, health and living standards. In South Africa, unemployment is incorporated into the global MPI measure. The SAMPI is an index constructed using eleven indicators across four dimensions, namely health, education, living standards and economic activity. The score is calculated from two measures the 'poverty headcount' and the "intensity of poverty". The poverty headcount shows the proportion of households considered to be "multidimensionally poor" in the defined area. The intensity of poverty is the average proportion of indicators in which multidimensional poor households are deprived.<br>Data: Scores derived by Stats SA from Census 2011 and Community Survey 2016 data. | |
| **Gini coefficient** | **4.2** |
| The Gini coefficient for income inequality – indicates the distribution of income across the local municipality. A higher Gini coefficient indicates greater income inequality.<br>Data: Gini coefficients derived by David et al. (2018) using income data from Census 2011. | |
| **Dependency ratio** | **4.2** |
| A measure of the number of dependents aged less than 1 year up to 14 years of age and over the age of 65, compared with the total population aged 15 to 64. The indicator gives insight into the number of people of non-working age, compared with the number of those of working age. | |

| Indicator | Section |
|---|---|
| Data: Census 2011 and Community Survey 2016. | |
| **Households** | **4.2** |
| The number of households within the LM. A household is defined as all individuals who live together under the same roof or in the same yard, and who share resources such as food or money to keep the household functioning.<br>Data: Census 2011 and Community Survey 2016. | |
| **Household size** | **4.2** |
| The average household size (number of persons) across the LM.<br>Data: Census 2011 and Community Survey 2016. | |
| **Female-headed** | **4.2** |
| Proportion (%) of households where the household head is identified as female. A household head is a person recognised as such by the household, usually the main decision-maker, or the person who owns or rents the dwelling, or the person who is the main breadwinner. If two people are equal decision-makers, or in a household of unrelated persons, the older or oldest is named as the household head.<br>Data: Census 2011 and Community Survey 2016. | |
| **Tenure - housing owned** | **4.2** |
| Proportion (%) of households within the LM where the tenure status is 'Owned and fully paid-off' or 'Owned - but not yet paid off'. Tenure refers to the arrangement under which a household occupies its dwelling.<br>Data: Census 2011 and Community Survey 2016. | |
| **Dwelling of traditional materials** | **4.2** |
| Proportion (%) of households whose main dwelling is constructed primarily of clay, mud, reeds or other locally available natural materials.<br>Data: Community Survey 2016. | |
| **'Natural' water source** | **4.2** |
| Proportion (%) of households within the LM where the main source of water for household use is 'Borehole in the yard', 'Rain-water tank in the yard', 'Borehole outside the yard', 'Flowing water/stream/river', 'Well' or 'Spring'.<br>Data: Community Survey 2016. | |
| **Wood for energy** | **4.2** |
| Proportion (%) of households within the LM where wood is used as an energy source.<br>Data: Community Survey 2016. | |
| **Employment** | **4.3** |
| The proportion of the labour force of each LM that is employed. The labour force includes all employed and unemployed persons of working age (15 – 64 years).<br>Data: Census 2011 (Labour Force). | |
| **Employment sector** | **4.3** |
| Proportion (%) of those employed that are employed in the formal sector and the informal sector. The formal sector of employment is made up of all employing businesses that are registered in any way. The informal sector is defined as the subset of unincorporated enterprises comprising those that produce at least some output for the market and are less than a specialised size in terms of the number of persons engaged or of employees employed continuously, and/or not registered under specific forms of national legislation.<br>Data: Census 2011 (Labour Force). | |
| **GDP (Gross Domestic Product)** | **4.3** |
| Simulated GDP at the local municipal scale, reported as billions of Rands (R billion) and Rands (R) per capita for each LM (current prices, 2011). The GDP of a region is a measure of the market value of all goods and services (including public services), produced within the region, over a period of one year, plus taxes and minus subsidies. It indicates the overall economic activity of each LM. While reported as GDP per capita, to compare LMs, GDP is not a sign of the material well-being of the population.<br>Data: Reported in Stats SA (2012), values derived from various official data as published by Stats SA. | |

| Indicator | Section |
|---|---|
| | |
| **Land cover** | **4.4** |
| Proportional representation of land cover types by LM. Types/categories follow the National Land Cover Classes and Definitions Standard (2017), which has a hierarchal structure: 73 Classes, with Level 1 aggregated to 9 classes and Level 2 aggregated to 24 classes.<br>Data: 2020 South African National Land Cover dataset. | |
| **GVA (Gross Value Added)** | **4.4** |
| An indicator of economic production per sector based on Gross Value Added (GVA) by economic sector. Reported in millions of Rands (R million). Suitable for spatial and temporal comparisons of regions. Sector GVA is a measure of the output (total production) of a region in terms of the value that was created within that region. GVA is broken down into various production sectors. Sector classifications follow the standard adopted by Stats SA.<br>Data: Sourced from the SA CSIR MesoZone 2018v1 Dataset (spatial derivation of GVA indicator) (CSIR, 2018). Original data produced by Quantec. | |
| **Agricultural households** | **4.4** |
| The percentage (%) of all households of the LM involved in producing agricultural goods, whether sold or consumed.<br>Data: Census 2011 and Community Survey 2016. | |
| **Type of agricultural activity** | **4.4** |
| The percentage (%) of all households of the LM involved in a particular agricultural activity. Types aggregated to 'Livestock', 'Poultry' and 'Crops'. A household can participate in more than one activity.<br>Data: Community Survey 2016. | |
| **Farm practice for crop production** | **4.4** |
| The percentage (%) of all households of the LM engaging in a particular practice of crop production. Namely, 'Irrigation', 'Irrigation and dry land, or 'Dry land'.<br>Data: Community Survey 2016. | |
| **Registered water use (abstraction)** | **4.5** |
| Registered water use (volumes and proportions) by Water Use Sector and Water Source, aggregated by LM for the Upper Orange study area.<br>Data: Water use Authorization and Registration Management System (WARMS) data for abstraction uses (Section 21(a) of the National Water Act (Act No. 36 of 1998)) for the Upper Orange area, 2021 annual period. WARMS is the national register of water use for South Africa defined in terms of section 139(2)(d) of the National Water Act 1998. For this analysis, abstraction-related water use was assessed. | |
| **Household water source** | **4.5** |
| The number of people identifying a specific water source as the main source of drinking water.<br>Data: Community Survey 2016. | |
| **Basic human needs (BHN) requirement** | **4.5** |
| Calculated BHN requirements sourced from the Basic Human Needs assessment undertaken as part of the broader study - Project Report No.: RDM/WMA13/00/CON/COMP/0822 (October 2022).<br>Data: Based on Census 2011 data on water sources. | |
| **Sites of cultural importance** | **4.6** |
| Sites of cultural importance identified within the Upper Orange area. A broad definition of cultural services has been adopted drawing on the Millennium Ecosystem Assessment and CICES frameworks.<br>Data: Multiple sources (listed in section 4.6) including municipal documents and websites. | |
| **Protected Areas (PAs)** | **4.6** |
| The number of protected areas (PAs) associated with each LM. A PA may be associated with more than one LM (i.e., the spatial extent of a PA may extend across/into more than one PA.)<br>Data: South African Protected Areas Database, Quarter 2, 2021 (DEFF, 2021). | |

# 4. SOCIO-ECONOMIC PROFILE

The Upper Orange Catchment (study area) encompasses portions of 26 local municipalities (LM)[2]. The municipal boundaries do not align completely with the boundary of the Upper Orange catchment. Table 4-1 lists the associated LMs and reports the proportion of each LM falling within the catchment area. There are eight (8) LMs for which 75% or more of the area of the LM falls within the Upper Orange catchment area and eight LMs of which less than 10% of the LM area falls within the catchment. The proportion of the Upper Orange catchment area associated with each LM is also reported in Table 4-1. Over 80% of the Upper Orange catchment area is made-up of 11 LMs (1 to 11 in Table 4-1).

**Table 4-1:** Description of the area extent of the Upper Orange (UO) study area by local municipality (LM)

| | Local municipality | Area (km²) | Proportion of LM within the UO catchment | Proportion of the UO catchment area | |
|---|---|---|---|---|---|
| 1 | Kopanong | 15 663 | 100.00% | 15.11% | |
| 2 | Walter Sisulu | 13 281 | 89.45% | 11.40% | |
| 3 | Letsemeng | 9 841 | 100.00% | 9.51% | |
| 4 | Mangaung | 9 899 | 96.74% | 9.19% | |
| 5 | Mohokare | 8 785 | 100.00% | 8.46% | |
| 6 | Senqu | 7 336 | 98.80% | 6.95% | 82.51% |
| 7 | Umsobomvu | 6 820 | 100.00% | 6.55% | |
| 8 | Siyancuma | 16 775 | 26.86% | 4.32% | |
| 9 | Renosterberg | 5 535 | 77.86% | 4.14% | |
| 10 | Thembelihle | 8 033 | 47.36% | 3.65% | |
| 11 | Tokologo | 9 339 | 36.06% | 3.23% | |
| 12 | Masilonyana | 6 627 | 40.60% | 2.58% | |
| 13 | Emthanjeni | 13 485 | 19.64% | 2.54% | |
| 14 | Mantsopa | 4 296 | 61.06% | 2.52% | |
| 15 | Setsoto | 5 439 | 35.86% | 1.87% | 16.31% |
| 16 | Ubuntu | 20 410 | 9.55% | 1.87% | |
| 17 | Enoch Mgijima | 13 595 | 13.00% | 1.70% | |
| 18 | Dihlabeng | 4 875 | 34.95% | 1.63% | |
| 19 | Sol Plaatjie | 3 150 | 52.92% | 1.60% | |
| 20 | Inxuba Yethemba | 11 672 | 6.30% | 0.71% | |
| 21 | Tswelopele | 6 534 | 3.59% | 0.22% | |
| 22 | Emalahleni | 3 487 | 5.99% | 0.20% | |
| 23 | Dr Beyers Naude | 28 669 | 0.10% | 0.03% | 1.18% |
| 24 | Maluti a Phofung | 4 344 | 0.37% | 0.02% | |
| 25 | Elundini | 5 024 | 0.12% | 0.01% | |
| 26 | Sakhisizwe | 2 320 | 0.13% | 0.00% | |

*Note: The local municipalities (LMs) are listed according to the proportion of the Upper Orange (UO) catchment area (highest to lowest). Darker orange fill indicates that 75% or more of the LM falls within the study area; light orange fill indicates that less than 10% of the LM falls with the study area. Darker blue fill highlights the LMs making up more than 80% of the study area; light blue fill highlights the LMs for which the overlap with the study area is less than 1% of the total catchment area.*

[2] Based on the local municipal demarcations of 2016 by the Municipal Demarcation Board.

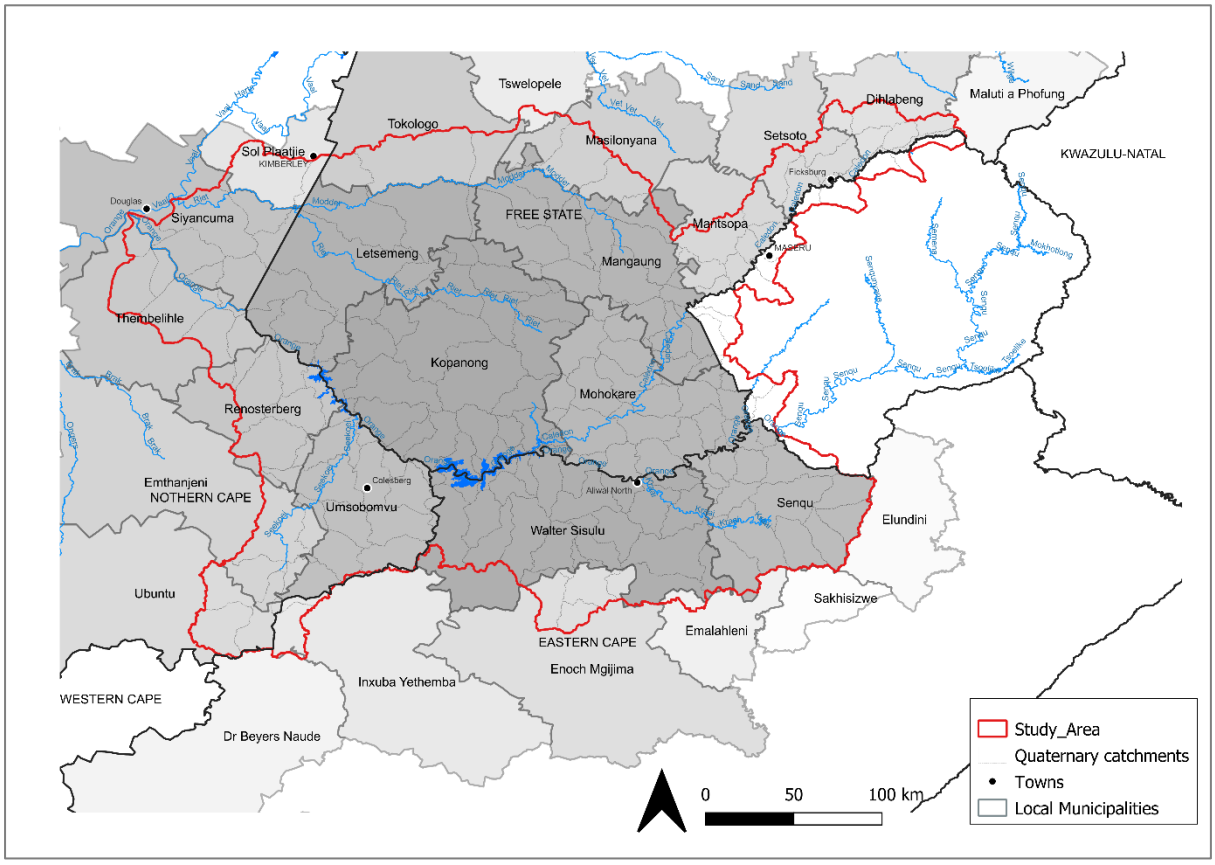


**Figure 4-1:** Local municipalities of the Upper Orange study area

## 4.1 Population and settlement type

The population size and population density (people/km$^2$) of each LM for the years 2011, 2016 and 2022 are reported in Table 4-2. The population sizes for 2022 are estimates projected by Stats SA (Stats SA Mid-Year Population Estimates). The trend (increase/decrease) in population size from 2016 to the 2022 projection is shown.

The proportion of settlement types within each LM, Census 2011, is also presented in Table 4-2. Settlement types are categorized in the 2011 Census as:

- Urban, including both formal and informal settlement;
- Tribal areas (settlements in areas legally proclaimed to be under tribal authorities) and rural informal settlements; and
- Commercial farms (cultivation and/or livestock).

**Table 4-2:** Population and settlement indicators by local municipality, Upper Orange study area

| | Local municipality | Population | | | | Population density (person/km²) | | | Settlement type (2011) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2016 | 2022 | Trend | 2011 | 2016 | 2022 | Urban | Tribal/Rural | Farm |
| 1 | Kopanong | 49 171 | 49 999 | 50 017 | ▲ | 3 | 3 | 3 | 83% | 0% | 17% |
| 2 | Walter Sisulu | 77 477 | 87 263 | 83 517 | ▼ | 6 | 7 | 6 | 89% | 0% | 11% |
| 3 | Letsemeng | 38 628 | 40 044 | 42 863 | ▲ | 4 | 4 | 4 | 85% | 0% | 15% |
| 4 | Mangaung | 775 184 | 787 803 | 882 390 | ▲ | 78 | 80 | 89 | 90% | 7% | 3% |
| 5 | Mohokare | 34 146 | 35 840 | 35 100 | ▼ | 4 | 4 | 4 | 80% | 0% | 20% |
| 6 | Senqu | 134 150 | 140 720 | 126 819 | ▼ | 18 | 19 | 17 | 17% | 78% | 5% |
| 7 | Umsobomvu | 28 376 | 30 883 | 33 871 | ▲ | 4 | 5 | 5 | 89% | 0% | 11% |
| 8 | Siyancuma | 37 076 | 35 941 | 41 003 | ▲ | 2 | 2 | 2 | 75% | 0% | 25% |
| 9 | Renosterberg | 10 978 | 11 818 | 12 907 | ▲ | 2 | 2 | 2 | 84% | 0% | 16% |
| 10 | Thembelihle | 15 701 | 16 230 | 19 189 | ▲ | 2 | 2 | 2 | 87% | 0% | 13% |
| 11 | Tokologo | 28 986 | 29 149 | 32 794 | ▲ | 3 | 3 | 4 | 75% | 0% | 25% |
| 12 | Masilonyana | 59 895 | 62 770 | 65 342 | ▲ | 9 | 9 | 10 | 91% | 0% | 9% |
| 13 | Emthanjeni | 42 356 | 45 404 | 47 655 | ▲ | 3 | 3 | 4 | 89% | 0% | 11% |
| 14 | Mantsopa | 51 056 | 53 525 | 54 604 | ▲ | 12 | 12 | 13 | 85% | 0% | 15% |
| 15 | Setsoto | 112 038 | 117 362 | 120 838 | ▲ | 21 | 22 | 22 | 90% | 0% | 10% |
| 16 | Ubuntu | 18 601 | 19 471 | 20 212 | ▲ | 1 | 1 | 1 | 73% | 0% | 27% |
| 17 | Enoch Mgijima | 250 776 | 267 011 | 228 316 | ▼ | 18 | 20 | 17 | 68% | 27% | 5% |
| 18 | Dihlabeng | 128 704 | 140 044 | 151 828 | ▲ | 26 | 29 | 31 | 86% | 0% | 14% |
| 19 | Sol Plaatjie | 248 041 | 255 041 | 275 614 | ▲ | 79 | 81 | 88 | 99% | 0% | 1% |
| 20 | Inxuba Yethemba | 65 560 | 70 493 | 61 235 | ▼ | 6 | 6 | 5 | 86% | 0% | 14% |
| 21 | Tswelopele | 47 625 | 47 373 | 47 753 | ▲ | 7 | 7 | 7 | 81% | 0% | 19% |
| 22 | Emalahleni | 120 758 | 124 532 | 102 027 | ▼ | 35 | 36 | 29 | 21% | 76% | 4% |
| 23 | Dr Beyers Naude | 79 292 | 82 197 | 78 186 | ▼ | 3 | 3 | 3 | 84% | 0% | 16% |
| 24 | Maluti a Phofung | 335 784 | 353 452 | 327 294 | ▼ | 77 | 81 | 75 | 40% | 57% | 2% |
| 25 | Elundini | 137 039 | 144 929 | 130 391 | ▼ | 27 | 29 | 26 | 30% | 68% | 2% |
| 26 | Sakhisizwe | 62 284 | 63 846 | 54 748 | ▼ | 27 | 28 | 24 | 47% | 49% | 5% |

*Note: Population values for the year 2022 are shown in grey as they are projections. Population values for 2011 and 2016 are estimates associated with the 2011 Census and 2016 Community Survey, respectively. Trend indicates increase/decrease in population from 2016 to the 2022 projection. Darker orange fill highlights the three most densely populated LMs; light orange fill highlights LMs with a low population density (<5 person/km²). Darker blue fill highlights LMs with relatively larger proportions of Tribal/Rural and Farm settlement type; light blue fill highlights LMs with a relatively lower proportion of 'Urban' settlement type. Settlement types as per the 2011 Census.*

## 4.2 Community well-being

Various household/population characteristics - financial, physical, social and natural - provide a sense of the well-being of communities. Indicators of community well-being for each of the LMs associated with the study area are presented in Tables 4.3 to 4.5. Where available, indicators for years 2011 and 2016 are reported. The trend (increase/decrease) between years is shown for key indicators where the data allows for direct comparisons[3].

### *4.2.1 Poverty, inequality and dependency*

Poverty, inequality and dependency indicators are presented in Table 4-3. Values are also presented for the provincial and national scale for comparison.

Income poverty reflects the proportion (%) of people falling below the upper income poverty line for South Africa defined by Stats SA (R779/person/month for 2011). The Gini coefficient is an indicator of the equality of income across a population (i.e., the extent of the difference between higher and lower incomes); a higher Gini coefficient indicates greater inequality.

The South African Multidimensional Poverty Index (SAMPI) reflects severe deprivations across non-income-based dimensions of poverty, specifically, education, health, living standards and unemployment. The higher the SAMPI score, the greater the level of overall poverty. The SAMPI indicator is represented spatially in Figure 4-2.

The dependency ratio is an indicator of the number of dependents (population aged zero to 14 and over the age of 65) relative to the population aged 15 to 64. The indicator gives insight into the number of people of non-working age, compared with the number of those of working age.

**Table 4-3:** Poverty, inequality and dependency indicators by local municipality, Upper Orange study area

| | Local municipality | Income poverty | Gini (income inequality) | Multidimensional poverty (SAMPI) | | | Dependency ratio | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2011 | 2011 | 2016 | Change | 2011 | 2016 | Change |
| 1 | Kopanong | 62% | 0.49 | 0.02 | 0.03 | ▲ | 57 | 50 | ▼ |
| 2 | Walter Sisulu | 62% | 0.75 | 0.03 | 0.01 | ▼ | 61 | 65 | |
| 3 | Letsemeng | 62% | 0.72 | 0.02 | 0.02 | ▼ | 54 | 45 | ▼ |
| 4 | Mangaung | 65% | 0.76 | 0.02 | 0.02 | | 48 | 54 | ▲ |
| 5 | Mohokare | 67% | 0.74 | 0.03 | 0.02 | ▼ | 63 | 57 | ▼ |
| 6 | Senqu | 73% | 0.74 | 0.06 | 0.06 | | 71 | 72 | |
| 7 | Umsobomvu | 67% | 0.72 | 0.04 | 0.03 | ▼ | 59 | 45 | ▼ |
| 8 | Siyancuma | 62% | 0.74 | 0.04 | 0.02 | ▼ | 61 | 48 | ▼ |
| 9 | Renosterberg | 62% | 0.82 | 0.03 | 0.01 | ▼ | 64 | 50 | ▼ |
| 10 | Thembelihle | 56% | 0.79 | 0.05 | 0.03 | ▼ | 59 | 46 | ▼ |

[3] There are differences between the questions (extent) of a Community Survey and a National Census, as such not all indicators are available in both. Furthermore, changes were made to some of the questions and categories of the 2016 survey from the 2011 Census, as such, certain indicators are not directly comparable between years.

| | Local municipality | Income poverty | Gini (income inequality) | Multidimensional poverty (SAMPI) | | | Dependency ratio | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2011 | 2011 | 2016 | Change | 2011 | 2016 | Change |
| 11 | Tokologo | 67% | 0.72 | 0.03 | 0.03 | | 59 | 52 | ▼ |
| 12 | Masilonyana | 67% | 0.72 | 0.02 | 0.03 | ▲ | 55 | 50 | |
| 13 | Emthanjeni | 56% | 0.74 | 0.01 | 0.02 | ▲ | 60 | 47 | ▼ |
| 14 | Mantsopa | 62% | 0.77 | 0.02 | 0.02 | ▼ | 59 | 54 | |
| 15 | Setsoto | 73% | 0.77 | 0.03 | 0.03 | | 61 | 57 | |
| 16 | Ubuntu | 56% | 0.77 | 0.03 | 0.03 | | 64 | 50 | ▼ |
| 17 | Enoch Mgijima | 73% | 0.71 | 0.03 | 0.04 | ▲ | 62 | 69 | ▲ |
| 18 | Dihlabeng | 56% | 0.74 | 0.03 | 0.02 | ▼ | 54 | 48 | ▼ |
| 19 | Sol Plaatjie | 50% | 0.72 | 0.02 | 0.02 | ▼ | 51 | 54 | |
| 20 | Inxuba Yethemba | 56% | 0.77 | 0.01 | 0.01 | ▲ | 55 | 64 | ▲ |
| 21 | Tswelopele | 73% | 0.79 | 0.02 | 0.02 | | 65 | 57 | ▼ |
| 22 | Emalahleni | 78% | 0.72 | 0.08 | 0.10 | ▲ | 82 | 91 | ▲ |
| 23 | Dr Beyers Naude | 62% | 0.73 | 0.01 | 0.01 | ▼ | 59 | 64 | |
| 24 | Maluti a Phofung | 73% | 0.72 | 0.03 | 0.03 | | 61 | 55 | |
| 25 | Elundini | 78% | 0.79 | 0.10 | 0.09 | ▼ | 77 | 76 | |
| 26 | Sakhisizwe | 78% | 0.74 | 0.06 | 0.05 | | 73 | 78 | |
| | Average | 65% | 0.74 | 0.03 | 0.03 | | 61 | 57 | |
| | Free State | 59% | n/a | 0.02 | 0.02 | | 54 | 63 | ▲ |
| | Eastern Cape | 69% | 0.61 | 0.06 | 0.05 | | 66 | 76 | ▲ |
| | Northern Cape | 55% | 0.58 | 0.03 | 0.03 | | 57 | 65 | ▲ |
| | South Africa (SA) | 54% | 0.63 | n/a | n/a | n/a | 53 | 61 | ▲ |
| | SA Rural | 74% | 0.55 | n/a | n/a | n/a | 70 | 82 | ▲ |
| | SA Urban | 43% | 0.62 | n/a | n/a | n/a | 44 | 51 | ▲ |

*Note: Darker orange fill indicates values greater than 10% above the average across all LMs. Change (arrow) indicates a greater than 10% increase/decrease between 2011 and 2016.*

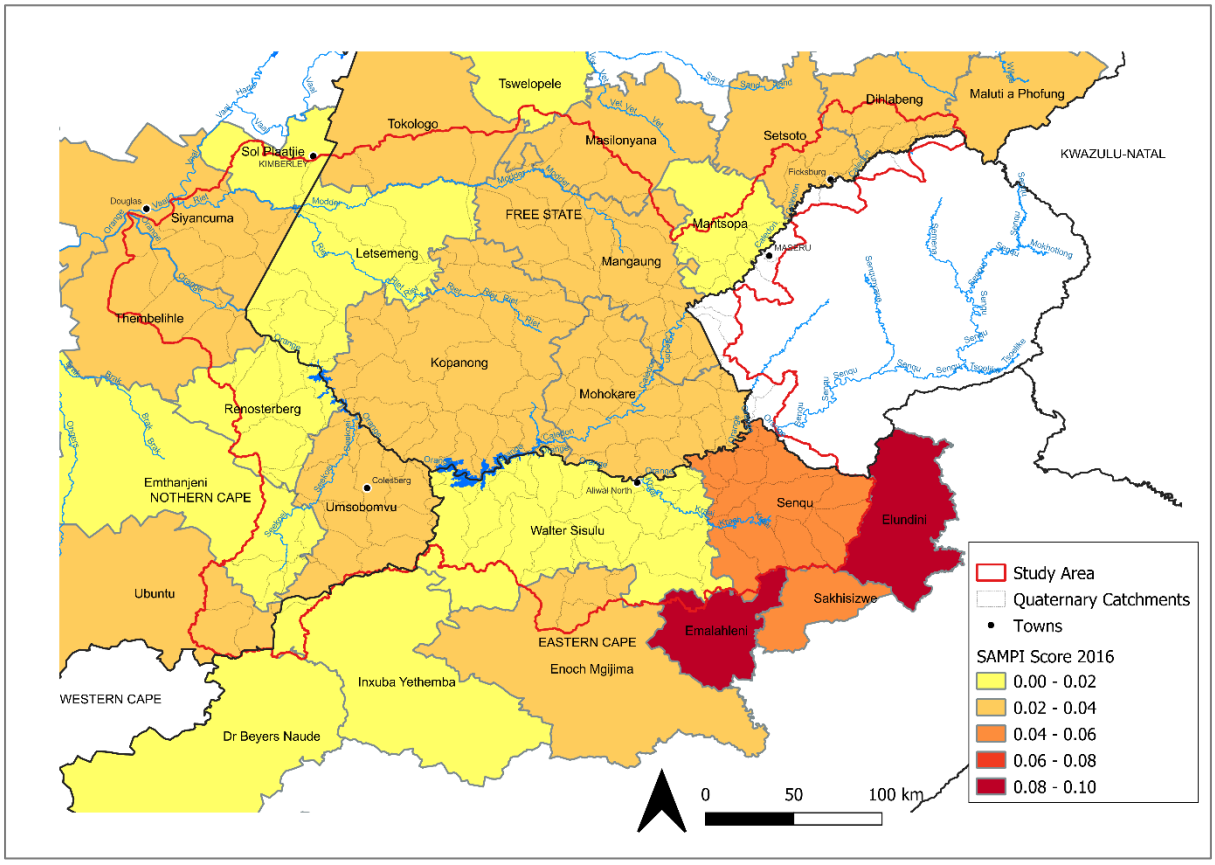


**Figure 4-2:** Spatial representation of the SA Multidimensional Poverty Index (SAMPI) score, 2016, for the local municipalities associated with the Upper Orange study area

*Note: The higher the SAMPI score, the greater the level of overall poverty.*

### *4.2.2 Household dynamics*

Indicators of household dynamics are presented in Table 4-4. 'Female-headed' indicates the proportion (%) of households within the LM where the head of a household has been identified as female. A household head is a person recognised as such by the household, usually the main decision-maker, or the person who owns or rents the dwelling, or the person who is the main breadwinner.

'Tenure status - Owned' indicates the proportion (%) of households within the LM where the house is 'Owned and fully paid-off' or 'Owned - but not yet paid off'. Tenure refers to the arrangement under which a household occupies its dwelling.

**Table 4-4:** Indicators of household dynamics by local municipality, Upper Orange study area

| | Local municipality | Number of households | | | Household size | | | Female-headed | | Tenure status - Owned | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2016 | Change | 2011 | 2016 | Change | 2011 | 2016 | 2011 | 2016 |
| 1 | Kopanong | 15 643 | 18 412 | ▲ | 3.1 | 2.7 | ▼ | 38% | 37% | 51% | 58% |
| 2 | Walter Sisulu | 21 874 | 23 706 | | 3.5 | 3.7 | | 42% | 42% | 48% | 61% |
| 3 | Letsemeng | 11 242 | 13 969 | ▲ | 3.4 | 2.9 | ▼ | 34% | 32% | 54% | 72% |
| 4 | Mangaung | 240 700 | 265 561 | ▲ | 3.2 | 3.0 | | 41% | 41% | 62% | 70% |
| 5 | Mohokare | 10 793 | 12 387 | ▲ | 3.2 | 2.9 | | 42% | 45% | 44% | 55% |
| 6 | Senqu | 38 046 | 35 597 | | 3.5 | 4.0 | ▲ | 51% | 48% | 69% | 83% |
| 7 | Umsobomvu | 7 841 | 9 575 | ▲ | 3.6 | 3.2 | ▼ | 42% | 40% | 53% | 54% |
| 8 | Siyancuma | 9 578 | 10 191 | | 3.9 | 3.5 | | 36% | 36% | 40% | 50% |
| 9 | Renosterberg | 2 995 | 3 563 | ▲ | 3.7 | 3.3 | | 35% | 34% | 52% | 68% |
| 10 | Thembelihle | 4 140 | 4 736 | ▲ | 3.8 | 3.4 | | 32% | 32% | 51% | 51% |
| 11 | Tokologo | 8 698 | 9 831 | ▲ | 3.3 | 3.0 | ▼ | 33% | 34% | 32% | 25% |
| 12 | Masilonyana | 16 476 | 21 558 | ▲ | 3.6 | 2.9 | ▼ | 43% | 40% | 65% | 68% |
| 13 | Emthanjeni | 10 457 | 11 923 | ▲ | 4.1 | 3.8 | | 39% | 40% | 60% | 70% |
| 14 | Mantsopa | 15 170 | 16 951 | ▲ | 3.4 | 3.2 | | 43% | 43% | 56% | 57% |
| 15 | Setsoto | 33 496 | 37 246 | ▲ | 3.3 | 3.2 | | 47% | 47% | 62% | 59% |
| 16 | Ubuntu | 5 129 | 6 034 | ▲ | 3.6 | 3.2 | ▼ | 35% | 34% | 55% | 69% |
| 17 | Enoch Mgijima | 68 354 | 65 146 | | 3.7 | 4.1 | ▲ | 48% | 48% | 60% | 56% |
| 18 | Dihlabeng | 38 593 | 46 857 | ▲ | 3.3 | 3.0 | ▼ | 41% | 41% | 48% | 54% |
| 19 | Sol Plaatjie | 60 297 | 71 939 | ▲ | 4.1 | 3.5 | ▼ | 41% | 42% | 61% | 68% |
| 20 | Inxuba Yethemba | 18 463 | 18 282 | | 3.6 | 3.9 | | 41% | 42% | 47% | 50% |
| 21 | Tswelopele | 11 992 | 13 705 | ▲ | 4.0 | 3.5 | ▼ | 40% | 41% | 60% | 77% |
| 22 | Emalahleni | 32 005 | 27 008 | ▼ | 3.8 | 4.6 | ▲ | 54% | 53% | 61% | 76% |
| 23 | Dr Beyers Naude | 19 922 | 20 748 | | 4.0 | 4.0 | | 39% | 40% | 56% | 66% |
| 24 | Maluti a Phofung | 100 228 | 110 725 | ▲ | 3.4 | 3.2 | | 51% | 50% | 72% | 84% |
| 25 | Elundini | 37 550 | 35 804 | | 3.6 | 4.0 | ▲ | 52% | 48% | 62% | 67% |
| 26 | Sakhisizwe | 15 827 | 14 848 | | 3.9 | 4.3 | | 52% | 50% | 42% | 60% |
| | Average | | | | 3.6 | 3.5 | | 42% | 42% | 55% | 63% |

*Note: Change (arrow) indicates a greater than 10% increase/decrease between 2011 and 2016. Darker orange fill highlights values higher than 10% above the average across the LMs; lighter orange fill highlights values lower than 10% below the average across the LMs. Blue fill highlights LMs where more than 50% of households are female-headed. Green fill highlights LMs where house ownership is below 50%.*

### *4.2.3 Natural resource use*

Indicators of the use of natural resources by the households of the study area are presented in Table 4-5. Each indicator reflects the proportion of households within the local municipality using the resource. 'Natural water source' is an aggregation of several water source categories of the 2016 Community Survey, specifically: 'Borehole in the yard', 'Rain-water tank in yard', 'Borehole outside the yard', 'Flowing water/stream/river', 'Well' and Spring. There are differences between the questions and categories related to these indicators between the 2011 Census and the 2016 Community Survey and so the data are not directly comparable. The more recent data – Community Survey 2016 – is presented in Table 4-5. The indicator 'natural water source' is illustrated spatially in Figure 4-3.

**Table 4-5:** Indicators of natural resource use (% households) by local municipality, Upper Orange study area

| | Local municipality | Wood for energy | Dwelling of traditional materials | Natural water source |
|---|---|---|---|---|
| | | 2016 | 2016 | 2016 |
| 1 | Kopanong | 19% | 0% | 4% |
| 2 | Walter Sisulu | 7% | 0% | 3% |
| 3 | Letsemeng | 18% | 0% | 4% |
| 4 | Mangaung | 7% | 1% | 1% |
| 5 | Mohokare | 18% | 0% | 2% |
| 6 | Senqu | 41% | 17% | 27% |
| 7 | Umsobomvu | 34% | 0% | 1% |
| 8 | Siyancuma | 70% | 0% | 8% |
| 9 | Renosterberg | 12% | 0% | 2% |
| 10 | Thembelihle | 37% | 1% | 7% |
| 11 | Tokologo | 45% | 5% | 7% |
| 12 | Masilonyana | 14% | 0% | 2% |
| 13 | Emthanjeni | 62% | 0% | 1% |
| 14 | Mantsopa | 16% | 1% | 6% |
| 15 | Setsoto | 27% | 1% | 5% |
| 16 | Ubuntu | 34% | 0% | 2% |
| 17 | Enoch Mgijima | 27% | 7% | 2% |
| 18 | Dihlabeng | 30% | 3% | 2% |
| 19 | Sol Plaatjie | 6% | 0% | 0% |
| 20 | Inxuba Yethemba | 25% | 0% | 2% |
| 21 | Tswelopele | 35% | 0% | 4% |
| 22 | Emalahleni | 20% | 55% | 8% |
| 23 | Dr Beyers Naude | 63% | 1% | 6% |
| 24 | Maluti a Phofung | 35% | 8% | 3% |
| 25 | Elundini | 61% | 54% | 39% |
| 26 | Sakhisizwe | 43% | 31% | 5% |
| | Average | 31% | 7% | 6% |

*Note: Darker orange fill highlights values more than 10% above the average across the LM.*

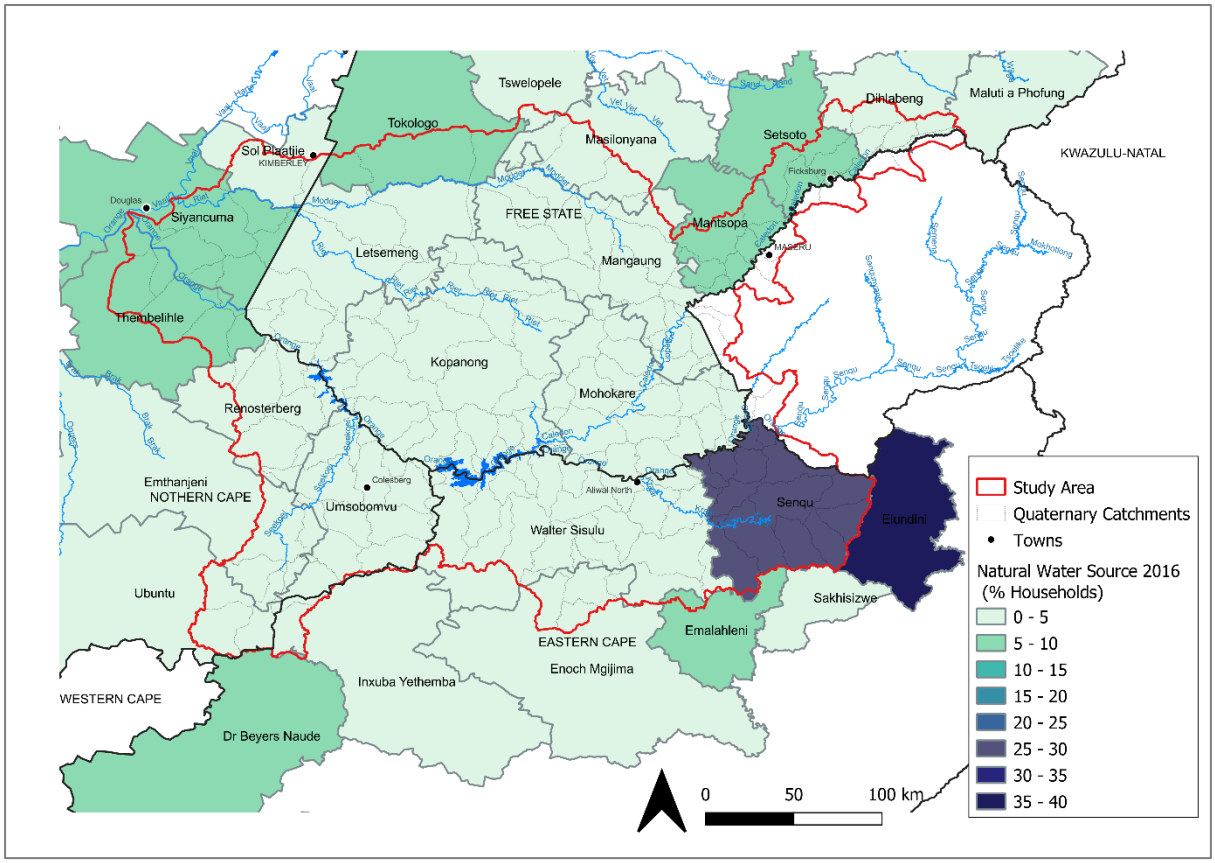


**Figure 4-3:** Spatial representation of the 'natural water source' indicator (% households), 2016, Upper Orange study area

Considering several indicators together provides nuanced insights into the vulnerability of communities to changes in river flows and quality. For example, Figure 4-4, provides an indication of the relative vulnerability of households based on an integration of the poverty (SAMPI), population density and reliance on flowing water/stream/river sources for drinking water indicators[4].

[4] A relative ranking approach was applied to integrate the indicators. The indicators are weighted equally.

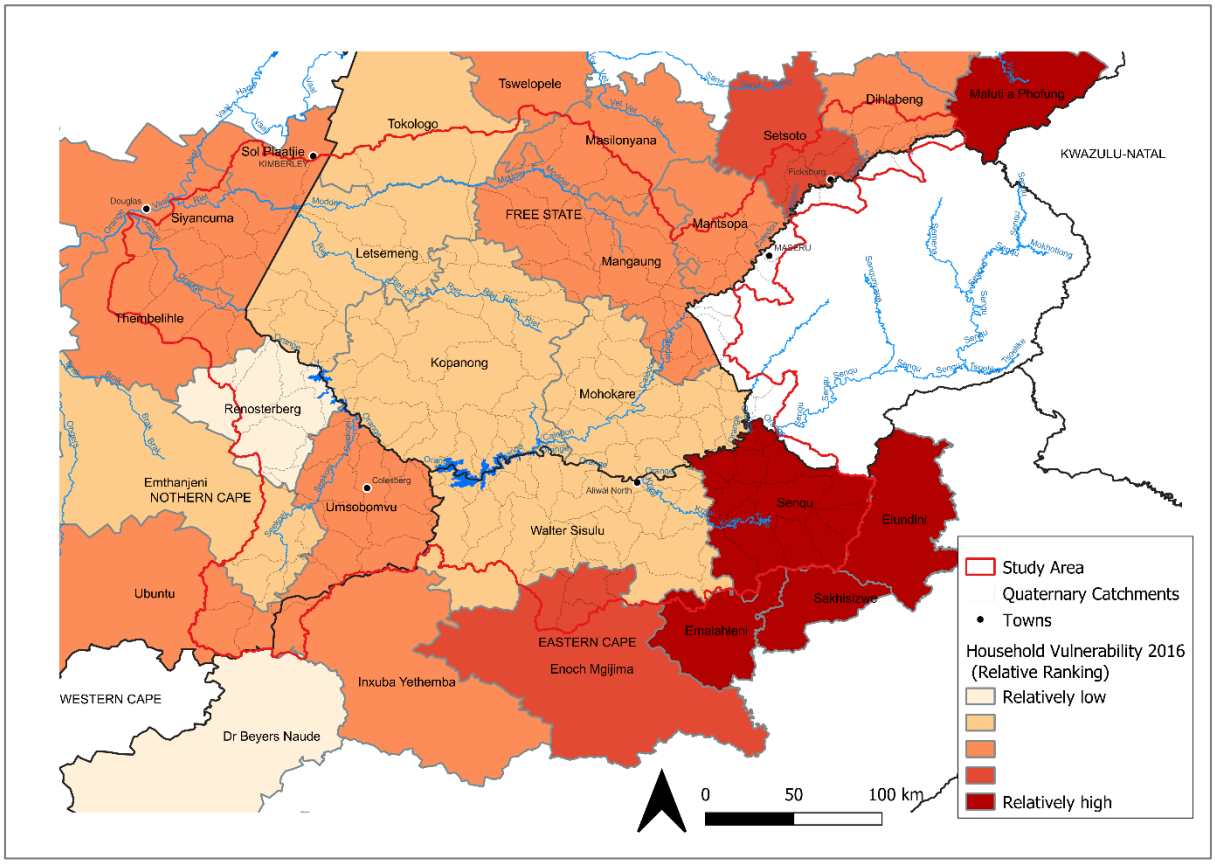


**Figure 4-4:** Spatial representation of household vulnerability to changes in water security/resources (relative ranking), 2016, Upper Orange study area

## 4.3 Overview of the economy

The characteristics of the economy of each of the LMs associated with the study area are presented in Table 4-6 (employment, size of the economy as reflected by Gross Domestic Product – GDP) and Table 4-7 (main economic sectors).

'Employed' reflects the proportion of the labour force of each LM that is employed. Labour force refers to all persons of working age, employed and unemployed. 'Formal Sector' and 'Informal Sector' indicates the proportion of those employed working in the respective sectors[5].

The GDP of a region is a measure of the market value of all goods and services produced within the region (including public services such as the police and public health care) over a period of one year. GDP is not measured at the LM scale. However, Stats SA undertook to simulate representative GDP estimates for the LM scale for the 2011 year (Stats SA, 2012). The GDP indicator in Table 4-6 reports the simulated GDP and provides an indication of the overall economic activity of each LM. GDP per capita is presented as a means to compare LMs; however, GDP is not an indication of the welfare of

[5] 'Formal Sector' and 'Informal Sector' do not sum to 100% as there are additional categories/sectors (e.g., 'Do not know' and 'Unspecified'.

the municipality or well-being of the population. 'GDP Proportion' reflects the contribution (%) of the LM to the aggregated GDP of all the LMs associated with the study area.

**Table 4-6:** Indicators of the economy of each local municipality, Upper Orange study area

| | Local municipality | Employed | Formal Sector | Informal Sector | GDP (R billion) | GDP/ capita (R) | GDP proportion |
|---|---|---|---|---|---|---|---|
| | | 2011 | 2011 | 2011 | 2011 | 2011 | 2011 |
| 1 | Kopanong | 23% | 56% | 24% | 1.7 | 35 075 | 1.2% |
| 2 | Walter Sisulu | 24% | 64% | 16% | 3.4 | 43 523 | 2.3% |
| 3 | Letsemeng | 24% | 55% | 31% | 1.9 | 48 247 | 1.3% |
| 4 | Mangaung | 28% | 69% | 13% | 58.2 | 75 120 | 40.1% |
| 5 | Mohokare | 22% | 58% | 21% | 1.0 | 28 600 | 0.7% |
| 6 | Senqu | 14% | 58% | 26% | 0.8 | 6 157 | 0.6% |
| 7 | Umsobomvu | 22% | 67% | 16% | 1.2 | 42 989 | 0.8% |
| 8 | Siyancuma | 21% | 59% | 19% | 1.3 | 35 879 | 0.9% |
| 9 | Renosterberg | 24% | 60% | 31% | 0.8 | 72 880 | 0.6% |
| 10 | Thembelihle | 25% | 69% | 20% | 0.5 | 33 473 | 0.4% |
| 11 | Tokologo | 23% | 60% | 16% | 0.5 | 17 347 | 0.3% |
| 12 | Masilonyana | 18% | 64% | 12% | 1.7 | 28 805 | 1.2% |
| 13 | Emthanjeni | 23% | 67% | 19% | 2.7 | 64 677 | 1.9% |
| 14 | Mantsopa | 23% | 63% | 18% | 2.1 | 40 980 | 1.4% |
| 15 | Setsoto | 19% | 66% | 13% | 3.5 | 31 194 | 2.4% |
| 16 | Ubuntu | 27% | 69% | 19% | 1.2 | 63 931 | 0.8% |
| 17 | Enoch Mgijima | 17% | 70% | 13% | 6.0 | 23 978 | 4.1% |
| 18 | Dihlabeng | 26% | 72% | 11% | 7.2 | 56 210 | 5.0% |
| 19 | Sol Plaatjie | 25% | 76% | 11% | 25.1 | 101 334 | 17.3% |
| 20 | Inxuba Yethemba | 26% | 75% | 13% | 2.2 | 33 008 | 1.5% |
| 21 | Tswelopele | 20% | 67% | 13% | 0.9 | 18 910 | 0.6% |
| 22 | Emalahleni | 8% | 67% | 17% | 0.5 | 3 776 | 0.3% |
| 23 | Dr Beyers Naude | 24% | 64% | 20% | 2.7 | 34 580 | 1.9% |
| 24 | Maluti a Phofung | 16% | 67% | 20% | 16.6 | 49 385 | 11.4% |
| 25 | Elundini | 10% | 65% | 23% | 1.1 | 7 959 | 0.8% |
| 26 | Sakhisizwe | 14% | 63% | 24% | 0.4 | 5 792 | 0.2% |
| | Average | 21% | 65% | 18% | 5.6 | 38 608 | - |
| | Free State | 24% | 69% | 14% | 153.3 | 53 039 | - |
| | Eastern Cape | 16% | 72% | 14% | 219.2 | 33 718 | - |
| | Northern Cape | 25% | 72% | 15% | 65.3 | 57 751 | - |
| | South Africa | 25% | 74% | 12% | 2 917.5 | 56 107 | - |

*Note: GDP Proportion refers to the proportional contribution of the local municipal GDP relative to the total of all the LMs within the study area. Orange fill highlights values lower than 10% below the average across the LMs. Blue fill indicates the highest (darker blue) and lowest (lighter blue) three values.*

Table 4-7 identifies the three main economic sectors (by GDP contribution) of each LM and the key local economic development focus areas. By GDP contribution, 'Government and community services' and 'Finance, insurance, real estate and business services' are the major sectors; however, agriculture and mining are key economic activities for many of the LMs in the study area (see section 4.4). Agriculture related activities often account for a relatively larger contribution to employment than other sectors.

**Table 4-7:** Major economic sectors and local economic development focus areas by local municipality, Upper Orange study area

| | Local municipality | Three major economic sectors | Local economic development focus areas |
|---|---|---|---|
| | | 2016 | Latest available IDP Report |
| 1 | Kopanong | Government and community services. Wholesale and retail trade, catering and accommodation. Agriculture, forestry and fishing. | Tourism associated with Gariep Dam. Agriculture, especially livestock farming (Agri-park in Springfontein). Mining (Jagersfontein and Edenburg). |
| 2 | Walter Sisulu | Government and community services. Finance, insurance, real estate and business services. Wholesale and retail trade, catering and accommodation. | Agriculture and land reform. Tourism (Gariep Dam, Game reserves). Renewable energy. Fishing (development of infrastructure). |
| 3 | Letsemeng | Government and community services. Mining and quarrying. Wholesale and retail trade, catering and accommodation. | Agriculture (beneficiation potential of the Vanderkloof dam and Riet River irrigation networks). Game Farms. Tourism - Vanderkloof Dam and the Rolfontein nature reserve as tourism node; Historical and cultural experiences; main road routes. Renewable energy. |
| 4 | Mangaung | Government and community services. Finance, insurance, real estate and business services. Wholesale and retail trade, catering and accommodation. | Mining (minerals value addition, production of fuel from shale gas, salt repackaging, salt lakes and salt bars). Agro-industrial development. Tourism. |
| 5 | Mohokare | Wholesale and retail trade, catering and accommodation. Government and community services. Finance, insurance, real estate and business services. | Agriculture (irrigated). Tourism (Orange River, heritage sites, nature reserves (Vulture Conservation Area, Tussen-die-Riviere and Oviston), game lodges). |
| 6 | Senqu | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Mining (sandstone for bricks). Renewable energy. Agriculture (agri-parks, new crops). Tourism (historical, adventure/outdoor). |
| 7 | Umsobomvu | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Renewable energy. Agriculture (agri-service centres). Tourism (Gariep Dam). |
| 8 | Siyancuma | Government and community services. Agriculture, forestry and fishing. Wholesale and retail trade, catering and accommodation. | Agriculture and agro-processing. Manufacturing. Tourism. Wholesale and retail. Mining and value adding. |
| 9 | Renosterberg | Government and community services. Agriculture, forestry and fishing. Wholesale and retail trade, catering and accommodation. | Energy. Manufacturing. Agriculture and agro-processing. Wholesale and retail. Mining (semi-precious stones) and value adding – beneficiation. Tourism. |
| 10 | Thembelihle | Government and community services. Agriculture, forestry and fishing. Wholesale and retail trade, catering and accommodation. | Mining. Renewables. Agriculture. Tourism. |
| 11 | Tokologo | Government and community services. Wholesale and retail trade, catering and accommodation. Agriculture, forestry and fishing. | Mining. Renewables. Agriculture. Tourism. Game farms (marketing). |

| | Local municipality | Three major economic sectors | Local economic development focus areas |
|---|---|---|---|
| | | 2016 | Latest available IDP Report |
| 12 | Masilonyana | Mining and quarrying. Wholesale and retail trade, catering and accommodation. Government and community services. | Tourism - route development, growth in the heritage sector, promotion of underground mine tours. Transport. Community agricultural development. |
| 13 | Emthanjeni | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Renewable energy. Grow 'Karoo' mutton supply. Manufacturing and warehousing. Tourism - restore existing attractions. |
| 14 | Mantsopa | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Agriculture. Tourism. Commercial (retail). |
| 15 | Setsoto | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Informal Sector. Agricultural Sector - small-scale, youth. Home and commonage gardens. Tourism - attractions, corridors/routes, marketing. |
| 16 | Ubuntu | Government and community services. Agriculture, forestry and fishing. Wholesale and retail trade, catering and accommodation. | Tourism - disadvantaged communities, marketing. Agriculture & Agri-processing. Industry. Commerce. |
| 17 | Enoch Mgijima | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Rural Development and Agrarian Reform - co-operatives. Tourism and heritage. Economic corridors (along road routes). Molteno (within UO area) - livestock farming, lucerne production, brick-making, light industry, tourism - Molteno dam. |
| 18 | Dihlabeng | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | SMME - market linkages, value adding and packaging, leather tannery. Agriculture - Agro-processing, agro-tourism (considered developed to its optimum concerning agriculture production - limited further development). Tourism – scenery, recreation, heritage (Clarens and Golden Gate NP). Transport. |
| 19 | Sol Plaatjie | Government and community services. Finance, insurance, real estate and business services. Wholesale and retail trade, catering and accommodation. | Agriculture and Agro-processing - agri-parks, Sol Plaatjie as a rural-urban market centre, small-scale farming. Mining - small-scale miners. Tourism attraction and promotion. Manufacturing and beneficiation. Knowledge economy and Information and Communication Technology - Sol Plaatjie University. |
| 20 | Inxuba Yethemba | Government and community services. Finance, insurance, real estate and business services. Wholesale and retail trade, catering and accommodation. | Agricultural - sugar beet initiative. Tourism - attraction and retention of major events. SMME. Commercial and industrial - emerging construction companies. (Water from Fish River as an opportunity to support LED). |

| | Local municipality | Three major economic sectors | Local economic development focus areas |
|---|---|---|---|
| | | 2016 | Latest available IDP Report |
| 21 | Tswelopele | Government and community services. Wholesale and retail trade, catering and accommodation. Agriculture, forestry and fishing. | Agriculture and agri-park development - aligned to the broader Lejweleputswa focus. Informal sector trading - support and permits. |
| 22 | Emalahleni | Mining and quarrying. Manufacturing. Electricity, gas and water. | Trade. Tourism. Land administration and tenure security - land for economic development. Agricultural production (Community vegetable gardens). Monitor and maintain the irrigation scheme, sheep farming, and maize production) and appropriate agro-processing. Mining. |
| 23 | Dr Beyers Naude | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Agriculture. Manufacturing. Trade and construction. Tourism. |
| 24 | Maluti a Phofung | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Agriculture - small-scale and emerging farmers, existing and new agro-projects, and new agricultural opportunities. Mining - formalise small-scale operations and expansion. Manufacturing - expansion. Tourism - events, new products, marketing. |
| 25 | Elundini | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Micro-enterprises and the informal economy - priority. Agriculture - diversification and agro-food processing. Non-farm product business - forest/timber-based, mineral-based, arts and crafts. Renewable energy. |
| 26 | Sakhisizwe | Government and community services. Wholesale and retail trade, catering and accommodation. Finance, insurance, real estate and business services. | Agriculture - sheep and cattle potential, dry-land maize potential, improved efficiency of irrigation schemes (limited expansion potential), hydroponics, biofuels. Tourism - corridor development, game farms, nature reserves, heritage sites. |

*Note: Blue fill highlights those LMs where a primary sector (Agriculture, forestry and fishing / Mining and quarrying) is one of the three major economic sectors.*

## 4.4 Land-use and related economic activities

Sub-sections 4.4.1 to 4.4.3 present indicators of land-use and related economic activities within the Upper Orange study area. The water use of various sectors is reported in section 4.5.1 based on registered water use data.

### *4.4.1 Land cover*

The land cover indicators reflect the proportional representation (% of total) of selected land cover types for each of the LMs associated with the study area. The proportion of land cover types was derived from the South African National Land-Cover dataset for 2020.

Table 4-8 presents the proportion of each of the broad (level 1)[6] land cover classes for each LM. Table 4-9 provides further detail on the 'Cultivated' land type including the proportion of cultivated area classed as 'Commercial annual crops irrigated' and 'Subsistence / small-scale annual crops'. These two indicators are also represented spatially in Figure 4-5 and Figure 4-6, respectively. Agricultural water use is addressed in section 4.5.1 based on registered water use data.

Table 4-10 provides further detail on the 'Built-up' class.

Table 4-11 identifies important water-related land-use/infrastructure features of the Upper Orange study area and the associated economic activities.

[6] The National Land Cover data has a hierarchal structure: 73 types; a Level 2 aggregation to 24 classes; and a Level 1 aggregation to 9 classes.

**Table 4-8:** National Land Cover 2020, 'level 1' classes (proportion) by local municipality, Upper Orange study area

| | Local municipality | Area of LM ($km^2$) | Forested land | Shrubland | Grassland | Waterbodies | Wetlands | Barren land | Cultivated | Built-up | Mines & quarries |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 15 663 | 4.21% | 7.73% | 79.08% | 1.55% | 0.41% | 1.54% | 5.13% | 0.31% | 0.05% |
| 2 | Walter Sisulu | 13 281 | 1.85% | 9.74% | 74.34% | 1.83% | 0.94% | 3.05% | 7.86% | 0.37% | 0.02% |
| 3 | Letsemeng | 9 841 | 4.33% | 11.60% | 62.05% | 0.73% | 0.64% | 2.46% | 17.80% | 0.31% | 0.09% |
| 4 | Mangaung | 9 899 | 5.65% | 0.17% | 58.34% | 1.04% | 1.13% | 2.29% | 26.47% | 4.71% | 0.20% |
| 5 | Mohokare | 8 785 | 6.14% | 0.50% | 74.13% | 0.69% | 1.02% | 3.29% | 13.81% | 0.38% | 0.04% |
| 6 | Senqu | 7 336 | 2.88% | 0.02% | 72.07% | 0.19% | 0.63% | 14.10% | 7.73% | 2.36% | 0.01% |
| 7 | Umsobomvu | 6 820 | 0.30% | 56.24% | 37.62% | 0.50% | 2.69% | 1.26% | 1.14% | 0.24% | 0.01% |
| 8 | Siyancuma | 16 775 | 4.44% | 45.66% | 44.27% | 0.23% | 0.02% | 2.61% | 2.18% | 0.27% | 0.34% |
| 9 | Renosterberg | 5 535 | 0.36% | 64.41% | 27.77% | 1.09% | 0.75% | 4.16% | 1.19% | 0.25% | 0.02% |
| 10 | Thembelihle | 8 033 | 0.79% | 58.83% | 34.49% | 0.54% | 0.22% | 2.52% | 2.22% | 0.19% | 0.19% |
| 11 | Tokologo | 9 339 | 9.30% | 1.67% | 63.00% | 0.31% | 0.37% | 1.02% | 23.87% | 0.31% | 0.13% |
| 12 | Masilonyana | 6 627 | 6.34% | 0.13% | 61.89% | 0.73% | 0.31% | 0.61% | 29.28% | 0.52% | 0.19% |
| 13 | Emthanjeni | 13 485 | 0.48% | 83.22% | 7.77% | 0.16% | 0.46% | 6.27% | 1.20% | 0.37% | 0.05% |
| 14 | Mantsopa | 4 296 | 3.62% | 0.00% | 45.62% | 0.66% | 1.01% | 4.45% | 43.80% | 0.81% | 0.03% |
| 15 | Setsoto | 5 439 | 3.00% | 0.02% | 43.76% | 0.32% | 1.10% | 4.05% | 46.63% | 1.08% | 0.04% |
| 16 | Ubuntu | 20 410 | 0.29% | 84.82% | 4.03% | 0.08% | 0.14% | 9.81% | 0.70% | 0.12% | 0.02% |
| 17 | Enoch Mgijima | 13 595 | 7.40% | 6.43% | 74.60% | 0.36% | 1.90% | 2.62% | 5.28% | 1.39% | 0.02% |
| 18 | Dihlabeng | 4 875 | 3.29% | 0.00% | 48.56% | 0.43% | 2.09% | 3.15% | 41.12% | 1.32% | 0.04% |
| 19 | Sol Plaatjie | 3 150 | 5.74% | 3.50% | 82.52% | 0.62% | 0.07% | 0.78% | 2.79% | 2.54% | 1.45% |
| 20 | Inxuba Yethemba | 11 672 | 2.57% | 35.22% | 55.62% | 0.30% | 0.87% | 1.50% | 3.60% | 0.32% | 0.01% |
| 21 | Tswelopele | 6 534 | 8.33% | 0.46% | 31.03% | 2.15% | 0.80% | 0.32% | 56.41% | 0.48% | 0.02% |
| 22 | Emalahleni | 3 487 | 5.14% | 0.17% | 63.82% | 0.79% | 0.10% | 4.84% | 18.92% | 6.19% | 0.02% |
| 23 | Dr Beyers Naude | 28 669 | 3.36% | 54.54% | 19.75% | 0.16% | 0.56% | 20.07% | 1.20% | 0.36% | 0.02% |
| 24 | Maluti a Phofung | 4 344 | 2.34% | 0.00% | 63.50% | 1.79% | 1.21% | 1.98% | 25.27% | 3.88% | 0.03% |
| 25 | Elundini | 5 024 | 13.55% | 0.00% | 64.55% | 0.20% | 2.26% | 1.27% | 13.45% | 4.71% | 0.01% |
| 26 | Sakhisizwe | 2 320 | 10.63% | 0.00% | 66.34% | 0.13% | 1.11% | 1.32% | 17.00% | 3.43% | 0.05% |
| | All | 245 234 | 3.90% | 29.95% | 46.98% | 0.61% | 0.76% | 5.62% | 11.15% | 0.95% | 0.09% |

*Note: 'All' reflects the total area of all the LMs associated with the study area (portions of certain of the LMs extend outside of the UO boundary).*

**Table 4-9:** National Land Cover 2020, 'Cultivated' classes (proportions) by local municipality, Upper Orange study area

| | Local municipality | Area cultivated (km²) | Commercial annual crops irrigated | Commercial annual crops rain-fed / dryland | Commercial permanent orchards & vines (often irrigated) | Fallow land & old fields | Subsistence / small-scale annual crops |
|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 804 | 11.77% | 73.20% | 0.11% | 14.92% | 0.00% |
| 2 | Walter Sisulu | 1 044 | 16.46% | 58.06% | 0.17% | 25.30% | 0.01% |
| 3 | Letsemeng | 1 751 | 25.66% | 57.59% | 0.46% | 16.29% | 0.00% |
| 4 | Mangaung | 2 620 | 5.72% | 74.09% | 0.04% | 9.01% | 11.14% |
| 5 | Mohokare | 1 213 | 6.64% | 77.01% | 0.47% | 15.88% | 0.00% |
| 6 | Senqu | 567 | 20.67% | 40.19% | 0.01% | 11.09% | 28.04% |
| 7 | Umsobomvu | 78 | 26.44% | 40.85% | 0.00% | 32.71% | 0.00% |
| 8 | Siyancuma | 365 | 75.94% | 7.61% | 2.86% | 13.59% | 0.00% |
| 9 | Renosterberg | 66 | 64.81% | 9.37% | 0.00% | 25.82% | 0.00% |
| 10 | Thembelihle | 179 | 86.32% | 4.60% | 0.76% | 8.32% | 0.00% |
| 11 | Tokologo | 2 230 | 16.19% | 60.17% | 0.13% | 23.52% | 0.00% |
| 12 | Masilonyana | 1 940 | 3.49% | 87.72% | 0.00% | 8.79% | 0.00% |
| 13 | Emthanjeni | 162 | 3.22% | 23.66% | 0.00% | 71.04% | 2.08% |
| 14 | Mantsopa | 1 882 | 1.93% | 86.29% | 0.01% | 11.70% | 0.07% |
| 15 | Setsoto | 2 536 | 1.52% | 91.36% | 0.02% | 7.05% | 0.05% |
| 16 | Ubuntu | 142 | 7.71% | 20.16% | 4.90% | 67.23% | 0.00% |
| 17 | Enoch Mgijima | 718 | 9.94% | 39.01% | 0.04% | 31.82% | 19.19% |
| 18 | Dihlabeng | 2 004 | 1.91% | 90.61% | 0.11% | 7.37% | 0.00% |
| 19 | Sol Plaatjie | 88 | 66.78% | 6.60% | 0.00% | 26.62% | 0.00% |
| 20 | Inxuba Yethemba | 420 | 51.67% | 29.78% | 0.46% | 16.85% | 1.24% |
| 21 | Tswelopele | 3 686 | 7.64% | 85.46% | 0.08% | 6.82% | 0.00% |
| 22 | Emalahleni | 660 | 1.47% | 22.16% | 0.00% | 13.93% | 62.44% |
| 23 | Dr Beyers Naude | 343 | 14.41% | 57.87% | 0.27% | 27.26% | 0.18% |
| 24 | Maluti a Phofung | 1 098 | 2.05% | 77.18% | 0.05% | 20.31% | 0.41% |
| 25 | Elundini | 676 | 3.83% | 28.94% | 0.05% | 13.12% | 54.05% |
| 26 | Sakhisizwe | 394 | 2.11% | 44.77% | 0.00% | 23.33% | 29.79% |
| | All | 27 345 | 10.37% | 69.85% | 0.18% | 14.09% | 5.51% |

*Note: 'All' reflects the total area of all the LMs associated with the study area (portions of some of the LMs extend outside of the UO boundary). Orange fill highlights the five largest areas of cultivation. Blue fill highlights the five LMs with the highest proportions of 'Commercial annual crops irrigated' and 'Subsistence/small-scale annual crops'.*

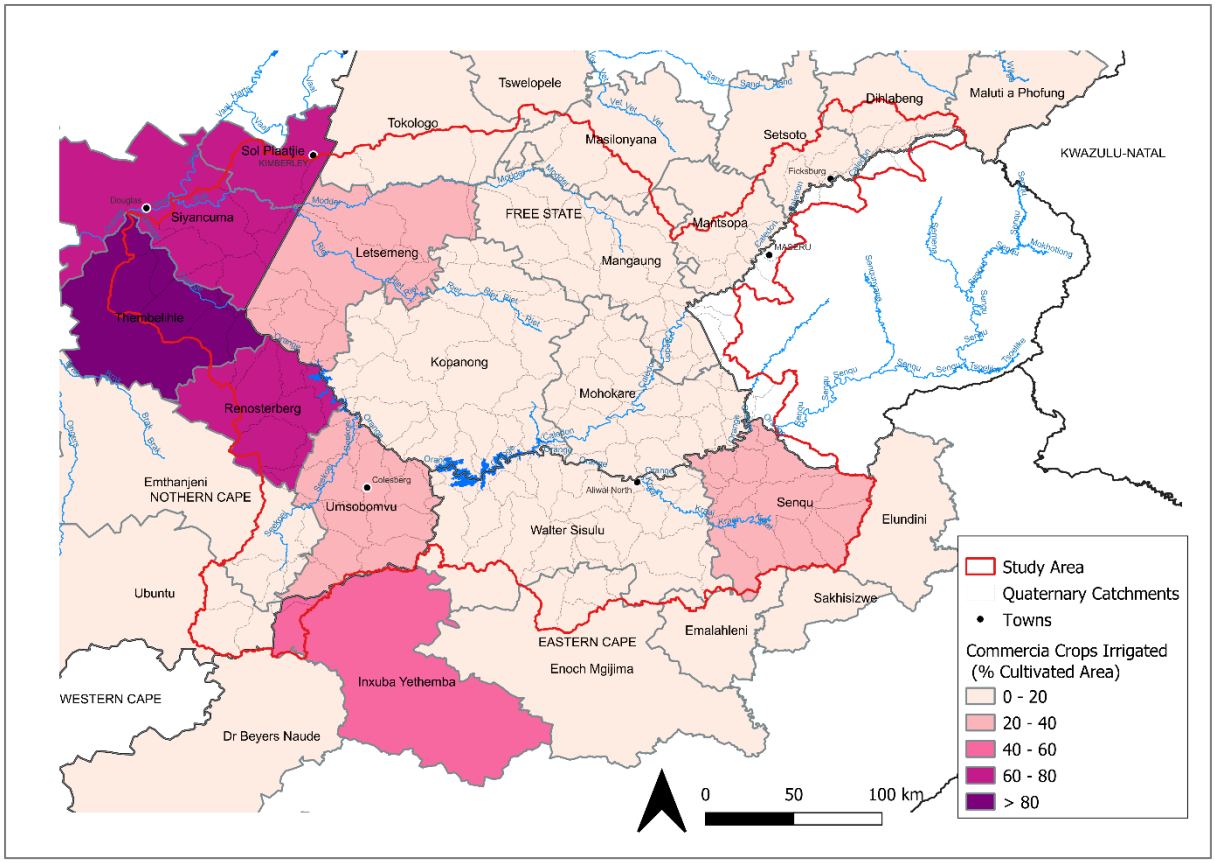


**Figure 4-5:** Spatial representation of the proportion of cultivated area classed as 'Commercial annual crops irrigated', National Land Cover 2020, Upper Orange study area

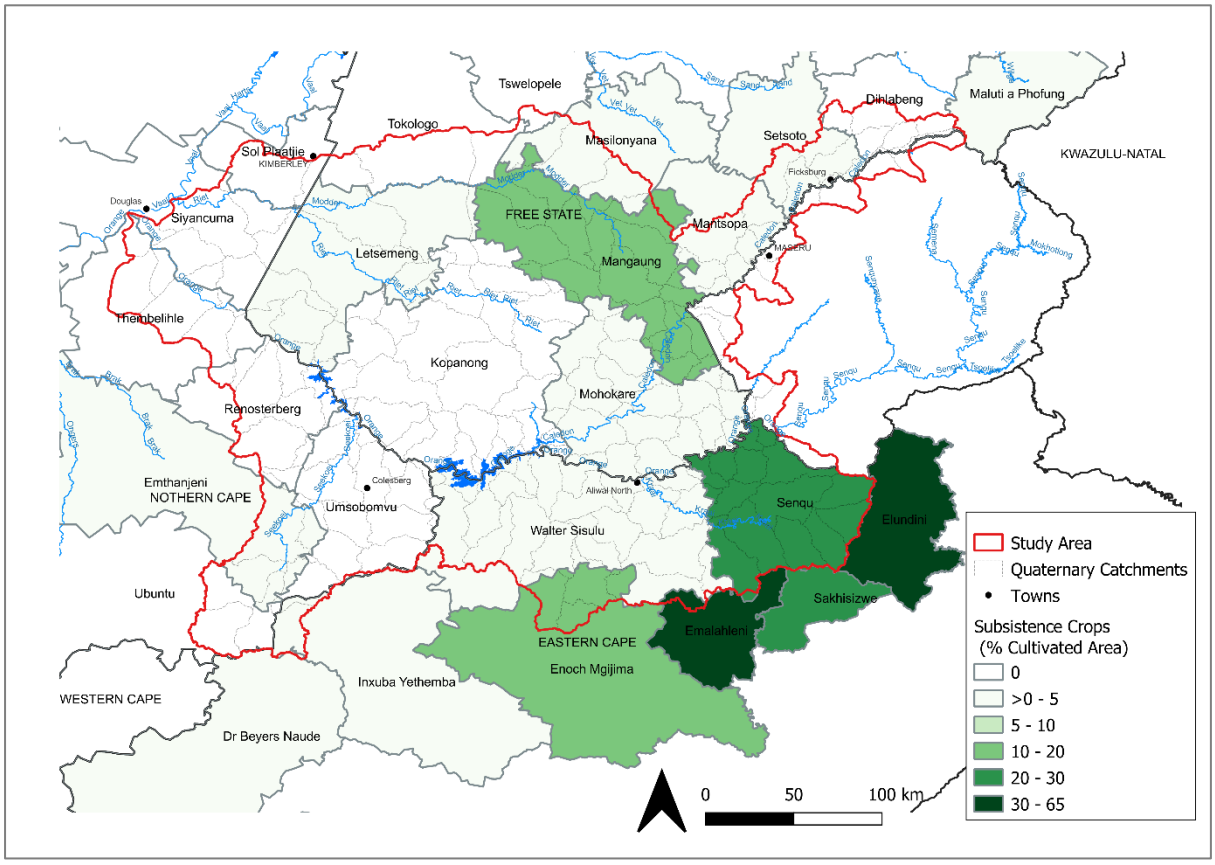


**Figure 4-6**: Spatial representation of the proportion of cultivated area classed as 'Subsistence / small-scale annual crops', National Land Cover 2020, Upper Orange study area

**Table 4-10:** National Land Cover 2020, 'Built-up' classes (proportions) by local municipality, Upper Orange study area

| | Local municipality | Area built-up ($km^2$) | Commercial | Industrial | Residential | Small-holdings | Transport | Urban Vegetation (recreation) | Village |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 49 | 2.79% | 0.57% | 30.98% | 5.00% | 34.31% | 4.50% | 21.86% |
| 2 | Walter Sisulu | 49 | 2.26% | 3.84% | 57.58% | 0.00% | 18.06% | 1.34% | 16.93% |
| 3 | Letsemeng | 30 | 2.40% | 2.40% | 30.99% | 0.93% | 38.47% | 2.63% | 22.18% |
| 4 | Mangaung | 466 | 3.87% | 3.33% | 40.10% | 43.25% | 3.69% | 1.88% | 3.87% |
| 5 | Mohokare | 33 | 1.35% | 1.12% | 30.57% | 0.00% | 42.78% | 3.17% | 21.01% |
| 6 | Senqu | 173 | 0.23% | 0.31% | 81.59% | 0.00% | 5.89% | 0.06% | 11.91% |
| 7 | Umsobomvu | 17 | 6.72% | 4.91% | 41.94% | 0.99% | 18.38% | 5.81% | 21.24% |
| 8 | Siyancuma | 44 | 1.66% | 7.48% | 17.29% | 0.59% | 54.00% | 1.04% | 17.93% |
| 9 | Renosterberg | 14 | 3.27% | 12.71% | 27.06% | 0.00% | 40.51% | 0.33% | 16.13% |
| 10 | Thembelihle | 15 | 5.27% | 5.50% | 21.98% | 2.31% | 41.80% | 0.76% | 22.38% |
| 11 | Tokologo | 29 | 2.79% | 5.47% | 23.88% | 1.89% | 46.37% | 0.61% | 18.99% |
| 12 | Masilonyana | 35 | 2.80% | 2.61% | 39.81% | 3.32% | 29.07% | 2.38% | 20.01% |
| 13 | Emthanjeni | 50 | 3.78% | 25.75% | 20.48% | 0.02% | 37.68% | 2.92% | 9.38% |
| 14 | Mantsopa | 35 | 2.55% | 1.56% | 35.52% | 0.00% | 32.43% | 5.40% | 22.53% |
| 15 | Setsoto | 59 | 3.21% | 6.21% | 40.15% | 0.96% | 23.51% | 4.78% | 21.17% |
| 16 | Ubuntu | 25 | 2.77% | 2.15% | 21.33% | 0.00% | 48.44% | 3.04% | 22.26% |
| 17 | Enoch Mgijima | 190 | 1.42% | 0.74% | 77.25% | 4.03% | 4.89% | 0.82% | 10.85% |
| 18 | Dihlabeng | 64 | 3.69% | 8.50% | 41.69% | 11.77% | 7.79% | 4.69% | 21.87% |
| 19 | Sol Plaatjie | 80 | 10.89% | 9.35% | 58.29% | 5.91% | 9.56% | 2.68% | 3.33% |
| 20 | Inxuba Yethemba | 37 | 4.58% | 4.96% | 69.03% | 0.00% | 4.86% | 0.78% | 15.78% |
| 21 | Tswelopele | 31 | 2.81% | 3.06% | 26.25% | 2.91% | 40.15% | 3.21% | 21.61% |
| 22 | Emalahleni | 216 | 0.21% | 0.02% | 86.09% | 0.03% | 1.69% | 0.02% | 11.93% |
| 23 | Dr Beyers Naude | 102 | 2.31% | 2.64% | 43.88% | 0.66% | 37.15% | 0.32% | 13.02% |
| 24 | Maluti a Phofung | 168 | 3.26% | 2.50% | 85.57% | 0.75% | 2.34% | 1.40% | 4.18% |
| 25 | Elundini | 237 | 0.04% | 0.09% | 84.20% | 0.00% | 1.21% | 0.15% | 14.32% |
| 26 | Sakhisizwe | 80 | 0.36% | 0.15% | 80.98% | 0.97% | 2.21% | 0.55% | 14.78% |
| | All | 2 323 | 2.45% | 3.02% | 59.29% | 9.83% | 12.19% | 1.48% | 11.75% |

*Note: 'All' reflects the total area of all the LMs associated with the study area (portions of some of the LMs extend outside of the UO boundary).*

**Table 4-11:** Important water-related land-use/infrastructure features and associated economic activities, Upper Orange study area

| Feature | Economic/ Livelihood activity |
|---|---|
| **Hydroelectric Power Generation – run-of-river.**<br>Dams owned and operated by DWS. Power stations owned and operated by Eskom.<br>Gariep Dam power station (1971, 1976)<br>• Walter Sisulu LM; quaternaries D34A, D35K.<br>Vanderkloof Dam power station (1977)<br>• Renosterberg LM; quaternaries D31E, D33A. | **Power generation**<br>Supply electricity during peak and emergency demand periods (peaking stations). Provide base load energy when excess water poses a flood risk.<br>• Gariep power station – 360 MW capacity.<br>• Vanderkloof power station (1977) – 240 MW capacity. |
| **Irrigation schemes**[7]<br>Consist largely of a series of weirs and canals.<br>• Orange-Riet (Riet River Settlement) and Orange-Riet Canal.<br>• Leeu River (Armenia Dam).<br>• Modder River (Krugersdrift Dam).<br>• Orange River (Gariep Dam, Vanderkloof Dam and Orange-Fish Tunnel).<br>• Orange River (Vanderkloof Canals).<br>• Riet River (Kalkfontein Dam).<br>• Wittespruit (Egmont Dam).<br>• Douglas Irrigation Scheme. | **Agriculture**<br>Provide irrigation and water for livestock to riparian farmers.<br><br>Irrigational use makes-up 78% of the registered water-use in the Upper Orange study area (the year 2021).<br><br>Gariep Transfer Project (proposed increase) – would support expansion of existing irrigated agriculture in the Eastern Cape (Chris Hani District Municipality) – 7600 hectares potential. |
| **Arid-Innovation Region**<br>Affected LMs:<br>Enoch Mgijima, Walter Sisulu, Kopanong, Letsemeng, Emthanjeni, Renosterberg, Siyancuma, Sol Plaatjie, Thembelihle, Ubuntu, Umsobomvu, Dr Beyers Naude, Inxuba Yethemba. | **Economic development**<br>Region identified as significantly vulnerable to future climate change trends, notably (1) higher temperatures and (2) less rainfall in large parts of the region. Requires a consolidated response.<br>Key characteristics: under constant threat from limited availability of water; most of the towns are heavily reliant on a single economic sector, typically agriculture or mining.<br>A potential change in the economic base required in response to climate change. |
| **Gariep Dam - Aquaculture Technology Demonstration Centre and fish hatchery**<br>• Located in Bethulie (Kopanong LM) next to the Gariep Dam, receives its water supply from the Orange River (quaternary drainage region D35B).<br>• The centre is an upgrade (in the year (2013) of the previous Nature Conservation Gariep Dam Hatchery. | **Local economic development - aquaculture**<br>Associated with the production and distribution of fingerlings to government-community aquaculture projects in the small towns of Bethulie, Zastron, Springfontein, Koffiefontein, Fauresmith and Petrusberg.<br>Aquaculture is identified as a small-town economic enterprise development option for several of the local municipalities of the Upper Orange area.<br>Current operational status unclear. |
| **Gariep and Vanderkloof Dams, associated nature reserves and rivers of the study area** | **Tourism**<br>The water resources of the study area support existing tourism. Tourism is identified as a key potential driver of economic development within many of the local municipalities of the Upper Orange area. |

[7] Irrigation schemes identified from the Orange-Senqu River Awareness Kit V2.0 and analysis of the registered water user's data for the Upper Orange area (year 2021).

| Feature | Economic/ Livelihood activity |
|---|---|
| **Strategic Water Source Areas (SWSAs)[8]**<br><br>See Figure 4-7<br>• Surface Water (SWSA-SW): (1) Portion of Eastern Cape Drakensberg (National importance) - parts of Senqu and Elundini municipalities.<br>• Groundwater (SWSA-GW) – (1) Central Pan Belt (National importance) - parts of Letsemeng, Kopanong and Mangaung municipalities; (2) Portion of De Aar Region SWSA-GW (National importance) - Emthanjeni municipality, (3) Portion of Eastern Upper Karoo SWSA-GW (Sub-national importance) – parts of Umsobomvu, Inxuba Yethemba and Dr Beyers Naude municipalities. | **Households, livelihoods, economic activity and development potential**<br>Nationally, water produced by SWSAs disproportionally supports the population and the economy (including irrigated agriculture) – impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream (Le Maitre et al., 2018). High rainfall areas with a substantial water storage capacity and/or high groundwater recharge are particularly important because they continue to produce water during dry seasons and droughts. This is especially critical for people who depend directly on rivers and groundwater for their water and for other ecosystem services.<br><br>Characteristics of the Central Pan Belt (which falls entirely within the study area) (Le Maitre et al., 2018):<br>• Municipal sole groundwater supply towns: Petrusburg Town Area: approximate population of 7 014.<br>• Agricultural GW use as a % total water use by agriculture within the SWSA-GW: 92%.<br>• Industrial GW use as a % total water use by industry within the SWSA-GW: 96.5%,<br>• GW vulnerability: 91.6% of the SWSA area is classified as 'low vulnerability'.<br>• Drought risk: 70.5% of the SWSA area is classified as 'moderate drought risk'. |

[8] Defined as areas of land that either: (a) supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b) (Le Maitre et al., 2018).

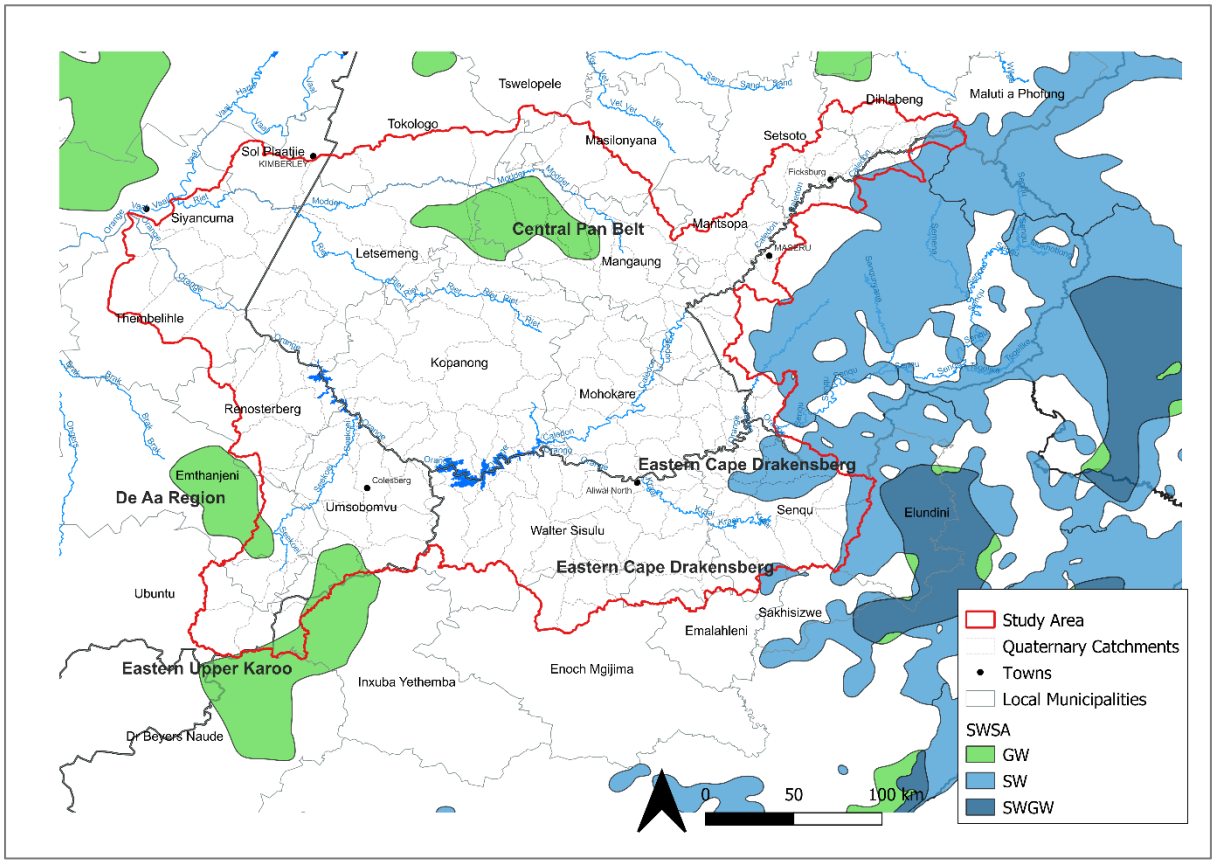


**Figure 4-7:** Strategic Water Source Areas (SWSA), Upper Orange study area

*Note: 'GW' is Groundwater, 'SW' is Surface Water.*

### *4.4.2 Gross Value Added (GVA) – primary sector*

Primary sector economic activities are most directly related to land-use. In the Upper Orange catchment area, the primary sector consists of the Agriculture, Forestry and Fishing and Mining and Quarrying sectors. Gross Value Added (GVA) is a measure of the 'size' of an economic sector. Sector GVA is a measure of the output of a region (total production) in terms of the value that was created within that region. Those regions with larger Agriculture, Forestry and Fishing and Mining and Quarrying sectors are relatively more vulnerable to changes in water resources and water security in terms of greater economic impact.

This section presents an indicator of GVA for the Agriculture, Forestry and Fishing and Mining and Quarrying sectors for the LMs associated with the study area. Quarrying reflects only formal activities and the figures do not include informal activities (e.g., informal sand mining). While tourism is often also closely related to land use, there is no designated tourism sector[9]. Tourism activities are captured under the broad category of trade and GVA is not measured explicitly for tourism. Tourism features of the Upper Orange catchment are addressed in section 4.6.

The GVA indicator values for the study area were synthesized from a national dataset (CSIR, 2018) of spatially and temporally aligned socio-economic data developed to support planning, particularly at a local level. To create the dataset, socio-economic data were aligned to a 'mesozone' spatial unit[10]. The Mesozone Set is a demarcation of South Africa into a complete grid of 25 000 spatial units. The mesozones are not uniform in shape, but aim to be approximately the same size (~50km$^2$), and fit completely within municipal boundaries (CSIR, 2018).

Table 4-12 presents the economic production value indicator, based on GVA aligned to the mesozone unit[11]. The values reflect the GVA indicator for the entire LM (aggregated mesozone data). The indicator is represented spatially in Figure 4-8 for the Agriculture, Forestry and Fishing sector (AgGVA) and Figure 4-9 for the Mining and Quarrying sector (MiningGVA).

A significant proportion of the study area falls within the Arid Innovation Region classification (Table 4-11), which identifies regions significantly vulnerable to future climate change trends, notably higher temperatures and less rainfall. Areas with larger agricultural sectors that also fall within the Arid Innovation Region are relatively more vulnerable to changes in water resources. For example, it is apparent from Figure 4-8, that Mangaung, Kopanong and Siyancuma have relatively higher Agriculture, Forestry and Fishing GVA, while also being identified as significantly vulnerable to future climate change trends.

[9] As per the sector classifications standard adopted by Stats SA and applied in South Africa.

[10] The various socio-economic datasets are assigned to spatial units (the mesozones) based on an algorithm developed by the CSIR following the principles of dasymetric mapping (CSIR, 2018).

[11] Owing to the transformation in the data through the spatial alignment process, the indicator does not reflect absolute GVA, but rather reflects ratio data (CSIR, 2018). It is a sound indicator of economic production by sector within a particular mesozone that can be used to compare a mesozone with other mesozones across space (spatial comparison) and to compare a mesozone with itself over time (temporally) (CSIR, 2018).

**Table 4-12:** The gross value added (GVA, R million) of the Agriculture, Forestry and Fishing and Mining and Quarrying sectors by local municipality, Upper Orange study area

| | Local municipality | GVA Indicator Agriculture, Forestry and Fishing (R million) | | | GVA Indicator Mining and Quarrying (R million) | | |
|---|---|---|---|---|---|---|---|
| | | 2011 | 2016 | Change | 2011 | 2016 | Change |
| 1 | Kopanong | 273 | 204 | ▼ | 0 | 0 | |
| 2 | Walter Sisulu | 150 | 141 | | 2 | 3 | ▲ |
| 3 | Letsemeng | 234 | 177 | ▼ | 247 | 270 | |
| 4 | Mangaung | 580 | 456 | ▼ | 300 | 348 | ▲ |
| 5 | Mohokare | 157 | 113 | | 68 | 113 | ▲ |
| 6 | Senqu | 92 | 88 | | 0 | 0 | |
| 7 | Umsobomvu | 73 | 77 | | 0 | 0 | |
| 8 | Siyancuma | 260 | 269 | | 133 | 141 | |
| 9 | Renosterberg | 50 | 51 | | 0 | 0 | |
| 10 | Thembelihle | 93 | 95 | | 21 | 19 | |
| 11 | Tokologo | 222 | 209 | | 44 | 47 | |
| 12 | Masilonyana | 212 | 163 | ▼ | 1 030 | 931 | |
| 13 | Emthanjeni | 86 | 90 | | 7 | 8 | |
| 14 | Mantsopa | 244 | 184 | ▼ | 0 | 0 | |
| 15 | Setsoto | 467 | 360 | ▼ | 27 | 33 | ▲ |
| 16 | Ubuntu | 121 | 127 | | 0 | 0 | |
| 17 | Enoch Mgijima | 164 | 158 | | 14 | 13 | |
| 18 | Dihlabeng | 542 | 418 | ▼ | 25 | 30 | ▲ |
| 19 | Sol Plaatjie | 142 | 152 | | 1 152 | 1 287 | ▲ |
| 20 | Inxuba Yethemba | 150 | 143 | | 0 | 0 | |
| 21 | Tswelopele | 292 | 217 | ▼ | 0 | 0 | |
| 22 | Emalahleni | 160 | 178 | ▲ | 21 052 | 21 979 | |
| 23 | Dr Beyers Naude | 172 | 155 | | 1 | 1 | |
| 24 | Maluti a Phofung | 246 | 187 | ▼ | 75 | 89 | ▲ |
| 25 | Elundini | 86 | 79 | | 19 | 18 | |
| 26 | Sakhisizwe | 36 | 36 | | 0 | 0 | |
| | Average | 204 | 174 | | 931 | 974 | |

*Note: Change (arrow) indicates a greater than 10% change between 2011 and 2016. Blue fill indicates the highest (darker blue) and lowest (lighter blue) three values. Only the highest values are highlighted for the Mining and Quarrying sector as the GVA for several of the LMs is 0.*

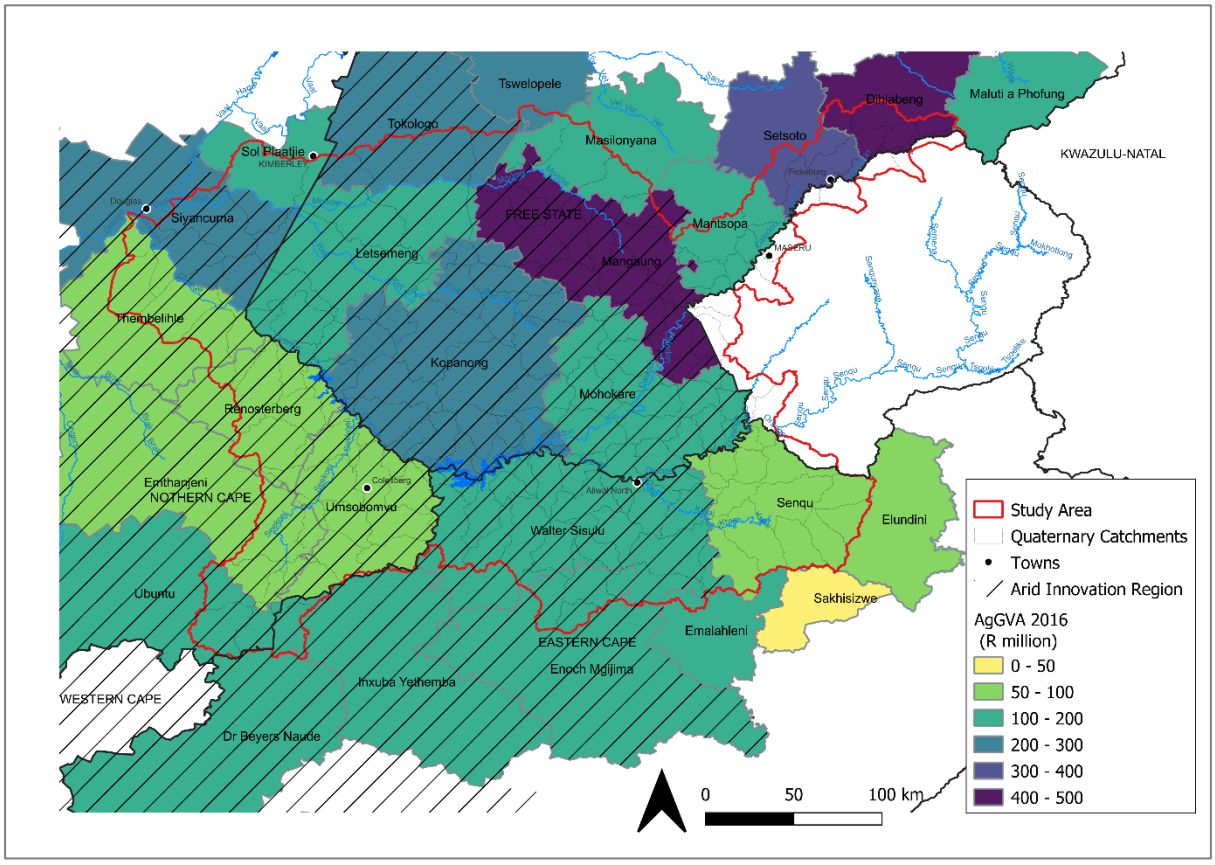


**Figure 4-8:** Spatial representation of the gross value added (GVA) indicator (R million) of the Agriculture, Forestry and Fishing sector (AgGVA) 2016, aggregated to local municipality scale, Upper Orange study area

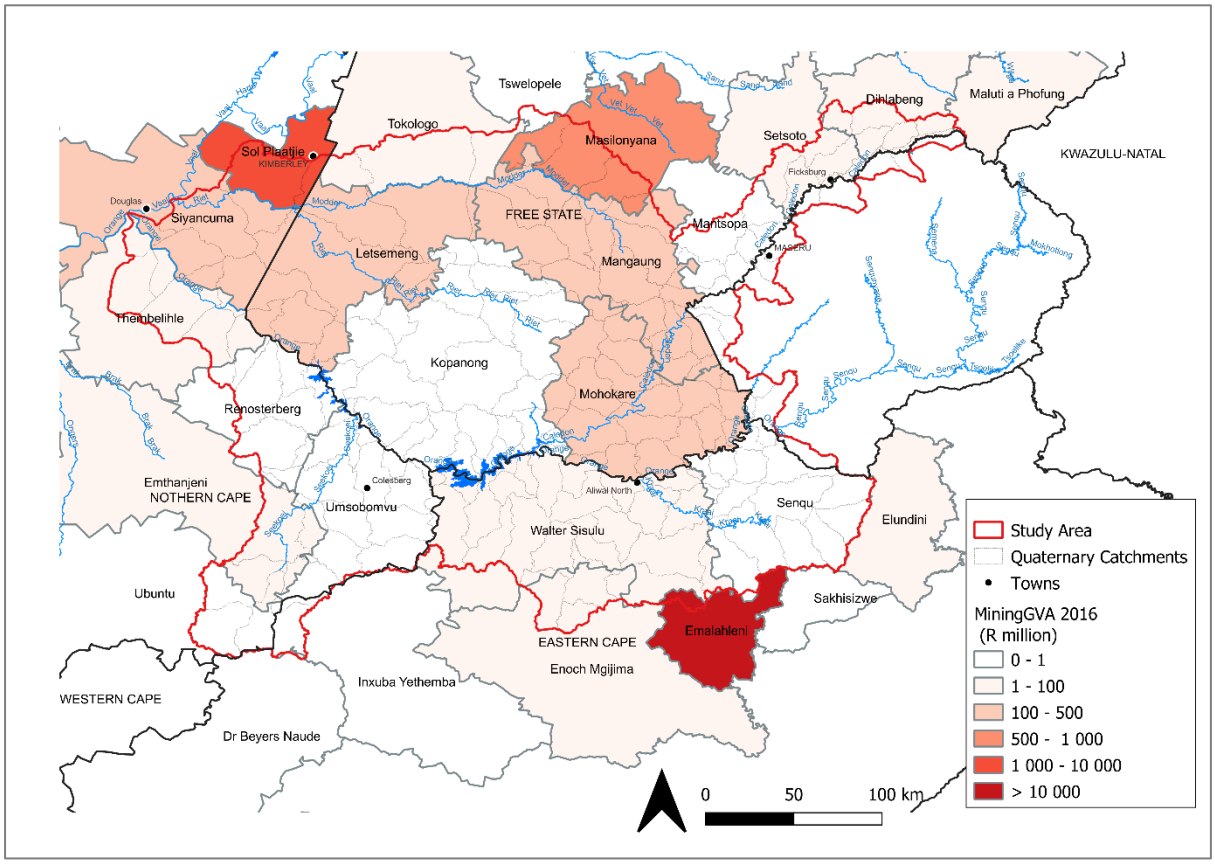


**Figure 4-9:** Spatial representation of the gross value added (GVA) indicator (R million) of the Mining and Quarrying sector (MiningGVA) 2016, aggregated to local municipality scale, Upper Orange study area

Using the mesozone dataset, it is possible to consider GVA at a finer scale. Figure 4-10 shows the Agriculture, Forestry and Fishing sector GVA (AgGVA) and Figure 4-11 the Mining and Quarrying sector GVA (MiningGVA) for the mesozones of the LMs associated with the Upper Orange catchment area[12].

[12] While it is possible to refine the spatial area using the mesozones to more closely reflect only the study area (i.e., to exclude portions of the LMs outside of the catchment boundary), it is necessary to consider that water sourced/abstracted within the catchment boundary could be supporting economic activity within the portions of the LMs that fall strictly outside of the catchment boundary.

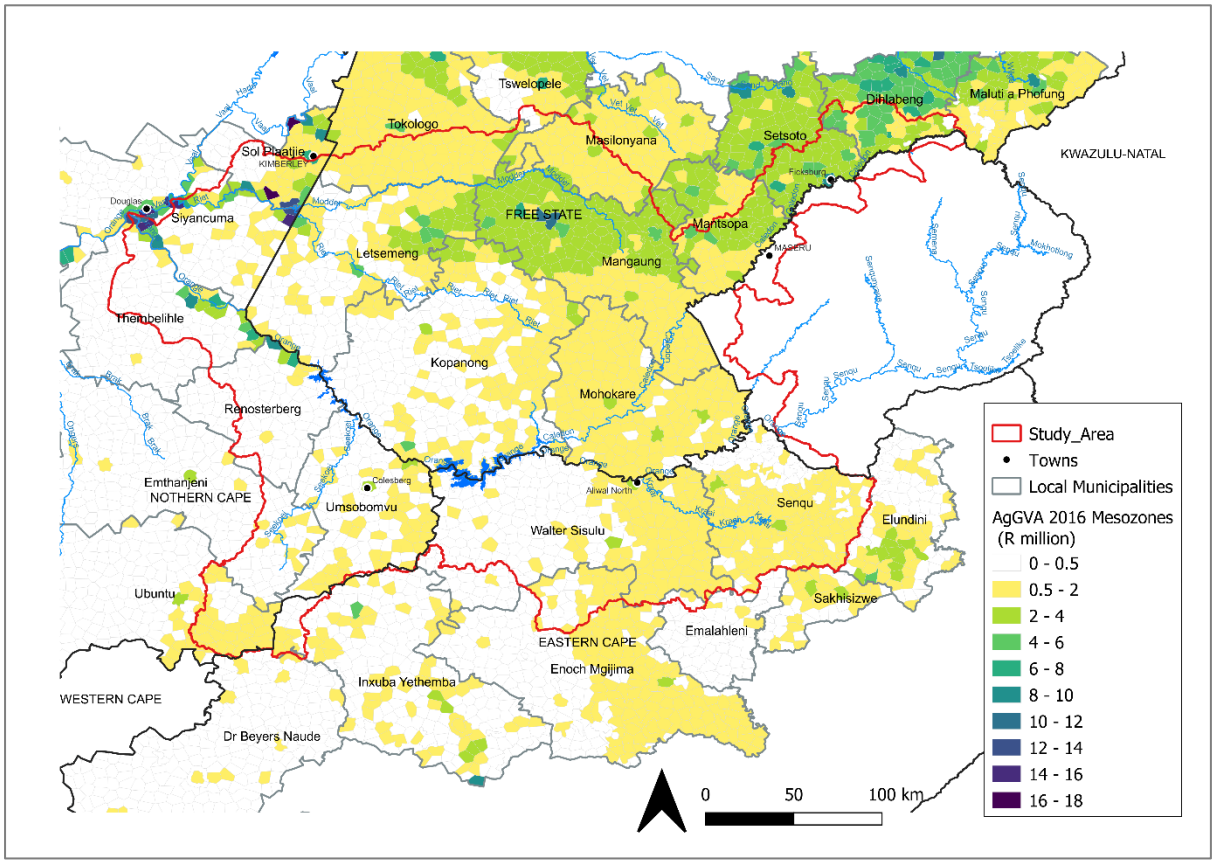


**Figure 4-10:** Spatial representation of the gross value added (GVA) indicator (R million) of the Agriculture, Forestry and Fishing sector (AgGVA) 2016, by mesozone, Upper Orange study area

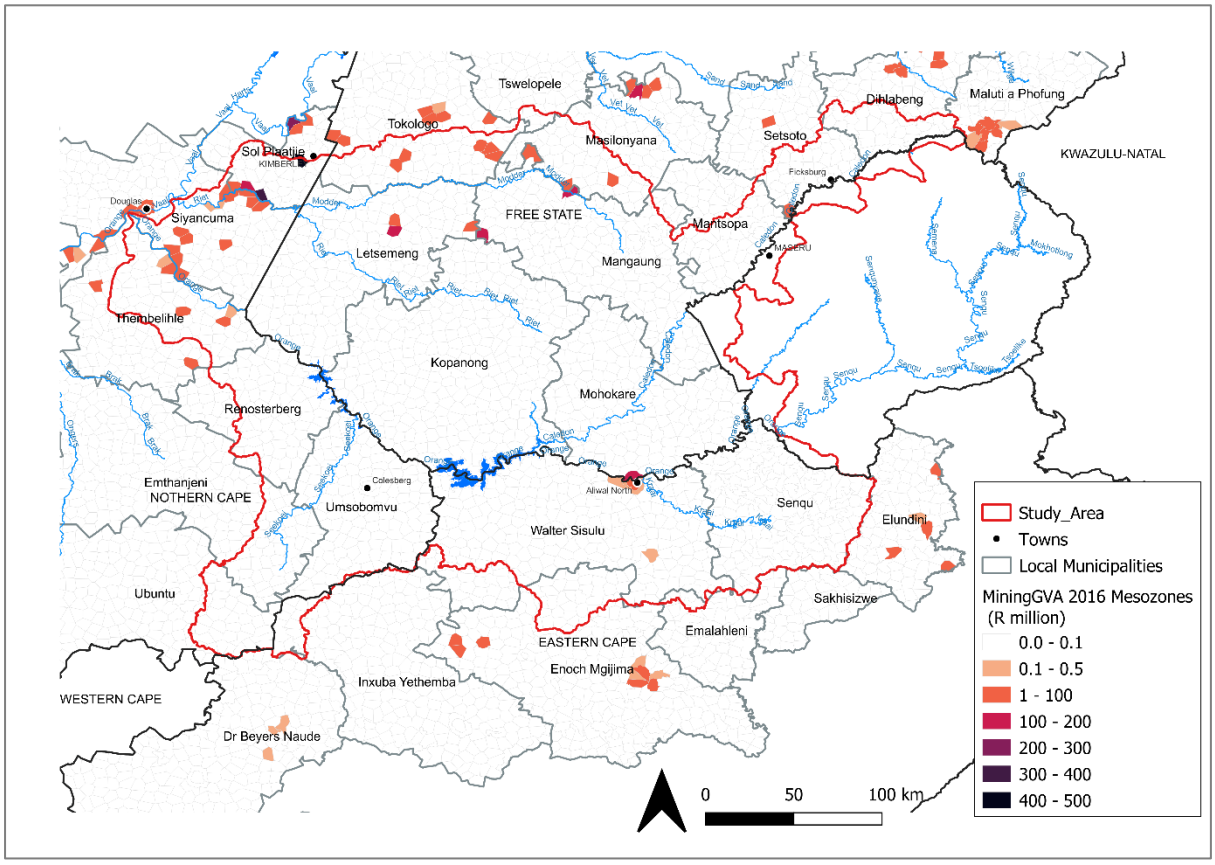


**Figure 4-11:** Spatial representation of the gross value added (GVA) indicator (R million) of the Mining and Quarrying sector (MiningGVA) 2016, by mesozone, Upper Orange study area

### *4.4.3 Agricultural households*

The proportions of households involved in producing agricultural goods and associated agricultural practices are presented in Table 4-13. The information is synthesized by local municipality. The percentage of all households of each LM involved in producing agricultural goods is reported for the years 2011 and 2016 and the change (increase/decrease) is illustrated. 'Type of agricultural activity' reflects the percentage of all households of the LM involved in the specific agricultural activity. A household can participate in more than one activity. 'Farm practice for crop production' indicates the percentage of all households of the LM engaging in a particular practice of crop production, namely, 'Irrigation', 'Irrigation and dry land, or 'Dry land'.

**Table 4-13:** Proportion of agricultural households and agricultural activities (% of all households) by local municipality, Upper Orange study area

| | Local municipality | Proportion of agricultural households | | | Type of agricultural activity* | | | Farm practice for crop production | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Livestock | Poultry | Crops | Irrigation | Irrigation and dry land | Dry land |
| | | 2011 | 2016 | Change | 2016 | 2016 | 2016 | 2016 | 2016 | 2016 |
| 1 | Kopanong | 24% | 22% | | 9% | 9% | 16% | 3% | 2% | 11% |
| 2 | Walter Sisulu | 23% | 16% | ▼ | 6% | 4% | 13% | 3% | 2% | 7% |
| 3 | Letsemeng | 23% | 18% | ▼ | 9% | 11% | 14% | 2% | 2% | 10% |
| 4 | Mangaung | 20% | 10% | ▼ | 3% | 3% | 9% | 2% | 3% | 4% |
| 5 | Mohokare | 22% | 28% | ▲ | 10% | 5% | 23% | 1% | 3% | 19% |
| 6 | Senqu | 45% | 33% | ▼ | 25% | 14% | 25% | 6% | 2% | 17% |
| 7 | Umsobomvu | 14% | 26% | ▲ | 6% | 11% | 20% | 0% | 15% | 4% |
| 8 | Siyancuma | 22% | 20% | | 7% | 16% | 12% | 2% | 2% | 9% |
| 9 | Renosterberg | 21% | 14% | ▼ | 9% | 6% | 9% | 0% | 6% | 3% |
| 10 | Thembelihle | 26% | 12% | ▼ | 5% | 8% | 8% | 0% | 0% | 7% |
| 11 | Tokologo | 21% | 17% | ▼ | 9% | 10% | 15% | 5% | 1% | 8% |
| 12 | Masilonyana | 25% | 14% | ▼ | 6% | 6% | 9% | 1% | 5% | 3% |
| 13 | Emthanjeni | 12% | 13% | | 4% | 6% | 9% | 0% | 6% | 3% |
| 14 | Mantsopa | 26% | 27% | | 10% | 8% | 23% | 1% | 14% | 8% |
| 15 | Setsoto | 29% | 36% | ▲ | 9% | 9% | 33% | 11% | 4% | 18% |
| 16 | Ubuntu | 29% | 15% | ▼ | 6% | 9% | 9% | 2% | 3% | 4% |
| 17 | Enoch Mgijima | 30% | 32% | | 19% | 15% | 23% | 4% | 5% | 13% |
| 18 | Dihlabeng | 29% | 24% | ▼ | 8% | 9% | 21% | 5% | 5% | 11% |
| 19 | Sol Plaatjie | 9% | 4% | ▼ | 0% | 2% | 3% | 0% | 1% | 2% |
| 20 | Inxuba Yethemba | 18% | 9% | ▼ | 4% | 4% | 7% | 1% | 1% | 5% |
| 21 | Tswelopele | 25% | 22% | ▼ | 9% | 7% | 18% | 4% | 5% | 10% |
| 22 | Emalahleni | 52% | 53% | | 46% | 41% | 31% | 4% | 10% | 16% |
| 23 | Dr Beyers Naude | 16% | 7% | ▼ | 4% | 4% | 6% | 1% | 0% | 5% |
| 24 | Maluti a Phofung | 52% | 42% | ▼ | 7% | 12% | 39% | 18% | 6% | 15% |
| 25 | Elundini | 51% | 54% | | 43% | 41% | 36% | 9% | 6% | 21% |
| 26 | Sakhisizwe | 47% | 54% | ▲ | 39% | 34% | 39% | 4% | 8% | 27% |
| | Average | 27% | 24% | | 12% | 12% | 18% | 3% | 26% | 57% |

*Note: *Households can participate in more than one activity. Change (arrow) indicates a greater than 10% increase/decrease between 2011 and 2016. Orange fill indicates the highest (darker orange) and lowest (lighter orange) three values for each indicator.*

## 4.5 Description of water uses and sources

Sub-sections 4.5.1 to 4.5.2 present indicators of water use and water sources for the Upper Orange study area. Section 4.5.1 addresses registered water use based on data from the Water use Authorization and Registration Management System (WARMS). Section 4.5.2 synthesizes household water source data from the 2016 Community Survey. Section 4.5.3 presents the basic human needs requirements for the catchment drawn from the Basic Human Needs assessment undertaken as part of the broader study.

### *4.5.1 Registered 'water use' by sector and resource type*

This section of the report presents the results of an analysis of water use records (registered abstraction volume[13]) for the Upper Orange catchment from the WARMS for the 2021 annual period. The data pertains only to records (co-ordinates) within the Upper Orange catchment boundary. The records have been aggregated by municipal area, but do not reflect the water use for portions of LMs falling outside of the catchment boundary. There are no records associated with the portions of the Dr Beyers Naude, Maluti a Phofung and Sakhisizwe LMs falling within the catchment boundary.

Table 4-14 reports registered abstraction volumes aggregated by municipal area; the proportion of the volume as a percentage of the total volume for the catchment area; and water use as a volume per unit area (CM/Ha). Figure 4-12 provides a spatial representation of the proportion of total water use by municipal area.

Table 4-15 addresses water use by sector and presents the proportion of water use by sector across each municipal area within the Upper Orange catchment. For the whole catchment, 78% of registered water use (abstraction) is for irrigation.

Table 4-16 addresses water use by resource type and presents the proportion of water use by resource across each municipal area within the Upper Orange catchment. The main water resource types for the whole catchment are Scheme (49%), River/Stream (21%) and Borehole (16%). The River/Stream indicator (column 3, Table 4-16) is represented spatially in Figure 4-13 and highlights those areas within the catchment where registered users have a higher (direct) reliance on River/Stream resources. These areas/users are relatively more vulnerable to changes in river water quantity and quality. However, it is important to note that 'Schemes' are also associated with river and dam resources.

Table 4-17 provides additional detail on the specific water schemes of the Upper Orange study area and reports the abstraction volume attributed to each scheme.

[13] 'Water use' in this analysis pertains to water use as define in Section 21(a) of the National Water Act (Act No. 36 of 1998) 'taking water from a water resource'.

**Table 4-14:** Registered water use 2021 by municipal area for the Upper Orange catchment

| | Local municipality | Volume (CM) | Proportion of total (%) | Volume (CM/Ha) |
|---|---|---|---|---|
| 1 | Kopanong | 67 105 765 | 7.27% | 43 |
| 2 | Walter Sisulu | 77 450 355 | 8.39% | 65 |
| 3 | Letsemeng | 151 657 891 | 16.43% | 153 |
| 4 | Mangaung | 245 929 622 | 26.65% | 257 |
| 5 | Mohokare | 53 438 339 | 5.79% | 61 |
| 6 | Senqu | 23 560 111 | 2.55% | 33 |
| 7 | Umsobomvu | 22 766 053 | 2.47% | 33 |
| 8 | Siyancuma | 28 338 087 | 3.07% | 63 |
| 9 | Renosterberg | 35 877 342 | 3.89% | 83 |
| 10 | Thembelihle | 110 707 030 | 12.00% | 291 |
| 11 | Tokologo | 13 714 563 | 1.49% | 41 |
| 12 | Masilonyana | 13 995 068 | 1.52% | 52 |
| 13 | Emthanjeni | 2 848 294 | 0.31% | 11 |
| 14 | Mantsopa | 18 153 308 | 1.97% | 69 |
| 15 | Setsoto | 29 336 699 | 3.18% | 150 |
| 16 | Ubuntu | 141 440 | 0.02% | 1 |
| 17 | Enoch Mgijima | 8 926 316 | 0.97% | 51 |
| 18 | Dihlabeng | 12 828 605 | 1.39% | 75 |
| 19 | Sol Plaatjie | 1 667 911 | 0.18% | 10 |
| 20 | Inxuba Yethemba | 1 477 076 | 0.16% | 20 |
| 21 | Tswelopele | 1 233 529 | 0.13% | 53 |
| 22 | Emalahleni | 1 467 640 | 0.16% | 70 |
| 25 | Elundini | 197 000 | 0.02% | 327 |
| | All | 922 818 045 | 100.00% | 89 |

*Note: There are no records for the portions of Dr Beyers Naude, Maluti a Phofung and Sakhisizwe LMs overlapping the catchment boundary. Blue fill highlights the top five water use volumes. Darker orange fill indicates the highest three values; lighter orange fill indicates the lowest three values.*

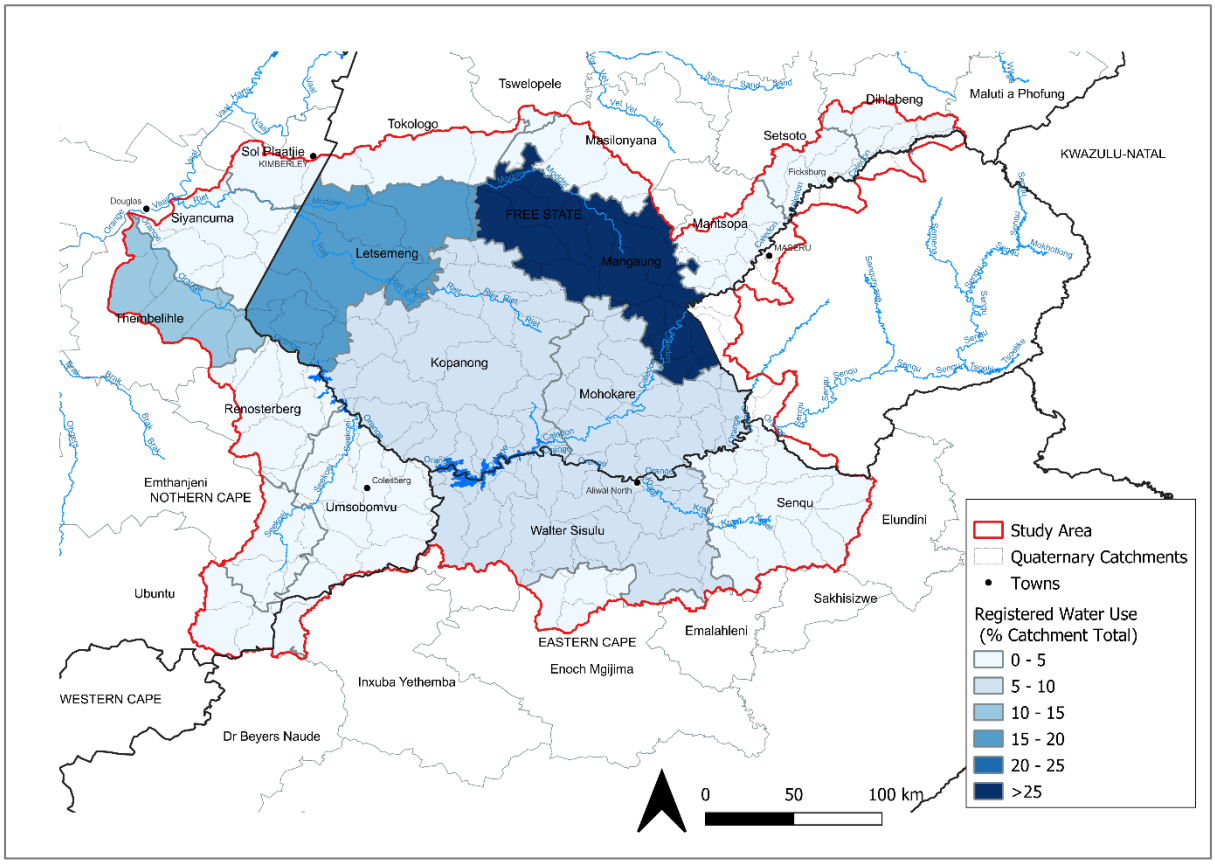


**Figure 4-12:** Spatial representation of registered water use 2021 by municipal area as a proportion (%) of the total for the Upper Orange catchment

*Note: The figure is a spatial representation of the data reported in column 3 of* Table 4-14 *'Proportion of total (%)'.*

**Table 4-15:** Registered water use 2021, proportional water use by sector across each municipal area within the Upper Orange catchment

| | Local municipality | Irrigation | Water Supply Service | Mining | Industry (Urban) | Livestock Watering | Industry (Non-Urban) | Aqua-culture | Power Generation | Schedule 1 | Recreation | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 95.89% | 1.66% | 2.26% | 0.17% | 0.03% | 0.01% | | | | | 100.00% |
| 2 | Walter Sisulu | 89.63% | 6.78% | 0.02% | 1.57% | 0.25% | 1.27% | 0.48% | 0.00% | | | 100.00% |
| 3 | Letsemeng | 96.55% | 0.94% | 1.99% | 0.01% | 0.26% | 0.24% | | 0.01% | | | 100.00% |
| 4 | Mangaung | 38.25% | 61.50% | 0.03% | 0.03% | 0.03% | 0.15% | | 0.00% | | 0.00% | 100.00% |
| 5 | Mohokare | 95.60% | 3.00% | | | 1.35% | 0.06% | | | | | 100.00% |
| 6 | Senqu | 69.79% | 25.46% | | 4.36% | | 0.30% | | | 0.08% | | 100.00% |
| 7 | Umsobomvu | 81.00% | 11.00% | 0.05% | 7.60% | | 0.13% | | 0.22% | | | 100.00% |
| 8 | Siyancuma | 99.72% | | 0.09% | | | 0.19% | | | | | 100.00% |
| 9 | Renosterberg | 99.92% | 0.01% | | | 0.04% | 0.03% | | | | | 100.00% |
| 10 | Thembelihle | 98.36% | 0.79% | 0.80% | | | 0.05% | | | | | 100.00% |
| 11 | Tokologo | 98.10% | 0.40% | 0.64% | | | 0.86% | | | | | 100.00% |
| 12 | Masilonyana | 98.13% | 0.71% | | 0.05% | 0.21% | 0.90% | | | | | 100.00% |
| 13 | Emthanjeni | 93.32% | 5.70% | 0.37% | | 0.18% | 0.38% | | 0.04% | | | 100.00% |
| 14 | Mantsopa | 83.81% | 15.80% | | | | 0.39% | | | | | 100.00% |
| 15 | Setsoto | 49.38% | 45.52% | | 0.25% | 4.80% | 0.04% | | | | | 100.00% |
| 16 | Ubuntu | 100.00% | | | | | | | | | | 100.00% |
| 17 | Enoch Mgijima | 90.26% | 9.57% | | | 0.04% | 0.12% | | | | | 100.00% |
| 18 | Dihlabeng | 78.72% | 21.05% | | | | 0.24% | | | | | 100.00% |
| 19 | Sol Plaatjie | 89.24% | | 3.24% | 4.52% | | 3.00% | | | | | 100.00% |
| 20 | Inxuba Yethemba | 100.00% | | | | | | | | | | 100.00% |
| 21 | Tswelopele | 100.00% | | | | | | | | | | 100.00% |
| 22 | Emalahleni | 29.14% | 70.86% | | | | | | | | | 100.00% |
| 25 | Elundini | 100.00% | | | | | | | | | | 100.00% |
| | All | 77.58% | 20.71% | 0.62% | 0.47% | 0.31% | 0.26% | 0.04% | 0.01% | 0.00% | 0.00% | 100.00% |

*Note: There are no records for the portions of Dr Beyers Naude, Maluti a Phofung and Sakhisizwe LMs overlapping the catchment boundary. Blank cells indicate no registered water use. Orange fill highlights the main water use sectors for each LM area.*

**Table 4-16:** Registered water use 2021, proportional water use by resource type across each municipal area within the Upper Orange catchment

| | Local municipality | Scheme | River/ Stream | Borehole | Dam | Spring/ Eye | Lake | Wetland | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 16.51% | 29.85% | 35.57% | 13.46% | 4.62% | | | 100.00% |
| 2 | Walter Sisulu | 3.93% | 47.53% | 10.51% | 37.65% | 0.38% | | | 100.00% |
| 3 | Letsemeng | 71.69% | 0.67% | 26.84% | 0.48% | 0.01% | 0.31% | | 100.00% |
| 4 | Mangaung | 50.88% | 11.26% | 18.91% | 18.78% | 0.17% | | 0.00% | 100.00% |
| 5 | Mohokare | | 74.97% | 2.52% | 20.09% | 1.57% | 0.86% | | 100.00% |
| 6 | Senqu | 17.82% | 57.37% | 7.86% | 14.61% | 2.35% | | | 100.00% |
| 7 | Umsobomvu | 56.42% | 16.47% | 21.72% | 2.96% | 2.36% | | 0.07% | 100.00% |
| 8 | Siyancuma | 96.33% | 0.14% | 3.53% | | | | | 100.00% |
| 9 | Renosterberg | 98.14% | 0.16% | 1.08% | 0.28% | 0.34% | | | 100.00% |
| 10 | Thembelihle | 99.75% | 0.04% | 0.10% | 0.11% | | | | 100.00% |
| 11 | Tokologo | 69.67% | 4.05% | 26.29% | | | | | 100.00% |
| 12 | Masilonyana | | 55.83% | 41.20% | 2.00% | 0.97% | | | 100.00% |
| 13 | Emthanjeni | | 13.17% | 39.91% | 46.57% | 0.35% | | | 100.00% |
| 14 | Mantsopa | 28.96% | 40.73% | 1.06% | 27.84% | 1.40% | | | 100.00% |
| 15 | Setsoto | | 78.26% | 1.21% | 18.84% | 0.01% | 1.67% | | 100.00% |
| 16 | Ubuntu | | | | 100.00% | | | | 100.00% |
| 17 | Enoch Mgijima | | 22.81% | 5.28% | 68.38% | 3.54% | | | 100.00% |
| 18 | Dihlabeng | | 52.09% | 1.82% | 41.57% | 4.52% | | | 100.00% |
| 19 | Sol Plaatjie | 80.92% | 10.76% | 8.32% | | | | | 100.00% |
| 20 | Inxuba Yethemba | | 11.46% | 71.40% | 12.94% | 4.20% | | | 100.00% |
| 21 | Tswelopele | | | 100.00% | | | | | 100.00% |
| 22 | Emalahleni | | 8.48% | | 91.52% | | | | 100.00% |
| 25 | Elundini | | 100.00% | | | | | | 100.00% |
| | All | 49.21% | 20.75% | 15.50% | 13.60% | 0.78% | 0.15% | 0.00% | 100.00% |

*Note: There are no records for the portions of Dr Beyers Naude, Maluti a Phofung and Sakhisizwe LMs overlapping the catchment boundary. Blank cells indicate no registered water use. Blue fill highlights the main water source(s) for each municipal area.*

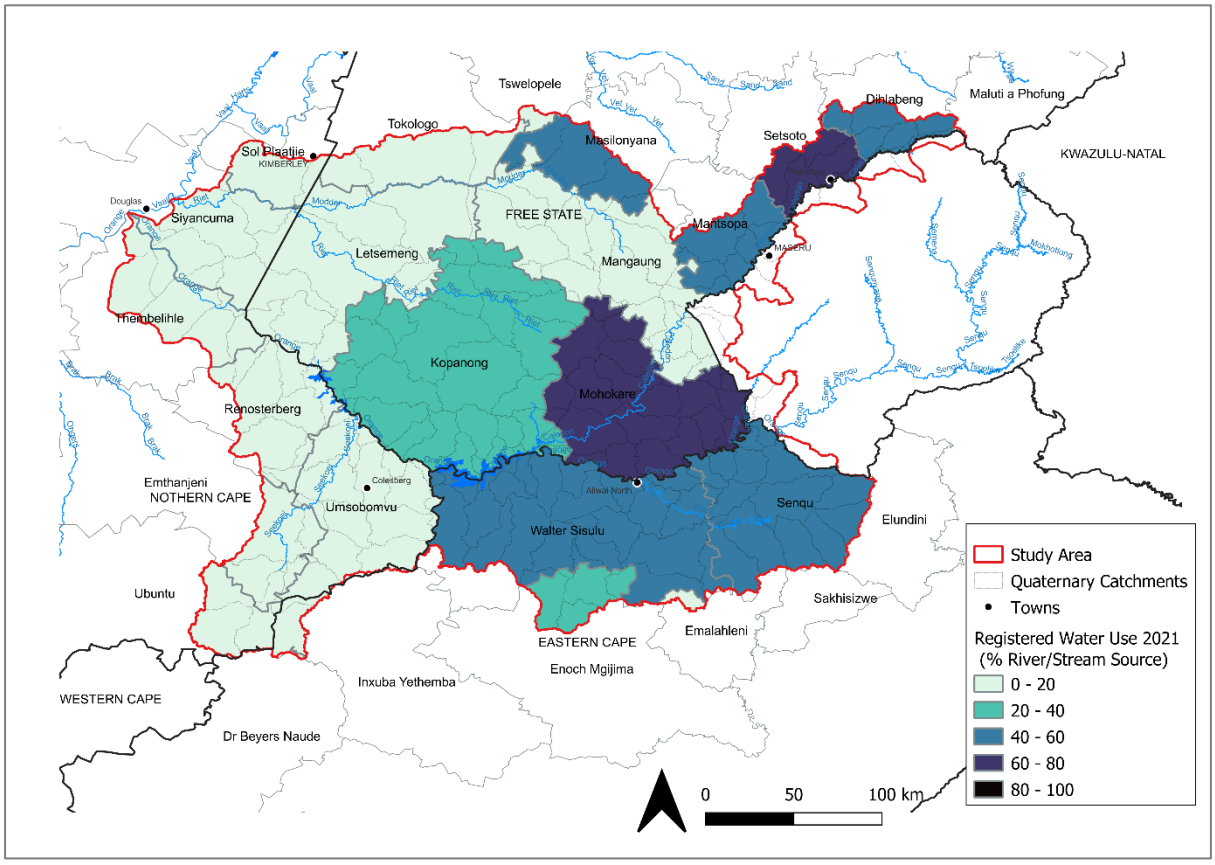


**Figure 4-13:** Spatial representation of registered water use 2021, as a proportion of River/Stream resource type for each municipal area within the Upper Orange catchment

*Note: For example, 20% to 40% of the registered water use of the Enoch Mgijima area falling within the catchment is classified as a River/Stream resource type.*

**Table 4-17:** Registered water use 2021, volume by scheme, Upper Orange catchment

| Scheme | Volume (CM) | Volume (% all schemes) |
|---|---|---|
| Orange River (Gariep Dam, Vanderkloof Dam, Orange-Fish Tunnel) | 213 276 357 | 46.97% |
| Caledon River (Welbedacht Dam, Rustfontein Dam, Knellpoort Dam | 107 315 307 | 23.63% |
| Orange River (Vanderkloof Canals) | 64 406 700 | 14.18% |
| Modder River (Krugersdrift Dam) | 29 596 022 | 6.52% |
| Orange-Riet (Riet River Settlement) And Orange-Riet Canal | 12 161 260 | 2.68% |
| Riet River (Kalkfontein Dam) | 5 622 700 | 1.24% |
| Leeu River (Armenia Dam) | 5 487 560 | 1.21% |
| Wittespruit (Egmont Dam) | 5 229 972 | 1.15% |
| Kgabanayane River (Groothoek Dam) | 5 000 000 | 1.10% |
| Sterkspruit (Jozanashoek Dam) | 4 197 500 | 0.92% |
| Sand-Vet River (Erfenis and Allemans-Kraal Dam) | 1 818 400 | 0.40% |
| Total | 454 111 778 | 100.00% |

### *4.5.2 Household water sources*

This section presents 2016 Community Survey data on household drinking water sources. Table 4-18 reports the proportion of people relying on each water source type[14] as the main source of drinking water across each LM associated with the study area. The number of people per source type is reported in Table 4-19.

Survey questions and categories related to 'household water source' differed between the 2011 Census and 2016 Community Survey, and, therefore, are not directly comparable. As such, the more recent data, Community Survey 2016, is presented in this section.

'Flowing water/ stream/ river' is a particularly important indicator, as people relying on these resources as their main source of drinking water are particularly vulnerable to changes in the quality and quantity of water in surface water systems. For example, households directly reliant on surface water sources, who are also located downstream of Waste Water Treatment Works (WWTW), are at higher risk should the WWTW fail[15]. Similarly, households directly reliant on surface water sources are more vulnerable to droughts or upstream water abstractions than households supplied through a municipal system.

Households, and municipalities, directly or wholly, reliant on groundwater may also be relatively more vulnerable as aquifers are also susceptible to contamination from surface sources, droughts and other aspects impacting recharge. The level of groundwater susceptibility to contamination from surface sources depends on the prevailing hydrogeological properties such as porosity[16].

Municipalities with relatively higher proportions of the population (Table 4-18) and numbers of people (Table 4-19) reliant on 'flowing water/ stream/ river' and groundwater sources are highlighted in the corresponding tables.

[14] Several categories of the raw data were combined: Piped (tap) includes 'Piped (tap) water inside the dwelling/house', 'Piped (tap) water inside yard', and 'Piped water on community stand'; Borehole includes 'Borehole inside the yard' and 'Borehole outside the yard'.

[15] WWTWs within the study area, including their functional status, is being investigated under the 'Rivers' component of the study and the two aspects will be integrated in the scenarios analysis (e.g., through overlaying the relevant spatial layers).

[16] Aquifer contamination susceptibility (groundwater vulnerability) and groundwater drought risk have been mapped, nationally for South Africa and for the Southern African Development Community region, respectfully. These resources will be integrated with information presented in this report of groundwater use in the scenario analysis.

**Table 4-18:** Community survey 2016, main source of water for drinking (% of people) by local municipality, Upper Orange study area

| | Local municipality | Piped (tap) | Public/ communal tap | Flowing water/ stream/ river | Borehole | Neighbours tap | Water-carrier/ tanker | Rain-water tank (yard) | Spring | Well | Other | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 94.21% | 0.04% | 0.00% | 4.09% | 0.61% | 0.43% | 0.00% | 0.06% | 0.00% | 0.57% | 100.00% |
| 2 | Walter Sisulu | 95.15% | 0.87% | 0.00% | 2.37% | 0.83% | 0.24% | 0.23% | 0.00% | 0.00% | 0.31% | 100.00% |
| 3 | Letsemeng | 94.72% | 0.12% | 0.11% | 3.94% | 0.22% | 0.68% | 0.00% | 0.00% | 0.00% | 0.20% | 100.00% |
| 4 | Mangaung | 95.71% | 1.55% | 0.00% | 0.78% | 1.54% | 0.21% | 0.01% | 0.00% | 0.00% | 0.20% | 100.00% |
| 5 | Mohokare | 93.66% | 0.15% | 0.00% | 2.05% | 3.94% | 0.05% | 0.00% | 0.00% | 0.00% | 0.15% | 100.00% |
| 6 | Senqu | 56.33% | 8.90% | 9.88% | 3.95% | 6.64% | 0.90% | 7.97% | 0.36% | 4.99% | 0.08% | 100.00% |
| 7 | Umsobomvu | 93.92% | 0.86% | 0.04% | 0.40% | 4.48% | 0.17% | 0.11% | 0.00% | 0.00% | 0.00% | 100.00% |
| 8 | Siyancuma | 74.71% | 15.93% | 4.65% | 3.28% | 0.10% | 1.02% | 0.12% | 0.00% | 0.00% | 0.19% | 100.00% |
| 9 | Renosterberg | 96.32% | 0.14% | 0.00% | 1.63% | 1.23% | 0.00% | 0.00% | 0.00% | 0.69% | 0.00% | 100.00% |
| 10 | Thembelihle | 87.77% | 2.64% | 1.29% | 5.48% | 1.31% | 0.00% | 0.00% | 0.00% | 0.00% | 1.51% | 100.00% |
| 11 | Tokologo | 87.42% | 2.42% | 0.00% | 6.65% | 3.30% | 0.10% | 0.11% | 0.00% | 0.00% | 0.00% | 100.00% |
| 12 | Masilonyana | 92.62% | 0.27% | 0.00% | 1.75% | 0.73% | 0.20% | 0.00% | 0.00% | 0.00% | 4.42% | 100.00% |
| 13 | Emthanjeni | 97.88% | 0.71% | 0.00% | 1.13% | 0.11% | 0.07% | 0.04% | 0.00% | 0.00% | 0.06% | 100.00% |
| 14 | Mantsopa | 92.86% | 0.00% | 0.34% | 5.94% | 0.04% | 0.49% | 0.00% | 0.03% | 0.00% | 0.30% | 100.00% |
| 15 | Setsoto | 90.77% | 2.25% | 0.13% | 4.85% | 1.06% | 0.05% | 0.02% | 0.01% | 0.11% | 0.74% | 100.00% |
| 16 | Ubuntu | 97.95% | 0.03% | 0.32% | 1.70% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 100.00% |
| 17 | Enoch Mgijima | 86.48% | 8.79% | 0.74% | 0.93% | 1.20% | 0.63% | 0.47% | 0.02% | 0.00% | 0.73% | 100.00% |
| 18 | Dihlabeng | 93.11% | 2.96% | 0.11% | 1.58% | 0.20% | 1.35% | 0.13% | 0.14% | 0.33% | 0.08% | 100.00% |
| 19 | Sol Plaatjie | 97.91% | 1.31% | 0.17% | 0.17% | 0.21% | 0.03% | 0.00% | 0.00% | 0.00% | 0.20% | 100.00% |
| 20 | Inxuba Yethemba | 96.52% | 0.53% | 0.37% | 1.08% | 0.41% | 0.68% | 0.22% | 0.00% | 0.00% | 0.20% | 100.00% |
| 21 | Tswelopele | 92.79% | 0.10% | 0.46% | 3.50% | 1.11% | 1.27% | 0.13% | 0.00% | 0.00% | 0.64% | 100.00% |
| 22 | Emalahleni | 70.98% | 19.05% | 3.85% | 3.42% | 1.62% | 0.21% | 0.30% | 0.24% | 0.00% | 0.33% | 100.00% |
| 23 | Dr Beyers Naude | 93.49% | 0.00% | 0.00% | 1.75% | 0.13% | 0.00% | 4.14% | 0.36% | 0.03% | 0.09% | 100.00% |
| 24 | Maluti a Phofung | 84.27% | 1.51% | 0.57% | 0.74% | 2.49% | 8.41% | 0.27% | 0.86% | 0.32% | 0.55% | 100.00% |
| 25 | Elundini | 50.38% | 9.60% | 23.23% | 1.77% | 0.18% | 0.81% | 2.75% | 8.02% | 3.13% | 0.12% | 100.00% |
| 26 | Sakhisizwe | 77.27% | 14.48% | 2.05% | 0.61% | 1.96% | 1.07% | 0.73% | 1.17% | 0.10% | 0.57% | 100.00% |
| | All (%) | 87.64% | 3.84% | 1.96% | 1.67% | 1.47% | 1.32% | 0.72% | 0.54% | 0.43% | 0.40% | 100.00% |

*Note: Orange fill highlights those LMs with relatively higher proportions of the population reliant on 'flowing water/ stream/ river' sources.*

**Table 4-19:** Community survey 2016, main source of water for drinking (number of people) by local municipality, Upper Orange study area

| | Local municipality | Piped (tap) | Public/ communal tap | Flowing water/ stream/ river | Borehole | Neighbours tap | Water-carrier/ tanker | Rain-water tank (yard) | Spring | Well | Other | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kopanong | 47 104 | 21 | 0 | 2 044 | 304 | 213 | 0 | 28 | 0 | 285 | 49 999 |
| 2 | Walter Sisulu | 83 034 | 756 | 2 | 2 071 | 723 | 206 | 201 | 0 | 0 | 270 | 87 263 |
| 3 | Letsemeng | 37 931 | 48 | 44 | 1 579 | 90 | 274 | 0 | 0 | 0 | 79 | 40 044 |
| 4 | Mangaung | 754 004 | 12 194 | 20 | 6 126 | 12 107 | 1 648 | 105 | 17 | 0 | 1 582 | 787 803 |
| 5 | Mohokare | 33 568 | 55 | 0 | 734 | 1 413 | 17 | 0 | 0 | 0 | 53 | 35 840 |
| 6 | Senqu | 79 265 | 12 531 | 13 897 | 5 559 | 9 348 | 1 266 | 11 212 | 507 | 7 027 | 107 | 140 720 |
| 7 | Umsobomvu | 29 005 | 267 | 13 | 125 | 1 385 | 52 | 35 | 0 | 0 | 0 | 30 883 |
| 8 | Siyancuma | 26 851 | 5 725 | 1 671 | 1 180 | 36 | 365 | 44 | 0 | 0 | 68 | 35 941 |
| 9 | Renosterberg | 11 383 | 17 | 0 | 193 | 145 | 0 | 0 | 0 | 81 | 0 | 11 818 |
| 10 | Thembelihle | 14 245 | 429 | 210 | 889 | 213 | 0 | 0 | 0 | 0 | 245 | 16 230 |
| 11 | Tokologo | 25 482 | 704 | 0 | 1 938 | 963 | 28 | 33 | 0 | 0 | 0 | 29 149 |
| 12 | Masilonyana | 58 137 | 172 | 0 | 1 100 | 461 | 128 | 0 | 0 | 0 | 2 772 | 62 770 |
| 13 | Emthanjeni | 44 443 | 321 | 0 | 512 | 50 | 34 | 17 | 0 | 0 | 28 | 45 404 |
| 14 | Mantsopa | 49 705 | 0 | 181 | 3 181 | 21 | 263 | 0 | 14 | 0 | 161 | 53 525 |
| 15 | Setsoto | 106 525 | 2 640 | 158 | 5 691 | 1 239 | 62 | 28 | 13 | 133 | 873 | 117 362 |
| 16 | Ubuntu | 19 072 | 6 | 63 | 331 | 0 | 0 | 0 | 0 | 0 | 0 | 19 471 |
| 17 | Enoch Mgijima | 230 922 | 23 478 | 1 984 | 2 482 | 3 201 | 1 682 | 1 261 | 48 | 0 | 1 954 | 267 011 |
| 18 | Dihlabeng | 130 396 | 4 151 | 157 | 2 206 | 287 | 1 896 | 176 | 201 | 457 | 117 | 140 044 |
| 19 | Sol Plaatjie | 249 706 | 3 336 | 441 | 424 | 548 | 83 | 0 | 0 | 0 | 503 | 255 041 |
| 20 | Inxuba Yethemba | 68 037 | 371 | 259 | 761 | 289 | 482 | 155 | 0 | 0 | 139 | 70 493 |
| 21 | Tswelopele | 43 958 | 48 | 218 | 1 658 | 525 | 600 | 61 | 0 | 0 | 303 | 47 373 |
| 22 | Emalahleni | 88 393 | 23 718 | 4 800 | 4 264 | 2 012 | 257 | 372 | 303 | 0 | 412 | 124 532 |
| 23 | Dr Beyers Naude | 76 847 | 0 | 0 | 1 439 | 109 | 0 | 3 406 | 298 | 22 | 75 | 82 197 |
| 24 | Maluti a Phofung | 297 869 | 5 341 | 2 018 | 2 619 | 8 810 | 29 724 | 942 | 3 049 | 1 143 | 1 938 | 353 452 |
| 25 | Elundini | 73 017 | 13 913 | 33 668 | 2 560 | 259 | 1 176 | 3 986 | 11 630 | 4 542 | 179 | 144 929 |
| 26 | Sakhisizwe | 49 336 | 9 246 | 1 308 | 387 | 1 250 | 684 | 464 | 750 | 61 | 361 | 63 846 |
| | All (number of people) | 2 728 235 | 119 488 | 61 112 | 52 053 | 45 788 | 41 140 | 22 498 | 16 858 | 13 466 | 12 504 | 3 113 142 |
| | All (%) | 87.64% | 3.84% | 1.96% | 1.67% | 1.47% | 1.32% | 0.72% | 0.54% | 0.43% | 0.40% | 100.00% |

*Note: Orange fill highlights those LMs with relatively higher numbers of the population reliant on 'flowing water/ stream/ river' sources.*

### *4.5.3 Basic human needs requirement*

This section draws from the BHN assessment undertaken as part of the broader study[17]. The calculated BHN requirements are represented spatially in Figure 4-14 for river/stream sources and Figure 4-15 for groundwater sources. The BHN volumes were calculated by ward level adjusted to a quaternary catchment representation. The calculations were based on 2011 census data on water sources adjusted according to population estimates for the year 2022. A lifeline amount of 25 litres of water per person per day was applied. Quaternary catchments with higher BHN requirements indicate where people are relatively more vulnerable to changes in river/stream and groundwater sources.

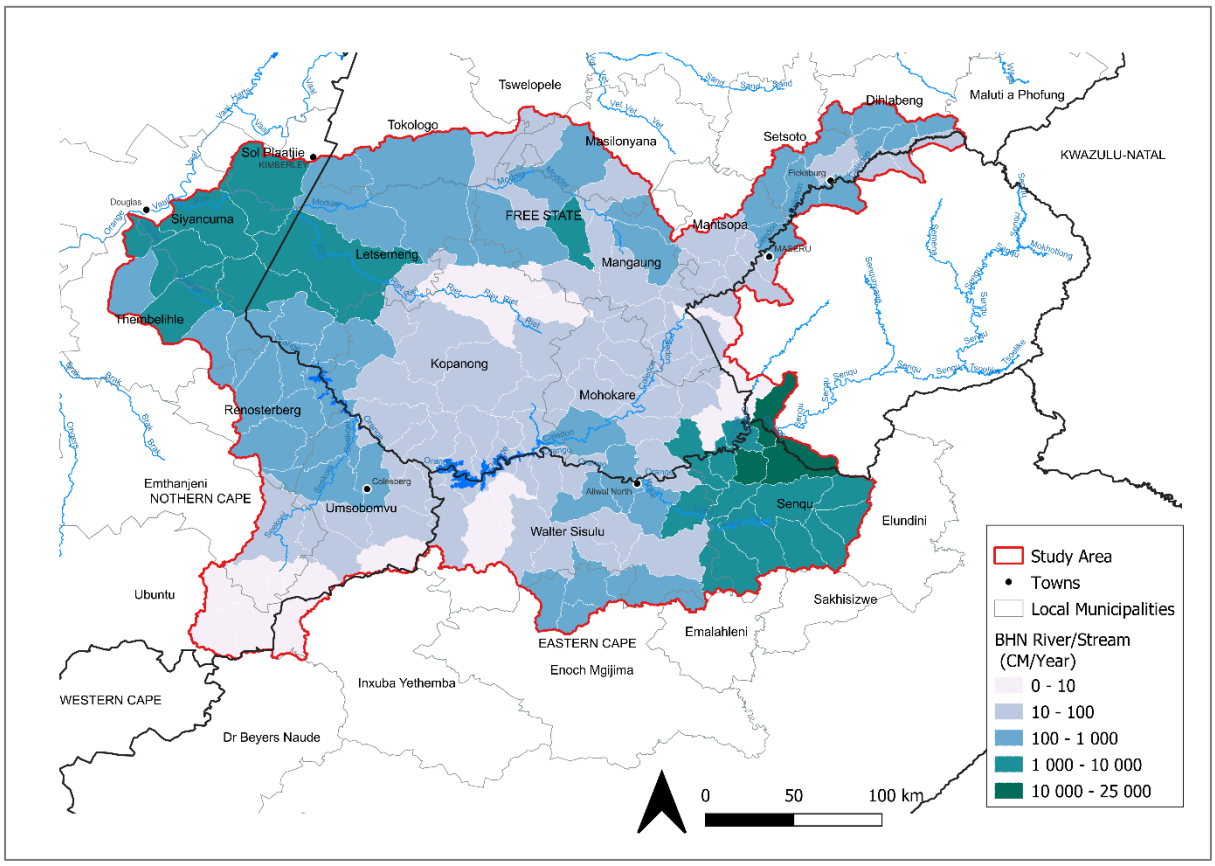


**Figure 4-14:** Spatial representation of the Basic Human Needs (BHN) requirements for river/stream resources by quaternary catchment, Upper Orange catchment

*Note: CM is cubic metre.*

[17] Report No.: RDM/WMA13/00/CON/COMP/0822 (October 2022).

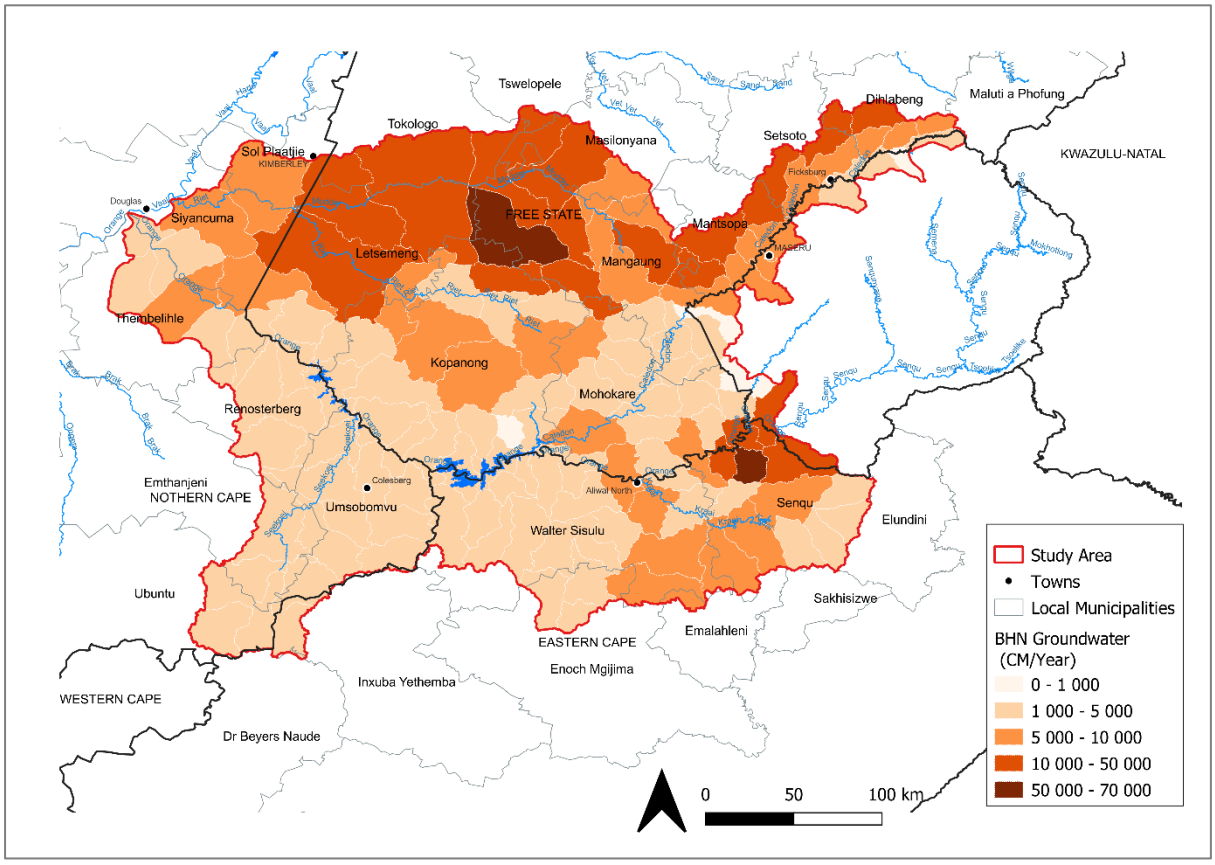


**Figure 4-15:** Spatial representation of the Basic Human Needs (BHN) requirements for groundwater resources by quaternary catchment, Upper Orange catchment

*Note: CM is cubic metre.*

## 4.6 Sites of cultural importance

This section presents the results of a desktop assessment of sites of cultural importance within the Upper Orange catchment area. Consideration of cultural ecosystem services is an important element of the socio-economic context of the area and relevant in evaluating potential changes in aquatic systems and water flows. The identification and categorisation of sites of cultural importance were informed by the Millennium Ecosystem Assessment framework (MEA, 2005) and the Common International Classification of Ecosystem Services (CICES, 2013). Sites were classified based on the main cultural aspect/value associated with the site/feature as Heritage, Educational, Tradition/Subsistence, Spiritual/Ritual; Biodiversity/Conservation. Table 4-20 lists key[18] sites by quaternary catchment.

An indication of the diversity of cultural values associated with each quaternary drainage region of the study area is given in Figure 4-16. The diversity is measured as the number of different classes (i.e.,

[18] The list of sites is not exhaustive, but does provide a sound overview of the more important/well-known sites or features, indicating key areas and highlighting the range of cultural values.

tourism, heritage etc.) associated with each quaternary, based on the assessment presented in Table 4-20.

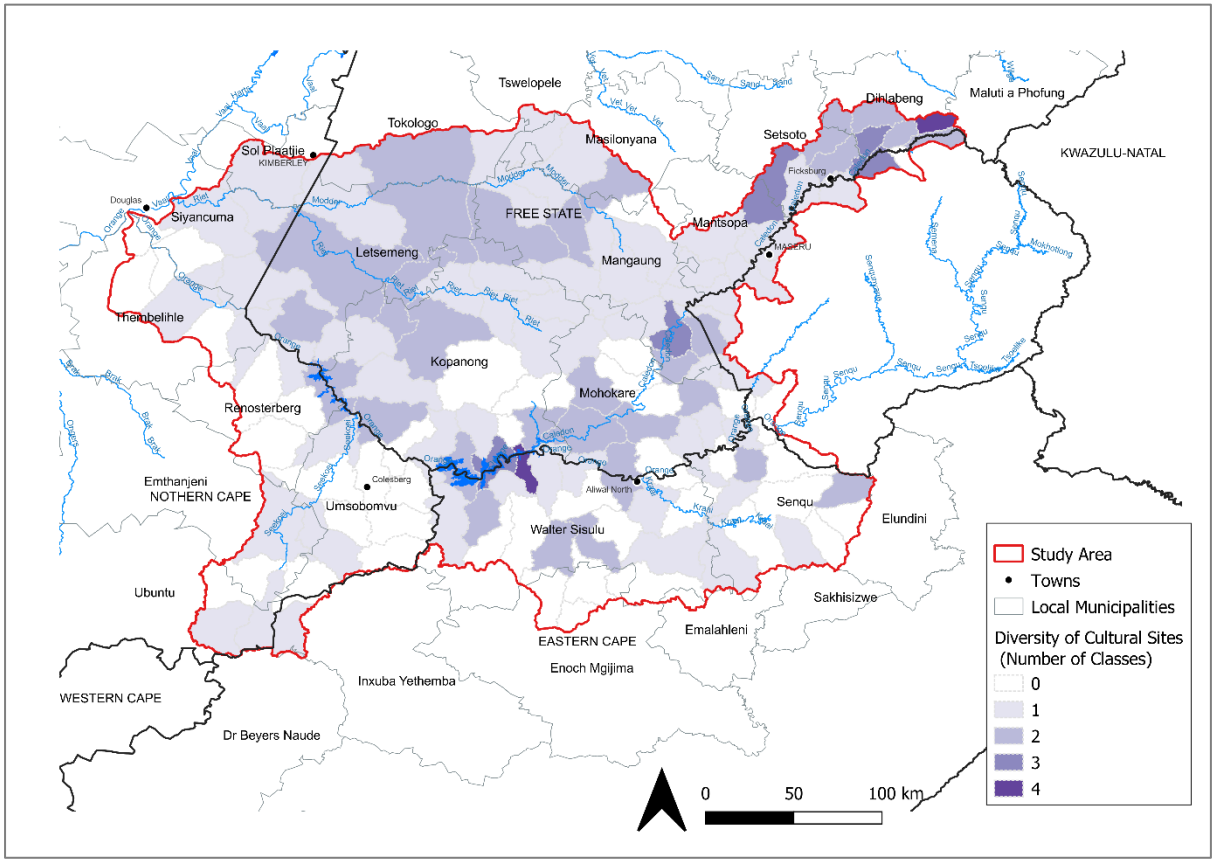


**Figure 4-16:** Spatial representation of the diversity of cultural values associated with each quaternary drainage region, Upper Orange catchment

**Table 4-20:** Sites of cultural importance, Upper Orange study area

| Site/area | Quaternary | Cultural aspect/benefit | Source |
|---|---|---|---|
| Protected areas (Figure 4-17 and Table 4-21) | Multiple | Biodiversity and non-use/indirect values, tourism (and tourism development), recreation | SA Protected Areas database (2021) |
| The "Diamond and Wine" tourist route - Jagersfontein, Koffiefontein, Landzicht Wine Cellars (R704) | C51H, K | Prominent tourism route - social economic development, open mines at Jagersfontein and Koffiefontein and the "Mining Village" at Jagersfontein are tourist attractions | Xhariep profile |
| Kalkfontein Dam & Nature Reserve (Riet River) | C51J | Recreation - local camping, fishing and picnics, not a main tourism destination | Online search |
| Spitskop Verkeerdevlei - rock art | C52E | Heritage - rock paintings | Online search |
| Slypsteenberg - Bushman/San engraving site | C52J | Heritage - Bushman/San engraving site | Online search |
| Petrusburg | C52K | Game farm areas - tourism | Xhariep profile |
| Sterkspruit - rock art | D12B | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Zastron & surrounds - rock art | D12D | Heritage - rock art | Xhariep Profile |
| Lady Grey - rock art | D12E | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Sterkstroom rock art site (between Rouxville & Aliwal North) | D12F | Heritage - rock paintings | Online search (Rock Art in the FreeState) |
| Tiffindell Ski Resort (Barkley East) | D13B | Recreation, Tourism | https://tiffindell.co.za/ |
| Rhodes - rock art | D13B | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Barkley East - rock art | D13D | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Rossouw - rock art | D13G | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Jamestown - rock art | D13J | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Aliwal North - rock art | D14A | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Burgersdorp area - rock art | D14E | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| De Bruin Dam | D14F | Targeted for tourism development & other development opportunities | Joe Gqabi Profile |
| Upper Caledon (previous EFR site C5) | D21A | Spiritual / ritual - high value given the densities of people, not sensitive to flow changes unless the river dries up completely. | Huggins et al. (2010) |

| Site/area | Quaternary | Cultural aspect/benefit | Source |
|---|---|---|---|
| Greater Clarens, Fouriesberg, Ficksberg area | D21D, D21G, D21H, D22C | Landscape aesthetic & tourism - fishing, hiking, cycling, running (including events), rafting, Heritage - rock paintings (Kiara, Schaapplaats), Heritage sites - Surrender Hill, Mushroom Rock, Titanic Rock, Nkokomohi Caves, Anglo-Boer war sites and graves | DWA (2009), Dihlabeng IDP 2020/21. |
| Senekal Fossil discoveries | Setsoto LM (outside the UO boundary). | Intellectual development, scientific knowledge, tourism potential, heritage. | Setsoto IDP 2020/21 |
| Sandstone caves -The Motouleng caves - located in the mountains between Clarens and Fouriesberg. | D21D, E, F | Spiritual/ritual, Pilgrimage - There is a fountain at the entrance of Motouleng called 'Sediba sa Bophelo', meaning 'The Fountain of Life' where people drop coins for good fortune. | Ngobese & Masoga (2019); Online search |
| Sandstone caves (Sacred caves of the Basotho) - Mount Mautse, Mautse area, Badimong cave - a complex valley with caves and isolated areas. The area lies between Ficksburg and Fouriesburg. | D22A, B; D21G, H | Spiritual/ritual - traditional healers use water from the waterfalls and herbs from the mountains; water is an ancestrally important element and the streams and pools of the caves have an important role in the ceremonies. Close to these caves is a prominent sacred medicinal clay site called 'Nkokomoni', meaning 'the swelling place'; Heritage - rock paintings; Tourism | Ngobese & Masoga (2019); Online search |
| Nkgono Annah Mantsopa Cave Site - Modderpoort farm outside Ladybrand) | D22G | Spiritual/ritual, Heritage, Pilgrimage | Ngobese & Masoga (2019) |
| Basotho Cultural Village – Golden Gate National Park | D21D | Intellectual development, heritage/culture preservation. | Online search |
| Tandjiesberg, Modderpoort - rock art site | D22G, H | Heritage, Pilgrimage | Online search |
| Old wagon-bridge, Caledon River, Wepener District | D23G | Heritage - Provincial heritage site | Online - heritage sites of the Free State |
| The Maluti route which originates in the north and includes the towns of Wepener, Van Stadensrus, Zastron and Rouxville (R26) | D23G, J, D24A,B,C,G D12D,E | Prominent tourism route - social economic development | Xhariep profile |
| Welbedacht Dam (Caledon River) & Caledon Nature Reserve - situated between Wepener and Smithfield | D23J | Heritage - rock paintings; Tourism - fishing and 4x4 (limits access) | Huggins et al. (2010); Online search |
| The Xhariep Dam Route - including Smithfield, Bethulie and Xhariep/Gariep dam (R701) | D24H, J, L, D35B, H, K | Prominent tourism route - social economic development | Xhariep profile |
| Lower Caledon (previous EFR site C6) | D24J | Tourism - the river is an important aspect of the reserve and fishing tourism. | Huggins et al. (2010) |
| Tussen-2-Riviere Nature Reserve (Confluence of Caledon & Orange) | D24L & surrounds | Recreation, Tourism - targeted for tourism expansion leisure & water sport. | Xhariep profile |
| Vanderkloof Dam | D31E | Recreation - fishing, water sports | https://adventurekayaking.co.za/ |
| Kraai (EFR K7) | D13M | Tradition & subsistence - sedges, reeds & grazing use in the former homeland areas | Huggins et al. (2010) |
| Luckhoff | D33C | Game farm areas - tourism | Xhariep profile |

| Site/area | Quaternary | Cultural aspect/benefit | Source |
|---|---|---|---|
| Archaeological occurrences – banks of the Orange River, Hopetown area | D33G | Heritage - 33 archaeological occurrences comprising more than 120 stone artefacts were recorded across the proposed development site | Matenga (2020) citing Kaplan (2017) |
| Heritage site - Old Wagon Bridge | D33G | Heritage - Provincial Site (Grade III) | Matenga (2020) |
| Phillipolis | D34G | Game farm areas - tourism | Xhariep profile |
| DH (Hennie) Steyn / Bethulie Bridge (Bethulie, Gariep Dam area) | D35B | Heritage - longest bridge in the country, landscape aesthetic, spiritual (local legend of river snake - coins tossed from bridge by returning mine workings as a peace offering) | Online search |
| Aquaculture Technology Demonstration Centre - Bethulie Town, Orange River | D35B | Intellectual development. The centre (fish hatchery) is supplied with water from the Orange River. | Xhariep profile |
| Bethulie Town | D35B | Heritage - sandstone architecture of historical importance | Xhariep Profile |
| Bethulie Town surrounds | D35B | Game farm areas - tourism | Xhariep profile |
| Gariep Dam & Nature Reserves | D35K, H & surrounds | Recreation, Tourism - game viewing, nature trails, fishing, top micro-lighting spot; targeted for tourism expansion leisure & water sport | Online search, Xhariep profile |
| Venterstad rock art | D35G | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |
| Oviston surrounds rock art | D35H | Heritage - rock art, generally sites located close to the main rivers, as well as the tributaries and streams feeding these rivers | Green (2017) |

*Note: Coloured fill indicates the main cultural aspect/value classification: Yellow – Heritage/Symbolic; Green – Recreation and Tourism; Blue – Intellectual development; Purple – Tradition/Culture/Subsistence; Orange* - Spiritual/ritual*; Grey – Biodiversity/Conservation/Intrinsic (Protected Area, also associated with tourism, heritage and intellectual values).*

Protected areas (PAs) are associated with biodiversity/conservation values as well as a range of additional cultural values, often simultaneously, such as tourism, heritage and educational importance. There are 119 PAs in the study area, Figure 4-17. Table 4-21 reports the number of PAs by LM. The PAs was extracted from the South African Protected Areas Database Quarter 2 2021 (DFFE, 2021).

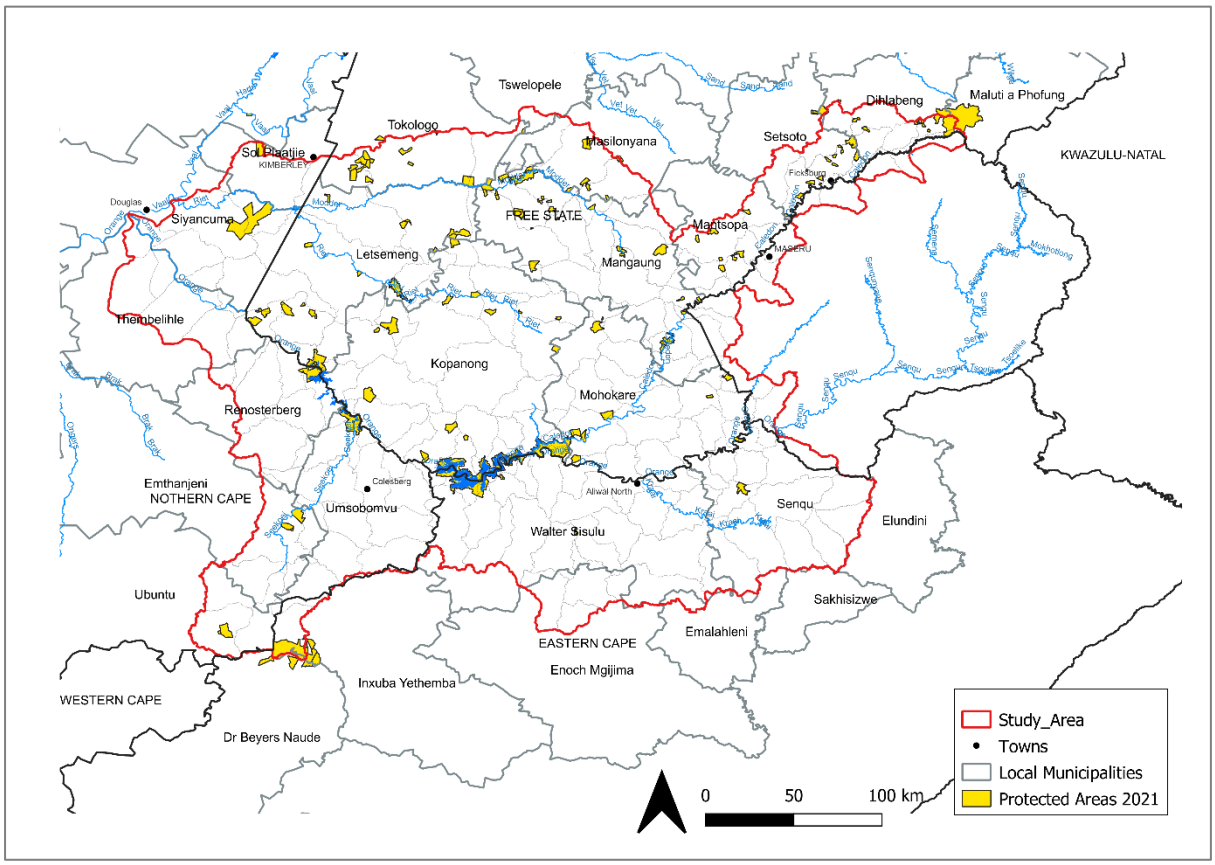


**Figure 4-17:** Protected Areas (Q2 2021) of the Upper Orange catchment

**Table 4-21:** The number of Protected Areas (PAs, Q2 2021), by local municipality, Upper Orange catchment

| | Local municipality | Number of PAs |
|---|---|---|
| 1 | Kopanong | 18 |
| 2 | Walter Sisulu | 5 |
| 3 | Letsemeng | 17 |
| 4 | Mangaung | 23 |
| 5 | Mohokare | 11 |
| 6 | Senqu | 2 |
| 7 | Umsobomvu | 3 |
| 8 | Siyancuma | 1 |
| 9 | Renosterberg | 4 |
| 10 | Thembelihle | 1 |
| 11 | Tokologo | 14 |
| 12 | Masilonyana | 7 |

| | Local municipality | Number of PAs |
|---|---|---|
| 13 | Emthanjeni | 2 |
| 14 | Mantsopa | 7 |
| 15 | Setsoto | 14 |
| 16 | Ubuntu | 2 |
| 17 | Enoch Mgijima | 0 |
| 18 | Dihlabeng | 11 |
| 19 | Sol Plaatjie | 2 |
| 20 | Inxuba Yethemba | 2 |
| 21 | Tswelopele | 1 |
| 22 | Emalahleni | 0 |
| 23 | Dr Beyers Naude | 2 |
| 24 | Maluti a Phofung | 1 |
| 25 | Elundini | 0 |
| 26 | Sakhisizwe | 0 |

*Note: There are 119 PAs in total associated with the LMs of the study area; some PAs overlap more than one LM.*

# 5. CONCLUSION

This report has profiled the socio-economic context of the Upper Orange River Catchment and documented the available data. The assessment was undertaken at the scale of local municipality as this is the finest scale supported by the broadest range of existing, representative, information. Maps have been used to spatially represent many of the socio-economic aspects/indicators. The report and associated data provide the baseline for evaluating the social consequences of potential operational flow scenarios.

The approach to the assessment was informed by the relevant DWS guidelines (DWAF, 2007; DWS, 2016). Important to note, however, is that these guidelines include methodologies and steps required for Classification and RQO determination studies, a Reserve determination study does not go into the same level of detail. Specifically, the quantification of the value of market and/or commercial use of water (i.e., macro-economic modelling) and the monetary valuation of ecosystem service and social benefit changes is beyond the scope of this study.

The following indicators have been detailed:

- Demographic characteristics;
- Indicators of the local economy;
- Land-use and related economic activities;
- Financial, physical, social and natural resource use characteristics of households;
- Current water use; and
- Features of cultural importance.

The socio-economic indicators are based on existing data and supporting information drawn from a range of sources, including Statistics South Africa reports and databases, municipal reports, spatial coverages, the Water use Authorization and Registration Management System (WARMS) and previous studies.

A high-level summary of the socio-economic profile, with a focus on water use and cultural importance, is presented in Table 5-1.

The socio-economic baseline and associated data will be used in steps 5 and 6 of the Reserve Determination process “Scenario determination, evaluation and consequences”. The information presented in this report will be integrated with information from the ecological assessments and the changes associated with the scenarios to identify and evaluate potential consequences. This will involve specialist workshops and desktop analysis.

**Table 5-1:** High level summary of the socio-economic profile, Upper Orange catchment

| Socio-economic indicators and link to vulnerability to changes in water security (quantity and/or quality) | Local Municipalities of greater vulnerability |
|---|---|
| **Population and settlement type**<br>Areas with larger populations require greater volumes of water (of potable quality). Areas with growing populations indicate increased future water demand. High population density drives local water demand, competition for resources and pressure on water resources. | Higher population size and density: Mangaung, Enoch Mgijima, Sol Plaatjie, Maluti a Phofung (only a small portion of the LM falls within the study boundary). |

| Socio-economic indicators and link to vulnerability to changes in water security (quantity and/or quality) | Local Municipalities of greater vulnerability |
|---|---|
| Areas of significant farm settlements may require greater volumes of water for irrigation/livestock watering (of appropriate quality). Rural settlement areas are likely to be more reliant directly on surface or groundwater sources. | Higher % rural settlement: Senqu, also Maluti a Phofung, Emalahleni, Elundini and Sakhisizwe (only a small portion of these LMs fall within the study boundary).<br>Higher % farm settlement: Ubuntu, Siyancuma, Tokologo, Mohokare. |
| **Community well-being**<br>Several household/population characteristics - financial, physical, social and natural - provide a sense of the well-being of communities. These indicate the ability of households/ people to cope with and adapt to shocks (such as changes in water quantity and quality) and suggest areas of municipal infrastructure service delivery needs.<br>Higher levels of poverty and dependence, for example, suggest lower levels of resilience and adaptive capacity.<br>High levels of relience on natural water sources indicate greater vulnerability to impacts on surface water, groundwater and drought (rain-water tanks) and suggest areas requiring municipal infrastructure investment. | Considering several of these indicators together provides a more nuanced sense of the vulnerability of communities to changes in river flows and quality (e.g., Figure 4-4).<br><br>Senqu, Enoch Mgijima, also Maluti a Phofung, Emalahleni, Elundini and Sakhisizwe (although only a small portion of these LMs fall within the study boundary). |
| **Overview of the economy**<br>Characteristics of the local economy indicate where people are likely to be more economically vulnerable and have fewer alternative opportunities should their livelihood activities be affected by changes in water security.<br>The size of the local economy also indicates the capacity of municipalities to support their populations in the event of shocks (such as drought).<br>The major economic sectors and local economic development plans of the municipalities provide a sense of where local economies may be highly dependent on water or where water demand may increase, with potential knock-on effects for local livelihoods if these sectors are impacted. | Senqu, Tokologo, Enoch Mgijima, also Emalahleni, Elundini, Sakhisizwe (although only a small portion of these LMs fall within the study boundary) |
| **Land-use and related economic activities**<br>These indicators provide a contextual understanding of the livelihood and economic activities of the study area, with a focus on water use and users (e.g., subsistence cultivation, irrigated commercial crops, primary economic sectors).<br>Higher water users are potentially more vulnerable to changes in water supply and/or quality in terms of greater economic or livelihood impact.<br><br>The dominant land cover across the LMs are grassland, shrubland and cultivation – overall only 10% of the cultivated area across all the LMs is classed as irrigated, but irrigation accounts for 78% of registered water use.<br><br>Hydroelectric power generation associated with Gariep and Vanderkloof Dams – local and regional benefits | A relatively higher proportion of irrigated commercial crop area: Thembelihle, Siyancuma, Sol Plaatjie, Renosterberg. Mangaung, Kopanong and Siyancuma - relatively higher Agriculture, Forestry and Fishing GVA, while also being identified as significantly vulnerable to future climate change trends (Figure 4-8). These areas may require irrigation support in future to maintain the agricultural sector.<br><br>SWSA-GW – (1) Central Pan Belt (national importance) - parts of Letsemeng (Petrusburg area – sole GW municipal supply), Kopanong and Mangaung (Figure 4-7). |
| **Water uses and sources**<br>These indicators provide a direct understanding of the reliance on surface and groundwater sources by different users. Areas of higher (direct) reliance are relatively more | Registered water use |

| Socio-economic indicators and link to vulnerability to changes in water security (quantity and/or quality) | Local Municipalities of greater vulnerability |
|---|---|
| vulnerable to changes in river and groundwater water supply and quality. Household reliance on these sources for drinking water is of particular concern (and addressed through the BHN requirement and Reserve). | Higher volumes: Letsemeng (irrigation), Mangaung (municipal supply), Thembelihle (irrigation).<br>Higher proportional reliance on SW: Mohokare, Senqu, Setsoto, Dihlabeng.<br>Higher proportional reliance on GW: Inxuba Yethemba, Tswelopele (however, low absolute water use in the study area).<br><br>Household use and BHN<br>Higher proportion of households reliant on SW: Senqu, Siyancuma.<br>Higher proportion of households reliant on GW: Thembelihle, Tokologo, Mantsopa.<br>Higher BHN SW requirements: Portions of Siyancuma, Letsemeng, Senqu, Mohokare, Thembelihle, Sol Plaatjie, Mangaung.<br>Higher BN GW requirements: Mangaung, Letsemeng, Senqu |
| **Sites of cultural importance**<br>Cultural ecosystem services are an important element of the well-being of people and many cultural services are connected to water and aquatic ecosystems. Cultural ecosystem services/values include heritage/culture/ tradition, recreation, aesthetic enjoyment, spiritual experience, intellectual and knowledge development, and intrinsic (biodiversity, conservation) value. Areas with several sites of cultural importance or sites of particularly greater value, which are associated with water or aquatic ecosystems, are more vulnerable to changes in water flows and/or quality and aquatic ecosystems. The sensitivity to change depends on the nature of the association between the cultural site/service and water. | Higher diversity of cultural services/values: Dihlabeng and Sesotho (Caledon River and surrounds), Walter Sisulu and Kopanong (Gariep Dam and surrounds).<br><br>Protected Areas (PAs), which are associated with a range of cultural values (e.g., Biodiversity/ Conservation/Intrinsic, recreation /aesthetic/ tourism, heritage and intellectual values), are spread throughout the study area.<br>Higher numbers of PAs: Mangaung, Kopanong,Letsemeng.<br>Larger PAs: Siyancuma, Gariep and Vanderkloof Dam areas. |

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