REFINEMENT OF STRATEGIC GROUNDWATER SOURCE AREAS OF SOUTH AFRICA

WP11446

INCEPTION REPORT

RDM/NAT00/02/CON/SWSA/0124
May 2024

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water & sanitation

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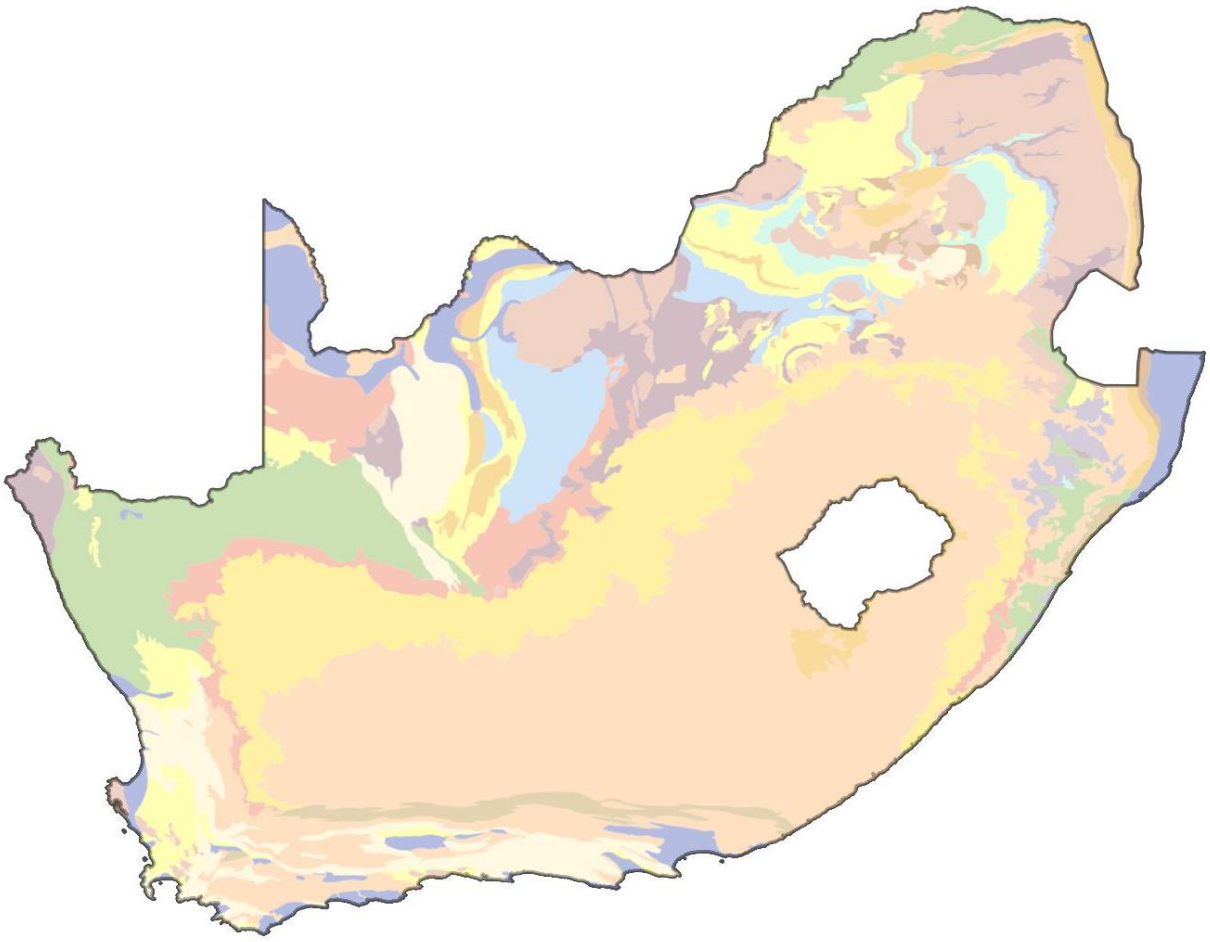
REFINEMENT OF STRATEGIC GROUNDWATER SOURCE AREAS OF SOUTH AFRICA



Inception Report
Final

Prepared for:

Department of Water and Sanitation
Chief Directorate: Water Ecosystems Management

Executive Summary

BACKGROUND

Sustainability, efficiency, and equity are core principles guiding South Africa's efforts to conserve, protect, develop, and manage its water resources. Aligned with the National Water Act (NWA; Act No. 36 of 1998), the Department of Water and Sanitation (DWS) has implemented various measures to ensure the sustainable development and protection of the country's natural water sources.

Initially labelled as "high water yield areas" in 2004, Water Source Areas (WSAs) were identified as mountainous regions that contribute significantly more to Mean Annual Runoff (MAR) compared to surrounding lowlands due to climatic factors such as abundant rainfall, or physical characteristics such as soil composition, slope and rock permeability which facilitate groundwater storage. These WSAs were subsequently refined into Strategic Water Source Areas (SWSAs), after being recognized as critical water resources.

In 2013, the Water Research Commission (WRC) conducted a comprehensive study across South Africa, Lesotho, and Eswatini (previously known as Swaziland) to identify and delineate these SWSAs. This study identified 21 areas covering 8% of South Africa and providing 50% of the country's MAR. Subsequently, in 2018, the WRC updated the definition of SWSAs to include, for the first time, Strategic Groundwater Source Areas (SWSA-gw) alongside Strategic Surface Water Source Areas (SWSA-sw). However, it is important to note that only the delineation of SWSA-sw was refined in the 2018 study. The updated classification revealed 22 SWSA-sw and 37 SWSA-gw, with groundwater source areas covering 9% of South Africa's land surface and significantly contributing to river baseflow (see **Figure A** below).

With regards to identifying groundwater areas of importance, a number of challenges emerged in the WRC 2018 study, including under- or overestimation of recharge rates and misrepresentation of groundwater usage. Nevertheless, the methodology identified areas crucial for national water supply, with some consideration given to transboundary aquifers.

In 2021, the Department of Environment, Forestry, and Fisheries (DEFF) developed a methodology for updating the WRC (2018) delineation of SWSA-sw, resulting in the creation of a fine-scale spatial layer for SWSA-sw (see **Figure A** below). While this refinement was only done for surface water, it holds promise for enhancing the delineation of SWSA-gw, aligning with the objectives of this study titled "The Refinement of Strategic Groundwater Source Areas for South Africa".

AIMS & OBJECTIVES

The DWS Chief Directorate: Water Ecosystems Management (CD: WEM) initiated this study and appointed Umvoto South Africa (Pty) Ltd as the Professional Service Provider (PSP). The project aims to assist the DWS CD: WEM in refining the delineation of South Africa's Strategic Water Source Areas (SWSA), specifically Groundwater Sources. This refinement will enhance spatial precision, refining SWSA-gw to be aquifer-specific (where feasible). The updated delineation of SWSA-gw will guide the implementation of protective measures, requiring collaboration among government and non-government stakeholders, in line with the Integrated Water Resource Management (IWRM) initiative mandated by the National Water Act (NWA; Act No. 36 of 1998).

The objective of this report is to establish a clear understanding of the project's scope from the outset. These elements, including associated discussions and agreements, are incorporated into a comprehensive project plan, which also details the stakeholder engagement and capacity-building program. This forms Deliverable 1 - the Inception Report, acting as a foundational document facilitating continuous monitoring, evaluation, and management of the project's progress according to predetermined objectives and performance metrics, encompassing cost, time, and quality.

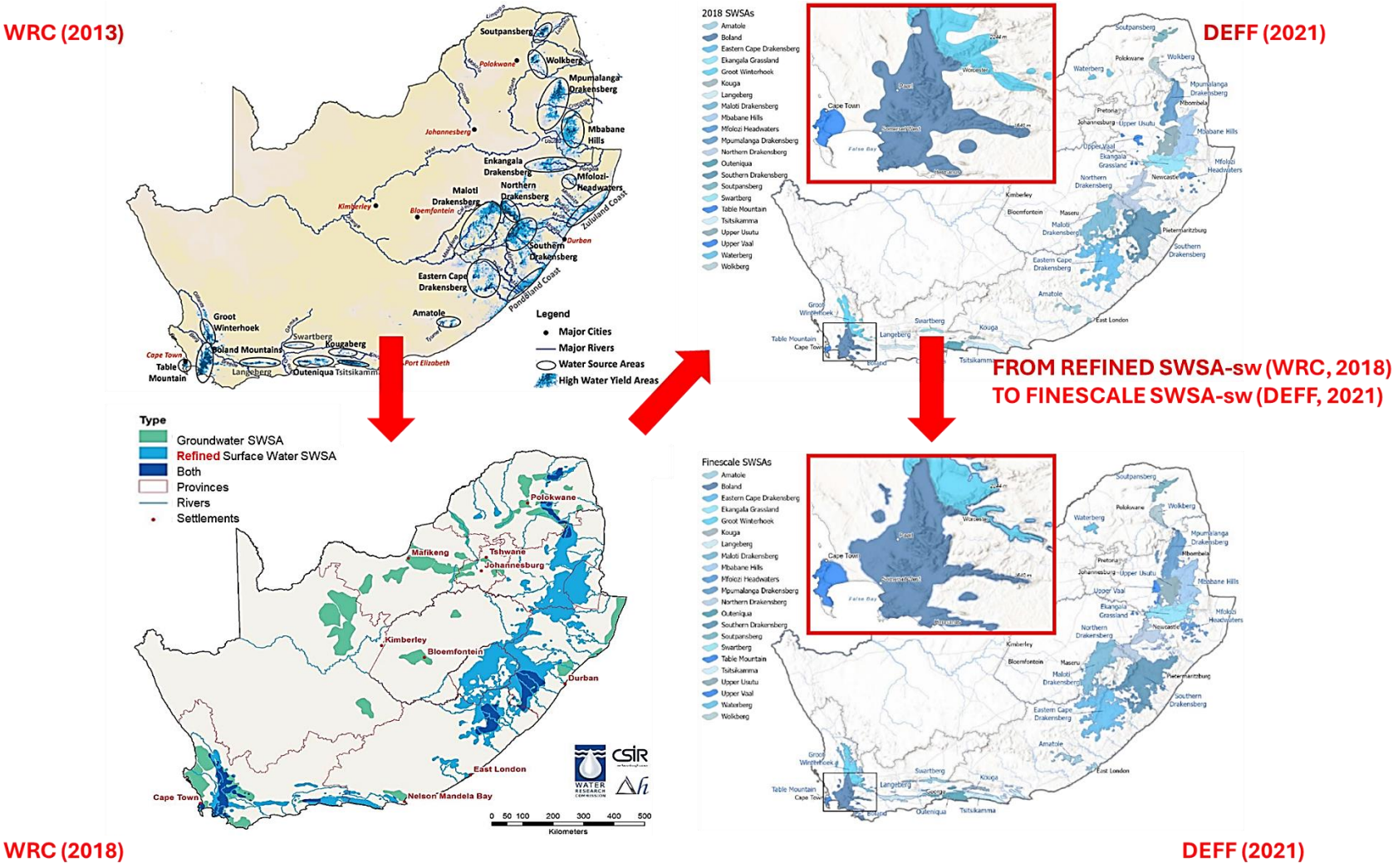


Figure A: The evolution of Strategic Water Source Areas (SWSA) for South Africa (after WRC, 2013; WRC, 2018; and DEFF, 2021).

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List of Abbreviations and Acronyms

BHN	-	Basic human Needs
BID	-	Background Information Document
BSc	-	Bachelor of Science
CB	-	Capacity Building
CD: WEM	-	Chief Directorate: Water Ecosystems Management
CGS	-	Council for Geoscience
CMA	-	Catchment Management Agency
CSIR	-	Council for Scientific and Industrial Research
DEFF	-	Department of Environment, Forestry and Fisheries
DPME	-	Department of Planning, Monitoring and Evaluation
DWAF	-	Department of Water Affairs and Forestry
DWS	-	Department of Water and Sanitation
EWR	-	Ecological Water Requirements
GIS	-	Geographic Information System
GRAII	-	Groundwater Resource Assessment II
GW	-	Groundwater
HDI	-	Historically Disadvantaged Individuals
IWRM	-	Integrated Water Resource Management
Ltd	-	Limited Company
MAP	-	Mean Annual Precipitation
MAR	-	Mean Annual Runoff
MTSF	-	Medium-Term Strategic Framework
NGA	-	National Groundwater Archive
NSSDF	-	National Spatial Strategic Development Framework
NWA	-	National Water Act
NWMP	-	National Water Master Plan
NWRS	-	National Water Resource Strategy
PMC	-	Project Management Committee
PO	-	Purchase Order
PR	-	Progress Report
PS	-	Public Stakeholder
PSC	-	Project Steering Committee
PSP	-	Professional Service Provider
Pty	-	Proprietary Limited
QGIS	-	Quantum Geographic Information System
QSE	-	Qualifying Small Enterprise
SACNASP	-	South African Council for Natural Scientists
SANBI	-	South African National Biodiversity Institute
SQL	-	Structured Querying Language
SWSA	-	Strategic Water Source Areas
SWSA-gw	-	Strategic Groundwater Source Areas
SWSA-sw	-	Strategic Surface Water Source Areas
ToR	-	Terms of Reference
VAT	-	Value Added Tax
WARMS	-	Water use Authorization & Registration Management System
WP	-	Work Package
WR2005	-	National Water Resources Assessments (2005)
WR90	-	National Water Resources Assessments (1990)
WRC	-	Water Research Commission
WSA	-	Water Source Areas
WWF SA	-	Worldwide Fund for Nature in South Africa

1. INTRODUCTION

1.1. Background

The Department of Water and Sanitation (DWS) Chief Directorate: Water Ecosystems Management (CD: WEM), initiated a study for the "Refinement of Strategic Groundwater Source Areas of South Africa" (WP114466) and appointed Umvoto South Africa (Pty) Ltd (hereafter referred to as Umvoto) as the Professional Service Provider (PSP) based on a tender submitted in August 2023.

The objective of the project is to support the DWS CD: WEM in enhancing the delineation of South Africa's Strategic Water Source Areas (SWSA), specifically Groundwater Sources (SWSA-gw), refining them with increased precision, to a spatial scale fine enough to be aquifer specific (where feasible). This updated delineation will serve as a guide for implementing various protective measures, which will require collaboration among government and non-government stakeholders, in line with the Integrated Water Resource Management (IWRM) initiative mandated by the National Water Act (NWA, Act No. 36 of 1998).

This project will build upon baseline studies conducted in 2013 by the Water Research Commission (WRC), supported by the Worldwide Fund for Nature in South Africa (WWF SA) and the Council for Scientific and Industrial Research (CSIR), titled "Defining South Africa's Water Source Areas" (WRC, 2013), the outcomes of which were integrated into the 2013 National Water Resource Strategy (NWRS-2, 2013), which designates SWSAs as sites requiring specific protection for the country's water security.

Following these publications, a study by the WRC (2018), in consultation with the CSIR and Delta-h Water Systems Modelling, updated the definition of SWSA 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). They included transboundary Water Source Areas that extend into Lesotho and Swaziland".

The WRC (2018) study not only identified and refined Strategic Surface Water Source Areas (SWSA-sw) of national significance but also, for the first time, recognized and identified Strategic Groundwater Source Areas (SWSA-gw) of national and sub-national significance. These areas were assessed based on available volumes or their significance in terms of supplying water to settlements and agriculture. Consequently, 22 SWSA-sw and 37 SWSA-gw were identified at a national scale (**Figure 1**).

The benefits and risks to these areas were evaluated, including supply to urban areas, for domestic and industrial purposes, for irrigation, and to the economic activities that those centres sustain. Additionally, the study assessed the impacts and potential risks to these areas from changes in land cover, mining and alien plant invasions. The findings were integrated into the National Water Master Plan (NWMP; DWS, 2018) and in the National Spatial Strategic Development Framework (NSSDF) - a study done by the Department of Planning, Monitoring and Evaluation (DPME, 2018).

A more detailed summary of the WRC (2018) study can be found in **Section 2** with the main results included in the projects Main Integrated Report (Le Maitre, et al., 2018a) and the Management Framework and Implementation Guidelines for Planners and Managers Report (Le Maitre, et al., 2018b) outlining relevant policy and legislation, and summarizing the significance of SWSAs, key findings, and recommendations for the public.

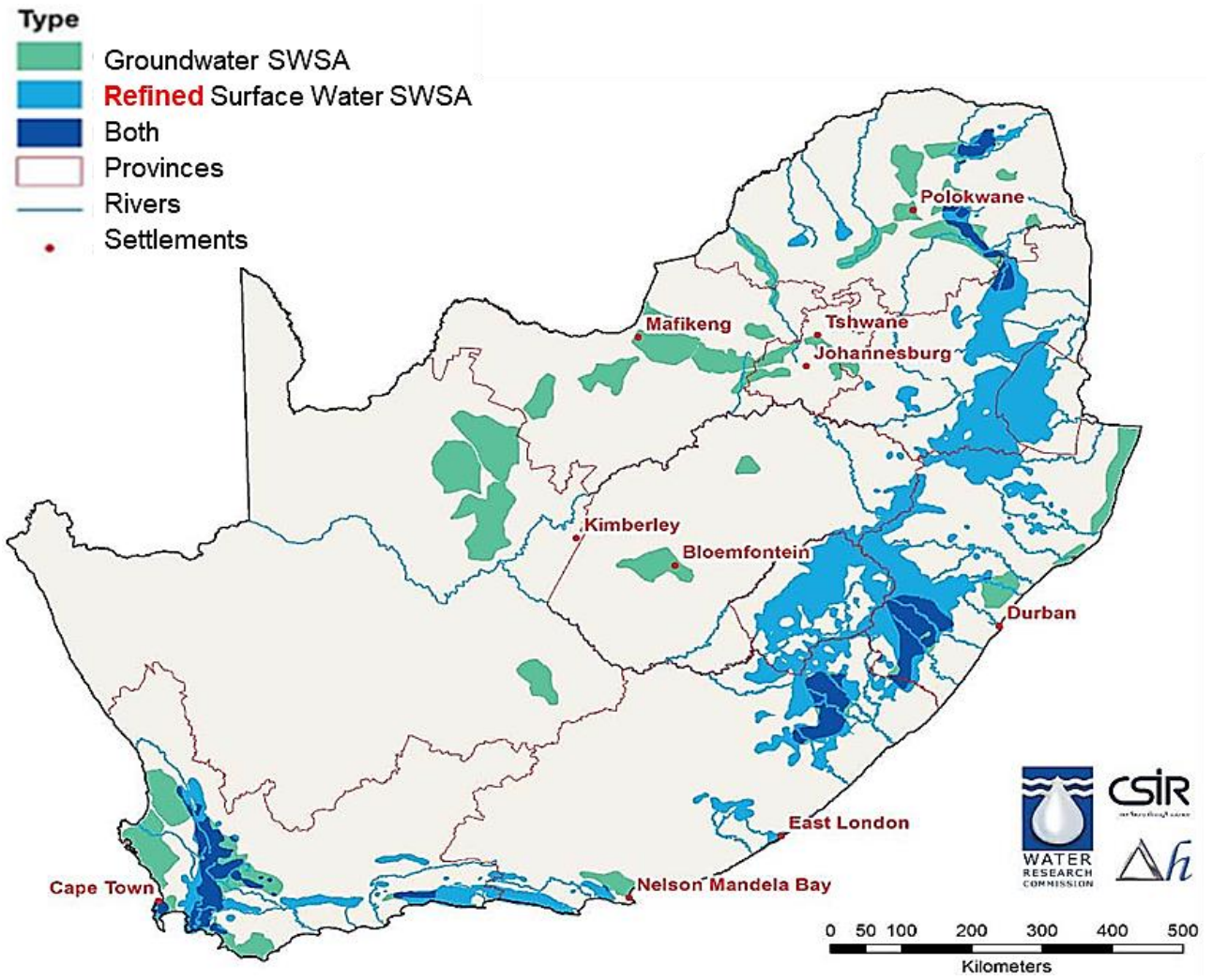

Figure 1: **Strategic Water Source Areas for surface water and groundwater (SWSAs) in South Africa, Lesotho and Swaziland. SWSA for groundwater were not identified in Lesotho and Swaziland because suitable datasets were not available (after WRC, 2018).**

Since SWSA-sw were refined in the WRC (2018) study, a similar refinement process is now required for SWSA-gw, one that integrates an updated delineation process. This refinement is necessitated by the recognition of limitations within the WRC (2018) study, especially concerning the delineation criteria and thresholds used for identifying and delineating groundwater resource areas (discussed further in **Section 2**).

This project will leverage the foundational information from the studies and national strategies mentioned above to “Refine Strategic Groundwater Source Areas of South Africa” as stated in the projects Terms of Reference (ToR; **Section 1.2**).

It is important to clarify that the refinement of SWSA-gw does not aim to be a complete revision of the WRC (2018) study. Instead, its primary objective is to update the methodology and criteria used in the identification and delineation process for SWSA-gw only. The process aims to improve spatial resolution, where feasible, thereby enabling their integration into various catchment- and local-level planning, management, and regulatory processes.

1.2. Terms of Reference

The Terms of Reference prepared by the DWS CD: WEM for this study outline the aims and objectives as follows:

"The primary aim of the project is to enhance the delineation of SWSA-gw to an aquifer-specific scale, building upon the baseline information provided by the 2018 study. The objectives include:

1. Developing a scientifically sound methodology for delineating SWSA-gw for both national and transboundary aquifers/aquifer systems, incorporating considerations for groundwater quality.
2. Reviewing and refining the scale of SWSA-gw to the aquifer level.
3. Developing an approach for the protection and management of the refined SWSA-gw.

Throughout these processes, it is imperative to ensure consultative engagement, keeping all interested and affected parties, stakeholders, water users, etc., informed about developments."

1.3. Aims and Objectives of this Report

The purpose of this report is to define, assess, and understand the nature of the project, establishing a clear and concise project scope from the outset. This inception phase serves as an opportunity to review the project requirements and provide an overview of the existing literature and information related to SWSAs. This will lay the necessary foundation for the subsequent SWSA-gw refinement process as outlined in Section 3.1; pg. 6 of the Tender document and detailed in **Sections 3** and **5** of this report. Below is a summary of the report outcomes:

- Outlining the project's scope,
- Conducting a high-level review of existing refinement methodologies
- Presenting a comprehensive overview of the SWSA-gw of South Africa,
- Developing a preliminary list of key stakeholders and engagement plan,
- Developing a capacity-building and mentorship program.

These components, along with the associated discussions and agreements is consolidated into a comprehensive project plan, forming **Deliverable 1 - Inception Report**. This report serves as a foundational point of reference, facilitating continuous monitoring, evaluation, and control of the project's progress regarding the predefined objectives and performance metrics, including cost, time, and quality.

1.4. Project Dates

The project's duration spans 36 months, commencing officially on 1st April 2024 and scheduled for completion on 31st March 2027. For specific reporting milestones and work plan, refer to **Section 5: Work Programme.**

2. OVERVIEW

2.1. Background of Strategic Water Source Areas

Historically, the term Water Source Areas (WSAs) has typically denoted mountainous regions that play a significant role in generating the Mean Annual Runoff (MAR) and supporting the water needs of neighbouring lowlands (Meybeck et al., 2001; Nel et al., 2013b; Viviroli et al., 2007; WWF-SA, 2013). This substantial contribution stems from a variety of factors, such as climatic conditions like high rainfall and physical characteristics like soil composition, slope, and rock permeability, all of which facilitate groundwater storage.

In South Africa, the recognition of mountain catchments as WSAs emerged as a national concern following droughts in the 1800s and the 1920s and 1930s (Beinart, 1984).Subsequently, the Soil Conservation Board initiated various conservation strategies for primary mountain catchments in 1959, designating them as WSA after comprehensive analysis identified 109 important catchments based on their geographic features, river data, runoff significance, forested area, and ecological conditions (Government of South Africa, 1961). This effort led to the enactment of the Act for the Proclamation of Mountain Catchment Areas (Act 63 of 1970), which only designated some of these areas as a “critical” water resource, limiting their conservation and sustainable management.

In 2004, the first National Spatial Biodiversity Assessment of South Africa (Driver et al., 2005) examined quaternary catchments contributing more than 20% of the country's MAR. This evolved into identifying “high water yield areas” also known as Strategic Water Source Areas (SWSAs), using refined MAR data at the quaternary catchment resolution from the National Water Resources Assessments in 1990 (WR90, Midgley et al., 1994) and 2005 (WR2005, Middleton and Bailey, 2009).

In 2013, a study conducted by the WRC, WWF-SA, and the CSIR for South Africa, Lesotho, and Eswatini expanded on these findings, focusing on SWSAs of national importance (Nel et al., 2013a). This study aimed to establish SWSAs using defined criteria and thresholds, primarily focusing on surface water resources. A total of 21 SWSAs were identified which were then incorporated into the NWRS (2013) as protected areas. These areas were identified using WR2005 data for mean annual rainfall at a quaternary catchment scale, which was then disaggregated to a 1 x 1 minute grid resolution using published rainfall-runoff relationships for South Africa. The outputs highlighted areas with MAR >135 mm, representing over 50% of surface water runoff (see **Table 1** and **Figure 2**).

The total area of SWSAs defined in 2013 is 102,172 km^2 (8% of the total land area), producing a MAR of 25,099 million m^3/a (50% of the total MAR), based solely on surface water runoff. Notably, groundwater, despite its importance as a reliable water source in South Africa, was not considered in this study (WRC, 2018).

Table 1: Mean annual runoff (MAR) classes used to distinguish water source areas. These are 1 x 1 minute grid cells producing ≥ 135 mm per year (WRC, 2013).

			% MAR contribution from:		
mm/year range	% regional MAR	% regional land surface area	South Africa	Lesotho	Eswatini
≥ 420	10	1	86	9	5
≥ 290	20	2	79	13	8
≥ 220	30	3	78	13	9
≥ 135	50	8	80	12	8
≥ 60	75	19	84	11	5
≥ 25	90	33	89	7	4

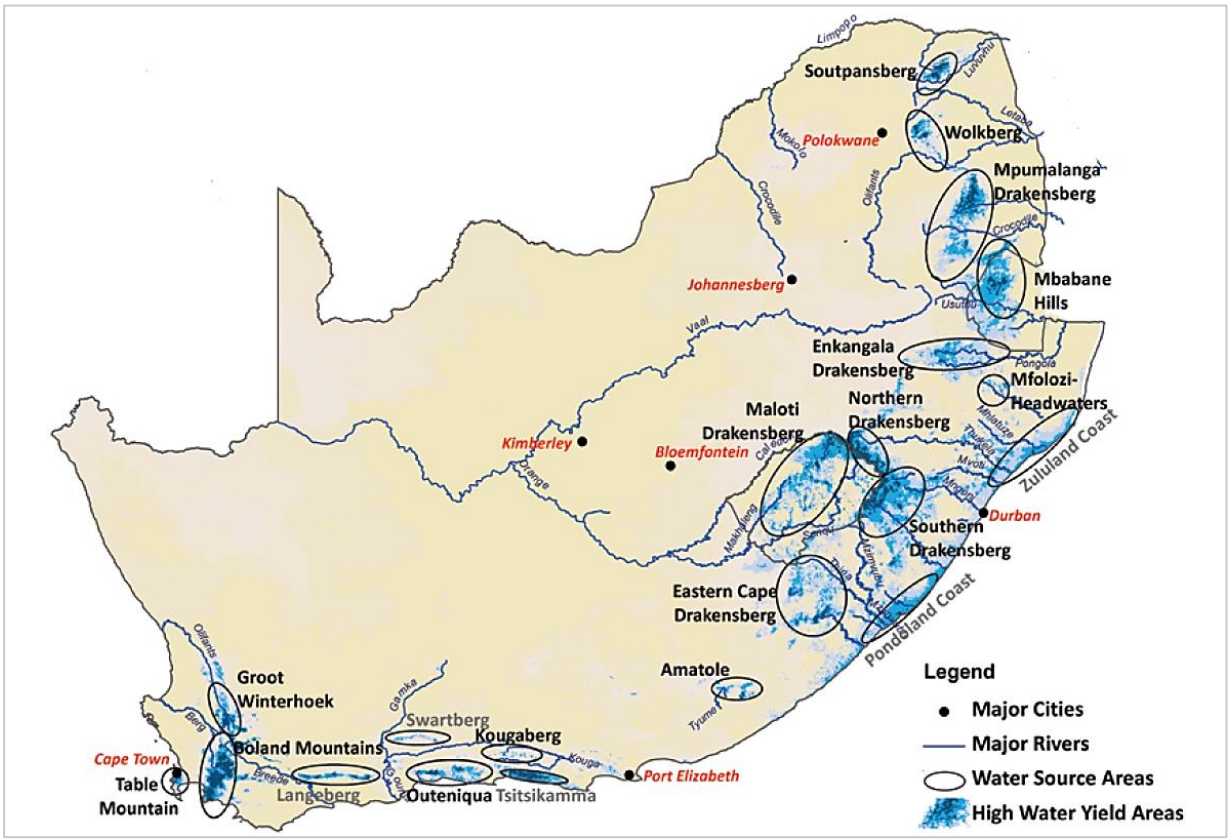

Figure 2: **The strategic water source areas (SWSA) identified on a national scale in South Africa, Lesotho, and Swaziland in WRC (2013). This study serves as the foundation for the WRC (2018) study. See Figure 1.**

A subsequent shift in perspective towards national water planning prompted a study by the WRC (2018) aimed at updating the 2013 definition of SWSAs. This study not only refined the WRC (2013) SWSA-sw but also, for the first time, identified Strategic Groundwater Source Areas (SWSA-gw) at both national (**Table 2**) and sub-national levels (**Table 3**). The identification of both the SWSA-sw and SWSA-gw considered available volumes and their national importance in supplying water for settlements and agriculture. As a result, 22 SWSA-sw and 37 SWSA-gw were identified (refer to **Figure 1** and **Figure 3**).

The final grouping of 22 SWSA-sw cover 124 075 km^2 (10% of the region, which extend into Lesotho and Eswatini) and provide a MAR of 24 954 million m^3 (50% of the total). These areas are predominantly situated in high rainfall regions along the central and eastern sides of the country, which feed into major river systems such as the Orange, Thukela, and Mzimvubu.

The identification of 37 SWSA-gw were primarily based on high groundwater availability and national importance. Five criteria, along with associated thresholds (see **Table 4**), were utilized to identify and delineate the areas. These SWSA-gw hold considerable groundwater potential and often intersect with SWSA-sw, highlighting the relationship between rainfall, recharge, and baseflow. The 37 SWSA-gw areas cover approximately 9% of South Africa's land surface, contributing up to 42% of river baseflow. The total recharge for South Africa is estimated at 34,912 million m^3/a, with recharge generated by SWSA-sw accounting for ~ 11,675 million m^3/a (33%) and SWSA-gw contributing ~ 5,397 million m^3/a (15%) of the total recharge (WRC, 2018).

Challenges noted during the WRC (2018) study were centred around comprehensively assessing SWSA-gw due to under- or over-estimated recharge. The methodology focused solely on areas where high recharge coincided with significant usage (or dependency) on a national scale. Although some transboundary aquifers were evaluated for SWSA-gw, they did not meet the study's criteria for nationally important SWSA-gw (see **Figure 1**).

Table 2: SWSA-gw of National Importance (WRC, 2018).

Number	SWSA-gw or WSA-gw Name	Area (km^2)
1	Bo-Molopo Karst Belt	5 268
2	Cape Peninsula and Cape Flats	599
3	Central Pan Belt	3 368
4	Coega TMG Aquifer	1 682
5	Crocodile River Valley	2 163
6	De Aar Region	2 475
7	Eastern Kalahari A	2 010
8	Eastern Kalahari B	2 656
9	Eastern Karst Belt	1 984
10	Far West Karst Region	1 382
11	George and Outeniqua	727
12	Giyani	438
13	Ixopo/Kokstad	7 150
14	Kroondal/Marikana	795
15	Kroonstad	799
16	KwaDukuza	2 352
17	Letaba Escarpment	2 151
18	Northern Ghaap Plateau	6 274
19	Northern Lowveld Escarpment	5 168
20	Northwestern Cape Ranges	3 638
21	Nyl and Dorps River Valley	2 036
22	Overberg Region	2 261
23	Phalaborwa	433
24	Richards Bay GW Fed Lakes	606
25	Sandveld	4 010
26	Sishen/Kathu	4 827
27	Southern Ghaap Plateau	6 542
28	Southwestern Cape Ranges	2 749
29	Soutpansberg	2 573
30	Transkei Middleveld	5 607
31	Tulbagh-Ashton Valley	3 560
32	Upper Sand (Polokwane) Aquifer System	966
33	Ventersdorp/Schoonspruit Karst Belt	2 875
34	Vivo-Dendron	2 555
35	West Coast Aquifer	4 586
36	Westrand Karst Belt	1 090
37	Zululand Coastal Plain	3 305

Table 3: SWSA-gw of Sub-National Importance (WRC, 2018).

Number	SWSA-gw or WSA-gw Name	Area (km^2)
38	Arlington	1 553
39	Beaufort West	786
40	Blouberg	666
41	Carnarvon	659
42	Eastern Upper Karoo	6 131
43	Great Kei	1 416
44	Hertzogville	447
45	Kamieskroon	3 314
46	Komaggas Cluster	364
47	Lower Mzimvubu	1 199
48	Loxton	397
49	Nelspoort	509
50	Northern Highveld	1 345
51	Port Nolloth	512
52	Strandfontein	291
53	Sutherland	1 253
54	Upper Keurbooms	1 223
55	Van Wyksdorp	599
56	Vanrhynsdorp	1 423
57	Willowmore	289

Table 4: Criteria and thresholds used in groundwater source area delineation (WRC, 2018).

Criteria	Description	Threshold	Motivation
1	Recharge as mm/a (GRAII, (DWAF, 2006)).	>65 mm/a	Corresponds to >50% of the national recharge volume.
2	Ratio of recharge per 1 km^2 grid cell compared to the average recharge of the secondary catchment.	>1.5	Threshold set iteratively and subjectively.
3	Registered groundwater use (WARMS) as l/s per km^2 (Kernel function).	>0.3 l/s/km^2	Threshold set iteratively and subjectively.
4	Towns/village clusters with groundwater as sole supply, for current domestic water supply, mapped as points with a 10 km radius.	None (i.e., all areas included)	All areas are relevant, no threshold to be met.
5	Groundwater resource unit used for current or future supply to an area of national economic importance, and groundwater control areas	None (i.e., all areas included)	National interest.

SWSA-gw supply about 46% of agricultural and 47% of industrial groundwater needs, with 8% of economic centres falling within national SWSA-gw. Roughly 24% of settlements within SWSA-gw rely on groundwater for their Basic Human Needs (BHN), compared to around 10% of national settlements. The role of groundwater in maintaining surface water flow and meeting Ecological Water Requirements (EWRs) is also very important and should have been considered in the delineation (WRC, 2018).

Several limitations were identified in the WRC (2018) study attributed to the scarcity of comprehensive groundwater use and recharge data, especially on a national scale. Additionally, the subjective nature of translating and establishing criteria for SWSA into specific parameters for groundwater sources introduced potential discrepancies in identifying areas of significance, possibly leading to underestimation or overestimation at the national level. Furthermore, inconsistencies in classifying areas primarily dependent on groundwater as significant sources raise concerns regarding the delineation process and the formulation of associated resource protection strategies.

In 2021, the Department of Environment, Forestry and Fisheries (DEFF), in collaboration with the South African National Biodiversity Institute (SANBI), WWF-SA, and CSIR, undertook a study to establish a methodology for developing a fine-scale spatial layer for SWSA-sw in South Africa (see **Figure 5**). This approach, utilizing Empirical Bayesian Kriging Regression Predictions, aimed to support the achievement of Medium-Term Strategic Framework (MTSF) targets, particularly securing 11 of the 22 SWSA-sw by 2024. The study emphasized the need for more precise delineation of SWSA-sw to facilitate reliable application at the catchment level. The DEFF (2021) Technical Report details the methodology for downscaling spatial surfaces and delineating fine-scale SWSA-sw for various strategic applications, especially those with legal implications.

In Summary, the DEFF (2021) refinement of the WRC (2018) SWSA-sw required a new interpolated and downscaled Mean Annual Precipitation (MAP) surface for South Africa. Utilizing data from over 12,000 rain gauges provided by the University of KwaZulu-Natal, interpolation techniques were employed to estimate MAP values in unmeasured locations, creating a fine-scale continuous precipitation surface for the country.

The fine-scale SWSA delineation, validated against the 2018 SWSA layer, exhibited a high spatial overlap (74%). Both layers showed similarity in overall size (99.9%), summed MAR (97.6%), and summed MAP (96.8%). This suggests that while adapting the recognized WRC (2018) SWSA-sw for finer-scale implementation, the fine-scale layer retained the essential characteristics of the previously identified SWSA-sw.

While the DEFF (2021) study primarily targeted the refinement of Surface Water SWSA, the methodologies employed in this research hold promise for enhancing the delineation of SWSA-gw, which is the primary focus of this study.

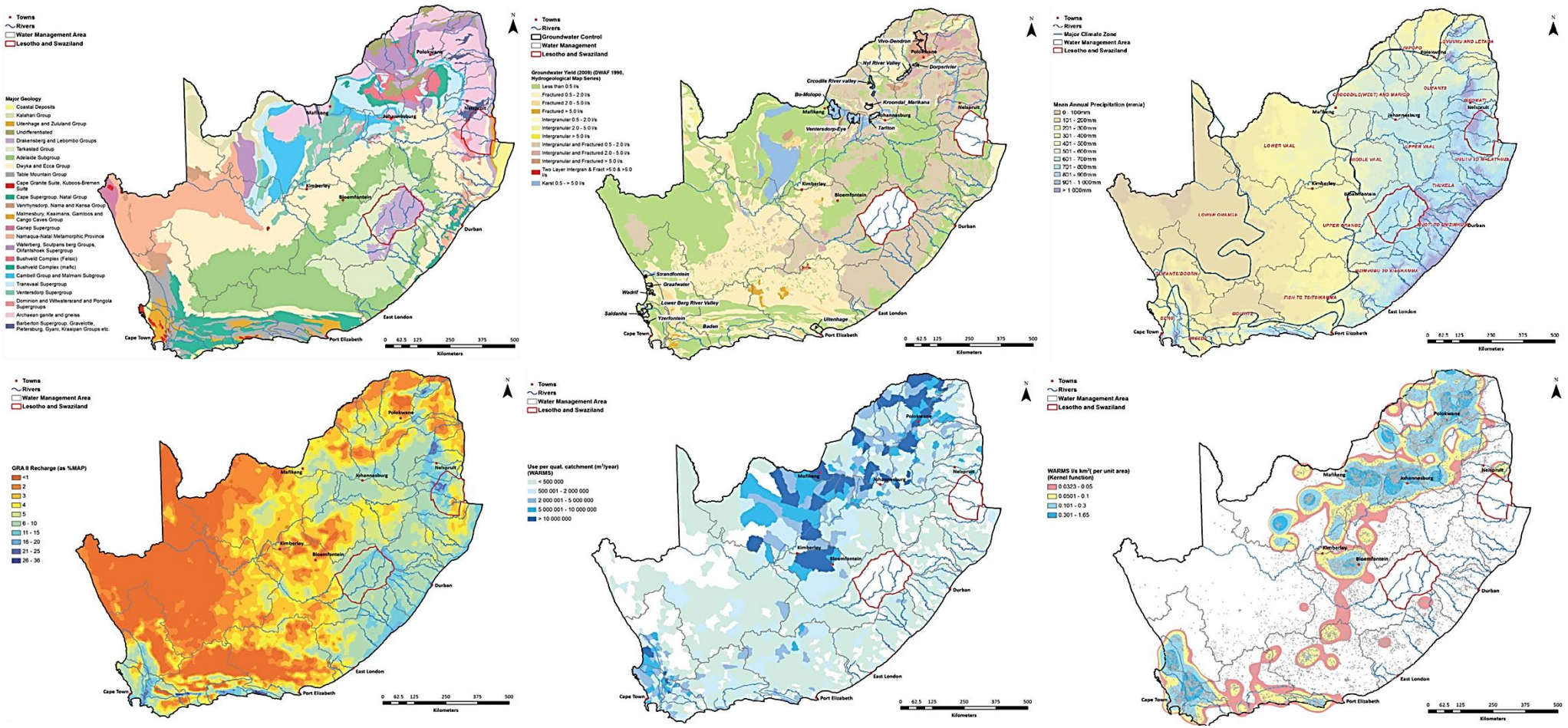

Figure 3: **A series of map layers from WRC (2018) study which were used in the SWSA-gw delineation. Top Left: 1: 1000 000 Geology showing the stratigraphy based on data from the CGS. Top Middle: 1: 1000 000 Aquifer types showing including typical borehole yields based on data from the NGA. Top Right: MAP based on data from the WR90 study. Bottom Left: Aquifer recharge as a % MAP based on the GRAII data. Bottom Middle: Groundwater use in WARMS – expressed as sum per quaternary catchment. Bottom Right: Groundwater use in WARMS – expressed as l/s per 1 km^2 (using Kernel function).**

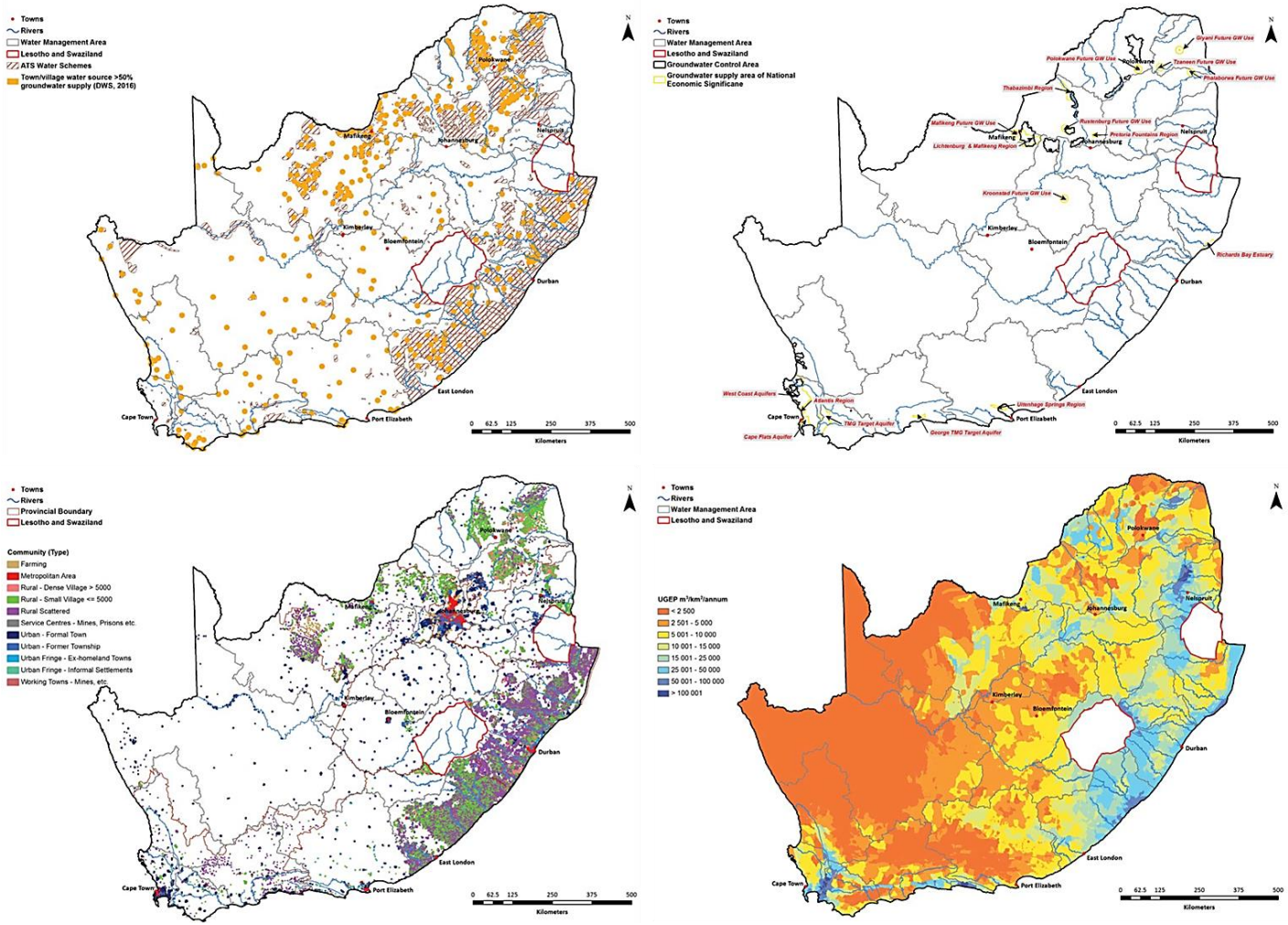

Figure 4: **A series of map layers from WRC (2018) study which were used in the SWSA-gw delineation. Top Left: Towns and villages where groundwater is >50% of the water supplied and thus qualifies as the sole supply. Top Right: Current and future groundwater supply to 26 areas of national economic significance and groundwater control areas. Bottom Left: Distribution of the different settlement types across South Africa. Bottom Right: Utilisable groundwater based on the exploitation potential.**

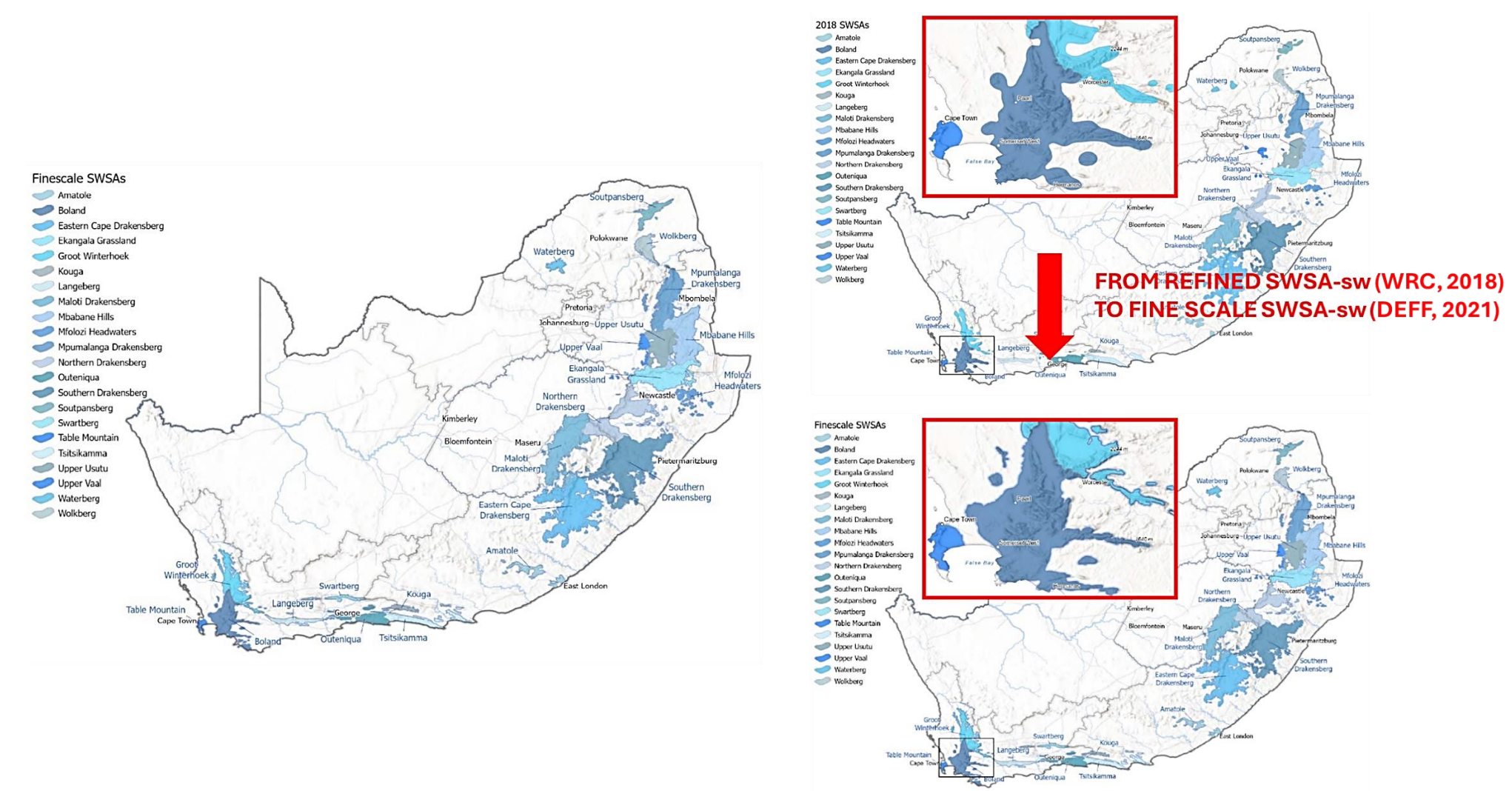

Figure 5: **A series of map layers from the DEFF (2021) study which were used in the fine scale SWSA-sw delineation. Left: Fine-scale national SWSA-sw based on the downscaled MAP surface for South Africa. Top Right: The 22 WRC (2018) SWSA-sw. Bottom Right: Fine Scale SWSA-sw to inform catchment- and local-level planning and decision-making. The inset map (red square) demonstrates the improvement in scale from WRC (2018) to DEFF (2021) for the Boland area.**

2.2. The Study Area

The study area covers the entirety of South Africa and will include areas related to transboundary aquifer systems in its neighbouring countries, including Namibia, Botswana, Zimbabwe, Mozambique, Eswatini, and Lesotho. There are four main types of aquifers based on geological and hydrogeological attributes, viz. Intergranular, Fractured, Intergranular / Fractured (weathered), and Karst aquifers. According to Jonck, F. and Mayer, S. (2003), around 10% of South Africa's groundwater is found in primary (Intergranular) aquifers, while the majority resides in secondary aquifers, where water movement is guided by natural pathways such as cracks, fractures, faults, joints, and dissolution channels (in Karst aquifers).

South Africa's climate varies spatially, with drier conditions prevailing in the northwestern regions compared to the more humid eastern and southern coastal areas. This gives rise to distinct rainfall and temperature patterns, influencing how different regions replenish their water sources. The country contends with water scarcity due to its arid to semi-arid climate.

South Africa has weathered a series of severe droughts. The 1991-1992 drought had a significant impact on the Eastern Cape, KwaZulu-Natal, and Free State provinces. More recently, the country experienced droughts from 2002 to 2005 and 2015 to 2018, predominantly affecting the Western Cape and Eastern Cape, with certain regions still struggling with arid conditions.

Specific Groundwater Source Areas (SWSA-gw) face heightened risks due to these droughts, particularly in the northwestern regions. On average, South Africa receives annual rainfall of 464 mm. However, some areas, like the Northern Cape region and the western interior, receive less than 35 mm of rainfall annually, making them among the driest in the country (WRC, 2018).

In addition to its national aquifers, South Africa shares nine transboundary aquifers with neighbouring countries (**Table 5** and **Figure 6**). Some of these aquifers fall within conservation areas, while others do not, as their sources (recharge zones) lie outside of South Africa.

Collaboration among these neighbouring countries is imperative for sustainable management and protection. However, data and information often lack alignment, hindering effective cooperation. Nonetheless, since these aquifers contribute to South Africa's water resources, they require suitable protection and should be considered in the SWSA-gw identification and refinement methodology.

Table 5: Known transboundary aquifers after IGRAC (International Groundwater Resources Assessment Centre), 2021 - Transboundary Aquifers of the World Map Scale 1: 50 000 000.

Aquifer Name	Countries	Source
Tuli Karoo Sub-Basin	Botswana, South Africa, Zimbabwe	SADC (2011)
Ramotswa /Zeerust / Lobatse Dolomite Basin Aquifer	Botswana, South Africa	XRI (2016)
Rhyolite-Breccia Aquifer	South Africa, Eswatini, Mozambique	TBA (2009)
Coastal Sedimentary Basin V	South Africa, Namibia	TBA (2009)
Stampriet Aquifer System	Botswana, Namibia, South Africa	SADC (2011)
Khakhea/Bray Dolomite	Botswana, South Africa	Slavek (2008)
Coastal Sedimentary Basin VI / Coastal Plain Sedimentary Basin Aquifer	Mozambique, South Africa	SADC (2011)
Karoo Sedimentary Aquifer	Lesotho, South Africa	TBA (2009)
Limpopo Basin	Mozambique, South Africa, Zimbabwe	TBA (2009)

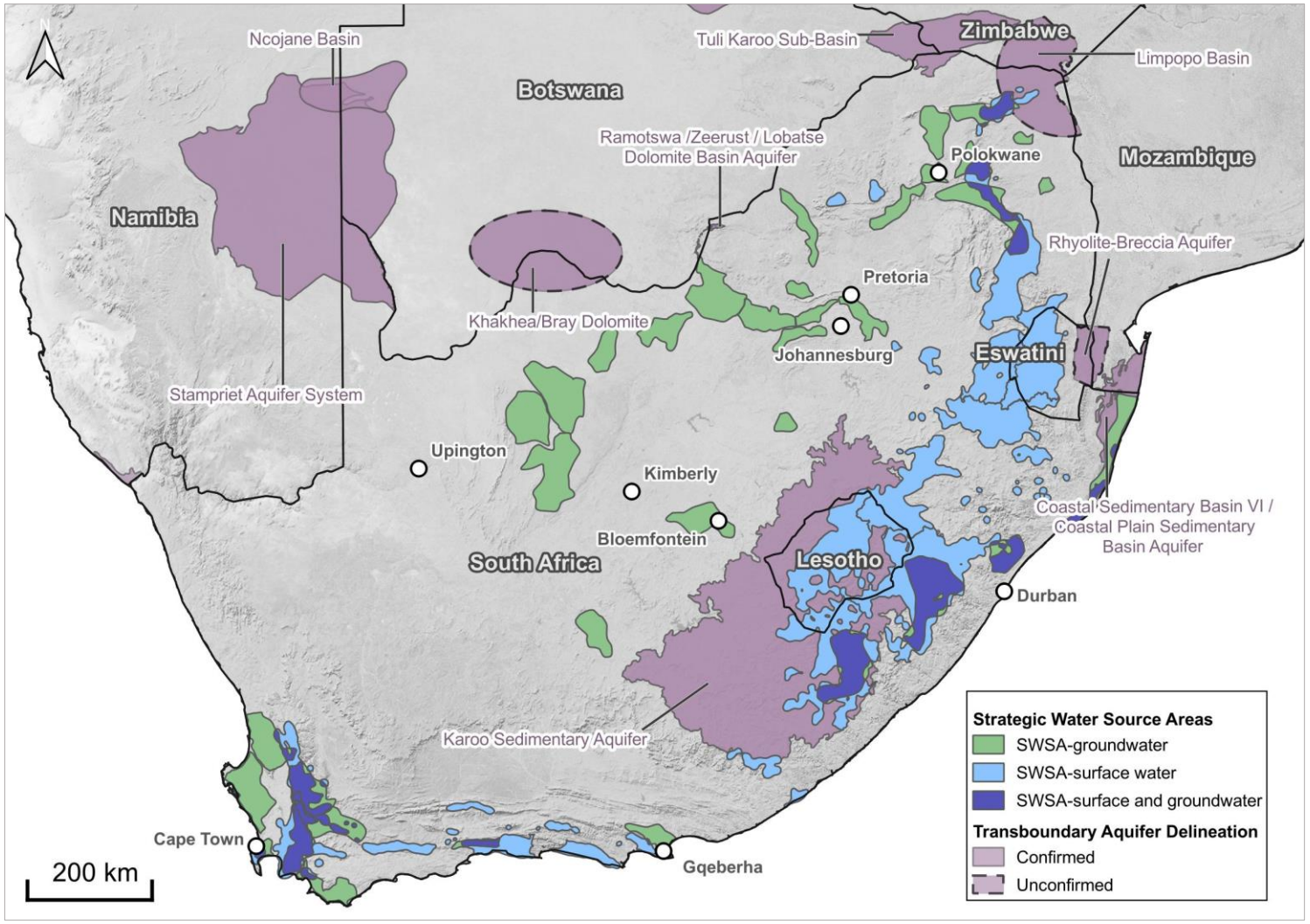

Figure 6: **The national and transboundary Strategic Water Source Areas (SWAS) of South Africa, Lesotho, and Eswatini showing both SWSA-sw and SWSA-gw and their overlaps. Note that no groundwater SWSAs were identified in Eswatini or Lesotho due to a lack of suitable data on water demand (after WRC, 2018). Transboundary aquifers from IGRAC, 2022 (Scale 1: 50 000 000) are also displayed with Partly Confirmed and Unconfirmed aquifer boundaries shown as black dashed lines.**

3. SCOPE OF WORK

3.1. Project Tasks and Deliverables

The project is structured into 4 primary phases, each with its distinct set of deliverables. These phases are complemented by an ongoing project management phase. A detailed breakdown of these phases is provided in **Sections 3.1.2 - 3.1.5**, with a project Gantt Chart available in **Section 5**. An overview of the project phases, associated tasks, and deliverables is presented in **Table 6**.

Phase 0 – Project Management, Administration, Communication and Capacity Building

Phase 1 – Project Inception

Phase 2 – Information and Data Gathering

Phase 3 – Refinement of SWSA-gw

Phase 4 – Project Closure

Table 6: Deliverables and Associated Tasks by Project Phase.

Phase 0: Project Management, Administration, Communication and Capacity Building		
P0	**P0.1** General Project Management	
	P0.2 PMC Meetings	
	P0.3 PSC Meetings	
	P0.4 PS Meetings	
	P0.5 Ad Hoc Meetings	
	P0.6 Monthly Progress Reports	
	P0.7 Capacity Building	
Phase 1: Project Inception		
P1	**D1.1**: Inception Report	**T1.1.1**: Lit Review
Phase 2: Information and Data Gathering		
P2	**D2.1**: Gap Analysis Report	**T2.1.1**: Data and Information Assessment **T2.2.1**: Inventory of Water Resource Tools
Phase 3: Refinement of SWSA-gw		
P3	**D3.1:** Status Quo SWSA Report	**T3.1.1**: Status Quo SWSA Assessment
	D3.2: Refined Methodology Report	**T3.2.1**: Refined Methodology Assessment
	D3.3: Delineation of Refined SWSA-gw Report	**T3.3.1**: Delineation of Refined SWSA-gw **T3.3.2**: Groundwater Quality **T3.3.3**: Transboundary Aquifers **T3.3.4**: Updated Status Quo SWSA Assessment
	D3.4: SWSA-gw Protection and Management Report	**T3.4.1**: SWSA-gw Protection and Management
Phase 4: Project Closure		
P4	**D4.1**: Refined Strategic Groundwater Source Areas of South Africa Report	**T4.1.1**: Report Integration
	D4.2: External Review Summary Report	
	D4.3: Electronic Database	
	D4.4: Close Out Report	

3.1.1. Phase 0

Phase 0: Project Management, Administration, Communication is crucial for achieving the project's success and will be an ongoing phase for the duration of the project. Umvoto will be responsible for all project management duties as specified in Section 3.4 (pg. 7-8), 3.5 (pg. 8), 3.6 (pg. 8-9), 10 (pg. 21-22), 11 (pg. 22), and 12 (pg. 22) of the ToR outlined in the Tender document. Additionally, Umvoto will ensure transparent and accurate communication throughout the project which includes providing monthly progress reports, maintaining a project file, managing project databases, and organizing and facilitating mandated meetings.

Project Management Committee (PMC) Meetings:

PMC meetings are scheduled every 3 months or aligned with specific project milestones throughout the 36-month study period. These gatherings will convene the project team including the Client – DWS CD: WEM, officials from other DWS Directorates, and the PSP's project team. With a total of 12 meetings planned, these sessions will be conducted virtually. During these meetings, the Client and the PSP will deliver a technical review of the project and provide updates on progress made, including financial tracking.

To ensure coordination and avoid repetition, the PSP will share the draft presentation with the DWS Project Manager before the scheduled meeting. The DWS will oversee administrative tasks, such as sending out meeting invitations, preparing the agenda, and documenting meeting minutes. These responsibilities were established during the project's Inception Meeting (held on April 12, 2024) and are outlined in Section 3.4 (pg. 7-8) of the Tender documentation.

Project Steering Committee (PSC) Meetings:

PSC meetings are scheduled every 6 months throughout the 36-month study period, convening various DWS directorates, external reviewers, local specialists, organizational representatives, and other relevant stakeholders. With a total of 6 PSC meetings planned, these sessions will be conducted in a hybrid format (virtually and in-person). To ensure balanced representation from various regions, the venue will alternate among the DWS regional offices in Cape Town, Pretoria, and Durban.

To ensure coordination and avoid repetition, the PSP will share the draft presentation with the DWS Project Manager before the scheduled meeting. Administrative tasks, such as sending out meeting invitations, preparing the agenda, preparing the background information document (BID), and documenting meeting minutes, will be overseen by the PSP. These responsibilities were established during the project's Inception Meeting and are outlined in Section 3.4 (pg. 7-8) of the Tender documentation.

Public Stakeholder (PS) Meetings:

PS meetings are scheduled to occur twice during the 36-month study period, convening a diverse array of public stakeholders. Attendees will include DWS (CD: WEM) officials, the PSP's project team, officials from other DWS Directorates, representatives from Catchment Management Agencies (CMAs), external reviewers, local specialists, organizational representatives, and other relevant public stakeholders with a vested interest in the project outcomes. To ensure broad participation, these PS engagements are structured as a series of meetings held at the DWS regional offices in Cape Town, Durban, Pretoria, Polokwane, and Kimberly. This will comprise of 2 rounds of 5 meetings each, totalling 10 meetings conducted in a hybrid format (virtually and in-person).

The first round of meetings will introduce the study, while the second round will focus on communicating the study's outcomes. Administrative tasks, including sending out meeting invitations, preparing the agenda, compiling the BID, and documenting meeting minutes, will be overseen by the PSP. Additionally, advertising invitations to these public meetings in local newspapers and radio stations will be the responsibility of the PSP. These responsibilities were established during the project's Inception Meeting and are detailed in Section 3.4 (pg. 7-8) of the Tender documentation.

Ad-Hoc Meetings

Provision has been made for 6 ad-hoc meetings and will be arranged in a hybrid format (virtually and in-person). These meetings will be coordinated between the PSP's technical team and other relevant technical stakeholders to address specific challenges and queries that may arise during the 36-month study period.

3.1.2. Phase 1

As outlined in **Section 0: The**

Aims and Objectives of this Report, Phase 1 - Project Inception focuses on establishing a clear project scope from the onset of the study. This initial phase is essential for identifying, assessing, and understanding the project's inherent requirements associated with the refinement process for the SWSA-gw of South Africa. These objectives are outlined in Section 3.1 (pg. 6) of the Tender documentation and summarised below (see **Table 6**).

Deliverable 1.1: Inception Report

Task T1.1.1 is aimed at providing a literature review of SWSA, laying the necessary foundation and understanding for the subsequent SWSA-gw refinement process. The following studies have been reviewed thus far.

- Defining South Africa's Water Source Areas (WRC, 2013)
- Enhancement of the Methodology to Identify and Delineate South Africa's Water Source Areas (WRC, 2018)
- Fine-scale delineation of Strategic Water Source Areas for surface water in South Africa using Empirical Bayesian Kriging Regression Prediction (DEFF, 2021)
- National Water Resource Strategy (NWRS-1, 2004; NWRS-2, 2013; and NWRS-3, 2023)
- National Water Resource Planning Reconciliation Strategies for All Towns and Planning Regions (DWS)

The literature review along with the associated discussions and agreements from Phase 1 are compiled into a comprehensive project plan for PMC input, resulting in **Deliverable 1 - Inception Report**. This serves as a foundational reference point for the project, facilitating continuous monitoring, evaluation, and control of the project's progress in line with predefined objectives and performance metrics.

3.1.3. Phase 2

Phase 2 - Review of Water Resource Information and Data Gathering aims to systematically collect, organize, review, and analyse all relevant water resource data and information for the project as detailed in Section 3.2 (pg. 6) of the Tender documentation and summarised below (see **Table 6**).

Deliverable 2.1: Gap Analysis Report

Task T2.1.1 involves gathering datasets from several categories, based on relevant literature (in addition to those listed in **Section 3.1.2**), maps, models, aerial imagery, remote sensing materials, and other, potentially sensitive, information. The collected datasets will undergo an assessment to gauge their accessibility, usability, and applicability to the study, encompassing both technical reports and project datasets.

Task T2.1.2 involves compiling an inventory of relevant groundwater resource tools and providing explanations on their applicability to the study. The emphasis is on understanding how these tools can be applied in the context and scope of the study, and how they can improve the refinement process for SWSA-gw.

The combination of Tasks T2.1.1 and T2.1.2 aims to identify any information gaps and determine if the data can confidently be used for decision-making. If identified gaps cannot be addressed through the project, then recommendations will be put forward for future studies, related to data collection and refinement.

Identified and unidentified data gaps can lead to an incomplete SWSA-gw refinement. To address identified gaps, a series of validation steps using multiple sources and expert opinions will be conducted to confirm these gaps in the study area data. Unidentified gaps may skew results, so a feedback loop will be established to continuously review and incorporate new data where possible. Data limitations will be clearly communicated, and considering the project scope, the PSP will propose an action plan for future data collection and refinement. The findings of this phase will be reported in Deliverable 2.1 - Gap Analysis Report.

3.1.4. Phase 3

Phase 3 - Refinement of Strategic Water Source Areas for Groundwater (SWSA-gw), the primary focus of this study and the phase of the project where the bulk of the work will be done, is designed to systematically review and update the methodology used to identify and delineated SWSA-gw (see **Table 6**).

Each deliverable of this phase represents a significant milestone for the project and is structured into various tasks that aim to 1) review the current status of the SWSA-gw delineated as per the WRC (2018), 2) develop an updated methodology for identifying and delineating SWSA-gw and incorporating components such as groundwater chemistry and transboundary aquifer systems, 3) conduct the re-delineation process of SWSA-gw using the updated methodology, and 4) develop protection plans for the refined SWSA-gw within the revised scale objective. These aspects are outlined in Section 3.3 (pg. 7) of the Tender documentation and summarised below.

Deliverable 3.1: Status Quo SWSA-gw Report

Task 3.1.1 aims to assess the present status of the WRC (2018) SWSA-gw, with the objective of enhancing our understanding of the current situation within these regions. This assessment will encompass an evaluation of their protection status, level of groundwater use, and groundwater quality in South Africa. Additionally, it will include an initial assessment of these aspects for recognized transboundary aquifer systems encompassing not only those extending into Lesotho and Eswatini but also those extending into Namibia, Botswana, Zimbabwe, and Mozambique.

The results of this assessment will be consolidated into the first deliverable of Phase 3, **Deliverable 3.1, the Status Quo SWSA-gw Report** offering valuable insights into the current state of SWSA-gw and the challenges the project faces.

Deliverable 3.2: Refined Methodology Report

The process of identifying SWSA-gw, as outlined in the WRC (2018) study, was guided by a specific set of criteria (see **Table 4**). However, this approach faced several limitations at the time. These included the availability of groundwater use and recharge data, the subjective nature of determining groundwater regions of "national significance", and inconsistencies in classifying areas reliant solely on groundwater as "significant sources" (see **Section 2**).

Nonetheless, a total of 57 SWSA-gw were identified, with 37 areas considered nationally important, 10 of which encompass various groundwater control areas (see **Table 2** and **Figure 4** – top right image, after WRC, 2018). The rest were initially considered as SWSA-gw but were ultimately deemed to be of "sub-national" importance and thus excluded from the final delineation despite meeting certain criteria within the identification process (see **Table 3**).

Task 3.2.1 will involve the development of a more refined methodology for identifying SWSA-gw by including additional criteria, such as groundwater quality and transboundary aquifer systems and possibly groundwater contribution to baseflow. The objective of this task is to update the approach to align with the scale objective and provide a defensible, numerical approach for the identification method while minimizing subjective manual inputs.

Furthermore, this assessment will examine other components of the groundwater systems, potentially including aspects such as groundwater storage, vulnerability to threats affecting groundwater quantity and quality, surface-groundwater interaction, hydraulic connectivity, climate variability, artesian basins, recharge areas, and the broader environmental and socio-economic relationships. The outcome will be incorporated into **Deliverable 3.2: Refined Methodology Report**.

Deliverable 3.3: Delineation of Refined SWSA-gw Report

Based on the updated methodology, as outlined in Deliverable 3.2, the number of SWSA-gw identified may change, potentially leading to the delineation of additional SWSA-gw. This re-delineation will be done as part of Task T3.3.1: Delineation of Refined SWSA-gw.

Task T3.3.2 and T3.3.3 will be included to address the groundwater quality and transboundary aquifer system components of the delineation, strengthening the inclusion of these criteria in the delineation process. Subsequently, a final set of SWSA-gw will be determined, and an updated Status Quo established (an outputs of Task T3.3.4: Updated Status Quo SWSA Assessment). The outcomes of these tasks will collectively contribute to **Deliverable 3.3: Delineation of Refined SWSA-gw Report.**

Deliverable 3.4: SWSA-gw Protection and Management Report

Once the final set of SWSA-gw is determined and their current status re-assessed, various protection and management plans will be developed. Task 3.4.1 centres around the review of the ongoing protection and management strategies already in place for the country (see **Section 3.1.2**), accounting for regulatory frameworks, conservation measures, and sustainable use practices, using the WRC 2018 study as a baseline. These will be updated and enhanced, where required, to extend to the new SWSA-gw. The resulting report, which is the final report for Phase 3 - **Deliverable 3.4: SWSA-gw Protection and Management Report** will provide an updated protection and management plan, which will include considerations for groundwater recharge areas, ensuring the sustainable use and preservation of the newly delineated SWSA-gw (see **Section 3.1.2**).

3.1.5. Phase 4

Phase 4 – Project Closure encompasses the finalization of the project, culminating in the integration of findings and ensuring the project's completion is comprehensive and well-documented. The deliverables and their associated tasks underscore this phase's significance (see **Table 6**).

Throughout Phase 4, the focus shifts towards consolidation, documentation, and validation of the project outcomes, ensuring that the project's insights are effectively captured, evaluated, and shared with the Client and project stakeholders.

Deliverable 4.1: Refined Strategic Groundwater Source Areas of South Africa Report

Task T4.1.1 serves to summarize all the technical components and outputs of the project. It concentrates on the integration of the outcomes from previous reports, consolidating the study's elements into a cohesive and comprehensive document, namely **Deliverable 4.1: Integrated Main Report**. This report will synthesise the insights, updated methodologies, and outcomes of the study, providing an in-depth understanding of the refined SWSA-gw identification, status quo, delineation, and management/protection approach.

Deliverable 4.2: External Review Summary Report

All deliverables from Phase 3 will undergo review by PMC members as well as an external technical reviewer. This review process will effectively run in parallel with the project's main deliverables, enabling continuous feedback, input, and insights into the project's direction and associated outputs. This ensures prompt attention to any necessary adjustments and prevents unexpected changes in approach at the project's conclusion.

In line with the DWSs request during the Inception Meeting, the PSP will provide a list of potential candidates to conduct the external review which will ensure the project's rigor and quality. **Deliverable 4.2: External Review Summary Report** will summarise the individual deliverable's reviews and capture those perspectives in a single report.

Deliverable 4.3: Electronic Database

All data that is collected and collated (which will occur throughout the duration of the project) will be organized into **Deliverable 4.3: Electronic Database**, a repository that centralises project-related data (including a spatial dataset with associated metadata sheets). This will be handed over to the Client in a standard database format at the closure of the project which serves as a valuable resource for future reference and research.

Deliverable 4.4: Close Out Report

This deliverable marks the conclusion of the project's active phases and reviews all activities, ensuring that all objectives have been satisfactorily completed and are aligned with the project scope. **Deliverable 4.4: Close Out Report** will list the submitted deliverables and their schedule, summarise the achievements, lessons learned, and recommendations for future studies. This will also include a breakdown of the costs and cash flow.

4. STAKEHOLDER ENGAGEMENT

Stakeholder engagement is a crucial aspect of this project, aimed at ensuring that all the concerns and issues related to the SWSA-gw refinement process are thoroughly represented and effectively addressed within the projects scope. Stakeholders from various sectors, including both public and private, will be invited to engage with the Client DWS CD: WEM and the PSP Project Team. These engagements have been integrated into different facets of project management, as outlined in **Section 3.1.1**.

To ensure comprehensive stakeholder involvement, the PSP utilized the stakeholder database compiled during the previous SWSA study (WRC, 2018) as the foundation for a preliminary stakeholder database for this study. The DWS supplemented this dataset with stakeholders from various regions, which was consolidated into a preliminary stakeholder list for South Africa and Transboundary areas (see **Appendix A** & **B**) for DWS: CD WEM inputs.

Stakeholder Engagement Plan

The Stakeholder Engagement Plan comprises the following steps, commencing with the first PSC/PS meeting in July/August 2024 (refer to **Section 3**):

1. **Identify Key Stakeholders:**

   This step aims to identify all stakeholders who are involved in or affected by the outcomes of this study. The PSP has compiled a preliminary stakeholder list and seeks input from the DWS to provide contact details of individuals from National, Provincial, and Local Government representatives who may be interested in the project's outcomes (see red text in **Appendix A** & **B**).

2. **Define Stakeholder Motives:**

   This step aims to understand the motivations of each stakeholder and their interests in the study, including concerns regarding the outcomes of the previous study (i.e., WRC 2018 SWSA-gw) and their initial concerns regarding the refinement process. This process will involve a survey sent to the PSC and PS members, with the aim of clarifying/addressing these concerns in the first PSC/PS meeting in July/August 2024.

3. **Rank Stakeholder Comments:**

   While the study aims to address the concerns of all stakeholders, the project team will prioritize stakeholder inputs or concerns (in consultation with the PMC) based on their influence on the project's outcomes and their relevance in terms of the national water resource strategy. This prioritization will help focus the efforts of the project team on the concerns that have the most significant impact on the study.

4. **Comments and Response Strategy:**

   a. Communication Channels:

      Stakeholder communication will primarily occur through PSC and PS meetings, emails of comments and responses, and published reports.

   b. Frequency of Communication:

      Stakeholder communication will take place prior to and after each PSC and PS meeting.

   c. Content of Communication:

      The project team aims to provide updates on the study, findings, changes to the project plan, etc.

5. WORK PROGRAMME

5.1. Report Preparation / Workplan

The project's success hinges on a well-defined project workflow and framework. Within each project phase (see **Section 3**), specific tasks are undertaken to achieve the project's overarching objectives. Following the completion of each task, draft reports will be forwarded to DWS for comment prior to finalization. These reports serve as building blocks towards the creation of the primary deliverable of the project which is the Refined Strategic Groundwater Source Areas of South Africa Report.

Additionally, throughout the project lifecycle, an independent external reviewer, agreed upon by both DWS and the PSP, will evaluate major deliverables. The reviewer's findings, including technical enhancements and recommendations, will be documented in a single external summary report. The inputs to this report will be discussed during various PMC meetings and the final external summary report appended to the Main Integrated Report.

Additionally, monthly progress reports will be submitted to the DWS at the end of each month for deliverable tracking purposes. These reports will be provided in months where no project deliverable is due, as the reporting deliverable itself will serve as the monthly report. For reference, the schedule and summary of the project timeline are displayed below (see **Table 7**).

Table 7: Gantt Chart of Project Phases, Deliverables and Tasks with associated Dates.

			2024									2025												2026												2027		
			Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Phase	Code	Task / Deliverable																																				
0	P0	Project Management / Capacity Building																																				
	P0.1	General Project Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	P0.2	PMC Meetings	X		X			X			X			X				X				X			X				X		X			X			X	
	P0.3	PSC Meetings				X						X					X						X							X					X				
	P0.4	PS Meetings					X																													X		
	P0.5	Ad Hoc Meetings								X			X			X				X				X				X											
	P0.6	Monthly Progress Reports	X		X	X	X		X	X	X	X	X		X	X	X		X	X	X	X	X	X		X	X	X	X	X		X	X			X		
	P0.7	Capacity Building				X						X				X					X			X						X								
1	P1	Project Inception																																				
	T1.1.1	Lit Review																																				
	D1.1	Inception Report		X																																		
2	P2	Information and Data Gathering																																				
	T2.1.1	Data and Information Assessment																																				
	T2.1.2	Inventory of Water Resource Tools Assessment																																				
	D2.1	Gap Analysis Report						X																														
3	P3	Refinement of SWSA for Groundwater (SWSA-gw)																																				
	T3.1.1	Status Quo SWSA Assessment																																				
	D3.1	Status Quo SWSA Report												X																								
	T3.2.1	Refined Methodology Assessment																																				
	D3.2	Refined Methodology Report																X																				
	T.3.3.1	Delineation of Refined SWSA-gw																																				
	T.3.3.2	Groundwater Quality																																				
	T.3.3.3	Transboundary Aquifers																																				
	T.3.3.4	Updated Status Quo SWSA Assessment																																				
	D3.3	Delineation of refined SWSA-gw Report																							X													
	T3.4.1	SWSA-gw Protection and Management																																				
	D3.4	SWSA-gw Protection and Management Report																														X						
	P4	Project Closure																																				
	T4.1.1	SWSA Main Integration																																				
4	D4.1	Integrated Main Report																																X				
	D4.2	External Review Report																																	X			
	D4.3	Electronic Database																																			X	
	D4.4	Close Out Report																																				X

Table 8: Summary of the project workplan and anticipated dates for meetings, draft reports, and final reports. PO: Purchase Order, PSC: Project Steering Committee, PMC: Project Management Committee, PS: Public Stakeholder, and CB: Capacity Building.

Month	Meetings/Deliverables	Anticipated Date
Mar-24	PO Issued	06/04/2024
Apr-24	Inception Meeting	12/04/2024
	Progress Report-01	30/04/2024
May-24	Inception Report Draft	14/05/2024
	Inception Report Final	**31/05/2024**
Jun-24	PMC-01	TBC
	Progress Report-02	30/06/2024
Jul-24	PSC-01	TBC
	CB-01	TBC
	Progress Report-03	31/07/2024
Aug-24	PS-01	TBC
	Progress Report-04	31/08/2024
Sep-24	PMC-02	TBC
	Gap Analysis Report Draft	13/09/2024
	Gap Analysis Report Final	**30/09/2024**
Oct-24	Progress Report-05	31/10/2024
Nov-24	Progress Report-06	30/11/2024
Dec-24	PMC-03	TBC
	Progress Report-07	31/12/2024
Jan-25	PSC-02	TBC
	CB-02	TBC
	Progress Report-08	31/01/2025
Feb-25	Progress Report-09	28/02/2025
Mar-25	PMC-04	TBC
	Status Quo SWSA Report Draft	14/03/2025
	Status Quo SWSA Report Final	**31/03/2025**
Apr-25	Progress Report-10	30/04/2025
May-25	Progress Report-11	31/05/2025
Jun-25	PSC-03	TBC
	Progress Report-12	30/06/2025
Jul-25	PMC-05	TBC
	Refined Methodology Report Draft	14/07/2025
	Refined Methodology Report Final	**31/07/2025**
Aug-25	Progress Report-13	31/08/2025
Sep-25	Progress Report-14	30/09/2025

Month	Meetings/Deliverables	Anticipated Date
Oct-25	CB-03	TBC
	Progress Report-15	31/10/2025
Nov-25	PMC-06	TBC
	Progress Report-16	30/11/2025
Dec-25	PSC-04	TBC
	Progress Report-17	31/12/2025
Jan-26	CB-04	TBC
	Progress Report-18	31/01/2026
Feb-26	PMC-07	TBC
	Delineation of refined SWSA-gw Report Draft	13/02/2026
	Delineation of refined SWSA-gw Report Final	**28/03/2026**
Mar-26	Progress Report-19	31/03/2026
Apr-26	Progress Report-20	30/04/2026
May-26	Progress Report-21	31/05/2026
Jun-26	PMC-08	TBC
	Progress Report-22	30/06/2026
Jul-26	PSC-05	TBC
	CB-05	TBC
	Progress Report-23	31/07/2026
Aug-26	PMC-09	TBC
	SWSA-gw Protection and Management Report Draft	14/08/2026
	SWSA-gw Protection and Management Report Final	**31/08/2026**
Sep-26	Progress Report-24	30/09/2026
Oct-26	Progress Report-25	31/10/2026
Nov-26	PMC-10	TBC
	Integrated Main Report Draft	13/11/2026
	Integrated Main Report Final	**30/11/2026**
Dec-26	PSC-06	TBC
	CB-06	TBC
	External Review Report Draft	11/12/2026
	External Review Report Final	**31/12/2026**
Jan-27	PS-02	TBC
	Progress Report-26	31/01/2027
Feb-27	PMC-11	TBC
	Electronic Database Draft	12/02/2027
	Electronic Database Final	**28/02/2027**
Mar-27	Close Out Report Draft	15/03/2027
	Close Out Report Final	**31/03/2027**

6. PROJECT TEAM

6.1. Organisation

Umvoto, a Qualifying Small Enterprise (QSE) based in Cape Town, will manage the study as the appointed PSP on behalf of the client, the DWS CD: WEM, with Dr Stanley Nzama as the DWS project manager. With a track record spanning of over 30 years in water resource management, Umvoto has previously been appointed as the principal consultant for various groundwater projects nationwide and has actively participated in variety of transboundary aquifer investigations.

Heading the PSPs project team is Dr Kornelius Riemann, a distinguished water resource specialist and Director at Umvoto. Dr Riemann will assume responsibility for all technical decisions, collaborating closely with the DWS, relevant specialists and support staff.

The rest of the PSPs organizational structure is shown in **Figure 7**, with further details provided in **Table 9** and **Table 10**, including the project components, team member qualifications, professional registrations, and experience.

Specialist Leads, including D. Blake, T. Flugel, D. McGibbon, J. Prinsloo, L. Towers, P. Lee and J. Weitz will oversee the project's strategic direction within their respective domains (refer to **Table 9**). Additionally, a team of support staff will provide invaluable expertise under the guidance of the Specialist Leads (refer to **Table 10**).

Table 9: Project Team's Senior Staff Members and Specialist Leads

Personal	Technical	Component	Qualification	Professional Registration	Experience (years)
K Riemann	Team Lead	Groundwater Ecology	PhD Geohydrology	SACNASP Pr.Sci.Nat 400249/04	>30
J Weitz	Team Member	Groundwater Resource Modelling	PhD Hydrogeology	SACNASP Pr.Sci.Nat 119623	10
D Blake	Team Member	Groundwater Quality	BSc (Hons) Geology	SACNASP Pr.Sci.Nat 400048/13	17
T Flugel	Team Member	Geographical Information Systems (GIS)	PhD Environment & Geographical Sciences	SACNASP Pr.Sci.Nat 119624	10.5
D McGibbon	Team Member	Groundwater Protection	MSc Structural Geology	SACNASP Pr.Sci.Nat 400250/16	10
J Prinsloo	Team Member	Geohydrology / Hydrogeology	MSc Environmental Science	SACNASP Pr.Sci.Nat 120546	10
L Towers	Team Member	Groundwater-Surface Water Interaction	MSc Hydrogeology	SACNASP Pr.Sci.Nat 114418	10
P Lee	Team Member	Stakeholder Engagement & Public Participation Practitioner	BSc (Hons) Environmental Science / Climatology	SACNASP Pr.Sci.Nat 400124/09	>20

Table 10: Project Team's Support Staff Members.

Personal	Technical	Component	Qualification	Professional Registration	Experience (years)
M Misrole	Team Member	Geohydrology / Hydrogeology	MSc Applied Geology	SACNASP Pr.Sci.Nat 125887	4
E Wise	Team Member	Geographical Information Systems (GIS)	BSc Forest and Natural Resource Management	SACNASP Cand.Sci.Nat 114200	9
K Parker	Team Member	Groundwater Ecology	MSc Conservation Biology		2
A Vicente	Team Member	Groundwater Resource Modelling	MSc Environmental and Water Science	SACNASP Pr.Sci.Nat 138769	5
K Mokoena	Team Member	Groundwater Quality	BSc (Hons) Environmental Water Management	SACNASP Cand.Sci.Nat 127087	2
K Gibson	Team Member	Groundwater Protection	MSc Hydrogeology	SACNASP Cand.Sci.Nat 124274	2
L Gumede	Team Member	Groundwater-Surface Water Interaction	MSc Hydrogeology	SACNASP Pr.Sci.Nat 167936	5
G Bluff	Team Member	Stakeholder Engagement & Public Participation Practitioner	MSc Environmental and Geological Science	SACNASP Pr.Sci.Nat 119599/18	6

6.2. External Review

During the Inception Meeting discussions, it was agreed that the PSP will identify a potential external reviewer who will be consulted throughout the duration of the project (**Section 3.1.5** and **Section 5.1**). Umvoto identified the following specialist as potential candidate for DWS CD: WEM approval:

- Helen Seyler, ERM (previously involved in WRC (2018) study)

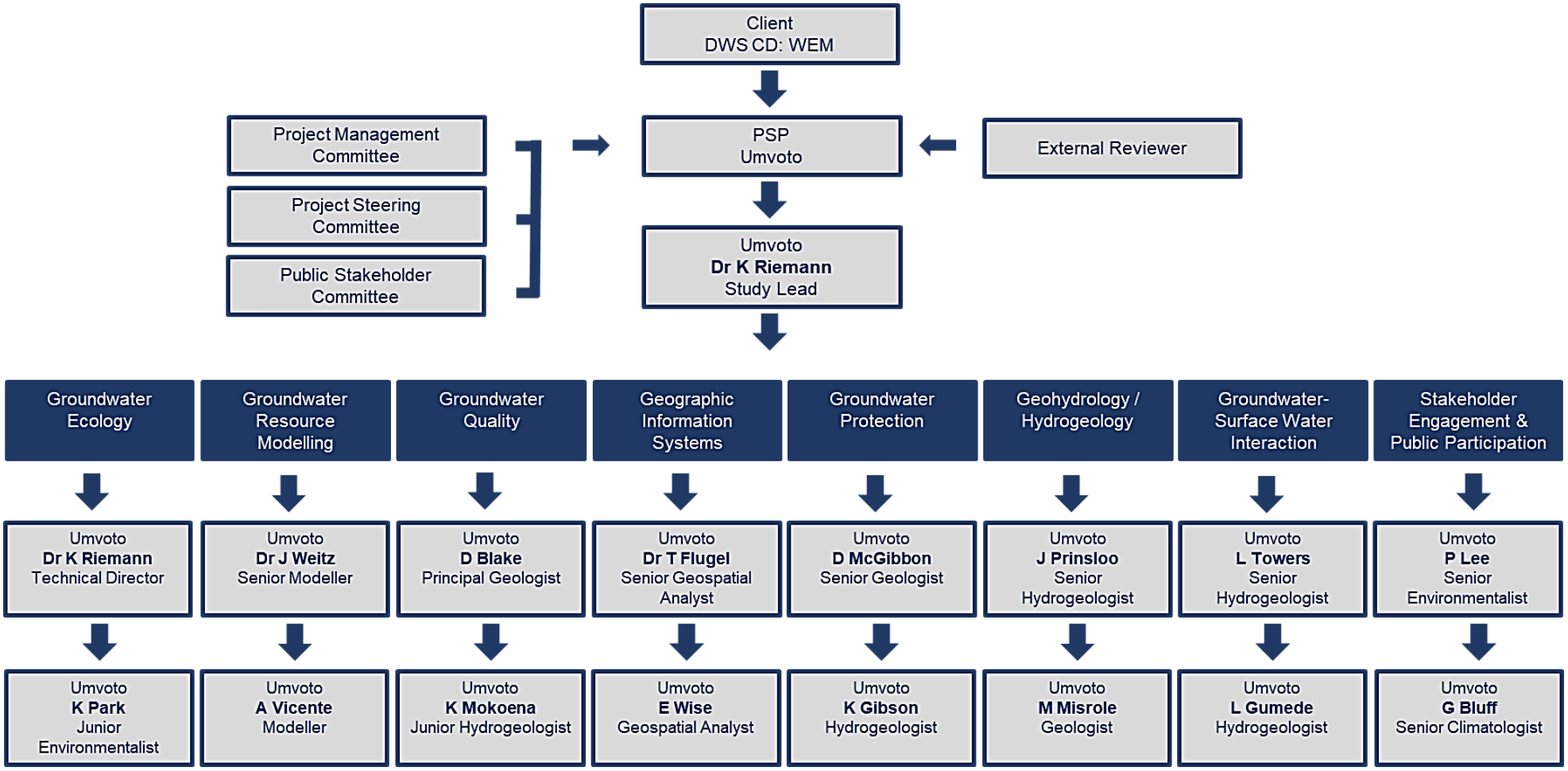

Figure 7: Project Team Organogram.

7. CAPACITY BUILDING

Umvoto proudly maintains a robust internship and capacity building program, which has supported over 60 individuals in pursuing postgraduate opportunities over the last 18 years. This initiative is dedicated to rectifying historical disparities within the science and water sector, with a particular focus on historically disadvantaged individuals (HDI). Umvoto's dedication to nurturing career advancement is exemplified by its recognition with the Southern African Young Water Professionals Professional Development Award in 2012 and its participation in various capacity building and training sessions during DWS projects between 2021 and 2023.

7.1. Capacity Building with Umvoto

During the project, Umvoto will provide training to its own historically disadvantaged staff and student interns, encompassing individuals from black, Indian, and coloured backgrounds. The preliminary outline of the capacity-building program is summarised in **Table 11**, which will be expanded upon in more detail as the project progresses, specifying measurable actions designed to foster skills development throughout the project. This will involve mentoring and workshops as integral components of the initiative.

7.2. Capacity Building with DWS

The capacity-building initiative not only concentrates on enhancing the internal skills of the PSPs but also targets the specific skill sets needed by officials responsible for water resources management and protection within the DWS. Nominated DWS officials will engage in practical-based workshops, fostering active idea sharing and augmenting their groundwater resource management skills with a more hands-on and in-depth consultancy-level perspective.

DWS staff will be seconded to various project phases, including specialized areas such as Groundwater/Geohydrology, Groundwater Resource Modeling and Decision Analysis, Groundwater Quality, and Groundwater-Surface Water Interaction. Moreover, these participants will actively engage in practical scientific and technical tasks, directly contributing to the project's milestones and deliverables. Comprehensive training materials will be provided to support their involvement.

Table 11 has been designed to assist interested DWS staff in selecting the training sessions they would like to attend. It also serves as a tool for DWS managers to identify key skills they wish their staff to develop. All discussions, training workshops, and data analysis sessions will take place at Umvoto offices.

Table 11: Summary of capacity building tasks and associated timeline.

Associated Task	Capacity Building Details/Description	Date Scheduled	Type of Training
T2.1.1	**Data and Information Assessment** The Data and Information Assessment Workshop, scheduled for July 2024, aims to explore streamlined methods for acquiring, evaluating, and cleaning national datasets to ensure their suitability for the intended purpose. Participants will receive guidance on effective strategies for collecting and collating datasets from open-source platforms. The workshop will focus on utilizing various data tools, including querying languages like SQL, Python, R, and visualization software such as MS Power Tools (Excel and Power BI), QGIS, and Google Earth. These tools will be employed to facilitate the data exploration process, aligning with the objectives of the Gap Analysis.	Jul 2024	**Type**: Workshop (CPT) **Format**: Face-to-Face **Session:** 1 Day **Face-to-Face Personal**: • PSP and DWS Staff (10 People Max)
T3.1.1	**Status Quo SWSA-gw Assessment** The Status Quo SWSA-gw Assessment, scheduled for January 2025, focuses on determining and evaluating the current status of SWSA-gw. This session will build upon the methodology outlined in **Section 3.1.4** of the Inception Report, involving the acquisition and modification of existing groundwater datasets (a continuation from Capacity Building 01: Data and Information Assessment). The methodology associated with the accepted WRC (2018) SWSA-gw definition, criteria, and thresholds will be applied. The objective is to assess the current status of the defined groundwater source areas. Specialized software and tools such as Google Earth Engine, QGIS (utilized for visualization), and Python and SQL (employed for processing) will be utilized for the assessment, including an initial groundwater quality evaluation.	Jan 2025	**Type**: Workshop (CPT) **Format**: Face-to-Face **Session:** 1 Day **Face-to-Face Personal**: • PSP and DWS Staff (10 People Max)

Associated Task	Capacity Building Details/Description	Date Scheduled	Type of Training
T3.2.1	**Refined Methodology Assessment** The Refined Methodology Assessment Workshop, scheduled for May 2025, involves evaluating and refining the WRC (2018) delineation methodology, with a particular emphasis on integrating Groundwater Quality and Transboundary Aquifer components. Through stakeholder engagement and rigorous scientific evaluation, participants will deliberate on and finalize the criteria used to identify and delineate new SWSA-gw. The workshop will cover various topics related to groundwater assessment and management, fostering collaboration among project specialists and ensuring the robustness of the delineation process.	May 2025	**Type**: Workshop (CPT) **Format**: Hybrid **Session:** 1 Day **Online Personal**: • DWS Staff (Unlimited) **Face-to-Face Personal**: • PSP and DWS Staff (10 People Max)
T3.3.1	**Delineation of Refined SWSA-gw** The Delineation of Refined SWSA-gw, scheduled for October 2025, will adopt a GIS approach for the spatial delineation of updated/new SWSA-gw. Participants will receive an in-depth look at specific GIS tools used for spatial refinements, ranging from basic functionalities to more advanced spatial analysis techniques. The session aims to equip participants with essential GIS skills necessary for accurate and effective delineation of SWSA-gw, incorporating various data types and ensuring spatial accuracy in mapping efforts.	Oct 2025	**Type**: Workshop (CPT) **Format**: Face to Face **Session:** 2 Days **Face-to-Face Personal**: • PSP and DWS Staff (5 People Max)

Associated Task	Capacity Building Details/Description	Date Scheduled	Type of Training
T.3.3.4	**Updated Status Quo SWSA-gw** The Updated Status Quo SWSA-gw Assessment, scheduled for January 2026, serves as a follow-up to Task T3.1.1. During this session, participants will define the updated Status Quo for the newly delineated SWSA-gw areas and undergo advanced software/workflow training. The focus will be on utilizing outputs directly relevant to the project deliverables and integrating datasets into the project's electronic database. Participants will be exposed to best practices in data management and large-scale database assessments, aligning with the project's vision of promoting public data sharing and transparency.	Jan 2026	**Type**: Workshop (CPT) **Format**: Face to Face **Session:** 2 Days **Face-to-Face Personal**: • PSP and DWS Staff (5 People Max)
T3.4.1	**SWSA-gw Protection and Management** The SWSA-gw Protection and Management Workshop, scheduled for July 2026, aims to establish and evaluate protection and management procedures for SWSA-gw. Similar to Task 3.2.1: Refined Methodology Assessment, the session will encourage collaborative networking, providing participants with opportunities to engage with various specialists and industry representatives. Talks from consultancy representatives will shed light on industry trends and future directions in water resource management, fostering dialogue and knowledge exchange among participants.	Jul 2026	**Type**: Workshop (CPT) **Format**: Hybrid **Session:** 1 Day **Online Personal**: • DWS Staff (Unlimited) **Face-to-Face Personal**: • PSP and DWS Staff (10 People Max)

8. FINACIAL

8.1. Project Cost

Umvoto proposes to undertake the project and the tasks outlined by the ToR and outlined in **Section 1.2** for a price of **R5,990,189.00** including disbursements, allowance for escalation, and 15% VAT. **Table 12**, **Table 13** and **Table 14** displays financial breakdown and the total project hours, professional rates and costs for each team member, and the project disbursements.

Table 12: Project budget breakdown

Code	Task / Deliverable	Professional Fees	Disbursements	Total	Hours	Days
P0	**Phase 0: Project Management / Capacity Building**					
P0.1	General Project Management	R 258,480.00		R 258,480.00	144	18
P0.2	PMC Meetings	R 116,640.00	R 3,000.00	R 119,640.00	96	12
P0.3	PSC Meetings	R 203,480.00	R 103,300.00	R 306,780.00	180	23
P0.4	PS Meetings	R 314,440.00	R 207,700.00	R 522,140.00	268	34
P0.5	Ad Hoc Meetings	R 38,340.00	R 7,500.00	R 45,840.00	24	3
P0.6	Monthly Progress Reports	R 146,160.00		R 146,160.00	144	18
P0.7	Capacity Building	R 116,080.00	R 12,900.00	R 128,980.00	96	12
	Sub-Total (excl. VAT)	**R 1,193,620.00**	**R 334,400.00**	**R 1,528,020.00**	**952**	**119**
P1	**Phase 1: Project Inception**					
D1.1	Inception Report	R 91,500.00	R 1,500.00	R 93,000.00	112	14
T1.1.1	Lit Review	R 24,960.00	-	R 24,960.00	42	5
	Sub-Total (excl. VAT)	**R 116,460.00**	**R 1,500.00**	**R 117,960.00**	**154**	**19**
P2	**Phase2: Information and Data Gathering**					
D2.1	Gap Analysis Report	R 241,400.00	R 1,500.00	R 242,900.00	336	42
T2.1.1	Data and Information Assessment	R 71,800.00	-	R 71,800.00	88	11
T2.2.1	Inventory of Water Resource Tools Assessment	R 42,400.00	-	R 42,400.00	38	5
	Sub-Total (excl. VAT)	**R 355,600.00**	**R 1,500.00**	**R 357,100.00**	**462**	**58**
P3	**Phase3: Refinement of SWSA for Groundwater (SWSA-gw)**					
D3.1	Status Quo SWSA Report	R 186,420.00	R 1,500.00	R 187,920.00	260	33
T3.1.1	Status Quo SWSA Assessment	R 330,620.00	-	R 330,620.00	482	60
D3.2	Refined Methodology Report	R 166,000.00	R 1,500.00	R 167,500.00	200	25
T3.2.1	Refined Methodology Assessment	R 238,680.00	-	R 238,680.00	312	39
D3.3	Delineation of refined SWSA-gw Report	R 285,240.00	R 1,500.00	R 286,740.00	312	39
T.3.3.1	Delineation of refined SWSA-gw Assessment	R 413,880.00	-	R 413,880.00	464	58
T.3.3.2	Groundwater Quality Assessment	R 324,400.00	-	R 324,400.00	352	44
T.3.3.3	Transboundary Aquifers Assessment	R 222,820.00	-	R 222,820.00	282	35
T.3.3.4	Updated Status Quo SWSA Assessment	R 198,040.00	-	R 198,040.00	248	31
D3.4	SWSA-gw Protection and Management Report	R 163,800.00	R 1,500.00	R 165,300.00	200	25
T3.4.1	SWSA-gw Protection and Management Assessment	R 241,200.00	-	R 241,200.00	312	39
	Sub-Total (excl. VAT)	**R 2,771,100.00**	**R 6,000.00**	**R 2,777,100.00**	**3424**	428
P4	**Phase4: Project Closure**					
D4.1	Integrated Main Report	R 203,400.00	R 1,500.00	R 204,900.00	240	30
T4.1.1	SWSA Main Integration Assessment	R 50,760.00	-	R 50,760.00	68	9
D4.2	Close Out Report	R 23,440.00	R 1,500.00	R 24,940.00	28	4
D4.3	Electronic Database	R 109,080.00	R 1,500.00	R 110,580.00	128	16
D4.4	External Review Summary Report	R 36,000.00	R 1,500.00	R 37,500.00	24	3
	Sub-Total (excl. VAT)	**R 422,680.00**	**R 6,000.00**	**R 428,680.00**	**488**	**61**
	Total (excl. VAT)	**R 4,859,460.00**	**R 349,400.00**	**R 5,208,860.00**	**5480**	**685**
	15%VAT	**R 728,919.00**	**R 52,410.00**	**R 781,329.00**	**-**	**-**
	Total (incl. VAT)	**R 5,588,379.00**	**R 401,810.00**	**R 5,990,189.00**	**-**	**-**

Table 13: Project Team Professional Rates and Project Hours

Personal	Component	Hourly Rate	Daily Rate	Total Hours	Total Days
Dr Kornelius Riemann	Groundwater Ecology	R 2,260.00	R 18,080.00	462	57.75
Dr Jannie Weitz	Groundwater Resource Modelling	R 770.00	R 6,160.00	130	16.25
Dylan Blake	Groundwater Quality	R 1,470.00	R 11,760.00	198	24.75
Tyrel Flugel	GIS	R 975.00	R 7,800.00	240	30.00
David McGibbon	Groundwater Protection	R 1,330.00	R 10,640.00	276	34.50
Jakobus Prinsloo	Geohydrology / Hydrogeology	R 840.00	R 6,720.00	188	23.50
Luke Towers	Groundwater-Surface Water Interaction	R 1,330.00	R 10,640.00	194	24.25
Paul Lee	Stakeholder Engagement & Public Participation Practitioner	R 1,000.00	R 8,000.00	120	15.00
Matthew Misrole	Geohydrology / Hydrogeology	R 600.00	R 4,800.00	1014	126.75
Kim Parker	Groundwater Ecology	R 500.00	R 4,000.00	398	49.75
Analisa Vicente	Groundwater Resource Modelling	R 650.00	R 5,200.00	258	32.25
Kopano Mokoena	Groundwater Quality	R 550.00	R 4,400.00	510	63.75
Eddie Wise	GIS	R 700.00	R 5,600.00	496	62.00
Kirsty Gibson	Groundwater Protection	R 610.00	R 4,880.00	390	48.75
Londeka Gumede	Groundwater-Surface Water Interaction	R 630.00	R 5,040.00	494	61.75
Gemma Bluff	Stakeholder Engagement & Public Participation Practitioner	R 660.00	R 5,280.00	32	4.00
TBC	External Reviewer	R 1,500.00	R 12,000.00	80	10.00

Table 14: Project Disbursements and Costs

Item	Description	Amount
Meeting	Venue, Catering, Delivery	R26,000.00
Admin	General, Printing, Report Delivery, Telephone Calls	R25,000.00
Travel	Flights (economy class), Accommodation (3/4 star), Car Rental, Petrol (R8/l), Kilometres Travel (5000)	R229,000.00
Misc.	Venue, Tolls, Catering	R69,400.00
	Total (excl. VAT)	R349,400.00
	VAT (15%)	R52,410.00
	Total (incl. VAT)	R401,810.00

8.2. Billing Schedule

The PSP has put together a preliminary billing schedule for DWS review. If agreed upon, payment will be processed after each deliverable is finalised, signed-off and delivered to the DWS in hard copy. The estimated billing schedule is outlined in **Table 15**. General project management tasks, project meeting, capacity building sessions and monthly progress reports will be billed in association with the deliverables.

Table 15: Project Billing Schedule

Reports, General Management, Meetings and Capacity Building		Billing Schedule												TOTAL
		May-24	Aug-24	Sep-24	Jan-25	Mar-25	Jul-25	Dec-25	Feb-26	Aug-26	Nov-26	Jan-27	Mar-27	
D1.1	Inception Report	R117,960.00												R117,960.00
D2.1	Gap Analysis Report			R357,100.00										R357,100.00
D3.1	Status Quo SWSA Report					R518,540.00								R518,540.00
D3.2	Refined Methodology Report						R406,180.00							R406,180.00
D3.3	Delineation of refined SWSA-gw Report								R1,445,880.00					R1,445,880.00
D3.4	SWSA-gw Protection and Management Report									R406,500.00				R406,500.00
D4.1	Integrated Main Report										R255,660.00			R255,660.00
D4.2	External Review Report											R37,500.00		R37,500.00
D4.3	Electronic Database												R110,580.00	R110,580.00
D4.4	Close Out Report												R24,940.00	R24,940.00
P0.1	General Project Management	R14,360.00	R21,540.00	R7,180.00	R28,720.00	R14,360.00	R28,720.00	R35,900.00	R21,540.00	R35,900.00	R21,540.00	R14,360.00	R14,360.00	R258,480.00
P0.2	PMC Meetings	R9,970.00	R9,970.00	R9,970.00	R9,970.00	R9,970.00	R9,970.00	R9,970.00	R9,970.00	R19,940.00	R9,970.00		R9,970.00	R119,640.00
P0.3	PSC Meetings		R51,130.00		R51,130.00		R51,130.00	R51,130.00		R51,130.00		R51,130.00		R306,780.00
P0.4	PS Meetings		R261,070.00									R261,070.00		R522,140.00
P0.5	Ad Hoc Meetings				R7,640.00	R7,640.00	R7,640.00	R7,640.00	R7,640.00	R7,640.00				R45,840.00
P0.6	Monthly Progress Reports	R8,120.00	R12,180.00	R4,060.00	R16,240.00	R8,120.00	R16,240.00	R20,300.00	R12,180.00	R20,300.00	R12,180.00	R8,120.00	R8,120.00	R146,160.00
P0.7	Capacity Building		R21,496.67		R21,496.67		R21,496.67	R21,496.67	R21,496.67	R21,496.67				R128,980.00
	Month Total (excl. VAT)	R150,410.00	R377,386.67	R378,310.00	R135,196.67	R558,630.00	R541,376.67	R146,436.67	R1,518,706.67	R562,906.67	R299,350.00	R372,180.00	R167,970.00	R5,208,860.00
	15% VAT	R22,561.50	R56,608.00	R56,746.50	R20,279.50	R83,794.50	R81,206.50	R21,965.50	R227,806.00	R84,436.00	R44,902.50	R55,827.00	R25,195.50	R781,329.00
	Month Total (incl. VAT)	R172,971.50	R433,994.67	R435,056.50	R155,476.17	R642,424.50	R622,583.17	R168,402.17	R1,746,512.67	R647,342.67	R344,252.50	R428,007.00	R193,165.50	R5,990,189.00

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Appendix A

Provisional List of Stakeholders

National Government Departments	
National Government	Department of Agriculture, Land Reform and Rural Development
National Government	Department of Forestry, Fisheries and the Environment
National Government	Department of Mineral Resources and Energy
National Government	Department of Public Works and Infrastructure
National Government	Department of Science and Innovation
National Government	Department of Water and Sanitation
Provincial Government Departments	
Provincial Government	Department of Water and Sanitation - Eastern Cape
Provincial Government	Department of Water and Sanitation - Free State
Provincial Government	Department of Water and Sanitation - Gauteng
Provincial Government	Department of Water and Sanitation - Kwazulu-Natal
Provincial Government	Department of Water and Sanitation - Mpumalanga
Provincial Government	Department of Water and Sanitation - Northwest
Provincial Government	Department of Water and Sanitation - Northern Cape
Provincial Government	Department of Water and Sanitation - Limpopo Province
Provincial Government	Department of Water and Sanitation - Western Cape
Local Government	
Local Government	Alfred Nzo District Municipality DC44
Local Government	Amajuba District Municipality DC25
Local Government	Amathole District Municipality DC12
Local Government	Bojanala District Municipality DC37
Local Government	Buffalo City District Municipality BUF
Local Government	Cape Winelands District Municipality DC2
Local Government	Capricorn District Municipality DC35
Local Government	Central Karoo District Municipality DC5
Local Government	Chris Hani District Municipality DC13
Local Government	City of Cape Town District Municipality CPT
Local Government	City of Johannesburg District Municipality JHB
Local Government	City of Tshwane District Municipality TSH
Local Government	Dr Kenneth Kaunda District Municipality DC40
Local Government	Dr Ruth Segomotsi Mompati District Municipality DC39
Local Government	Ehlanzeni District Municipality DC32
Local Government	Ekurhuleni District Municipality EKU
Local Government	eThekwini District Municipality ETH
Local Government	Fezile Dabi District Municipality DC20
Local Government	Frances Baard District Municipality DC9
Local Government	Garden Route District Municipality DC4
Local Government	Gert Sibande District Municipality DC30
Local Government	Harry Gwala District Municipality DC43
Local Government	iLembe District Municipality DC29
Local Government	Joe Gqabi District Municipality DC14
Local Government	John Taolo Gaetsewe District Municipality DC45
Local Government	Lejweleputswa District Municipality DC18
Local Government	Mangaung District Municipality MAN
Local Government	Mopani District Municipality DC33
Local Government	Namakwa District Municipality DC6
Local Government	Nelson Mandela Bay District Municipality NMA
Local Government	Ngaka Modiri Molema District Municipality DC38
Local Government	Nkangala District Municipality DC31
Local Government	O.R.Tambo District Municipality DC15
Local Government	Overberg District Municipality DC3
Local Government	Pixley ka Seme District Municipality DC7
Local Government	Sarah Baartman District Municipality DC10
Local Government	Sedibeng District Municipality DC42
Local Government	Sekhukhune District Municipality DC47
Local Government	Thabo Mofutsanyane District Municipality DC19

Local Government	Ugu District Municipality DC21
Local Government	Umgungundlovu District Municipality DC22
Local Government	Umkhanyakude District Municipality DC27
Local Government	Umzinyathi District Municipality DC24
Local Government	Uthukela District Municipality DC23
Local Government	Uthungulu District Municipality DC28
Local Government	Vhembe District Municipality DC34
Local Government	Waterberg District Municipality DC36
Local Government	West Coast District Municipality DC1
Local Government	West Rand District Municipality DC48
Local Government	Xhariep District Municipality DC16
Local Government	Z F Mgcawu District Municipality DC8
Local Government	Zululand District Municipality DC26
Water Use Associations, Irrigation Boards, and Catchment Management Agencies	
Water User Associations	Citrusdal
Water User Associations	Clanwilliam
Water User Associations	Egmont Dam
Water User Associations	Kalahari East
Water User Associations	Kalkfotein
Water User Associations	Klerksdorp
Water User Associations	Komati Basin Water Authority (KOBWA)
Water User Associations	Krom Antoniesrivier
Water User Associations	Leeuwriver
Water User Associations	Lower Olifants Water User Association
Water User Associations	Modder River
Water User Associations	Orange-Vaal
Water User Associations	Oranje-Riet
Water User Associations	Oranje-Riet
Water User Associations	Sand Vet
Water User Associations	Schoonspruit
Water User Associations	South African Association
Water User Associations	Spruit River
Water User Associations	Spruitrivier
Water User Associations	Tierpoort
Water User Associations	Tulbagh
Water User Associations	Vanderkloof
Water User Associations	Wynland
Irrigation Boards	Berg River
Irrigation Boards	Gamtoos
Irrigation Boards	Banhoek
Irrigation Boards	Bergriver Main
Irrigation Boards	Upper Bergriver
Irrigation Boards	Lower Bergriver
Irrigation Boards	Daljosafat IB
Irrigation Boards	Bo-Daljosafat IB
Irrigation Boards	Groenberg Wyk
Irrigation Boards	Krommerivier
Irrigation Boards	La Motte
Irrigation Boards	Noord Agter Paarl
Irrigation Boards	Palmietrivier
Irrigation Boards	Perdeberg
Irrigation Boards	Riebeeck Kasteel
Irrigation Boards	Riebeeck Wes Wyk
Irrigation Boards	Simondium
Irrigation Boards	Simonsberg
Irrigation Boards	Simonsberg
Irrigation Boards	Suid Agter Paarl
Irrigation Boards	Vier en Twintigriviere
Irrigation Boards	Kubusi Irrigation Board
Irrigation Boards	Mooi River I
Catchment Management Agencies	Limpopo
Catchment Management Agencies	Olifants (Mpumalanga Province)
Catchment Management Agencies	Inkomati-Usutu
Catchment Management Agencies	Pongola-Umzimkulu

Catchment Management Agencies	Vaal
Catchment Management Agencies	Orange
Catchment Management Agencies	Mzimvubu-Tsitsikamma
Catchment Management Agencies	Breede-Gouritz
Catchment Management Agencies	Berg-Olifants
Non-Governmental Organizations	
Association / Private Company	African Farmers' Association of South Africa
Association / Private Company	African Women in Agricultural Research and Development
Association / Private Company	Agri Eastern Cape
Association / Private Company	Agri SA
Association / Private Company	Agri Western Cape
Association / Private Company	Deciduous Fruit Development Chamber
Association / Private Company	Food and Allied Workers Union Western Cape
Association / Private Company	National African Farmers' Union of SA (NAFU SA) Western Cape
Association / Private Company	USAAA
Association / Private Company	WC SANCO
Association / Private Company	Weenen & District Farmers Association
Association / Private Company	Wester Cape Civil Society: Farmer
Association / Private Company	Potatoes SA
Association / Private Company	Besters Farmers Association
Association / Private Company	Estcourt Farmers Association
Association / Private Company	Grain SA
Association / Private Company	Ladysmith Farmers Association
Association / Private Company	Milk Producers' Organisation Western Cape
Association / Private Company	Rooibos Best Practice
Association / Private Company	SA Olive
Association / Private Company	South Africa Table Grape Industry (SATI)
Association / Private Company	South African Sugar Association
Association / Private Company	Surplus people project
Association / Private Company	The Fruit Forum Group
Association / Private Company	VinPro
Association / Private Company	Western Cape Trout Farmer's Association
Association / Private Company	Women on Farms
Association / Private Company	Wupperthal Rooibos
Association / Private Company	Rietspruit Development Forum
Association / Private Company	Ebenhaeser CPA
Association / Private Company	Strandfontein Ratepayers Association
Association / Private Company	False Bay Ecology Park Steering Committee
Association / Private Company	St Helena WQ Trust
Association / Private Company	WC Estuary Task Team meeting
Association / Private Company	WC Wetland Forum
Association / Private Company	WCWSS Reconciliation Strategy SC
Association / Private Company	FGF Chamber of business
Association / Private Company	Newcastle Ratepayers Association
Association / Private Company	Vaal Environmental Justice Alliance
Association / Private Company	Wakkerstroom Natural Heritage Association
Association / Private Company	Western Cape Canoe Union
Association / Private Company	Friends of Verlorenvlei
Association / Private Company	West Coast Biosphere Reserve
Association / Private Company	BirdlifeSA
Association / Private Company	Cape Leopard Trust
Association / Private Company	Cape West Coast Bioshpere Reserve
Association / Private Company	Cape Winelands Biosphere Reserve
Association / Private Company	CapeNature
Association / Private Company	Conservation KZN
Association / Private Company	Conservation Outcomes
Association / Private Company	Endangered Wildlife Trust
Association / Private Company	Environmental Monitoring Group (EMG)
Association / Private Company	Ezemvel KZN Wildlife
Association / Private Company	Ezemvelo KZN Wildlife
Association / Private Company	Federation for Sustainable Environment
Association / Private Company	Greater Cederberg Biodiversity Corridor
Association / Private Company	GreenCape
Association / Private Company	Living Lands

Association / Private Company	Maloti Drakensberg Transfrontier Program
Association / Private Company	Marico Biosphere Reserve
Association / Private Company	Save the Vaal
Association / Private Company	Technologies for Economic Development
Association / Private Company	Verlorenvlei Estuary Coastcare
Association / Private Company	Wildlife And Environment Society of South Africa (WESSA)
Association / Private Company	Wildlife Foundation Africa
Association / Private Company	WWF-SA
Association / Private Company	Conservation SA (CSA)
Association / Private Company	SEED
Association / Private Company	Soil for life
Association / Private Company	WESSA
Association / Private Company	Cape Gate
Association / Private Company	ArcelorMittal
Association / Private Company	Almika Property
Association / Private Company	Arcelor Mittal
Association / Private Company	ArcelorMittal
Association / Private Company	Distell
Association / Private Company	East London Industrial Development Zone
Association / Private Company	Lucky Star
Association / Private Company	Lydenburg Smelter
Association / Private Company	Saldanha IDZ LicCo
Association / Private Company	Samancor Chrome
Association / Private Company	Siltech Smelter
Association / Private Company	VITITEC
Association / Private Company	Wine Industry Development Association (WIDA)
Association / Private Company	Winetech
Association / Private Company	Impala Platinum
Association / Private Company	Gold One
Association / Private Company	Seriti ZA
Association / Private Company	Afrimat
Association / Private Company	DRDGOLD
Association / Private Company	Assmang Mine
Association / Private Company	Chamber of Mines South Africa
Association / Private Company	Dwars River Chrome
Association / Private Company	EXXARO
Association / Private Company	Foskor
Association / Private Company	Harmony Gold Mine
Association / Private Company	Kudumane Manganese Resources
Association / Private Company	Petra Diamonds
Association / Private Company	Sedibeng Iron Ore
Association / Private Company	Seriti Mining
Association / Private Company	Sibanye Mine
Association / Private Company	Thungela mine
Association / Private Company	Village Main Reef
Association / Private Company	Karan Beef
Association / Private Company	PG Group
Association / Private Company	Calodex
Association / Private Company	McCain
Association / Private Company	Brikor
Association / Private Company	Goldi Chicken
Association / Private Company	Safripol
Association / Private Company	Omnia Strategic Counsel & Communications
Association / Private Company	Oryx Africa
Association / Private Company	Omnia Holdings Limited
Association / Private Company	The Synthetic Latex Company
Association / Private Company	AECI
Association / Private Company	AGES Omega (Pty) Ltd
Association / Private Company	Anthonij Rupert Wyne
Association / Private Company	Avontuur Farm
Association / Private Company	Batatise Consulting Engineers
Association / Private Company	Boulah Nursery
Association / Private Company	Canyon coal
Association / Private Company	CBSS

Association / Private Company	Fair Cape Daries / Fruitique (Pty) Ltd
Association / Private Company	Green H Ranches
Association / Private Company	HORTGRO
Association / Private Company	L'Ormarins
Association / Private Company	Loskop Valley Irrigation
Association / Private Company	Mountain Safety Research
Association / Private Company	Nestle
Association / Private Company	OBARO
Association / Private Company	Sandveld Organics
Association / Private Company	Sappi
Association / Private Company	Shell South Africa
Association / Private Company	St Malo Farm
Association / Private Company	Suiderland Plase
Association / Private Company	The WaterWorX Group (Pty) Ltd
Association / Private Company	Villiera Wines
Association / Private Company	Clanwilliam Tourism
Association / Private Company	Namaqua West Coast Tourism
Association / Private Company	Vredendal Toerisme
Association / Private Company	Lamberts Bay Tourism and Bird Island PAAC
Association / Private Company	Centre for Environmental Rights
Association / Private Company	Earthlife Africa
Association / Private Company	Goedgedacht Trust
Association / Private Company	Regenerative SPACE
Academic Institutions	
Institutions of Higher Learning	UNISA
Institutions of Higher Learning	Central University of Technology
Institutions of Higher Learning	Motheo College
Institutions of Higher Learning	National University of Lesotho Water Institute
Institutions of Higher Learning	Northwest University
Institutions of Higher Learning	University of KwaZulu-Natal
Institutions of Higher Learning	Durban University of Technology
Institutions of Higher Learning	University of Pretoria
Institutions of Higher Learning	University of Johannesburg
Institutions of Higher Learning	University of Witwatersrand
Institutions of Higher Learning	University of the Free State
Institutions of Higher Learning	Rhodes University
Institutions of Higher Learning	University of Cape Town
Institutions of Higher Learning	University of the Western Cape
Institutions of Higher Learning	Stellenbosch University
Research institution	SANBI-Biodiversity Research, Assessment & Monitoring
Research institution	Abalobi
Research institution	Cape Peninsula University of Technology
Research institution	Citrus Research International
Research institution	Council for Scientific and Industrial Research
Research institution	PLAAS
Research institution	South African Environmental Observation Network
Research institution	Freshwater Research Centre
Research institution	CSIR
Research institution	WRC
Research institution	SANBI
Research institution	GSSA
Research institution	GSSA GWD
Research institution	Council for Geoscience
Groundwater / Surface Water Consultancies	
Consultancy	BlueSciece
Consultancy	Waterignt
Consultancy	Stantec
Consultancy	COPPERLEAF CONSULTING
Consultancy	DAVIES LYNN & PARTNERS
Consultancy	Dihlashana
Consultancy	ENGEOCON / ENGEOLAB
Consultancy	GCS WATER & ENVIRONMENT
Consultancy	GEO HYDRAULIC & ENVIRONMENTAL TECHNOLOGY
Consultancy	GEOMEASURE GROUP

Consultancy	GEOSURE
Consultancy	GEOWATER IQ
Consultancy	GOODSPEED ENVIRONMENTAL SERVICES
Consultancy	Groundwater Africa
Consultancy	IN SITU CONSULTING
Consultancy	IX ENGINEERS
Consultancy	JG AFRIKA
Consultancy	WSP ENVIRONMENTAL
Consultancy	12J Consulting Geo-scientists and Environmental Engineers
Consultancy	Golder
Consultancy	ILZ consulting
Consultancy	SCN Consulting
Consultancy	SRK Consultantants
Consultancy	TALBOT & TALBOT
Consultancy	Terratest
Consultancy	WRP Consulting Engineers
Consultancy	WSM Leshika Consulting (Pty) Ltd
Consultancy	Lerotholi Polytechnic
Consultancy	Kongiwe
Consultancy	Icon Construction
Consultancy	Prime Resources
Consultancy	Earth Optiva Compliance Consultants
Consultancy	BECS Services

Appendix B

Provisional List of Transboundary Stakeholders

Country	National Department	Chief Directorate	Division	Sub-Division
Lesotho	Ministry of Natural Resources	The Department of Water Affairs	Hydrology	
			Groundwater	
			Water Rights	
			Research and Development	
Eswatini	Ministry of Natural Resources and Energy	The Department of Water Affairs	The Water Resources Section	
			The Rural Water Supply Section	
			The Hydrogeology and Drilling Section	
Namibia	Ministry of Agriculture, Water and Forestry	Department Of Water Affairs	Directorate of Water Resource Management	Division Geohydrology (Groundwater)
				Division Hydrology (Surface Water)
				Division Water Basin Management
Botswana	Ministry of Land Management, Water and Sanitation Services	Department of Water and Sanitation	Hydro-Informatics	
			Water Resources Planning & Modelling	
			Water Resource Management	
Zimbabwe	Ministry of Environment, Water and Climate	Zimbabwe National Water Authority		
		District Development Fund		
		Zimbabwe Parks and Wildlife Management Authority		
		Environmental Management Agency, formerly the Department of Natural Resources		
Mozambique	Ministry of Public Works, Housing and Water Resources	National Directorate of Water Resources Management		