



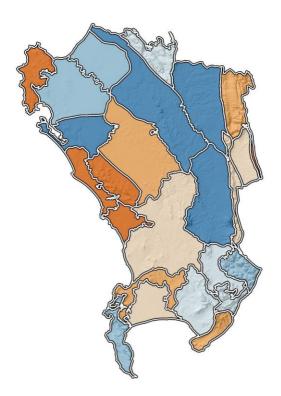
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High Confidence Groundwater Reserve Determination Study in the Berg Catchment WP11398

Groundwater Reserve Determination Report



Report Number: RDM/WMA19/02/CON/COMP/0124

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Department of Water and Sanitation
Chief Directorate: Water Ecosystems Management

HIGH CONFIDENCE GROUNDATER RESERVE DETERMINATION STUDY IN THE BERG CATCHMENT: GROUNDWATER RESERVE **DETERMINATION REPORT**

PROJECT High Confidence Groundwater Reserve

Determination Study in the Berg Catchment

REPORT TITLE **Groundwater Reserve Determination Report**

CLIENT Department of Water and Sanitation, Chief

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AUTHORS Matthew Misrole :

Eddie Wise

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APPROVED BY

UMVOTO South Africa (Pty) Ltd

Director

Kornelius Riemann

UMVOTO South Africa (Pty) Ltd

Technical Reviewer David McGibbon

Department of Water and Sanitation Chief Directorate: Water Ecosystems

Management Project Manager Philani Khoza

Department of Water and Sanitation **Chief Directorate: Water Ecosystems**

Management Scientific Manager Kwazikwakhe Majola

Department of Water and Sanitation Chief Directorate: Water Ecosystems Management Director

Yakeen Atwaru



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Executive Summary

In response to the increasing number of Water Use Licence Applications (WULAs) in the Berg catchment and the potential impacts of proposed developments on water resource quantity and quality, the Department of Water and Sanitation (DWS), Chief Directorate: Water Ecosystems Management (CD: WEM), initiated a 'High Confidence Groundwater Reserve Determination Study for the Berg Catchment'.

The National Water Act (NWA, No. 36 of 1998) establishes a legal framework for the effective and sustainable management of significant water resources in South Africa. The Resource Directed Measures (RDM; see **Figure 1**), aimed at balancing the protection, use, conservation, management, and control of water resources, is an important tool within the NWAs framework and consist of three main components: Classification, Reserve, and Resource Quality Objectives (RQOs). The Reserve, designated as the water 'set aside' to fulfil Basic Human Needs (BHN) and Ecological Water Requirements (EWR), is the only right to water in the NWA, and takes precedence over all other water uses. These requirements, coupled with other critical water demands on these water resources, are safeguarded by the RQOs identified for priority sites in the Berg catchment.

Given that two components of the RDM (i.e., the 'Classification' and the 'RQOs') have already been completed and gazetted (Gazette No.42451:121) for the Berg catchment, this study sought to conclude the RDM process and align with the gazetted water requirements. It is noteworthy that while the NWA explicitly includes groundwater in the definition of a 'water resource', the distinctive characteristics of groundwater systems sometimes require a unique management approach. Therefore, in determining the groundwater Reserve for the Berg catchment, careful consideration was given to the volume of groundwater that can be sustainably abstracted without adversely affecting its contribution to surface water flow.

The primary objective of this study was to provide insights into the groundwater resource systems within the Berg catchment, considering both the established conservation status of priority water resources and the complex geological and hydrogeological features of the study area. The overarching goal was to offer aquifer-specific information to facilitate well-informed management decisions concerning stressed or over-utilized groundwater resources.



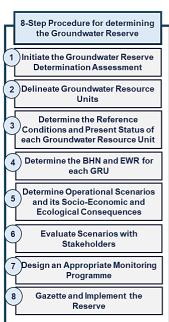


Figure 1 The overarching components of the RDM and the 8-step procedure for determining the Groundwater Reserve (after WRC, 2013).



As per Regulation 2(4) of the NWA (No. 36 of 1998), the Groundwater Reserve Determination (GRD) process must follow the eight-step procedure outlined and published in the RDM manuals. This report, represents Step 8 of the GRD procedure (see **Figure 1**), and provides a comprehensive summary of the findings and recommendations resulting from the High Confidence Groundwater Reserve Determination process. The report is broken down into 3 chapter, detailing the following:

- Chapter 1: serves as an introduction, providing insights into the study area and the GRD methodology.
- Chapter 2: provides a summary of the eight-step GRD procedure for the Berg Catchment, including Step 1: Data and Water Resource Models, Step 2: the Delineation of Groundwater Resource Units (GRUs), Step 3: the Assessment of Ecological Reference Conditions, Step 4: the Groundwater Requirements for BHN and EWR, Step 5 and 6: Defining Operational Scenarios and Analysing the Socio-Economic and Ecological Consequences, and Step 7: the Monitoring Programme to be implemented for the Reserve.
- **Chapter 3:** concludes the report with the outcomes GRD process per GRU and provides summary tables of the key hydrogeological components of the Groundwater Reserve.



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List of abbreviations, acronyms, symbols and units of measurement

ApproximatelyLess thana annum

Berg WAAS Berg Water Availability Assessment

BH Borehole

BHN Basic Human Needs

CD: WEM Chief Directorate: Water Ecosystems Management

CFA Cape Flats Aquifer
CGS Cape Granite Suite
CoCT City of Cape Town
Conc. Concentration

DWS Department of Water and Sanitation

e.g. For example Et al. and others etc. etcetera

EWR Ecological Water Requirement

Fm Formation

GDE Groundwater Dependent Ecosystems
GIS Geographic Information System
GRD Groundwater Reserve Determination
GRDM Groundwater Resource Directed Measure

GRU Groundwater Resource Unit

GW Groundwater i.e. That is.

IAP Invasive Alian Plants
IRF Irrigation Return Flow
IUA Integrated Unit of Analysis

km Kilometres

ℓ/p/d Litres per person per day

Ltd. Limited Liability

m Metres

M m³ Million Cubic Metres

m³ Cubic Metres

MAP Mean Annual Precipitation
MAT Mean Annual Temperature

mm Millimetres

mm/a Millimetres per annum

N North

NGA National Groundwater Archive

No. Number

NWA National Water Ac

pg. Page

PHA Philippi Horticulture Area

PS Present Status

PSP Professional Service Provider

Pty. Proprietary

RDM Resource Directed Measure

Ref Reference

RQO Resource Quality Objective



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RU Resource Unit Sc Scenario

SGWCA Subterranean Government Water Control Areas

SI Stress Index

SWSA Strategic Water Source Areas TEC Target Ecological Category TMG Table Mountain Group

TMGA Table Mountain Group Aquifer

TOR Terms of Reference

WARMS Water Use Authorization & Registration Management System

WCWSS Western Cape Water Supply System

WMA Water Management Area
WMS Water Management System

WQ Water Quality

WR2012 Water Resources of South Africa Study (2012)

WRC Water Research Commission
WRCs Water Resource Classes
WUL Water Use Licence

WULA Water Use Licence Application



1. INTRODUCTION

1.1. Background of the Study

In response to the increasing number of Water Use Licence Applications (WULAs) in the Berg catchment and the potential impacts proposed developments may have on water resource quantity and quality, the Department of Water and Sanitation (DWS): Chief Directorate: Water Ecosystems Management (CD: WEM) initiated a "High Confidence Groundwater Reserve Determination Study for the Berg Catchment". This study aimed to complete the Resource Directed Measures (RDM) process (**Figure 1-1**) for the Berg catchment and support the Water Resource Classes (WRCs) and Resource Quality Objectives (RQOs) gazetted on the 10th of May 2019 (Gazette No.42451:121, hereafter referred to as 'DWS, 2019b: 121').

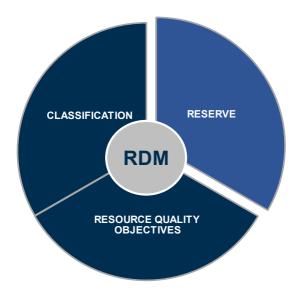


Figure 1-1 The three main components of the Resource Directed Measures (RDM) process as defined by Regulation 2(4) of the National Water Act (NWA; No. 36 of 1998).

The primary objective of this study was to offer insights into the groundwater resource systems within the Berg catchment, taking into account both the conservation status of priority water resources and the complex geological and hydrogeological features of the study area. The overarching goal was to provide aquifer-specific information with a high level of confidence to facilitate well-informed management decisions concerning stressed or over-utilized groundwater resources. This study therefore aimed to align with the gazetted requirements for the Berg catchment and to determine the necessary groundwater contribution to the Reserve. Specifically, the focus was on the groundwater contribution to Basic Human Needs (BHN) and Ecological Water Requirements (EWR), as outlined in the project's Terms of Reference (TORs) (refer to **Section 1.2**).

For the Berg catchment, WRCs and. RQOs were officially gazetted as an outcome of the 'Determination of Water Resource Classifications and Resource Quality Objectives in the Berg Catchment' study (hereafter referred to as 'DWS, 2016' or 'The Berg Catchment WRCs and RQOs Study'). The WRCs were completed in accordance with Section 13(4)(a)(i)(aa) of the National Water Act (NWA) of 1998 and the RQOs were completed for prioritized Resource Units (RUs) in accordance with Section 13(4)(a)(i)(bb) of the NWA of 1998. A summary of the information presented in the Gazette is provided in DWS (2022e).



1.2. Terms of Reference

The Terms of Reference (TOR), as provided by the DWS CD: WEM, and outlined in the projects Inception Report (DWS, 2022a), stipulates the aims and objectives for this study as follows:

"The objective of this study is to determine a high confidence groundwater Reserve requirements (quantity and quality) to satisfy the basic human needs and to protect aquatic ecosystems in priority water resources within the Berg catchment".

- BID no. WP 11398

"Detailed determinations aim to produce high-confidence results, are based on sitespecific data collected by specialists and are used for all compulsory licensing exercises, as well as for the individual licence applications that could have a large impact on any catchment, or a relatively small impact on ecologically important and sensitive catchments".

- BID no. WP 11398

1.3. The Study Area

The Berg catchment, delineated in the 19 Water Management Area (2004), serves as the primary study area boundary, and is situated within the Western Cape Province of South Africa. It covers approximately 13,891 km² and includes secondary drainage regions G1 and G2 (**Figure 1-1**).

This catchment experiences a Mediterranean climate characterized by winter rainfall, where the mean annual precipitation (MAP) varies significantly due to the region's topography, ranging from 300 mm in the low-lying coastal plains (northwest) to 3,000 mm in the high mountain ranges (east). Mean annual temperature's (MAT) also exhibits variation, with cooler temperatures in mountainous areas (10 - 14°C) and warmer temperatures along the coastal lowlands (16 - 20°C). Evaporation rates increase with latitude, particularly northwards (approximately 2200 – 2600 mm), while southern areas, around Cape Town, experience lower evaporation rates (approximately 1800 – 2200 mm).

Hydrologically, the Berg River (G1) catchment is the largest within the study area, covering approximately 8908 km². The study area includes 22 estuaries, with the Berg River estuary and Langebaan Lagoon among them, both receiving contributions from groundwater. Significant wetlands, such as the Edith Stephens Wetland Park, Zeekoevlei, Rondevlei, Zoarvlei, and Rietvlei, are also present. Additionally, six major dams are situated in the catchment, namely the Upper and Lower Steenbras, Wemmershoek, Voëlvlei, Theewaterskloof, and Berg River Dam.

Geologically, the majority of the Berg catchment is underlain by Klipheuwel and Malmesbury Group rocks. These basement rocks were intruded by the Cape Granite Suite (CGS), leading to a prolonged period of uplift and erosion. This geological process resulted in the deposition of sandstones forming the Table Mountain Group (TMG). The Peninsula and Nardouw Aquifers (TMG), arising from these formations, contribute to deep fractured rock aquifers. Further erosion of these formations, particularly the softer Malmesbury Group, shaped eroded valleys, leading to sediment deposition in the western and coastal portions of the catchment (see **Figure 1-2**). These sand deposits form the Bredasdorp Group, Sandveld Group, and Quaternary age deposits, comprising major primary sedimentary/intergranular aquifers such as the Cape Flats Aquifer (CFA), Atlantis/Silwerstroom aquifers, and the West Coast Aquifers (Yzerfontein, Adamboerskraal, Elandsfontein, and Langebaan Road Aquifers) (DWS, 2022a).



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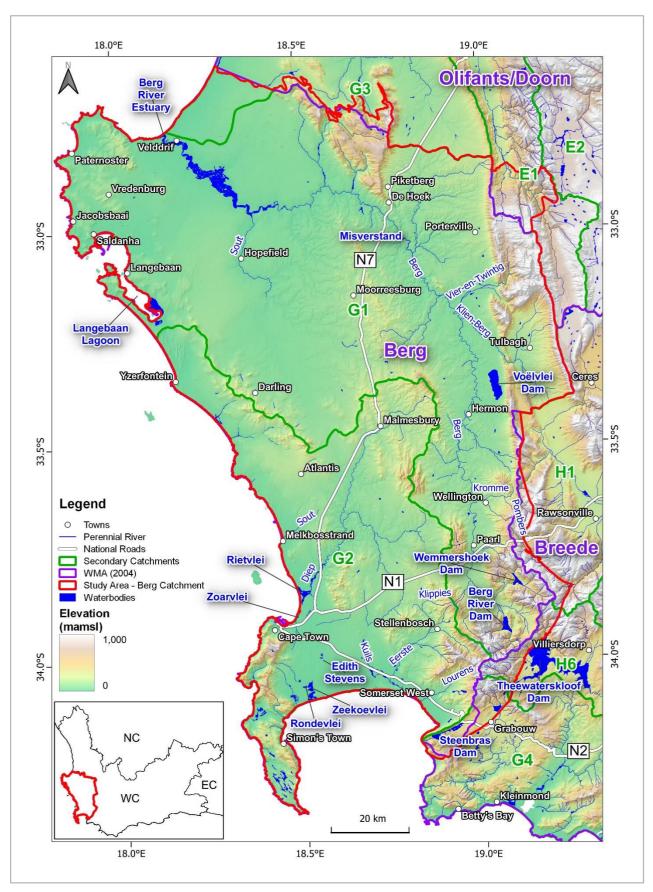


Figure 1-2 The Berg catchment and the project study area.



1.4. Study Methodology & Approach

As outlined in **Section 1.5**, the Groundwater Reserve Determination process followed the eight-step GRD procedure outlined GRDM (WRC, 2013). Consequently, the project was subdivided into three phases, each further split into tasks and key deliverables. These are summarized in **Table 1-1** and **Figure 1-3** as well as in the Inception Report (DWS, 2022a).

Table 1-1 Summary of project phases, tasks, and associated deliverables for the study.

Phase 1	Project Inception			
Task 1	Inception		Deliverable 1: Inception Report	
Phase 2	Review o	f Water Resource Information	and Data	
Task 2.1	Data collection and collation		Deliverable 2.1: Gap Analysis Report Deliverable 2.2: Inventory of Water Resource Models	
Phase 3	Reserve I	Determination		
Task 3.1	Step 1	Initiate Groundwater Reserve Study	Recorded in Deliverable 2.1 and Deliverable 2.2	
Task 3.2	Step 2	Water RU Delineation	Deliverable 3.1: Delineation of Water RUs Report	
Task 3.3	Step 3 Ecological Reference Conditions of RUs		Deliverable 3.2: Ecological Reference Conditions Report	
Task 3.4	Step 4	Step 4 Determine BHN and EWR Deliverable 3.3: BHN and EWR Requirement Report		
Task 3.5	Step 5 Operational Scenarios & Socio-economic		Deliverable 3.4: Operational Scenarios & Socio-Economic and Ecological Consequences Report	
Task 3.6	Step 6	Evaluate Operational Scenarios with Stakeholders	Deliverable 3.5: Stakeholder Engagement of Operational	
Task 3.7	Step 7	Monitoring Programme Deliverables 3.6: Monitoring Programme Report		
Task 3.8	Step 8	Gazette & implement Reserve	Deliverable 3.7: Groundwater Reserve Determination Report Deliverable 3.8: Database Deliverable 3.9: Gazette Template	

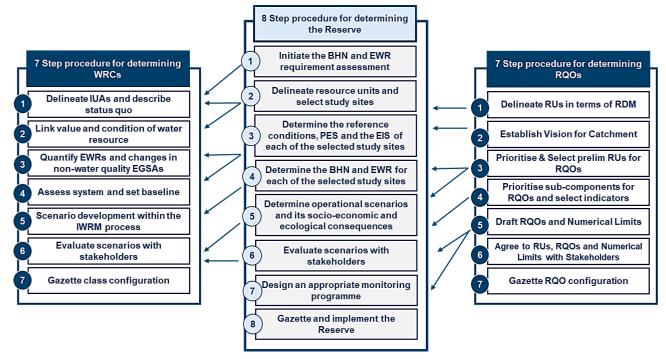


Figure 1-3 The eight-step GRD procedure and its alignment with the seven-step WRCs & RQO procedure (after WRC, 2013).



1.5. Aim of this Report

As per Regulation 2(4) of the NWA (No. 36 of 1998), the Reserve determination process must follow the eight-step procedure outlined in the RDM manuals. To differentiate between the general RDM and RDM specifically related to groundwater, the term Groundwater Resource Directed Measures (GRDM) is utilized. The GRDM manuals referenced in this report include WRC (2007), WRC (2013), and preliminary findings from an ongoing review of GRDM manuals conducted by the Water Research Commission (WRC).

The purpose of this report is to present a comprehensive summary of the findings and recommendations resulting from the Groundwater Reserve Determination (GRD) process conducted for the Berg catchment. Each section in this report presents a summary of the information and outputs of the detailed reports for each step of the eight-step GRD procedure.

In terms of the report structure, **Chapter 1** serves as an introduction, providing insights into the study area and the GRD methodology. **Chapter 2** provides a summary of the eight-step GRD procedure for the Berg Catchment, including the delineation of Groundwater Resource Units (GRUs), the assessment of ecological reference conditions, the requirements for BHN and EWR, operational scenarios and an analysis of the socio-economic and ecological consequences, and the proposed monitoring programme to be implemented for the Reserve. Finally, **Chapter 3** concludes the report with the outcomes of the study per GRU.

It must be noted that the perspectives, expertise, and concerns of stakeholders played an important role in shaping outcomes of this study, ensuring that the results of the assessment were well-informed, balanced, and reflective of the interests and needs of all involved parties.



2. RESERVE DETERMINATION

The National Water Act (No. 36 of 1998) establishes a legal framework for the effective and sustainable management of significant water resources in South Africa. The RDM, required to balance the protection, use, conservation, management, and control of water resources, comprises three main components: Classification, Reserve, and Resource Quality Objectives (RQOs) as detailed in **Section 1.1**. The Reserve, i.e., the water "set aside" to provide for BHN and EWR, is the **only** right to water in NWA, taking precedence over all other water use. Simply put, the Reserve's water requirements must be fulfilled before allocating water resources to other users. These requirements, along with other demands on water resources, are safeguarded by RQOs identified for priority sites in the Berg catchment.

Although the NWA explicitly includes groundwater in the definition of a "water resource", the distinctive characteristics of groundwater systems a sometimes necessitate a unique management approach. Consequently, in determining the groundwater Reserve for the Berg catchment, consideration was given to the volume of groundwater that can be sustainably abstracted without adversely affecting its contribution to surface water flow (WRC, 2013).

The following subsections offer a summary of the key outcomes of each step in the eight-step GRD process outlined in **Section 1.4.**

2.1. Step 1: Data and Water Resource Models

Following an extensive literature review, multiple data sources were collated and utilised in this GRD study. The Berg Catchment WRCs and RQOs Study (DWS, 2016) and the Berg Water Availability Assessment Study (Berg WAAS) project (DWAF, 2008) formed a crucial foundation, contributing information on aquifer type classification, aquifer boundaries, general hydrogeologic characteristics, regional groundwater flow, recharge, and groundwater quality. Additional studies, including the Pre-Feasibility and Feasibility Studies for the Augmentation of the Western Cape Water Supply System (WCWSS) (DWA, 2012), the Water Reconciliation Strategy for the WCWSS (DWS, 2016f), the Water Resources of South Africa Study (WRC, 2012), the Groundwater Projects associated with City of Cape Town's New Water Programme, and the Berg River Baseline Monitoring Programme (DWAF, 2007a & b), also provided valuable inputs.

After reviewing the available data and information, it became clear that a significant re-evaluation of surface water RUs was unnecessary within the defined project scope. The DWS (2016) conducted a comprehensive review of surface water data, which was effectively integrated into this GRD assessment. The study revealed no significant gaps in surface water information. Information on the spatial extent and groundwater dependency of wetlands was lacking sufficient regional mapping, and therefore additional data was integrated into an updated understanding of surface-groundwater interactions (DWS, 2022b).

Groundwater data was collated from national databases such as the National Groundwater Archive (NGA), Water Management System (WMS), Water Use Authorization & Registration Management System (WARMS), and Hydstra database and then underwent a rigorous quality check. Smaller scale geological maps (1:50 000) were used, with preference given to finer resolution maps in certain areas. Water resource models were also assessed and categorized, encompassing various model types such as desktop feasibility, conceptual, water balance, yield/storage, and numerical models. While aquifer-scale groundwater numerical models were developed for major aquifers, proprietary constraints limited access to the datafiles.

Detailed information on data and water resource models were provided in both the Gap Analysis Report (DWS, 2022b) and the Inventory of Water Resource Models Report (DWS, 2022c). These reports correspond to Step 1 in the eight-step GRD procedure, as illustrated in **Table 1-1** and **Figure 1-3**.



2.2. Step 2: Delineation of Groundwater Resource Units

The delineation of GRUs in the Berg Catchment WRCs and RQOs Study (DWS, 2016) was initially based on surface water catchments, resulting in the grouping of various aquifer systems into single GRUs to integrate them with surface water systems. Unfortunately, this approach had limitations, leading to potential groundwater management issues for the catchment, such as the exclusion of significant aquifer systems like the Table Mountain Group Aquifers (TMGA) in the Steenbras area.

The geology of the Berg catchment strongly influences topography, recharge (drainage, and orogenic control over precipitation), and groundwater chemistry. Due to the complex geological characteristics of different aquifers (i.e., the Sandveld Group, Table Mountain Group (TMG), and Basement Aquifers) and the strong compartmentalization of TMG formations due to major faults or fault zones, the existing GRU extents did not align with the actual aquifer boundaries.

To address these issues, Step 2 of the GRD process focused on delineating aquifer-specific GRUs and identifying areas requiring further investigation. This step aimed to refine the delineation process, ensuring the inclusion of overlooked aquifers and improving mapping accuracy for groundwater Reserve determination.

Three main criteria—physical, management, and functional—were used to re-delineate aquifer-specific GRUs. The approach involved analysing physical aquifer geometry, existing aquifer boundaries, recharge areas, topography, structural geology (faults, folds, hydrotects), and potential discharge areas. Functional and management criteria considered existing Integrated Units of Analysis (IUAs), WRCs, RQOs, Strategic Water Source Areas (SWSAs), Subterranean Government Water Control Areas (SGWCA), groundwater use, aquifer reliance, and groundwater-surface water interactions.

The updated GRU extents are presented in **Table 2-1** and displayed on a geological map in **Figure 2-1**. Comprehensive details on the approach, methodology, and results can be found in the Delineation of Groundwater Resource Units Report (DWS, 2022d).

Table 2-1 Summary of revised GRUs for the Berg catchment.

GRU Name	Associated Quaternary Catchment			
Primary / Intergranular Aquifers				
Cape Flats	G22C, G22D and G22E			
Atlantis	G21A, G21B and G21D			
Yzerfontein	G21A			
Elandsfontein	G10M and G10L			
Langebaan Road	G10M and G10L			
Adamboerskraal	G10M, G10K and G30A			
Fractured Table	e Mountain Group Aquifers			
Cape Peninsula	G22A, G22B, G22C and G22D			
Steenbras-Nuweberg	G40B, G40A, G40D, G22J, G22K, H60A and G40C			
Drakensteinberge	G10A, G10C, G22F, G22J, H60A and H60B			
Wemmershoek	G10B, G10A, G10C, H10J, H60B and H10K			
Voëlvlei-Slanghoek	G10E, G10J, G10D, G10F, H10E, H10F and H10J			
Witzenberg	G10E			
Groot Winterhoek	G10J, G10E, G10H, E10C and G10G			
Piketberg	G10M, G30D, G10K, G30A and G10H			
Fractured and Intergranular Basement				
Cape Town Rim	G22C, G22E, G22B and G22D			
Stellenbosch-Helderberg	G22G, G22H, G22F, G22J and G22K			
Paarl-Franschoek	G10C, G10A and G10B			
Malmesbury	G201E, G21C, G21D, G21F and G21B			
Wellington	G10D and G10F			
Tulbagh	G10E and G10G			
Eendekuil Basin	G10H, G10J, G10F and G10K			
Middle-Lower Berg	G10J, G30A, G10K and G10M			
Northern Swartland	G10L			
Darling	G10L and G21A			
Vredenburg	G10M			



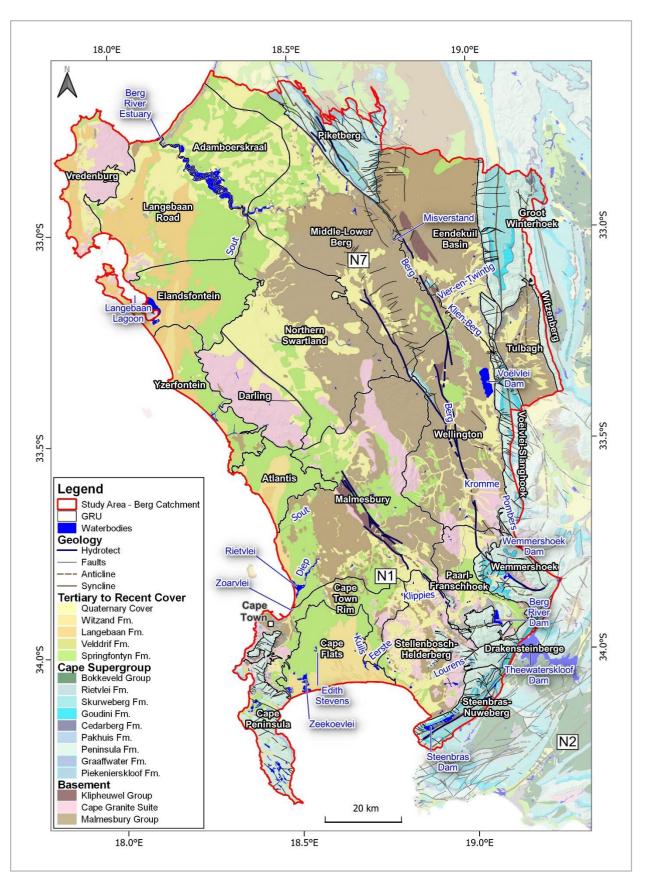


Figure 2-1 Summary of revised GRUs extents for the Berg catchment with associated geology and relevant structural features.



2.3. Step 3: Ecological Reference Conditions

To ensure alignment with the aquifer-specific GRUs identified in Step 2 (**Section 2.2**) as well as the information related to the gazetted WRCs and RQOs (DWS, 2019b: 121), Step 3 of the GRD process re-evaluated the ecological reference conditions and present status (PS) of the catchment. In the context of this study, 'ecological reference conditions' referred to the ambient or natural state of groundwater systems, while 'present status' referred to the current state in terms of groundwater utilization and water quality.

The objective of this step was to establish a correlation between the earlier assessments of the groundwater status quo in the Berg catchment (following DWS, 2016). This involved providing insights into the updated approach and criteria considered for a revised assessment of the groundwater status quo. This encompassed five critical hydrogeological components: 1) Recharge, 2) Groundwater Use, 3) Discharge, 4) Groundwater Quality, and 5) Aquifer Stress.

1. RECHARGE

Various recharge estimation techniques were used based on the hydrogeological characteristics of specific GRUs. The selection considered the confidence level and associated limitations of the technique; the amount, spread, and availability of data across the GRU; and the applicability of published datasets. The assessment took into account artificial recharge and lateral recharge (where applicable).

2. **GROUNDWATER USE**

Various data sources were collated to assess current groundwater use in the study area, providing a quantitative means of assessment per GRU as input to the groundwater Stress Index (SI). The index considered both groundwater availability (natural/artificial recharge) and groundwater use, aiming to quantify Aquifer Stress by assigning an associated PS category.

3. **DISCHARGE**

Groundwater discharge represented the outflow of groundwater from aquifers to the surface or surface water systems, either directly or laterally via an adjacent aquifer unit. Groundwater contribution to baseflow was calculated to provide aquifer-specific estimates.

4. GROUNDWATER QUALITY

Data from various sources were collated to provide a hydrochemical summary per GRU. Baseline water quality was assessed for each GRU (for select parameters), and potential sources of contamination were identified. Selected groundwater parameters were also evaluated for compliance with RQOs (DWS, 2019b:121), and groundwater quality PS categories were assigned per GRU.

5. AQUIFER STRESS

Three guidance tables were used in the aquifer stress assessment including 1) sustainable use, 2) level of stress, and 3) contamination / water quality, to define PS Category for both groundwater availability and groundwater quality per GRU.

A guide for determining Groundwater Availability and Water Quality PS Category is outline in **Table 2-6** while a summary of the results is presented per GRU in **Table 2-3**. Comprehensive details regarding the approach, methodology, and associated results can be found in the Ecological Reference Conditions Report (DWS, 2022e).



Table 2-2 Guide for determining both Groundwater Availability and Water Quality PS Categories (after WRC, 2007).

	Groundwater Availability Present Status Category		Water Quality Present Status Category	
	Stress Index (GW use / Recharge)	Description	Percentage Exceedance	Description
Α	<0.05	Unstressed or slightly stressed	<16.7 %	Unmodified, pristine conditions
В	0.05 – 0.20	Unstressed or slightly stressed	16.7 – 33.4 %	Localised, low levels of contamination, but no negative impacts apparent
С	0.20 – 0.40	Moderately stressed	33.4 – 50.1 %	Moderate levels of localised contamination, but little or no negative impacts apparent
D	0.40 – 0.65	Moderately stressed	50.1 – 66.8 %	Moderate levels of widespread contamination, which limit the use of potential use of the aquifer
E	0.65 – 0.95	Highly stressed	66.8 – 83.5 %	High levels of local contamination which render parts of the aquifer unusable
F	>0.95	Critically stressed	>83.5 %	High levels of widespread contamination which render the aquifer unusable

Table 2-3 Summary of the PS Category per GRU for both Groundwater Availability and Groundwater Quality.

GRU	Groundwater Availability Present Status Category	Groundwater Quality Present Status Category									
Primary / Intergranular Aquifers											
Cape Flats	С	D									
Atlantis	В	С									
Yzerfontein	Α	Α									
Elandsfontein	В	В									
Langebaan Road	С	В									
Adamboerskraal	В	В									
	Fractured Table Mountain Group Aquifers										
Cape Peninsula	В	В									
Steenbras-Nuweberg	В	В									
Drakensteinberge	A	-									
Wemmershoek	A	Α									
Voëlvlei-Slanghoek	A	-									
Witzenberg	A	-									
Groot Winterhoek	В	-									
Piketberg	С	-									
	Fractured and Intergranular Basement										
Cape Town Rim	С	С									
Stellenbosch-Helderberg	С	С									
Paarl-Franschhoek	С	-									
Malmesbury	С	В									
Wellington	В	В									
Tulbagh	С	-									
Eendekuil Basin	С	С									
Middle-Lower Berg	В	С									
Northern Swartland	В	С									
Darling	В	С									
Vredenberg	В	-									



2.4. Step 4: BHN and EWR Requirements

Step 4 of the GRD involved determining the groundwater component of both the BHN and EWR for the aquifer-specific GRUs updated in Step 2 (**Section 2.2**). These components were calculated as independent volumes, collectively constituting the Groundwater Reserve.

1. Basic Human Needs

The groundwater component of the BHN addresses individuals without access to a formal water supply and residing beyond 500 meters from a perennial river (here after referred to as the "Qualifying Population"). The Qualifying Population was calculated as 257,331 individuals within the Berg catchment, with a daily water demand set at a fixed value of 25 ℓ /p/d. Therefore, the groundwater component of the BHN was determined to be 2.35 Mm³/a. The Cape Flats (0.70 Mm³/a), Malmesbury (0.34 Mm³/a), Stellenbosch-Helderberg (0.24 Mm³/a), and Wellington (0.24 Mm³/a) GRUs collectively account for about 65% of the total groundwater component of the BHN Reserve (**Table 2-4** and **Figure 2-2**).

2. Ecological Water Requirements

Quantifying the groundwater component of the EWR involved using a baseflow separation technique, wherein groundwater discharge was calculated using monthly flow data calibrated to meet Target Ecological Categories (TECs) for all river nodes and priority estuaries in the study area. A "balancing and routing" tool factored in cumulative flow downstream, allowing calculations of changes in flow and TECs for downstream river nodes and estuaries. To assess the groundwater contribution to the EWR per GRU accurately, a detailed GIS-based catchment analysis re-evaluated incremental contributing catchments based on local topography, flow direction, aquifer model extents, and available literature. A recharge ratio was then applied to the total dry-season contribution of groundwater to baseflow per GRU and associated aquifer types.

The groundwater component of the EWR Reserve was calculated as 69.98 Mm³/a, with the Middle-Lower Berg (11.15 Mm³/a), Wellington (6.75 Mm³/a), Adamboerskraal (6.00 Mm³/a), Elandsfontein (6.39 Mm³/a), Langebaan Road (5.52 Mm³/a), and Eendekuil Basin (6.95 Mm³/a) GRUs accounting for approximately 61% of the total groundwater component of the EWR Reserve (**Table 2-4** and **Figure 2-2**).

The Groundwater Reserve, supporting both BHNs and EWRs, was therefore determined to be 72.33 Mm³/a. While groundwater is more widely distributed than surface water, this component is just part of the larger geohydrological system considered under the RDM. Once the volume of the Groundwater Reserve is quantified and RQOs have been met, the remaining water resource can be allocated to users. Since RQOs were defined for the Berg catchment before this high-confidence groundwater Reserve study, it is likely that RQOs will require adjustment or updating to accommodate the Groundwater Reserve.

Table 2-4 and the associated maps displayed in **Figure 2-2** present a summary of the groundwater contribution to the BHN and EWR, while the comprehensive details regarding the approach, methodology, and results can be found in the BHN and EWR Requirements Report (DWS, 2023a).



Table 2-4 Summary of the groundwater contribution to BHN and EWR per GRU.

GRU	The groundwater contribution to EWR (Mm³/a)	The groundwater contribution to BHN (Mm³/a)	The groundwater contribution to Reserve (Mm³/a)										
	Primary / Intergranular Aquifers												
Cape Flats	0.51	0.701	1.211										
Atlantis	0.08	0.026	0.106										
Yzerfontein	0.02	0.009	0.029										
Elandsfontein	6.39	0.005	6.395										
Langebaan Road	5.52	0.017	5.537										
Adamboerskraal	6.00	0.008	6.008										
	Fractured Table Mou	ntain Group Aquifers											
Cape Peninsula	5.43	0.085	5.515										
Steenbras-Nuweberg	1.16	0.016	1.176										
Drakensteinberge	2.88	0.003	2.883										
Wemmershoek	3.59	0.002	3.592										
Voëlvlei-Slanghoek	1.62	0.007	1.627										
Witzenberg	0.18	0.002	0.182										
Groot Winterhoek	0.77	0.017	0.787										
Piketberg	2.07	0.036	2.106										
	Fractured and Inter	rgranular Basement											
Cape Town Rim	0.87	0.195	1.065										
Stellenbosch-Helderberg	2.34	0.242	2.582										
Paarl-Franschhoek	3.01	0.127	3.137										
Malmesbury	1.18	0.343	1.523										
Wellington	6.75	0.235	6.985										
Tulbagh	1.28	0.023	1.303										
Middle-Lower Berg	11.15	0.085	11.235										
Northern Swartland	0.20	0.047	0.247										
Darling	0.03	0.015	0.045										
Vredenburg	0.00	0.011	0.011										
TOTAL	69.98	2.35	72.33										



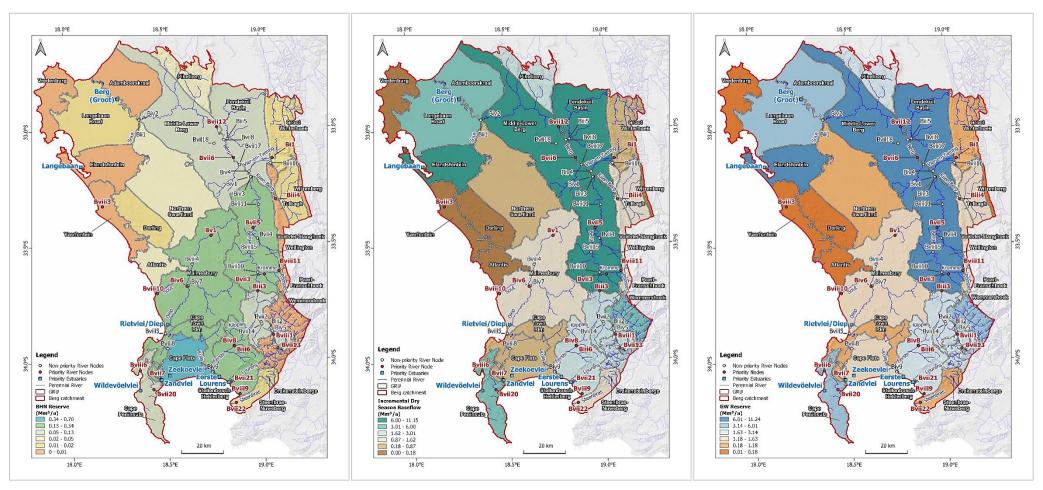


Figure 2-2 Left: the groundwater contribution to BHN per GRU; Middle: the groundwater contribution to EWR per GRU; and Right: Groundwater Reserve per GRU.



2.5. Step 5 & Step 6: Operational Scenarios

Steps 5 and 6 of the GRD process involved developing operational scenarios (refer to **Table 2-5**) aimed at assessing the socio-economic and ecological impacts on the Groundwater Reserve. These scenarios took into account inputs from relevant stakeholders which ensured that the assessment results were well-informed, balanced, and reflective of the diverse interests and needs of all parties involved (**Section 1.5**).

The scenarios offered valuable insights into both current and future trends of GRUs in the Berg catchment, focusing on aspects such as climate change, population growth, water supply scheme development, water conveyance, water sectoral growth, and the impact of invasive alien plants (IAPs). By integrating hydrogeological data, climate projections, and socio-economic trends, these scenarios provided a comprehensive understanding of the potential outcomes and challenges that may arise in maintaining the Groundwater Reserve and estimating allocable groundwater volumes.

By synthesizing findings from scenarios Sc 1 to Sc 6, two combined scenarios were developed: Sc 7a (Worst Case) and Sc 7b (Most-Likely Case). The Most-Likely Case (Sc 7b) considered factors such as the reduction in recharge due to climate change, the removal of all IAPs, the increase in groundwater contribution to the BHN Reserve based on population growth rate, and the augmented groundwater usage resulting from sectoral growth and the implementation of groundwater development schemes. These scenarios directly influenced the parameters used in determining the Groundwater Reserve, consequently impacting the still-allocable groundwater volumes¹. A comparative analysis of projected volumes in 2050 with baseline values from the Present Status (PS) provided valuable insights into the cumulative effects of the identified factors.

Table 2-5 Description of the scenarios considered in modelling the impacts on the groundwater Reserve and the associated allocable groundwater volume in the Berg catchment.

Scenario No.	Scenario Name	Scenario Description
Sc 1	Population Growth	Assess the impact of population growth on the groundwater component of the BHN Reserve and estimate volumes by projecting the qualifying population.
Sc 2	Water System Evaluation	Evaluate the national assessment of municipal wastewater conveyance and treatment systems, to estimate potential increase in groundwater reliance based on the deterioration of the water system.
Sc 3	Sectoral Water Demand	Explore historical trends in groundwater demand per sector, focusing on agriculture, industry, and other sectors, to understand future water use.
Sc 4	Groundwater Developments	Evaluate scheduled groundwater developments and strategies for the Berg catchment, calculating their impact on the Reserve and allocable volumes.
Sc 5	Climate Change	Investigate the impact of climate change, particularly under warmer conditions, on groundwater recharge rates and its effects on the Reserve.
Sc 6	Alien and Invasive Species	Examine the impacts of Invasive Alien Plants (IAPs) on groundwater recharge (Sc 6a – Clearing vs Sc 6b – Left Unchecked) and evaluate their effects on the Reserve and allocable volumes.
Sc 7a	Combination Scenario (Worst Case)	Integrate population growth, sectoral growth, groundwater developments, climate change, increased groundwater reliance based on the improvement of water system, and absence of clearing alien vegetation for impact assessment.
Sc 7b	Combination Scenario (Most-Likely Case)	Integrate population growth, groundwater developments, climate change, increased groundwater reliance based on the improvement of water system, and clearing alien vegetation for impact assessment.

¹ Still Allocable Groundwater: This term denotes the volume of groundwater that remains available for allocation or distribution after accounting for Reserve requirements and current water usage (WRC, 2013).



To evaluate the potential impact on GRUs, an "Allocation Factor" was developed which represents the ratio of still-allocable groundwater volume to the total recharge for the GRU. The Allocation Factor was categorized into six groups, labelled 'A' through 'F', reflecting a spectrum from unstressed to potentially critically stressed conditions (**Table 2-6**). As the ratio approaches zero, the stress level potentially increases, indicating minimal remaining volumes that are still allocable and posing a potential threat to the groundwater Reserve.

Table 2-6 Guide for determining the Allocation Factor.

Allocation Category	Description	Allocation Factor (Still Allocable Volume / Recharge Volume)			
A	Unstressed or slightly stressed	>0.95			
В	Unstressed or slightly stressed	0.75 – 0.95			
С	Moderately stressed	0.5 – 0.75			
D	Moderately stressed	0.35 - 0.50			
E	Potentially highly stressed	0.15 – 0.35			
F	Potentially critically stressed	<0.15			

Table 2-7 presents a summary of the results of the Sc 7b (Most-Likely Case) for the Berg catchment while the comprehensive details regarding the approach, methodology, and results of the operational scenario analysis can be found in the Operational Scenarios & Socio-Economic and Ecological Consequences Report (DWS, 2023c) and the Stakeholder Engagement of Operational Scenarios Report (DWS, 2023d).

It is important to highlight that Scenarios 1 to 6, which provided the necessary inputs for determining Scenario 7a (the Worst Case) and Scenario 7b (the Most-Likely Case), were thoroughly discussed and updated through stakeholder engagement.



Table 2-7 Summary table comparing parameters for calculating Groundwater Reserve and allocable volume per GRU, including results and parameters for Scenario 7b: Combination Scenario – Most-Likely Case.

		Groundwater Reserve									Combination Scenario – Most-Likely Case						
GRU	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)	Allocable Factor	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)	Allocable Factor	
Primary / Intergranular Aquifers																	
Cape Flats	41.25 ²	0.51	0.70	1.21	40.04	12.00 ³	28.04	0.68	38.70	0.51	1.29	1.80	36.90	23.02	13.88	0.36	
Atlantis	22.744	0.08	0.03	0.11	22.63	1.7 ⁵	20.93	0.83	21.63	0.08	0.05	0.13	21.50	3.31	18.19	0.84	
Yzerfontein	9.2	0.02	0.01	0.03	9.17	0.26	8.91	0.97	7.60	0.02	0.02	0.04	7.56	2.26	5.30	0.70	
Elandsfontein	15.47	6.39	0.01	6.40	9.08	1.09	7.99	0.52	13.17	6.39	0.01	6.40	6.77	2.70	4.07	0.31	
Langebaan Road	23.28	5.52	0.02	5.54	17.74	8.59	9.15	0.39	20.18	5.52	0.03	5.55	14.63	11.09	3.55	0.18	
Adamboerskraal	21.61	6.00	0.01	6.01	15.60	2.13	13.47	0.62	20.83	6.00	0.01	6.01	14.81	3.69	11.13	0.53	
					F	ractured Ta	able Mounta	ain Group A	quifers								
Cape Peninsula	10.99	5.43	0.09	5.52	5.48	0.07	5.41	0.49	9.19	5.43	0.16	5.59	3.60	0.15	3.45	0.38	
Steenbras- Nuweberg	58.76 ⁶	1.16	0.02	1.18	57.58	8.00 ⁷	49.58	0.84	57.97	1.16	0.02	1.18	56.79	24.52	32.26	0.56	
Drakensteinberge	27.6	2.88	0.00	2.88	24.72	0.05	24.67	0.89	26.86	2.88	0.01	2.89	23.97	1.21	22.77	0.85	
Wemmershoek	26.83	3.59	0.00	3.59	23.24	0.81	22.43	0.84	25.60	3.59	0.00	3.59	22.01	1.56	20.45	0.80	
Voëlvlei-Slanghoek	14.1	1.62	0.01	1.63	12.47	0.13	12.34	0.88	12.87	1.62	0.01	1.63	11.24	0.31	10.93	0.85	
Witzenberg	2.78	0.18	0.00	0.18	2.60	0.08	2.52	0.91	2.60	0.18	0.00	0.18	2.42	0.16	2.26	0.87	
Groot Winterhoek	22.5	0.77	0.02	0.79	21.71	1.39	20.32	0.90	20.11	0.77	0.03	0.80	19.31	3.27	16.04	0.80	
Piketberg	20.33	2.07	0.04	2.11	18.22	5.58	12.64	0.62	19.02	2.07	0.06	2.13	16.89	9.80	7.09	0.37	
	Fractured and Intergranular Basement																
Cape Town Rim	18.6	0.87	0.20	1.07	17.54	6.21	11.33	0.61	16.26	0.87	0.36	1.23	15.03	8.71	6.32	0.39	
Stellenbosch-Helderberg	41.52	2.34	0.24	2.58	38.94	8.81	30.13	0.73	38.49	2.34	0.46	2.80	35.69	11.30	24.39	0.63	
Paarl-Franschhoek	26.61	3.01	0.13	3.14	23.47	9.82	13.65	0.51	24.60	3.01	0.21	3.22	21.38	15.50	5.88	0.24	
Malmesbury	52.65	1.18	0.34	1.52	51.13	14.75	36.38	0.69	44.42	1.18	0.64	1.82	42.61	25.12	17.49	0.39	
Wellington	39.49	6.75	0.24	6.99	32.51	4.48	28.03	0.71	33.07	6.75	0.39	7.14	25.92	8.79	17.13	0.52	

² Rainfall recharge value is from a model-based calibrated recharge estimation (after CoCT, 2020).



³ Includes city municipal abstraction of 20 Mm³/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e)WUL) of up to 14.6 Mm³/a (as a negative water use).

⁴ Rainfall recharge value is from a model-based calibrated recharge estimation (after CoCT, 2018).

⁵ Includes city municipal abstraction of 5 Mm³/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e) WUL) of up to 4.2 Mm³/a (as a negative water use).

⁶ Rainfall recharge value is from the first order GRAII Spatial Distribution (modified after CoCT, 2022).

⁷ Includes city municipal abstraction of 8 Mm³/a in development (phase 1) as per NWA Section 21(a).

HIGH CONFIDENCE GROUNDATER RESERVE DETERMINATION STUDY IN THE BERG CATCHMENT: GROUNDWATER RESERVE DETERMINATION REPORT

		Groundwater Reserve								Combination Scenario – Most-Likely Case							
GRU	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)	Allocable Factor	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)	Allocable Factor	
Tulbagh	10.87	1.28	0.02	1.30	9.57	3.78	5.79	0.53	9.34	1.28	0.05	1.33	8.01	6.66	1.35	0.14	
Eendekuil Basin	21.88	6.95	0.09	7.04	14.84	4.85	9.99	0.46	17.31	6.95	0.16	7.11	10.21	6.57	3.64	0.21	
Middle-Lower Berg	42.49	11.15	0.09	11.24	31.26	2.23	29.03	0.68	36.88	11.15	0.16	11.31	25.57	5.09	20.48	0.56	
Northern Swartland	31.85	0.20	0.05	0.25	31.60	1.79	29.81	0.94	26.11	0.20	0.09	0.29	25.82	2.92	22.90	0.88	
Darling	9.95	0.03	0.02	0.05	9.91	0.768	9.15	0.92	8.02	0.03	0.03	0.06	7.97	1.40	6.56	0.82	
Vredenburg	7.43	0.00	0.01	0.01	7.42	1.16	6.26	0.84	6.63	0.00	0.02	0.02	6.61	1.97	4.64	0.70	
TOTAL	620.78	69.98	2.35	72.33	548.45	102.66	445.79		557.47	69.98	4.27	74.25	483.23	181.06	302.16		



⁸ The WARMS dataset places Yzerfontein's municipal abstraction of 0.26 Mm³/a in the Darling GRU. It has been updated to reflect for the Yzerfontein GRU.

2.6. Step 7: Monitoring Programme

Step 7 of the GRD process focused on designing a Monitoring Programme for the Berg catchment aimed at the sustainable management of the groundwater contribution to the Reserve. To achieve this, the report evaluated existing monitoring sites, considering both their spatial distribution and their relevance to the target aquifer unit, in order to determine their suitability for monitoring site-specific parameters. This effort built upon insights gained from The Berg Catchment WRCs and RQOs Study (DWS, 2016) as well as the other literature and data sources listed in **Section 2.1**, specifically the Groundwater Projects associated with City of Cape Town's New Water Programme, and the Berg River Baseline Monitoring Programme (DWAF, 2007).

Specific "Management Options" for the groundwater contribution to both the EWR and BHN Reserve, were developed, assigned, and prioritised using an Impact vs. Influence Matrix. Based on the outcomes of Steps 1-7 of the GRD process, the matrix integrated 'impact' factors, such as the 'Allocation Factor' (i.e., still allocable volume / recharge) and the 'Qualifying Population Density per GRU', as well as 'influence' factors such as the 'Groundwater Contribution to Baseflow' and the 'Groundwater Contribution to the BHN Reserve per GRU' (see **Figure 2-3** and **Table 2-8**).

While this matrix provided the overall prioritization framework, an additional layer of complexity was introduced to select aquifer-specific monitoring sites. Two key factors were considered: 1) the spatial misalignment between GRUs and surface water catchments, and 2) the need to monitor catchment-specific baseflow contributions.

To overcome these challenges, the groundwater contribution to baseflow (and by extension, its contribution to the EWR) was disaggregated to the respective river or estuary node's catchment area, aquifer type, and GRU. This approach identified catchments with the most significant influence on baseflow and therefore allowed for more representative monitoring site selection (**Figure 2-4**).

Similarly, for monitoring the groundwater contribution to the BHN Reserve, a higher resolution dataset for the 'Qualifying Population Density' was used to identify specific high-density areas within a GRU. This information guided the site selection in those areas (**Figure 2-4**).

Once the monitoring network was established, guidelines for monitoring activities, frequency, and the specific data collection at selected sites, were defined. Unique objectives were set for the groundwater contribution to both the EWR and BHN and was tailored to each GRU's respective Management Option. In instances where existing boreholes were inactive or no longer effective as a monitoring site (e.g., inaccessible or targeting the wrong aquifer unit, etc), recommendations on the locations of proposed new boreholes were provided.

Comprehensive details about the approach, methodology, and results can be found in the Monitoring Programme Report (DWS, 2023e).



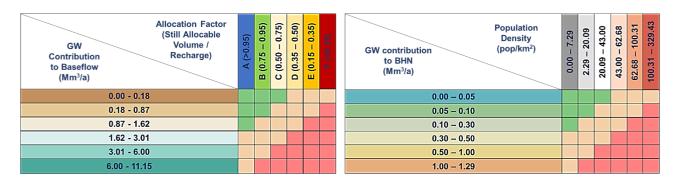


Figure 2-3 The Impact vs. Influence Matrix for groundwater contribution to the EWR Reserve (left) and for groundwater contribution to the BHN Reserve (right).

Table 2-8 Summary table of the Management Options per GRU for groundwater contribution to both the EWR and BHN, including the associated 'impact' and 'influence' variables considered in the Impact vs. Influence Matrix.

GRU	Allocation Factor per GRU	Groundwater Contribution to Baseflow per GRU (M m³/a)	Management Options for Groundwater Contribution to EWR	Groundwater Contribution to the BHN Reserve (M m³/a)	Qualifying Population Density per GRU (pop/km²)	Management Options for Groundwater Contribution to BHN
	Fac	ව ලික් ව	≱ ၁ ၅ ၅	၁	9 68	≥ ი ც
		Primary / Intergra	nular Aquifers			
Cape Flats	0.36	0.51	2	1.29	329.43	3
Atlantis	0.84	0.08	1	0.05	20.09	1
Yzerfontein	0.70	0.02	1	0.02	5.84	1
Elandsfontein	0.31	6.39	3	0.01	1.97	1
Langebaan Road	0.18	5.52	3	0.03	4.00	1
Adamboerskraal	0.53	6.00	3	0.01	2.50	1
	Fract	ured Table Moun	tain Group Aqui	fers		
Cape Peninsula	0.38	5.43	3	0.16	56.44	2
Steenbras- Nuweberg	0.56	1.16	2	0.02	13.11	1
Drakensteinberge	0.85	2.88	2	0.01	3.94	1
Wemmershoek	0.80	3.59	2	0.00	1.27	1
Voëlvlei-Slanghoek	0.85	1.62	2	0.01	6.11	1
Witzenberg	0.87	0.18	1	0.00	11.22	1
Groot Winterhoek	0.80	0.77	1	0.03	7.68	1
Piketberg	0.37	2.07	3	0.06	17.57	1
	Fra	ctured and Interg	ranular Baseme	ent		
Cape Town Rim	0.39	0.87	2	0.36	100.31	3
Stellenbosch-Helderberg	0.63	2.34	2	0.46	87.79	3
Paarl-Franschhoek	0.24	3.01	3	0.21	62.68	2
Malmesbury	0.39	1.18	2	0.64	43.46	3
Wellington	0.52	6.75	3	0.39	39.70	2
Tulbagh	0.14	1.28	3	0.05	17.74	1
Eendekuil Basin	0.21	6.95	3	0.16	18.16	2
Middle-Lower Berg	0.56	11.15	3	0.16	11.82	2
Northern Swartland	0.88	0.20	1	0.09	7.90	1
Darling	0.82	0.03	1	0.03	7.72	1
Vredenburg	0.70	0.00	1	0.02	6.24	1
TOTAL		69.98		4.27		



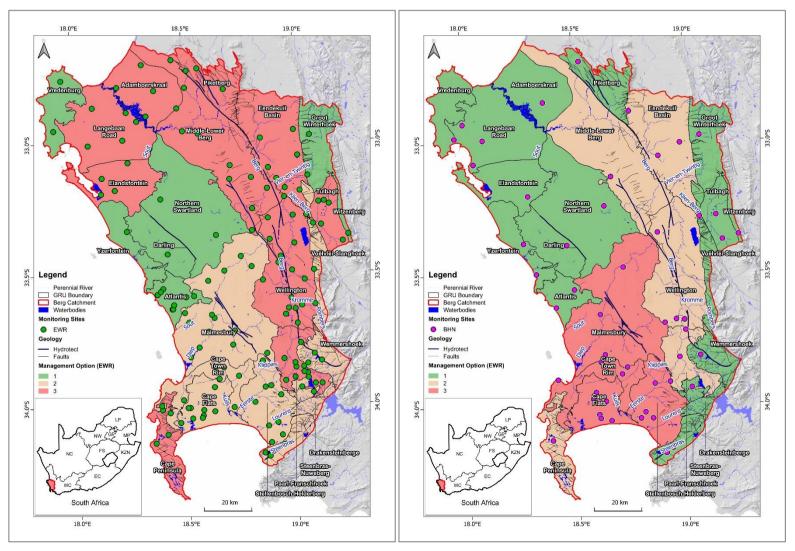


Figure 2-4 Summary maps (left) illustrating Management Options for the groundwater contribution to the EWR and associated monitoring locations (left); and (right) illustrating Management Options for the groundwater contribution to BHN Reserve and associated monitoring locations.



3. SUMMARY

Step 8 of the GRD process involved initiating the Gazetting process and implementing the Groundwater Reserve (see **Section 1.4**). This phase included the compilation of a single Groundwater Reserve Determination Report (i.e., Deliverable 3.7), offering a comprehensive summary of findings and recommendations resulting from the GRD process conducted for the Berg catchment. The overarching goal was to provide aquifer-specific information for various hydrogeological components considered for the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR.

The report integrated insights from the Ecological Reference Conditions Report (Step 3 of the GRD process), involving a reassessment of ecological conditions and present status of the catchment. It also correlated the analysis of various hydrogeological components, including Recharge, Groundwater Use, Discharge, Groundwater Quality, and Aquifer Stress. Building on the foundation of Step 3 and incorporating information from Steps 4-7 (see **Section 1.4**), this report offers a holistic perspective on the hydrogeological components for the catchment, with organized tables describing the Groundwater Reserve per GRU. The Reserve components are outlined below:

1. Groundwater Quantity Component

The groundwater quantity component of the Reserve was outlined in the GRU-specific tables provided below (refer to **Section 3.1 - 3.3**) and further discussed in **Sections 2.3** and **2.4**. It was calculated by considering the total groundwater contribution to both the EWR and BHN Reserves.

2. **Groundwater Quality Component**

The groundwater quality component of the Reserve was outlined in the GRU-specific tables provided below (refer to **Section 3.1 - 3.3**) and further discussed in **Sections 2.3** and **2.4**. It was determined by assessing two primary components:

A. Groundwater Quality Reserve

- I. The groundwater quality reserve is selected based on the higher concentration of either the baseline concentration or the 95th percentile within the specific aquifer in a GRU.
 - Baseline Concentration: This signifies the baseline concentration, reflecting the ambient or natural state of the aquifer system, for a specific parameter in a representative borehole (please refer to DWS, 2022d, 2022e, and 2023a for detailed information).
 - ii) 95th Percentile Concentration: This is calculated from all available data within a GRU and for the specific aquifer.

B. Groundwater Quality BHN Reserve

I. TBC (To Be Confirmed): Further confirmation is required for this component.

In essence, the Groundwater Reserve Determination Report signified the culmination of the High Confidence Groundwater Reserve Determination project for the Berg catchment, aligning with the gazetted requirements for the region as outlined in Gazette No. 42451:121.



3.1. Primary / Intergranular GRUs

3.1.1. Cape Flats GRU

GRU	GRU Name: Cape Flats Main Suburbs: Philippi, Bellville and Kuilsriver
GRO	Total Area (km²): 421.94
GRU Boundary Description	The Cape Flats GRU was delineated using the City of Cape Town's CFA model boundary (CoCT, 2018; 2020a). The aquifer model employed a slope separation criterion (<2 degrees) to distinguish the Cape Flats area from the adjacent hills and mountains. Additionally, it incorporated an interpolated geological extent of the basement, encompassing the Cape Granite Suite (CGS) and the Malmesbury Group rocks, along the GRU periphery. The southern boundary of the GRU was defined by the False Bay coastline (refer to Figure 3-1 and DWS, 2022d and 2023a).
Quaternary Catchments	G22C, G22D, G22E and G22H (see Figure 3-1)
Resource Unit	Primary / Intergranular Aquifer
Description	Geologically, the Cape Flats GRU comprises the Tertiary and Quaternary sedimentary deposits of the Sandveld Group, including fluvial, marine, and aeolian formations. These deposits unconformably overlie weathered Neoproterozoic to early Cambrian Malmesbury Group and CGS basement rocks (see Figure 3-1 and the cross section below). Hydrostratigraphically, the major aquifer units within the larger CFA are the Elandsfontyn, Varswater, and Springfontyn Fm. The CFA itself is a large, heterogeneous, stratified, intergranular, or primary (i.e., provise) sedimentary/sandy) aquifer within the Sandveld Group. The primary aquifer thickens to approximately 50 m towards the centre of the GRU and fills the paleochannels carved into the basement topography (see Figure 3-1 and the cross section below). One of these paleochannels coincides with the Philippi Horticultural Area (PHA; DWAF, 2008a; DWS, 2022d and 2023a). The Calcada Group in the Sandveld Group in the Sandveld Group in the Sandveld Group in the Indiana Group in the Sandveld Group in the Sandvel

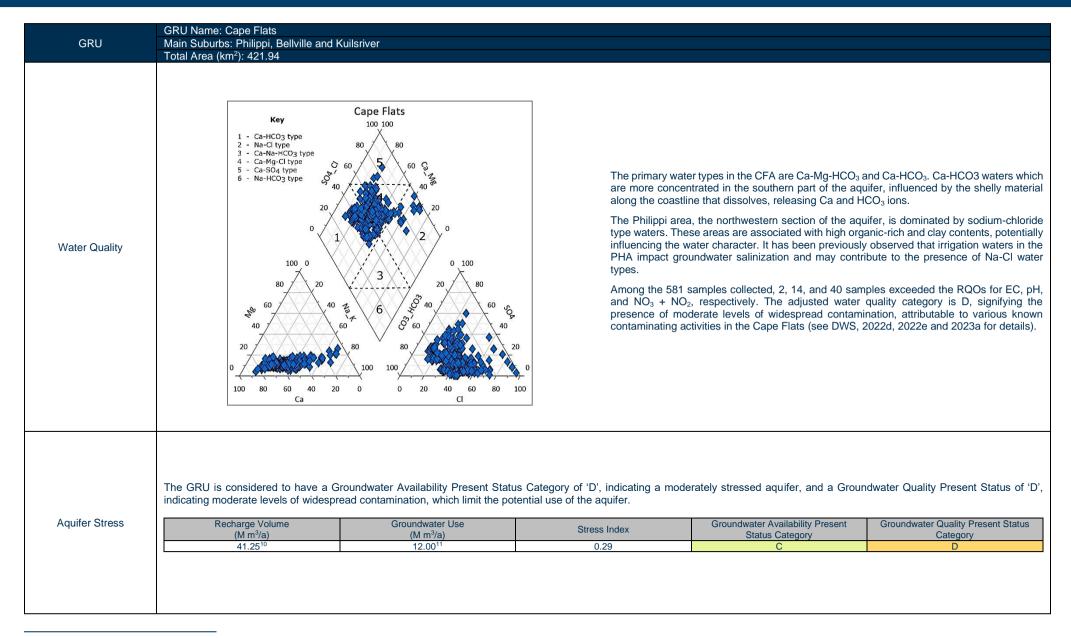


HIGH CONFIDENCE GROUNDATER RESERVE DETERMINATION STUDY IN THE BERG CATCHMENT: GROUNDWATER RESERVE DETERMINATION REPORT

0011	GRU Name: Cape Fla							
GRU		i, Bellville and Kuilsriver						
	Total Area (km²): 421.	94						
urface Water System	These rivers and wetland paleochannels, or on a construction only with the uppermost	ands are expected to be la a smaller local scale whe	otus, and Elsieskraal rivel hydraulically linked to the ere the aquifer is semi-cor CoCT, 2021). Wetlands s WS, 2022d and 2023a).	relatively shallow gro nfined by laterally disc	undwater. In cases where continuous calcrete or cla	re the aquifer is semi ay lenses, rivers and	i-confined, such as w wetlands are likely to	within the deep gravels to be connected hydrau
Water Resource	II, while the remaining	portions lack a Ground	lats IUA (E12) and has a water Resource Class de 3-1 and the table below).	esignation. This IUA of				
Classes & RQOs	IUA	Water Resource Class	Quaternary Catchment	RU	Resource Name	Biophysical Node	TEC	nMAR
			G22D	E12-R15	Keysers	Bvii7	D	93
	E12 Cape Flats	III	G22K	E12-E05	Zandvlei	Bxi9	С	93
			G22K	E12-E05	Zeekoevlei	Bxi9	D	N/A
Recharge	recharge rate was call because the model ca	culated at 97.76 mm/a b libration considers both r	tained from a model-base ased on the total GRU an natural recharge and Irriga	rea. A first-order rechation Return Flow (IR	arge calculation was per F). Refer to DWS (2022a	formed for the GRU a, 2022e and 2023a)	which differs from the for further details.	he CoCT (2018) estima
Recharge	recharge rate was call because the model ca	culated at 97.76 mm/a b libration considers both r ethod	ased on the total GRU ar natural recharge and Irriga Area (ki	rea. A first-order rechation Return Flow (IR	arge calculation was per F). Refer to DWS (2022a Recharge Volu	formed for the GRU a, 2022e and 2023a) me (M m³/a)	which differs from the for further details.	the CoCT (2018) estima
Recharge	recharge rate was call because the model ca	culated at 97.76 mm/a b libration considers both r	ased on the total GRU ar natural recharge and Irriga	rea. A first-order rechation Return Flow (IR	arge calculation was per F). Refer to DWS (2022a	formed for the GRU a, 2022e and 2023a) me (M m³/a)	which differs from the for further details.	he CoCT (2018) estima
Recharge	recharge rate was call because the model ca Me Model-based or (after Co	culated at 97.76 mm/a b libration considers both r ethod alibrated recharge oCT, 2018) red groundwater users i	ased on the total GRU and anatural recharge and Irrigation Area (kind 421.9) in the Cape Flats GRU,	rea. A first-order rechation Return Flow (IR m²) collectively utilizing	arge calculation was per F). Refer to DWS (2022a Recharge Volu 41.2	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25	which differs from the for further details.	the CoCT (2018) estima
Recharge	recharge rate was call because the model ca Me Model-based ca (after Co There are 95 register 12.00 M m³/a of groun	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oct, 2018)	ased on the total GRU and anatural recharge and Irrigation Area (kind 421.9) In the Cape Flats GRU, and Managed Aquifer Recipions and Managed Aquifer Recipions and Managed Aquifer Recipions.	rea. A first-order rechation Return Flow (IR m²) 4 collectively utilizing harge component of	arge calculation was per F). Refer to DWS (2022a Recharge Volu 41.2 Agriculture: Irrigation	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Inton	which differs from the for further details. Average R Average R tergranular Aquifer 50	Recharge Rate (mm/a) 97.76
Recharge	recharge rate was call because the model ca Me Model-based ca (after Co There are 95 register 12.00 M m³/a of groun -14.6 M m³/a ³). The	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oct, 2018) red groundwater users i dwater (note that there is primary sectors contributed)	ased on the total GRU and anatural recharge and Irrigation Area (kill 421.9) In the Cape Flats GRU, is a Managed Aquifer Recluting to groundwater use	rea. A first-order rechation Return Flow (IR m²) 44 collectively utilizing harge component of a are Water Supply	Agriculture: Irrigatic Agriculture: Watering Liv	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Into primary /	which differs from the for further details. Average R tergranular Aquifer 50 2	Recharge Rate (mm/a) 97.76 4.08 0.05
Recharge	recharge rate was call because the model ca Me Model-based ca (after Co There are 95 register 12.00 M m³/a of groun -14.6 M m³/a ³). The Services and Agricultu	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oct, 2018) red groundwater users i dwater (note that there is primary sectors contribute (irrigation), constituting	ased on the total GRU and anatural recharge and Irrigation Area (kill 421.9) In the Cape Flats GRU, is a Managed Aquifer Recluting to groundwater use g 75.4% and 15.32%, resp	rea. A first-order rechation Return Flow (IR m²) d4 collectively utilizing harge component of e are Water Supply pectively, of the total	Agriculture: Irrigatic Agriculture: Watering Lindustry (Non-Urba	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Into on vestock n)	which differs from the for further details. Average R Average R tergranular Aquifer 50 2 2	A.08 0.05 1.05
Recharge	There are 95 register 12.00 M m³/a of groundur -14.6 M m³/a of groundur groundwater use in the	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oct, 2018) red groundwater users i dwater (note that there is primary sectors contribute (irrigation), constituting a area (it's important to no	ased on the total GRU an natural recharge and Irrigative Area (kill 421.9) In the Cape Flats GRU, is a Managed Aquifer Reclauting to groundwater use g 75.4% and 15.32%, respote that these percentage	collectively utilizing harge component of e are Water Supply pectively, of the total as do not account for	Agriculture: Irrigatic Agriculture: Watering Liv Industry (Non-Urba) Industry (Urban)	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Into on vestock n)	which differs from the for further details. Average R tergranular Aquifer 50 2	Recharge Rate (mm/a) 97.76 4.08 0.05 1.05 0.97
	There are 95 register 12.00 M m³/a of groundwater use in the Managed Aquifer Rec	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oCT, 2018) red groundwater users i dwater (note that there is primary sectors contribute (irrigation), constituting a area (it's important to notharge). It is acknowled	ased on the total GRU an natural recharge and Irrigative Area (kill 421.9) In the Cape Flats GRU, is a Managed Aquifer Rectauting to groundwater use g 75.4% and 15.32%, respote that these percentaged ged that farmers likely of the natural rectains to the second secon	collectively utilizing harge component of e are Water Supply pectively, of the total as do not account for	Agriculture: Irrigatic Agriculture: Watering Liv Industry (Non-Urban) Mining	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Into on vestock n)	which differs from the for further details. Average R Average R tergranular Aquifer 50 2 2 31	A.08 0.05 1.05
	There are 95 register 12.00 M m³/a of groundwater use in the Managed Aquifer Rec	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oct, 2018) red groundwater users i dwater (note that there is primary sectors contribute (irrigation), constituting a area (it's important to no	ased on the total GRU an natural recharge and Irrigative Area (kill 421.9) In the Cape Flats GRU, is a Managed Aquifer Rectauting to groundwater use g 75.4% and 15.32%, respote that these percentaged ged that farmers likely of the natural rectains to the second secon	collectively utilizing harge component of e are Water Supply pectively, of the total as do not account for	Agriculture: Irrigatic Agriculture: Watering Liv Industry (Non-Urba) Industry (Urban)	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Int on vestock n)	which differs from the for further details. Average R Average R tergranular Aquifer 50 2 2 31 1 1	4.08 0.05 1.05 0.39 0
	There are 95 register 12.00 M m³/a of groun -14.6 M m³/a of groun groundwater use in the Managed Aquifer Registered volume (see	culated at 97.76 mm/a b libration considers both resthod alibrated recharge bCT, 2018) red groundwater users i dwater (note that there is primary sectors contribure (irrigation), constituting a area (it's important to not charge). It is acknowled be Figure 3-1 and the table	Area (king to groundwater useg 75.4% and 15.32%, respondent the the percentage ded that farmers likely of let to the right).	collectively utilizing harge component of eare Water Supply pectively, of the total est do not account for extract double their	Agriculture: Irrigatic Agriculture: Watering Liv Industry (Non-Urban) Mining Schedule 1 Urban (Excluding Indu And/Or Domestic)	rformed for the GRU a, 2022e and 2023a) me (M m³/a) 25 Primary / Inton vestock n)	which differs from the for further details. Average R Average R tergranular Aquifer 50 2 2 31 1 1 3	4.08 0.05 1.05 0.97 0.02
	There are 95 register 12.00 M m³/a of groun -14.6 M m³/a solution 3 register 4 days and Agricultu groundwater use in the Managed Aquifer Registered volume (see The registered ground	red groundwater users i dwater (note that there is primary sectors contribute (irrigation), constituting earea (it's important to note that the table of the primary sectors contribute (irrigation), constituting earea (it's important to note that get area (it's important to note that get area (it's important to note that get area (it's important to note area (it'	Area (ki 421.9 Area (ki 421.9	collectively utilizing harge component of eare Water Supply pectively, of the total extract double their onal industrial use in	Agriculture: Irrigatic Agriculture: Watering Liv Industry (Non-Urba Industry (Urban) Mining Schedule 1 Urban (Excluding Indu And/Or Domestic Water Supply Servi	Primary / Into primar	which differs from the for further details. Average R Average R tergranular Aquifer 50 2 2 31 1 1 3 5	4.08 0.05 1.05 0.97 0.39 0 0.02 20.09
Recharge Groundwater Use	There are 95 register 12.00 M m³/a of groun -14.6 M m³/a °). The Services and Agricultu groundwater use in the Managed Aquifer Recregistered volume (see The registered ground the northern section of	culated at 97.76 mm/a b libration considers both rethod alibrated recharge oct, 2018) red groundwater users i dwater (note that there is primary sectors contribute (irrigation), constituting a area (it's important to ne charge). It is acknowled to Figure 3-1 and the table water use is concentrate of the GRU, as well as o	Area (king to groundwater useg 75.4% and 15.32%, respondent the the percentage ded that farmers likely of let to the right).	collectively utilizing harge component of eare Water Supply pectively, of the total as do not account for extract double their onal industrial use in ses of the Peninsula	Agriculture: Irrigatic Agriculture: Watering Liv Industry (Non-Urban) Mining Schedule 1 Urban (Excluding Indu And/Or Domestic)	Primary / Into primar	which differs from the for further details. Average R Average R tergranular Aquifer 50 2 2 31 1 1 3	4.08 0.05 1.05 0.97 0.02

⁹ Includes city municipal abstraction of 20 Mm³/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e) WUL) of up to 14.6 Mm³/a (as a negative water use).





¹⁰ Rainfall recharge value is from a model-based calibrated recharge estimation (after CoCT, 2020).



¹¹ Includes city municipal abstraction of 20 Mm3/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e)WUL) of up to 14.6 Mm3/a (as a negative water use).

GRU	GRU Name: Ca Main Suburbs: Total Area (km²	Philippi, Bellville	and Kuilsriver									
	The groundwate			ve, detailed in the be confirmed).	table below and	d described in S	Section 2.3 & 2	2.4, is determine	d as two com	ponents 1) the G	Groundwater Qu	uality Reserv
	Aquifer Unit	Paramete	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwate Quality BHN Reserve
		Sulphate Electrical condu	mg/l ctivity mS/m			44.40 113.72	2.00 13.00	326.00 578.00	45.40 88.85	100.80 111.19	100.80 113.72	
		pH Ammonia	mg/l			8.30 0.08	5.07 0.02	8.55 31.89	7.84 0.06	8.27 0.82	8.30 0.82	
	Primary / Intergranular	Nitrate + nitr Fluoride	mg/l	37	581	8.35 0.26	0.02 0.05	23.20 3.05	1.12 0.15	11.92 0.28	11.92 0.28	
0 1 . 5	Aquifer	Orthophosph Calcium	ate mg/l	31	301	0.03 112.16	0.00 3.81	1.35 266.50	0.01 101.50	0.07 128.50	0.07 128.50	
Groundwater Reserve						14.62	1.00	124.70	11.60	16.40	16.40	
Groundwater Reserve		Magnesiur Sodium	mg/l			111.36	3.30	784.00	58.90	94.80	111.36	
Groundwater Reserve		Magnesiur Sodium Potassium Chloride	mg/l mg/l mg/l			111.36 2.95 209.22	0.15 5.00	53.66 1993.00	1.90 100.00	5.72 173.50	5.72 209.22	
Groundwater Reserve		Magnesiur Sodium Potassium Chloride Quantity Compor er quantity compor BHN Reserves.	mg/l mg/l mg/l	erve, detailed in that		111.36 2.95 209.22	0.15 5.00 Section 2.3 8	53.66 1993.00 & 2.4, is calculated	1.90 100.00	5.72 173.50	5.72 209.22 pundwater cont	ribution to b
Groundwater Reserve	The groundwat the EWR and B	Magnesiur Sodium Potassium Chloride Quantity Compor er quantity compor BHN Reserves.	mg/l mg/l mg/l ent		rve (Mm³/a)	111.36 2.95 209.22 and described in	0.15 5.00 Section 2.3 8	53.66 1993.00	1.90 100.00	5.72 173.50 ering the total gro	5.72 209.22 bundwater cont	
Future Scenario 2050	The groundwat the EWR and E Recharge (41.25 In Scenario 7b, factors directly in recharge fror growth and the	Magnesiur Sodium Potassium Chloride Quantity Compor er quantity compor BHN Reserves. Mm³/a) 12 which projects influenced the p m 41.25 to 38.70 implementation	mg/l mg/l mg/l ent connent of the Res WR Reserve (Mm³/s 0.51 conditions for the arameters used to M m³/a, influence of groundwater d	a) BHN Reser	onsiders the 'Mo roundwater Res change and the	111.36 2.95 209.22 and described in GW Reserve (M 1.21 ost-Likely Case'serve, specificalle elimination of I. Furthermore, th	0.15 5.00 Section 2.3 8 Im³/a) To for the GRU, ly the groundy APs. Additionne groundwater	53.66 1993.00 & 2.4, is calculated to tal Allocable Volum (Mm³/a) 40.04 the analysis for water contributionally, groundwater contribution to the	1.90 100.00 ed by consider with the second to the BHN Responds to	5.72 173.50 ering the total gro ater Use (Mm³/a) 12.00¹³ key factors: Rec N and EWR. The sed from 12.00 to	5.72 209.22 Dundwater cont Still Alloc 2 Charge and Warscenario involve 23.02 M m³/a	able (Mm³/a) 8.04 ter Use. The red a decreated due to sected
Future Scenario 2050 (Scenario 7b)	The groundwat the EWR and E Recharge (41.25 In Scenario 7b, factors directly in recharge fror growth and the	Magnesiur Sodium Potassium Chloride Ruantity Compor er quantity comp BHN Reserves. Mm³/a) 12 which projects influenced the p 41.25 to 38.70 implementation pulation growth.	mg/l mg/l mg/l ent connent of the Res WR Reserve (Mm³/s 0.51 conditions for the arameters used to M m³/a, influence of groundwater d	year 2050 and co determine the Ged by both climate evelopment scher hanges, the Alloca	onsiders the 'Mo froundwater Res change and the mes in the area. ation Category s	111.36 2.95 209.22 and described in GW Reserve (M 1.21 ost-Likely Case'serve, specificalle elimination of I. Furthermore, th	o.15 5.00 Section 2.3 & Im³/a) To for the GRU, ly the groundw APs. Addition ne groundwate o D (refer to Se	53.66 1993.00 & 2.4, is calculated to tal Allocable Volum (Mm³/a) 40.04 the analysis for water contributionally, groundwater contribution to the	at 1.90 100.00 ed by consider the second two on to the BHN representation of the BHN representa	5.72 173.50 ering the total gro ater Use (Mm³/a) 12.00¹³ key factors: Rec N and EWR. The sed from 12.00 to	Still Alloc Still Alloc Scharge and Wa scenario involv 23.02 M m³/a 0.70 to 1.29 M	able (Mm³/a) 8.04 ter Use. The red a decrea due to secto

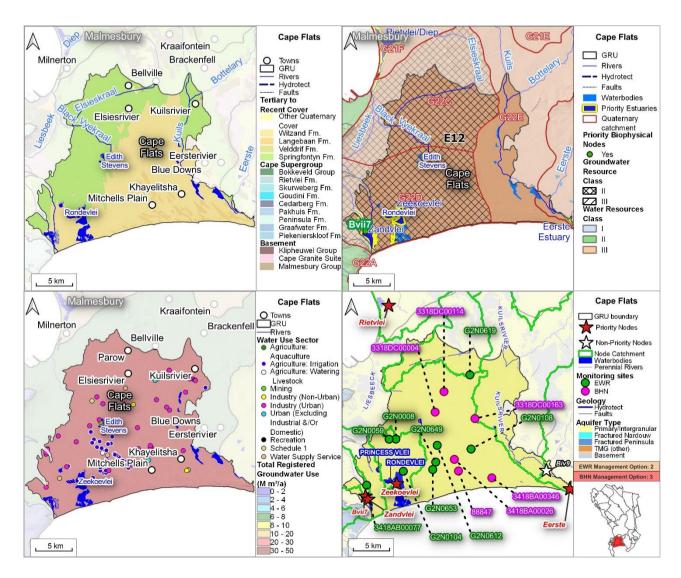


¹² Rainfall recharge value is from a model-based calibrated recharge estimation (after CoCT, 2020).

¹³ Includes city municipal abstraction of 20 Mm³/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e) WUL) of up to 14.6 Mm³/a (as a negative water use).

	CDII Namas Can	- Flata					
GRU	GRU Name: Cap		and Kuilariyar				
GRU	Main Suburbs: P Total Area (km²):		and Kullstiver				
	The Cape Flats G	RU was assign	ng sites for the E	WR and 6 for th	onitoring the gro e BHN were stra	undwater contril tegically selecte	bution to the EWR and a Management Option 3 for monitoring the groundwater contribution and within the Cape Flats GRU (see Figure 3-1 and the table below).
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
						EWR Managemen	
	G2N0008	HYDSTRA	Zeekoevlei	EWR	-34.01008	18.50937	Frequency: Quarterly
	G2N0104	HYDSTRA	Zeekoevlei	EWR	-34.050078	18.51937	1) Groundwater level:
	G2N0612	HYDSTRA	GRU	EWR	-34.01902	18.57068	 Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger.
	G2N0649	HYDSTRA	GRU	EWR	-34.03966	18.56788	 Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄
	G2N0653	HYDSTRA	GRU	EWR	-34.04875	18.56313	 Site specific additions for EWR: NO₂, NO₃, NH₄
Monitoring Programme	G2N0108	HYDSTRA	GRU	EWR	-34.02465	18.62082	 Site specific additions as per RQO ¹⁹:
Worldoning Frogramme	G2N0619	HYDSTRA	GRU	EWR	-33.9331	18.62162	Bxi20 (Zeekoevlei): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic
	G2N0059	HYDSTRA	Zeekoevlei	EWR	-34.01008	18.49937	Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System
	3418AB00077	NGA	Bvii7	EWR	-34.06602	18.46429	Variables (Temperature, pH, Dissolved Oxygen, etc)
						BHN Managemen	
	3318DC00004	NGA	GRU	BHN	-33.97801	18.56871	Frequency: Monthly or Quarterly
	3318DC00114	NGA	GRU	BHN	-33.95301	18.5826	1) Groundwater level:
	3318DC00163	NGA	GRU	BHN	-33.98717	18.6276	 Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems.
	3418BA00026	NGA	GRU	BHN	-34.03686	18.59568	Groundwater Quality (Background water quality and BHN):
	3418BA00346	NGA	GRU	BHN	-34.06075	18.65068	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms
	88847	WMS	GRU	BHN	-34.051389	18.601389	Sile opositio additions for Briti. E only rotal contenting and racoul contention





A series of maps for the Cape Flats GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.1.2. Atlantis GRU

GRU	GRU Name: Atlantis Main Towns: Atlantis and Melkbosstrand Total Area (km²): 255.68
GRU Boundary Description	The aquifer model boundary for the GRU, as outlined by CoCT (2020b), delineates the Atlantis GRU's extent (refer to Figure 3-2 and DWS, 2022d and 2023a). This boundary was established by considering areas with a marginal thickness of 0 m, indicating where the aquifer pinches out. The northeast and southeast boundaries are further refined by the outcrop extent of low-permeability basement lithologies, namely the Malmesbury Group and the CGS. To the north, the Modder and Louwskloof rivers define the boundary, while the southwestern extent is bounded by the Sout River, and the western edge is constrained by the coastline. Additionally, the boundary accounts for preferential flow directions towards the coastline on the eastern edge of the GRU (refer to Figure 3-2 and DWS, 2022d and 2023a).
Quaternary Catchments	G21A, G21B and G21D (Figure 3-2)
Resource Unit	Primary / Intergranular Aquifer
	The Atlantis Aquifer consists of Tertiary to Quaternary aged marine and aeolian sedimentary deposits belonging to the Sandveld Group. In the Atlantis area, these deposits, including the Langebaan, Witzand, Springfontyn, and Varswater Fms, unconformably overlie the Neoproterozoic to early Cambrian Tygerberg Fm (Malmesbury Group) and Darling Pluton (CGS). The Cenozoic aquifer unit, approximately 40-60 meters thick, is classified as a primary, unconsolidated, intergranular aquifer, allowing groundwater movement through the pores between sediment. Although mainly classified as unconfined, the presence of intermittent clay and calcrete lenses in the Springfontyn Fm may lead to semi-confined conditions (see Figure 3-2). The basement aquifer includes the Malmesbury Group (i.e., Tygerberg Fm - shales/phyllites) and plutonic CGS basement rocks. Interpolated basement geology from the CoCT (2020b) suggests a westward decrease in bedrock elevation from the Atlantis town region to the coast, potentially influencing groundwater flow parallel to the coast (see the cross sections below). The Malmesbury Group is considered a basal aquiclude to the overlying aquifer. The potential interaction between groundwater and the weathered shales of the Tygerberg Fm and the overlying Sandveld Group is not definitive and may require further investigation (refer to DWS, 2022d and 2023a). Two cross-sections illustrate the spatial variation of geology across the aquifer. Cross-section A shows the presence of the overlying Witzand Fm, while cross-section B highlights the prevalence of the Springfontyn Fm (refer to Figure 3-2 for the extent of the cross section).
Description	SW Witzand Fm. NE Bringfortyn Fm. Malmesbury Group Witzand Wellfield O 2000 4000 6000 8000 10000 12000 14000 Distance NE Sy Witzand Fm. Springfortyn Fm. Malmesbury Group Sy Witzand Fm. Springfortyn Fm. Malmesbury Group Witzand Wellfield O 2000 4000 6000 8000 10000 12000 12000 Distance



GRU	GRU Name: Atlantis Main Towns: Atlantis and Melkbosstrand Total Area (km²): 255.68					
Surface Water System	The Atlantis GRU comprises of the perennial swhile surface drainage to the north and east of up in summer (Tredoux et al., 2009). Groundward The Atlantis GRU is characterized by the perenarea. Additionally, surface drainage to the north drying up in the summer. In this region, groundward DWS, 2022d, 2022e and 2023a for detail).	Atlantis contributes to the catchment areas of the catchment areas of the catchment discharge and support minor wetlands and Silwerstroom River, fed by the Silwerstroom and east of Atlantis contributes to the catchment.	he Modder, Louwskloof and Diep s in coastal dunes, and to subma om spring. During the winter, the ent areas of the Modder, Louwsk	o rivers respective urine discharge (s e Donkergat and loof, and Diep riv	ely. All these riv see Figure 3-2 Sout Rivers flovers. Notably, the	vers are non-perennial, drying). by to the south of the Atlantichese rivers are non-perennia
Water Resource Classes & RQOs	The GRU falls within the West Coast (A3) and catchments G21B and G21D). This IUA does n				ss of III (only f	or portions of the GRU within
	An estimated recharge of 22.74 M m ³ /a was ob The average recharge rate was calculated as 8				tergranular Aq	uifer (refer to the table below)
Recharge	Method	Area (km²)	Recharge Volume (M m ³ /a)		Avera	age Recharge Rate (mm/a)
	Model-based calibrated recharge (after CoCT, 2020b)	255.68	22.74 ¹⁴			88.94
Groundwater Use	In the Atlantis GRU, there are 24 registered gro to the right) collectively utilizing 1.7 M m³/a of Aquifer Recharge component of -4.2 M m³/a). (Urban) is the predominant sector for groundw use in the area. Despite this high percentage, Scheme (Municipal Water Supply) is classific Supply Service' for Atlantis, therefore, it is a database. The Mining and Agricultural Sectors each contrigroundwater use, though it's essential to highlig the Managed Aquifer Recharge component. abstraction of 1 M m³/a by Eskom is not register.	groundwater (note that there is a Managed According to the WARMS database, Industry ater use, accounting for 86.8% of total water it is noted that the Atlantis Water Resource duder 'Industrial use' rather than 'Water a classification discrepancy in the WARMS ibute approximately 0.5 M m ³ /a to the annual and that these percentages do not incorporate Additionally, it's crucial to mention that the	Water Use Sector Agriculture: Irrigation Agriculture: Watering Livestock Industry (Non-Urban) Industry (Urban) Mining MAR Total	No. of Us Primary / Intergra 9 6 1 7 1 -	anular Aquifer	Total Volume (M m³/a) 0.16 0.33 0.04 5.00 0.37 - 4.2 1.7

¹⁴ Rainfall recharge value is from a model-based calibrated recharge estimation (after CoCT, 2018).



HIGH CONFIDENCE GROUNDATER RESERVE DETERMINATION STUDY IN THE BERG CATCHMENT: GROUNDWATER RESERVE DETERMINATION REPORT

GRU Name: Atlantis GRU Main Towns: Atlantis and Melkbosstrand Total Area (km2): 255.68 Atlantis 1 - Ca-HCO2 type Na-Cl type - Ca-Na-HCO3 type 4 - Ca-Mg-Cl type 5 - Ca-SQ4 type The primary water types in Atlantis are Na-Cl and Ca-HCO₃. Na-Cl waters are predominantly 6 - Na-HCO3 type influenced by the deposition of marine aerosols and recharge through coastal rainfall, exhibiting a typical Na-Cl signature. Boreholes situated near shallow basement rocks of the Tygerberg Fm may also contribute to elevated Na and Cl ion concentrations, imparting the Na-CI character to the groundwater in the primary aguifer above. Ca-HCO₃ waters result from the dissolution of calcium carbonate minerals found in calcareous sands of the Witzands Fm, releasing Ca and HCO3 ions. Out of the 39 samples Water Quality 100 0 collected 3 samples exceeded the RQO for EC, and 4 samples exceeded the RQO for pH. The occurrence of acidic waters in Atlantis (below RQO thresholds) may be attributed to the leaching of basic ions from soils, anthropogenic inputs, and the dissolution of humic compounds from overlying vegetation. The adjusted water quality category is C, indicating the presence of some localized contamination (refer to DWS, 2022d, 2022e and 2023a for details). 100 20 The GRU is considered to have a Groundwater Availability Present Status Category of 'C', indicating a moderately stressed aquifer, and a Groundwater Quality Present Status Category of 'C' indicating moderate levels of widespread contamination, which limit the use of potential use of the aquifer (refer to the table below). **Aquifer Stress** Groundwater Quality Present Status Recharge Volume Groundwater Use Groundwater Availability Present Stress Index (M m³/a) (M m³/a) Status Category Category 22.74¹⁵ 1.7 0.07



¹⁵ Includes city municipal abstraction of 5 M m³/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e) WUL) of up to 4.2 M m³/a (as a negative water use).

GRU	Main Towns: At Total Area (km²	lantis lantis and Melkb	osstrand									
	Groundwater Q The groundwate	uality Componer	t nent of the Reserve BHN Reserve (to be	, detailed in the e confirmed).	table below and	d described in S	Section 2.3 & 2	2.4, is determine	d as two com	nponents 1) the G	Groundwater Qu	uality Reserv
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwat Quality BH Reserve
		Sulphate	mg/l			24.70	2	355.7	19.8	125.77	125.77	
		Electrical conduc		7		99.74	38.1	156.7	85.55	143.43	143.43	
		pН				7.73	2.6	8.35	7.6	8.08	8.08	
		Ammonia	mg/l			1.16	0.02	1.22	0.06	0.3	1.16	
	Drim on /	Nitrate + nitrit	e mg/l			0.05	0.02	2.19	0.02	0.41	0.41	
	Primary /	Fluoride	mg/l	31	42	1.16	0.05	1.33	0.15	0.53	1.16	
Annual Control December	Intergranular Aquifer	Orthophospha	te mg/l	31	42	0.10	0.003	1.297	0.0305	0.15	0.15	
Groundwater Reserve	Aquilei	Calcium	mg/l			46.05	4.8	183.5	59.55	96.5	96.5	
		Magnesium	mg/l			17.28	4.9	35.8	9.9	26.89	26.89	
		Magnesium					0.00	040.4	95.35	200.31	200.31	
	-	Sodium	mg/l			116.14	22.6	219.4	95.35	200.31	200.31	1
				_		116.14 5.57	0.35	6.86	2.865	5.92	5.92	
		Sodium Potassium Chloride uantity Compone	mg/l mg/l mg/l	a datailed in the	o table below a	5.57 240.93	0.35 37.1	6.86 435.4	2.865 145.85	5.92 393.83	5.92 393.83	ribution to b
	The groundwate the EWR and B	Sodium Potassium Chloride uantity Compone er quantity comp iHN Reserves.	mg/l mg/l mg/l mg/l onent of the Reserv	BHN Reser	ve (Mm³/a)	5.57 240.93 nd described ir	0.35 37.1	6.86 435.4 & 2.4, is calculat otal Allocable Volu (Mm³/a)	2.865 145.85 ed by conside	5.92 393.83 ering the total groater Use (Mm³/a)	5.92 393.83 bundwater cont	able (Mm³/a)
	The groundwate the EWR and B	Sodium Potassium Chloride uantity Compone er quantity comp iHN Reserves.	mg/l mg/l mg/l ent onent of the Reserv		ve (Mm³/a)	5.57 240.93 nd described ir	0.35 37.1	6.86 435.4 & 2.4, is calculat	2.865 145.85 ed by conside	5.92 393.83 ering the total gro	5.92 393.83 bundwater cont	ribution to b able (Mm³/a)

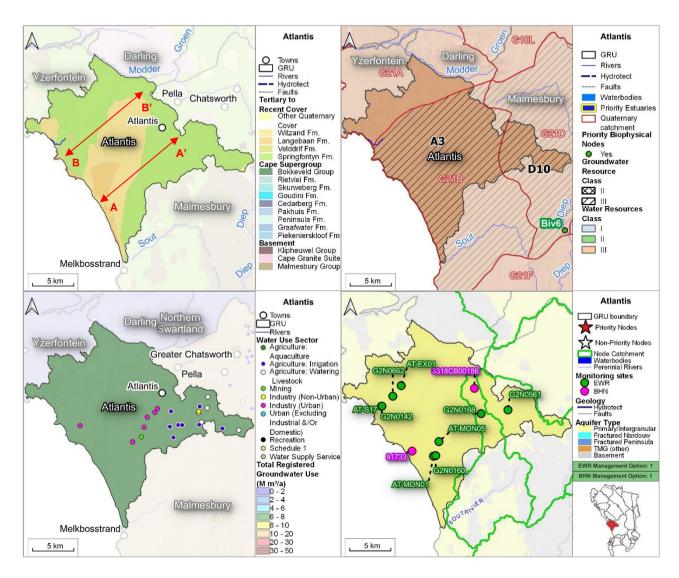
¹⁶ Rainfall recharge value is from a model-based calibrated recharge estimation (after CoCT, 2018).



¹⁷ Includes city municipal abstraction of 5 Mm³/a as per NWA Section 21(a). The total volume includes Managed Aquifer Recharge (as per NWA Section 21(e) WUL) of up to 4.2 Mm³/a (as a negative water use).

	GRU Name: Atla	ntis					
GRU	Main Towns: Atla		osstrand				
	Total Area (km²):	255.68					
							tion to the EWR and a Management Option 1 for monitoring the groundwater contribution d within the Atlantis GRU (Figure 3-2). Monitoring Description
		ı			E	WR Management	Option 1
	G2N0168	HYDSTRA	Bviii10	EWR	-33.58972222	18.50138889	
	G2N0561	HYDSTRA	Biv6	EWR	-33.58638889	18.53666667	Frequency: Quarterly or Biannual (Summer & Winter)
	AT-S17	CoCT	Silwerstroom	EWR	-33.57891838	18.37115813	Groundwater level:
	AT-MON01	CoCT	GRU	EWR	-33.63501833	18.43758444	2) Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄
	AT-EX01	CoCT	GRU	EWR	-33.55694787	18.39766521	 Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹:
Monitoring Programme	G2N0142	HYDSTRA	Silwerstroom	EWR	-33.57888889	18.37166667	Biv6:
	G2N0662	HYDSTRA	GRU	EWR	-33.5683	18.38632	Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen); Toxins (Atrazine and Endusulfan).
	G2N0160	HYDSTRA	GRU	EWR	-33.6344444	18.44055556	(Temperature, pri, Dissolved Oxygen), Toxins (Attazine and Endusulian).
	AT-MON05	CoCT	GRU	EWR	-33.61920291	18.44525844	
		l	l			BHN Management	
	91733	WMS	GRU	BHN	-33.628889	18.409722	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: Manual groundwater level measurements Condition (Registered water quality and RUN):
	3318CB00186	NGA	GRU	BHN	-33.5619	18.49342	 Groundwater Quality (Background water quality and BHN): Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms





A series of maps for the Atlantis GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.1.3. Yzerfontein GRU

GRU	GRU Name: Yzerfontein Main Towns: Yzerfontein Total Area (km²): 320.33						
GRU Boundary Description	The Yzerfontein GRU was delineated by the At southern and south-eastern edges. The dema catchment, taking into account the preferential that there may be a hydraulic connection between	rcation between the Yzer flow and discharge direction	fontein GRU and to on in the south-wes	he Elandsfontein GRU w terly direction. The coast	vas established along the line served as the western	G10M and G21A sui	rface water quaternary
Quaternary Catchments	G21A (Figure 3-3)						
Resource Unit			Primary / Inte	rgranular Aquifer			
Description	The primary aquifer in this region is formed by the difficulty in distinguishing between unconso with an approximation of around 50 meters (Tii The Sandveld Group comprises the Springfont is primarily composed of the Malmesbury Grees (see Figure 3-3 and DWS, 2022d and 2023a).	olidated deposits and weat merman, 1985). yn Fm, which is widesprea	hered bedrock ma	erials. Various geophysic ajority of the GRU, as we	cal prospecting methods well as the Witzand and Lang	ere employed to estir	nate the aquifer depth,
Surface Water System	Primary surface water bodies in the area conscontributes to submarine discharge into the occ				e plays a role in sustainin	g minor wetlands wit	hin coastal dunes and
Water Resource Classes & RQOs	The GRU falls within the West Coast (A3) and includes 1 priority biophysical river node with a	TEC of D (see Figure 3-3		w).	e Class specified. There a	re no EWR sites with	in this IUA; however, it
Classes & NQOS	IUA Water Resource Class A3 Wast Coast III	Quaternary Catchment G21A	RU A3-R01	Resource Name	Biophysical Node Bviii3	TEC D	nMAR 14.6
Recharge	An estimated recharge of 9.20 M m³/a was der Aquifer Stress assessment. The average rechardetails, please refer to DWS (2022e).	ived from first-order rechal	rge calculations us		lation method and was cho	osen as the estimated	recharge value for the
rtoonargo	Method	Area (km	n²)		e Volume	Average Rec	
	Map-Centric Simulation method	320.33	<u> </u>		n ³ /a) 20	(mm 28.7	
					·		



	GRU Name: Yzerfontein			
GRU	Main Towns: Yzerfontein			
	Total Area (km²): 320.33			
Groundwater Use	In the Yzerfontein GRU, there is a single registered groundwater user with a total annual groundwater use of 0.26 M m³/a in the Water Supply Scheme Service Sector. Notably, the WARMS dataset incorrectly assigns Yzerfontein's municipal abstraction of 0.26 M m³/a to the Darling GRU (as indicated by the red arrow in Figure 3-3). This information has been rectified to accurately represent the Yzerfontein GRU.	Water Use Sect Water Supply Ser Total	Primary / Intergranular	Total Volume (M m³/a) Aquifer 0.26 0.26
Water Quality	Yzerfontein 100 100 80 80 80 80 80 80 100 100 100 80 20 40 20 80 80 80 80 20 80 80 80 80 80 80 80 80 80 80 80 80 80	to the deposition of management of the deposition of management of management of the Na-Cl signature. Cawaters and Ca ²⁺ and Witzands Fms. No RQOs have been baseline threshold vainfluenced by the CG these observations, the company of the Na-Cl signature.	arine aerosols and recharge thro Mg-Cl waters result from Na ⁺ Mg ²⁺ ions in the lithology, primagazetted for the G21A drainage alues is noted for EC and orthology (for EC) and fertilizer use (for the adjusted water quality catego	I Ca-Mg-Cl. Na-Cl waters are attributed bugh coastal rainfall, displaying a typic cation exchange between Na-Cl type arily sourced from the Langebaan are region. Nevertheless, exceedance ophosphate. This could potentially borthophosphate) in agriculture. Despiry for this GRU is A, indicating that, over the could be an additional to the could be continued by the could be continued
Aquifer Stress	The GRU is considered to have a Groundwater Availability Present Status Category of 'A', inc Category of 'A' indicating unmodified, pristine conditions (see table below). Recharge Volume Groundwater Use Stress (M m³/a) Stress		or slightly stressed aquifer, and Groundwater Availability Present Status Category	a Groundwater Quality Present Status Groundwater Quality Present Status Category
		03	A Status Category	Category
	9.20 0.26 0.0	03	A	A



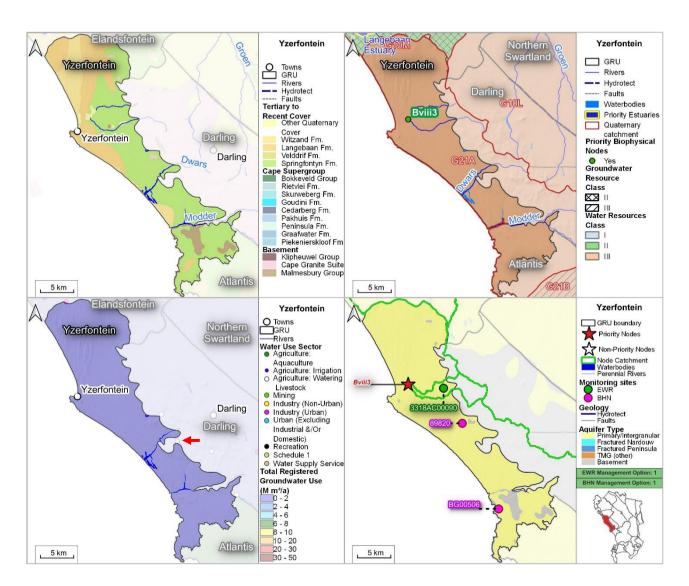
	GRU Name: Yz											
GRU	Main Towns: Ya											
	Total Area (km²	²): 320.33										
	The groundwate	uality Component er quality compon undwater Quality E	ent of the Reserv	re, detailed in the be confirmed).	table below and	d described in S	Section 2.3 & 2	2.4, is determine	d as two com	ponents 1) the G	roundwater Qı	uality Reser
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwat Quality BH Reserve
		Sulphate	mg/l		140	109.04	2.00	277.90	40.13	106.15	109.04	
		Electrical conduct			142	111.70	35.20	588.00	104.10	253.45	253.45	
		рН			142	7.97	1.00	8.76	7.24	8.13	8.13	
		Ammonia	mg/l		139	0.11	0.02	1.16	0.04	0.29	0.29	
	Drimon. /	Nitrate + nitrite	e mg/l		139	0.51	0.01	4.18	0.09	0.97	0.97	
	Primary / Intergranular	Fluoride	mg/l	49	136	0.44	0.03	0.88	0.20	0.46	0.46	
na de la composição de	Aquifer	Orthophosphat	e mg/l	49	139	0.05	0.00	0.81	0.06	0.38	0.38	
	Aquilei	Calcium	mg/l		140	24.06	6.20	221.70	19.20	93.42	93.42	
ilouliuwater Reserve			ma/l		139	34.34	7.00	152.80	22.30	44.36	44.36	
ilouliuwater Reserve		Magnesium					41.80	864.80	141.65	364.96	364.96	
Touridwater Reserve		Sodium	mg/l		138	146.72						
noundwater Reserve			mg/l mg/l		138	4.22	1.17	49.00	4.52	11.99	11.99	
orounawater Reserve		Sodium Potassium Chloride	mg/l mg/l		138 140	4.22 284.61	1.17 55.60	49.00 1646.00	4.52 263.25	11.99 666.04	11.99 666.04	
oroundwater Reserve	The groundwat	Sodium Potassium Chloride uantity Componer er quality compor	mg/l mg/l nt nent of the Rese	d to maintain the	138 140 e table below a EWR; and 2) the	4.22 284.61 nd described in	1.17 55.60 n Section 2.3 Quality BHN F	49.00 1646.00	4.52 263.25 ined as two os the ground	11.99 666.04 components 1) th	11.99 666.04 ne Groundwate	er Quality E
oroundwater Reserve	The groundwat Reserve, which	Sodium Potassium Chloride ruantity Compone er quality compor is the groundwat Mm³/a) EW	mg/l mg/l nt nent of the Reser er quality require	d to maintain the	e table below a EWR; and 2) the	4.22 284.61 nd described in	1.17 55.60 n Section 2.3 Quality BHN F	49.00 1646.00 8 2.4, is determ Reserve, which in	4.52 263.25 ined as two os the ground	11.99 666.04 components 1) the	11.99 666.04 ne Groundwate 3C	
Future Scenario 2050 (Scenario 7b)	The groundwat Reserve, which Recharge (9.2	Sodium Potassium Chloride ruantity Compone er quality compor is the groundwat Mm³/a) EW	mg/l mg/l mg/l mg/l mg/l mg/l mg/l mg/l	BHN Reser 0.0 year 2050 and codetermine the Groth climate changent schemes in the	e table below at EWR; and 2) the ve (Mm³/a) onsiders the 'Mo oundwater Resege and the elimi e area. Furthern	4.22 284.61 nd described in e Groundwater GW Reserve (No.03) st-Likely Case erve, specifical nation of IAPs. nore, the grour	n Section 2.3 (Compared to the control of the GRU, by the groundwood of the groundwood of the ground	49.00 1646.00 & 2.4, is determ Reserve, which i otal Allocable Volu (Mm³/a) 9.17 the analysis for atter contribution groundwater use bution to the BHN o Section 2.5 and	4.52 263.25 ined as two os the grounds me Was cused on two of to the BHN as increased from the second the table be	11.99 666.04 components 1) the water qualityTE atter Use (Mm³/a) 0.26 key factors: Recomd EWR. The score 0.26 to 2.26 for efrom 0.01 to 0.00	11.99 666.04 ne Groundwate BC Still Alloc harge and Wa enario involve M m³/a due to	ter Use. The da decreas sectoral gro
Future Scenario 2050	The groundwat Reserve, which Recharge (9.2	Sodium Potassium Chloride ruantity Componer er quality componer is the groundwat Mm³/a) Which projects configuenced the paragraph of the projects of the paragraph of the par	mg/l mg/l mg/l mg/l mg/l mg/l mg/l mg/l	BHN Reser 0.0 year 2050 and codetermine the Groth climate changent schemes in the Allocation Categorian.	e table below at EWR; and 2) the ve (Mm³/a) on siders the 'Mo oundwater Resege and the elimine area. Furthern bry did not changive (Mm³/a)	4.22 284.61 nd described in e Groundwater GW Reserve (No.03) st-Likely Case erve, specifical nation of IAPs. nore, the grour	n Section 2.3 Quality BHN F Guality BHN F To Additionally, godwater contrib gory C (refer to	49.00 1646.00 & 2.4, is determ Reserve, which i otal Allocable Volu (Mm³/a) 9.17 the analysis for ater contribution groundwater use oution to the BHN	4.52 263.25 ined as two of sthe grounds me Was cused on two of to the BHN as increased from the stable become	11.99 666.04 components 1) the water qualityTE atter Use (Mm³/a) 0.26 key factors: Recomd EWR. The score 0.26 to 2.26 for efrom 0.01 to 0.00	11.99 666.04 ne Groundwate 3C Still Alloc harge and Wa enario involve M m³/a due to o 02 M m³/a, prin	ter Use. The da decreas sectoral gro



¹⁸ The WARMS dataset places Yzerfontein's municipal abstraction of 0.26 Mm³/a in the Darling GRU. It has been updated to reflect for the Yzerfontein GRU.

GRU	GRU Name: Yze Main Towns: Yze	erfontein					
		GRU was assigr					ntribution to the EWR and a Management Option 1 for monitoring the groundwater contributed within the Yzerfontein GRU (see Figure 3-3 and the table below).
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
						EWR Manager	nent Option 1
Monitoring Programme	3318AC00090	NGA	Bviii3	EWR	-33.33662	18.23898	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level:
						BHN Managen	nent Option 1
	BG00506	NGA	GRU	BHN	-33.50172	18.32304	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: Manual groundwater level measurements Constitution of BUND:
	89820	WMS	GRU	BHN	-33.384722	18.267778	 Groundwater Quality (Background water quality and BHN): Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms





A series of maps for the Yzerfontein GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.1.4. Elandsfontein GRU

0011	GRU Name: Elandsfontein
GRU	Main Towns: None Total Area (km²): 531.57
GRU Boundary Description	The Elandsfontein GRU was confined by the boundaries of the Springfontyn Fm to the east, encompassing sections of the Sout River. Additionally, its southern extent was determined by an interpolated extension of the CGS outcrop. The surface water quaternary catchment divide, at G10M and G21A, is a shared boundary between the Yzerfontein and Elandsfontein GRUs, taking into consideration the south-westerly preferential flow direction and discharge. The demarcation between the Elandsfontein and Langebaan Road GRUs was established based on an inferred basement high, specifically the Malmesbury Group and CGS, which extended from the eastern edge of the GRU towards the coast. However, it is worth noting that there is a potential hydraulic connection between the Elandsfontein and Langebaan Road aquifers. The western boundary of the GRU was defined by the coastline (see Figure 3-4 and DWS, 2022d and 2023a).
Quaternary Catchments	G10M and G10L (Figure 3-4)
Resource Unit	Primary / Intergranular Aquifer
Description	The primary aquifer in this region consists of laterally continuous layers of the Sandveld Group, with an average thickness of approximately 70 meters. The Sandveld Group includes the Springfontyn Fm, prevalent across the majority of the GRU. This formation is mainly covered with Tertiary and Quaternary unconsolidated to semi-consolidated dune sands and calcrete. The groundwater recharge, flow, and discharge in the Elandsfontein Aquifer System are influenced by basement topography (paleochannels), faults, fissures, contact zones, and the stratigraphy of the Cenozoic deposits, contributing to the aquifer's complexity (see Figure 3-4 and DWS, 2022d and 2023a). The Elandsfontein Aquifer System comprises a lower and upper sand aquifer separated by a clay unit and is situated between Hopefield and Langebaan Lagoon. Palaeo-courses of the Berg River, as noted by Timmerman (1985a, 1985b, and 1985c) and DWAF (2008e), have created incisions in the basement topography. These incisions are infilled by fluvial sediment of the Elandsfontyn Fm within the Sandveld Group and represent high-yielding zones. The basement of the aquifer is formed by Malmesbury Group shales and granites from the CGS. Granite outcrops are present in various locations, with granite underlying the Tertiary layers in the west and Malmesbury shale in the east (refer to DWS, 2022d and 2023a).
Surface Water System	Surface water availability in the region is constrained due to factors such as low rainfall, gentle topography, and the prevalent permeable sand-dominated geology (Figure 3-4). The aquifer primarily discharges into the Langebaan Lagoon, serving as the main surface water system in the GRU (refer to DWS, 2022d and 2023a).
Water Resource Classes & RQOs	The GRU falls within the Langebaan (A2) and Lower Berg (B4) IUAs, with Water Resource Class II and III, respectively. The segments of the GRU falling within IUA A2 (catchment G10M) are designated Groundwater Resource Class II, while those within IUA B4 (catchment G10L) have no Groundwater Resource Class assigned. Within the GRU, there is 1 priority estuary EWR site – the Langebaan Lagoon, which holds a TEC of A (see table below). IUA



GRU	GRU Name: Elandsfontein Main Towns: None					
Cito	Total Area (km²): 531.57					
Recharge	An estimated recharge of 15.47 M m³/a was of the Aquifer Stress assessment (see table below connection is presumed to exist between the understanding Method Map-Centric Simulation method	w). The average recharge rate is 2	29.05 mm/a based on t	the total GRU area. For f		
	In the Upper Primary Intergranular Aquifer, ther	re are three registered groundwate	er users with	Water Use Sector	No. of Users	Total Volume (M m³/a)
ı	a collective annual groundwater use of 0.87 M r			Agriculture: Irrigation	1	0.16
	consumption in this aguifer are Mining and Ag	griculture (Irrigation), contributing	80.5% and	Industry (Urban)	1	0.01
Groundwater Use	18.3%, respectively, to the total annual ground	water use volume. The sole groun	dwater user	Mining	1	0.70
	in the Lower Primary Intergranular Aquifer is	Agriculture (Irrigation), with an	abstraction		rimary / Intergranular Aquife	
1	volume of 0.22 M m ³ /a (see Figure 3-4 and the	e table to the right).	F	Agriculture: Irrigation Total	<u> </u>	0.22 1.09
Water Quality	Ca-HCO3 type Ca-H	000 80 00 00 00 00 00 00 00 00 00 00 00	the de Na-CI s waters Witzan The EI were c The ac contan Howey	position of marine aeros signature. Ca-Mg-Cl type and Ca ²⁺ and Mg ²⁺ ionids Fms. landsfontein GRU falls collected from G10L, and djusted water quality chination exist, predomin	cols and recharge through waters result from Natics in the lithology, primal under the G10L and Grand from G10M, with all stategory is B, indicating nantly natural groundwof additional locations	g that, although some low levels of rater quality conditions are present. It is within the Elandsfontein GRU is
Aquifer Stress	The GRU is considered to have a Groundwater Category of 'B' indicating localised, low levels of Recharge Volume	of contamination, but no negative Groundwater Use	gory of 'B', indicating a impacts apparent (see	e table below). Groundwater	Present Status Category	Adjusted Groundwater Quality Present
	(M m ³ /a)	(M m ³ /a)	Otross mack	(aft	er WRC, 2007)	Status Category
	15.47	1.09	0.07	(ait	В	B Status Category

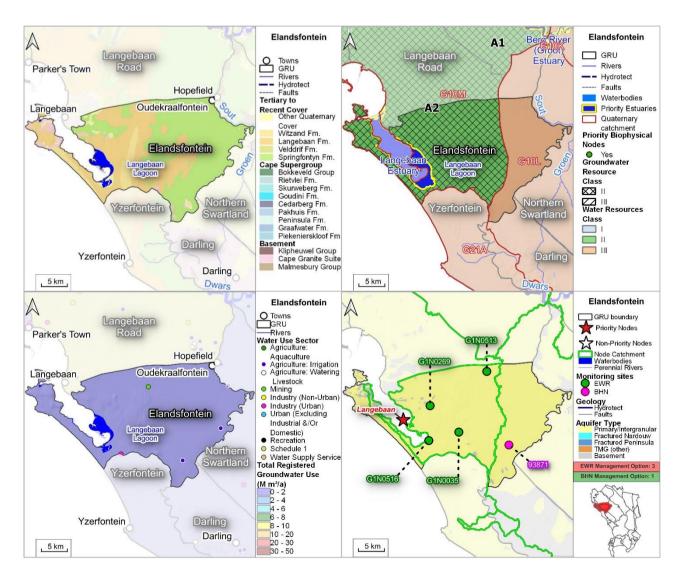


GRU	GRU Name: Ela Main Towns: No Total Area (km²	one										
Groundwater Reserve	Groundwater Q The groundwate	uality Component er quality component er quality component indwater Quality BH Parameter Sulphate Electrical conductivit pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium	Unit mg/l mS/m mg/l		No. Samples	Baseline Conc. 12.90 49.10 7.49 0.14 4.62 0.24 0.19 37.26 3.50 55.93	Min Conc. 12.10 45.50 7.17 0.04 0.15 0.17 0.01 26.50 3.50 50.90	2.4, is determine Max Conc. 29.20 101.90 7.60 0.14 4.62 0.82 0.30 83.40 12.60 109.70	Median Conc. 12.10 49.10 7.35 0.12 1.51 0.19 0.19 34.20 3.50 54.40	95 th Percentile Conc. 25.94 91.72 7.58 0.14 4.04 0.70 0.29 74.24 11.32 98.98	Groundwater Quality Reserve 25.94 91.72 7.58 0.14 4.62 0.70 0.29 74.24 11.32 98.98	Groundwa Quality BH Reserve
		Sodium Potassium Chloride	mg/l mg/l mg/l			1.99 100.82	0.48 97.50	2.03 195.10	1.02	1.94 178.02	1.99 178.02	
	The groundwate the EWR and B	Potassium Chloride uantity Component er quantity compone HN Reserves.	mg/l mg/l	1		1.99 100.82 and described in	0.48 97.50	2.03 195.10	1.02 101.00	1.94 178.02 ering the total gro	1.99 178.02 undwater cont	
	The groundwate the EWR and B	Potassium Chloride uantity Component er quantity compone HN Reserves.	mg/I mg/I nt of the Reserve	BHN Reserv	ve (Mm³/a)	1.99 100.82 and described in	0.48 97.50	2.03 195.10 & 2.4, is calculate otal Allocable Volu (Mm³/a)	1.02 101.00	1.94 178.02 ering the total gro ater Use (Mm³/a)	1.99 178.02 bundwater cont	able (Mm³/a)
Future Scenario 2050 (Scenario 7b)	The groundwate the EWR and B Recharge (I 15.47 In Scenario 7b, factors directly in recharge from	Potassium Chloride uantity Component er quantity compone HN Reserves.	mg/l mg/l mg/l mg/l nt of the Reserve Reserve (Mm³/a) 6.39 litions for the yeareters used to dem³/a, influenced	BHN Resen 0.0	nsiders the 'Moroundwater Researchange and the	1.99 100.82 and described in GW Reserve (N 6.40 ost-Likely Case serve, specifica ne elimination of	" for the GRU, ally the ground of IAPs. Additions the changes, the second secon	2.03 195.10 & 2.4, is calculate Otal Allocable Volu (Mm³/a) 9.08 the analysis foc lwater contributio onally, groundwa e Allocation Cate	used on two n to the BHN ter use increasegory shifted	1.94 178.02 ering the total gro ater Use (Mm³/a) 1.09 key factors: Rec I and EWR. The ased from 1.09 to	1.99 178.02 bundwater cont Still Alloc harge and War scenario involvo 2.70 M m³/a	able (Mm³/a 7.99 ter Use. Theed a decredue to sec
Future Scenario 2050 (Scenario 7b)	The groundwate the EWR and B Recharge (I 15.47 In Scenario 7b, factors directly in recharge fror growth and the	Potassium Chloride uantity Component er quantity compone HN Reserves. Mm³/a) which projects con- influenced the param 15.47 to 13.17 M implementation of g	mg/l mg/l mg/l mg/l nt of the Reserve Reserve (Mm³/a) 6.39 litions for the yeareters used to dem³/a, influenced	BHN Resen 0.0	nsiders the 'Moroundwater Rese change and the	1.99 100.82 and described in GW Reserve (N 6.40 ost-Likely Case serve, specifica ne elimination of	0.48 97.50 n Section 2.3 & Mm³/a) T If for the GRU, ally the ground of IAPs. Additions the changes, the manual of the changes of the chan	2.03 195.10 & 2.4, is calculate otal Allocable Volu (Mm³/a) 9.08 the analysis foculate contribution	used on two n to the BHN ter use increagory shifted	1.94 178.02 ering the total gro ater Use (Mm³/a) 1.09 key factors: Rec I and EWR. The ased from 1.09 to	1.99 178.02 bundwater cont Still Alloc harge and War scenario involvo 2.70 M m³/a er to Section 2.3	able (Mm³/a) 7.99 ter Use. Theed a decredue to seci



GRU	GRU Name: Ela Main Towns: No Total Area (km²)	one					
							ontribution to the EWR and a Management Option 1 for monitoring the groundwater ically selected within the Elandsfontein GRU (see Figure 3-4 and the table below).
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
1						EWR Managemen	nt Option 3
	G1N0516	HYDSTRA	Langebaan Lagoon	EWRII	-33.19332	18.1269	Frequency: Monthly or Quarterly 1) Groundwater level: O Manual water level measurements and continuous hourly readings from
	G1N0035	HYDSTRA	Langebaan Lagoon	EWR	-33.180118	18.189366	automatically recorded level loggers. Possible need for telemetry systems. 2) Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄
Monitoring Programme	G1N0513	HYDSTRA	Langebaan Lagoon		-33.07631	18.2503	 Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹: Bxi3 (Langebaan):
	G1N0269	HYDSTRA	Langebaan Lagoon	EWR	-33.13302	18.13159	Nutrients (NO ₃); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen, Secchi depth).
1						BHN Managemen	t Option 1
	93871	WMS	GRU	BHN	-33.204722	18.291944	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level:





A series of maps for the Elandsfontein GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.1.5. Langebaan Road GRU

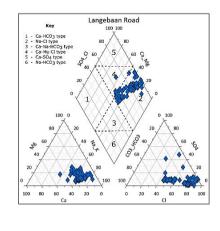
GRU	GRU Name: Langebaan Road Main Towns: Langebaan
	Total Area (km²): 903.71
GRU Boundary Description	The north-western boundary of the Langebaan Road GRU was determined by the interpolated extent of the CGS outcrop. The division between the Elandsfontein and Langebaan Road GRUs was established based on an inferred basement high, encompassing the Malmesbury Group and the CGS, which extended from the eastern edge of the GRU towards the coast of Saldanha Bay. The Berg and Sout rivers served as the boundaries for the eastern and south-eastern edges of the GRU, while the coastlines of Saldanha Bay and St Helena Bay defined the western and northern edges, respectively. The consideration of preferential flow direction towards Saldanha Bay played a role in defining the GRU boundary (see Figure 3-5 and refer to DWS, 2022d, 2022e and 2023a for detail).
Quaternary Catchments	G10M and G10L (Figure 3-5)
Resource Unit	Primary / Intergranular Aquifer
Description	The Langebaan region is characterized by semi- to unconsolidated Cenozoic sediments, with an average thickness ranging between approximately 50 meters to 70 meters. These sediments, dating from 65 million years ago to the present, unconformably overlie the metamorphosed shales of the Malmesbury Group and the granites of the CGS, which constitute the basement. The division between the Langebaan Road Aquifer System (Upper and Lower) and the Elandsfontein Aquifer System should be viewed primarily as a spatial distinction, as both aquifers are hydraulically connected in both the shallow and deep zones (WRC, 2016a). The Berg River flows roughly parallel to and just east of the regional contact between the Malmesbury Group and CGS, forming the eastern extent boundary of the GRU (Figure 3-5). The groundwater recharge, flow, and discharge in the Langebaan Road aquifer system are influenced by basement topography (paleochannels), faults, fissures, contact zones, and the stratigraphy of the Cenozoic deposits, contributing to the overall complexity of the system (refer to DWS, 2022d and 2023a).
Surface Water System	The Langebaan Road Aquifer System releases water into Saldanha Bay, St Helena Bay, and the Berg River/Groot Estuary, constituting the primary surface water system within this GRU (see Figure 3-5 and DWS, 2022d and 2023a).
Water Resource Classes & RQOs	The GRU falls within the Berg Estuary (A1), Langebaan (A2), and Lower Berg (B4) IUAs, with Water Resource Class II, II, and III, respectively. The segments of the GRU within IUAs A1 and A2 (catchment G10M) have a Groundwater Resource Class of II, while those within IUA B4 (catchment G10L) lack a Groundwater Resource Class designation. Within the GRU, there are 2 priority estuaries: 1) the Langebaan Lagoon (an Estuary EWR site) with a TEC of A, and 2) the Berg River (Groot) Estuary, which has a TEC of C (Figure 3-5 and the table below). IUA



GRU	GRU Name: Langebaan Road Main Towns: Langebaan Total Area (km²): 903.71									
Recharge	An estimated recharge of 23.28 M m³/a was determined from first-order recharge calculations using the Map-Centric Simulation method and was chosen as the estimated recharge various for the Aquifer Stress assessments. The average recharge rate is 25.76 mm/a based on the total GRU area. Additional recharge estimations are available in the literature. It is noted the leaky hydraulic connection is presumed to exist between the upper and lower RU (refer to DWS, 2022e, for further details).									
3	Method	Area (km²)	Recharge Volume (M m³/a)	Average Recharge Rate (mm/a)						
	Map-Centric Simulation method	903.71	23.28	25.76						
	In the Upper Primary/Intergranular Aquifer, there are user, accounting for 91.0% of the total annual ground. In the Lower Primary/Intergranular Aquifer, there are Water Supply Services, representing 87.4% of the total	dwater use volume. e 17 registered groundwater users, with a c	umulative groundwater use of 7.82 M m³/a	i. The primary groundwater user in this aquifer is tail.						
	Water Use Sector	No. of Us		Total Volume (M m³/a)						
Craundwater Hee		Primary / Intergranula	Aquifer (Upper)							
Groundwater Use	Agriculture: Irrigation	9		0.71						
	Agriculture: Watering Livestock	1 2		0.02						

Water Use Sector	No. of Users	Total Volume (M m ³ /a)
	Primary / Intergranular Aquifer (Upper)	
Agriculture: Irrigation	9	0.71
Agriculture: Watering Livestock	2	0.02
Industry (Non-Urban)	4	0.01
Industry (Urban)	1	0.04
	Primary / Intergranular Aquifer (lower)	
Agriculture: Irrigation	6	0.87
Agriculture: Watering Livestock	8	0.08
Water Supply Service	3	6.87
Total	33	8.59

Water Quality



The primary water type in the Langebaan Road GRU is Na-Cl, primarily resulting from the deposition of marine aerosols and recharge through coastal rainfall, displaying a typical Na-Cl signature. While Ca-HCO₃ waters are expected due to the extensive calcite-rich Langebaan Fm, no samples show this water type. Boreholes situated near shallow basement rocks of the Tygerberg Fm may contribute to the Na-Cl character in the overlying primary aquifer, given the elevated Na and Cl ion concentrations of this lithology.

Out of the 103 samples collected, 9 exceeded the RQO for EC, 18 for pH, and 1 for $NO_3 + NO_2$. Elevated EC values are likely influenced by the underlying Tygerberg Fm, while the predominantly basic pH is attributed to the dissolution of basic Ca and HCO_3 ions from the extensive Langebaan Fm. The adjusted water quality category is B, indicating that, although some low levels of contamination exist, predominantly natural groundwater quality conditions prevail.



GRU	GRU Name: La Main Towns: La Total Area (km²	ingebaan											
A su life a Change	The GRU is considered to have a Groundwater Availability Present Status Category of 'C', indicating a moderately stressed aquifer, and a Groundwater Quality Present Status Category 'B' indicating localised, low levels of contamination, but no negative impacts apparent (see table below).												
Aquifer Stress		arge Volume	Gro	undwater Use		Stress In	dev		er Availability Pre	esent Grour	ndwater Quality P	resent Status	
		M m ³ /a)		(M m ³ /a)			uex	Sta	tus Category		Category	•	
		23.28		8.59		0.37			С		В		
	The groundwate	uality Component er quality component of	the Reserve,	detailed in the	table below and	d described in	Section 2.3 & 2	2.4, is determin	ed as two com	ponents 1) the G	Froundwater Qu	uality Reser	
	Aquifer Unit	ndwater Quality BHN R	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwat Quality BH Reserve	
		Parameter Sulphate	Unit mg/l	,	89	Conc. 25.18	0.6	467.6	Conc. 25.5	Conc. 122.81	Quality Reserve 122.81	Quality BH	
		Parameter Sulphate Electrical conductivity	Unit	,	89 92	25.18 59.50	0.6 59.5	467.6 289.5	25.5 152	Conc. 122.81 259.25	Quality Reserve 122.81 259.25	Quality BF	
		Parameter Sulphate Electrical conductivity pH	Unit mg/l mS/m	,	89 92 92	25.18 59.50 8.41	0.6 59.5 6.77	467.6 289.5 8.707	25.5 152 8.11	Conc. 122.81 259.25 8.53	Quality Reserve 122.81 259.25 8.53	Quality BH	
	Aquifer Unit	Parameter Sulphate Electrical conductivity pH Ammonia	Unit mg/l mS/m	,	89 92 92 90	25.18 59.50 8.41 0.14	0.6 59.5 6.77 0	467.6 289.5 8.707 0.553	25.5 152 8.11 0.025	Conc. 122.81 259.25 8.53 0.14	Quality Reserve 122.81 259.25 8.53 0.14	Quality Bl	
	Aquifer Unit	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite	Unit mg/l mS/m mg/l mg/l	No. BHs	89 92 92 90 87	25.18 59.50 8.41 0.14 0.25	0.6 59.5 6.77 0	467.6 289.5 8.707 0.553 9.81	25.5 152 8.11 0.025 0.055	Conc. 122.81 259.25 8.53 0.14 2.99	Quality Reserve 122.81 259.25 8.53 0.14 2.99	Quality Bl	
	Aquifer Unit Primary / Intergranular	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride	Unit mg/l mS/m	,	89 92 92 90	25.18 59.50 8.41 0.14	0.6 59.5 6.77 0	467.6 289.5 8.707 0.553	25.5 152 8.11 0.025	Conc. 122.81 259.25 8.53 0.14 2.99 1.34	Quality Reserve 122.81 259.25 8.53 0.14	Quality BF	
oundwater Reserve	Aquifer Unit	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite	Unit mg/l mS/m mg/l mg/l mg/l	No. BHs	89 92 92 92 90 87 82	25.18 59.50 8.41 0.14 0.25 0.70	0.6 59.5 6.77 0 0.02 0.224	467.6 289.5 8.707 0.553 9.81 2.11	25.5 152 8.11 0.025 0.055 0.6075	Conc. 122.81 259.25 8.53 0.14 2.99	Quality Reserve 122.81 259.25 8.53 0.14 2.99 1.34	Quality Bl	
oundwater Reserve	Aquifer Unit Primary / Intergranular	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate	Unit mg/l mS/m mg/l mg/l mg/l mg/l mg/l	No. BHs	89 92 92 90 87 82 90	25.18 59.50 8.41 0.14 0.25 0.70 0.04	0.6 59.5 6.77 0 0.02 0.224	467.6 289.5 8.707 0.553 9.81 2.11 0.239	25.5 152 8.11 0.025 0.055 0.6075 0.029	Conc. 122.81 259.25 8.53 0.14 2.99 1.34 0.15	Quality Reserve 122.81 259.25 8.53 0.14 2.99 1.34 0.15	Quality BF	
oundwater Reserve	Aquifer Unit Primary / Intergranular	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium	Unit mg/l mS/m mg/l mg/l mg/l mg/l mg/l mg/l mg/l m	No. BHs	89 92 92 90 87 82 90 84 86 81	25.18 59.50 8.41 0.14 0.25 0.70 0.04 72.80 17.90 202.80	0.6 59.5 6.77 0 0.02 0.224 0	467.6 289.5 8.707 0.553 9.81 2.11 0.239 175 97.924 445.3	Conc. 25.5 152 8.11 0.025 0.055 0.6075 0.029 68.8905 17.7085 198.519	Conc. 122.81 259.25 8.53 0.14 2.99 1.34 0.15 114.23 62.57 320.2	Quality Reserve 122.81 259.25 8.53 0.14 2.99 1.34 0.15 114.23 62.57 320.2	Quality BF	
oundwater Reserve	Aquifer Unit Primary / Intergranular	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium Potassium	Unit mg/l mS/m mg/l mg/l mg/l mg/l mg/l mg/l mg/l m	No. BHs	89 92 92 90 87 82 90 84 86 81	Conc. 25.18 59.50 8.41 0.14 0.25 0.70 0.04 72.80 17.90 202.80 4.81	0.6 59.5 6.77 0 0.02 0.224 0 27 5.3 61	467.6 289.5 8.707 0.553 9.81 2.11 0.239 175 97.924 445.3 27.747	Conc. 25.5 152 8.11 0.025 0.055 0.6075 0.029 68.8905 17.7085 198.519 4.8	Conc. 122.81 259.25 8.53 0.14 2.99 1.34 0.15 114.23 62.57 320.2 12.94	Quality Reserve 122.81 259.25 8.53 0.14 2.99 1.34 0.15 114.23 62.57 320.2 12.94	Quality BH	
roundwater Reserve	Aquifer Unit Primary / Intergranular	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium	Unit mg/l mS/m mg/l mg/l mg/l mg/l mg/l mg/l mg/l m	No. BHs	89 92 92 90 87 82 90 84 86 81	25.18 59.50 8.41 0.14 0.25 0.70 0.04 72.80 17.90 202.80	0.6 59.5 6.77 0 0.02 0.224 0 27 5.3	467.6 289.5 8.707 0.553 9.81 2.11 0.239 175 97.924 445.3	Conc. 25.5 152 8.11 0.025 0.055 0.6075 0.029 68.8905 17.7085 198.519	Conc. 122.81 259.25 8.53 0.14 2.99 1.34 0.15 114.23 62.57 320.2	Quality Reserve 122.81 259.25 8.53 0.14 2.99 1.34 0.15 114.23 62.57 320.2	Quality BI	



GRU	GRU Name: Lan Main Towns: Lan Total Area (km²):	igebaan	I										
Future Scenario 2050 (Scenario 7b)	factors directly in recharge from 23 growth and the in	fluenced the 3.28 to 20.18 mplementation	parameters used to M m³/a, influenced n of groundwater de	determine the 0 by both climate velopment sch	Groundwater Rese change and the emes in the area	serve, specificalle e elimination of . Furthermore, t	y the groui IAPs. Addi he ground	RU, the analysis focused on dwater contribution to the litionally, groundwater use inwater contribution to the BH o Section 2.5 and the table	BHN and EWR. The scer ncreased from 8.59 to 11 HN Reserve rose from 0.0	ario involved a decrease i .09 M m³/a due to sectora			
	Recharge (Mi	m³/a)	EWR Reserve (Mm³/a)	BHN Res	serve (Mm³/a)	GW Reserve (N	/lm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)			
	20.18		5.52		0.03	5.55		14.63	11.09	3.55			
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude			Monitoring Description				
	Site Name	Data Source				9	t Onting 2	Мс	onitoring Description				
	Frequency: Monthly or Quarterly												
	G1N0050	HYDSTRA	Berg (Groot)	EWR	-32.86598	18.09559							
	G1N0337	HYDSTRA	Berg (Groot)	EWR	-32.990127	18.229369	1)		easurements and continuous d level loggers. Possible nee				
	G1N0507	HYDSTRA	Bii1	EWR	-33.02503	18.34761	2)	 Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, M Site specific additions for EWR: NO₂, NO₃, NH₄ 		k, MAIk, F, CI, PO ₄ , SO ₄			
Monitoring Programme	G1N0237	HYDSTRA	Berg (Groot)	EWR	-32.91996	18.2942	Site specific additions						
Worldring i Togramme	G1N0372	HYDSTRA	Langebaan Lagoon	EWR	-33.00888889	18.0725		Bxi1 (Berg Groot Estuary): Nutrients (Dissolved Inorganic Nutrients [DIN] ar Phosphate [DIP]); Salts; Pathogens (Enterococci & E					
	G1N0274	HYDSTRA	Berg (Groot)	EWR	-32.88552	18.24774			re, pH, Dissolved Oxygen, S				
		•				BHN Management							
	G1N0158	HYDSTRA	GRU	BHN	-33.080122	18.049363	Frequenc	: Quarterly or Biannual (Summer & Winter) Groundwater level:					
	3218CC00015	NGA	GRU	BHN	-32.92805	18.00483	2)	 Manual groundwater I Groundwater Quality (Backgroundwater Quality (Backgroundwater Standard Parameters)): k, MAIk, F, CI, PO4, SO4			
				_			1	 Site specific additions 	coli, Total Coliforms, Faecal				



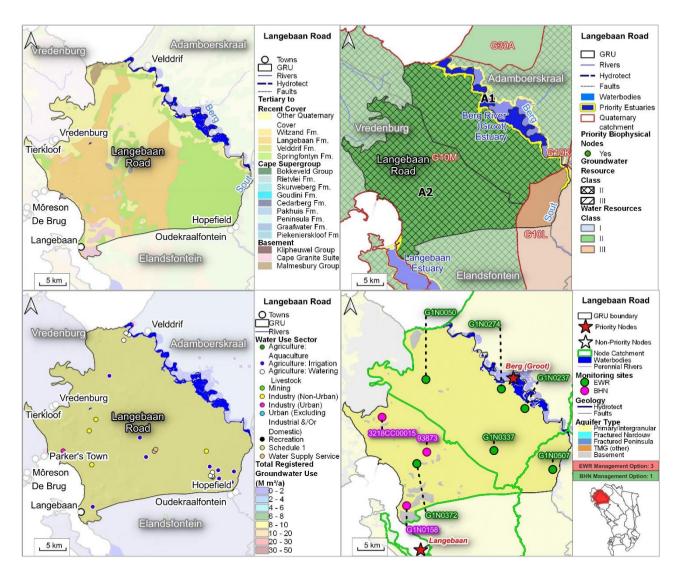


Figure 3-5 A series of maps for the Langebaan Road GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.1.6. Adamboerskraal GRU

	GRU Name: Adamboerskraal						
GRU	Main Towns: Velddrif						
	Total Area (km²): 612.30						
GRU Boundary Description	The extent of the Adamboerskraal GRU was or River, while the eastern and southern boundar thin layer of the Springfontyn Fm. The north-west The northern and north-western edge of the Gr	ries were established by a sterly preferential flow dire	an interpolated basemection, particularly at the	nent lithology extent. Th ne Berg River Estuary, a	is extent included the N Iso contributed to the de	Malmesbury Group and	d the CGS, overlaid by a
Quaternary Catchments	G10M, G10K and G30A (Figure 3-6)						
Resource Unit			Primary / Interg	ranular Aquifer			
Description	The Adamboerskraal region is characterized I sediments, dating from 65 million years ago to roughly parallel to and just west of the regional The groundwater recharge, flow, and discharg zones, and the stratigraphy of the Cenozoic de and 2023a).	the present, unconformation to the present, unconformation to the Maile in the Adamboerskraal	ably overlie the metam Imesbury Group and C region are influenced	norphosed shales of the CGS (refer to DWS, 202 by various factors, inc	Malmesbury Group and 2d and 2023a).	d the CĠŚ (Figure 3- raphy (paleochannels)	6). The Berg River flows , faults, fissures, contact
Surface Water System	The Adamboerskraal Aquifer discharges into S connection between the Adamboerskraal Aquif 2022d, 2022e and 2023a for further details.						
Water Resource Classes & RQOs	The GRU falls within the Berg Estuary (A1) ar assigned a Groundwater Resource Class of II, the GRU, there is 1 priority estuary EWR site – IUA Water Resource Class A1 Berg Estuary II	while no Groundwater Re	esource Class is desig	nated for the portions w	rithin IUA A1 (catchmen		
Recharge	An estimated recharge of 21.61 M m³/a was defor the Aquifer Stress assessments (see table before to DWS (2022e) for further details. Method Map-Centric Simulation method		arge rate is 35.29 mm		RU area. Additional rech e Volume ³ /a)	narge estimations are a	



Groundwater Use In this GRU, there are 12 registered groundwater users, collectively utilizing 2.13 M m²/s of groundwater. The primary sectors contributing to groundwater use are Agriculture (Irrigation) and Industry, constituting 62.9% and 37.1%, respectively, of the total annual groundwater use volume (Figure 3-6 and the table to the right). Water Quality Water Quality Water Quality Water Quality Mater Quality Water Quality Mater Lise Sector No. of Users Total Valume (M m²/sa) Formary / Intergranular Aquiter Agriculture: Irrigation 11 1 1.34 Industry / Urban) 1 1 0.79 Total 11 1.34 The primary water type in the Adamboerskraal GRU is Na-Cl, mainly attributed to deposition of marine aerosols and recharge through coastal rainfall, displaying a typica Cl signature. However, elevated salinity levels suggest that boreholes in this GRU intersect the underlying basement aquiler, serving as the likely reason for the presenval of the prese		GRU Name: Adamboerskraal			
Groundwater Use In this GRU, there are 12 registered groundwater users, collectively utilizing 2.13 M m³/a of groundwater. The primary sectors contributing to groundwater use are Agriculture (Irrigation) and Industry, constituting 62.9% and 37.1%, respectively, of the total annual groundwater use volume (Figure 3-6 and the table to the right). Water Quality Water Quality In this GRU, there are 12 registered groundwater users, collectively utilizing 2.13 M m³/a of groundwater users, collectively utilizing 2.13 M m³/a of groundwater. The primary sectors contributing to groundwater users are Agriculture (Irrigation) Agriculture: Irrigation Primary / Integranular Aquifer Agriculture: Irrigation 1 1.34 1.34	GRU				
Groundwater Use groundwater. The primary sectors contributing to groundwater use are Agriculture (Irrigation) and Industry, constituting 62.9% and 37.1%, respectively, of the total annual groundwater use volume (Figure 3-6 and the table to the right). Agriculture: Irrigation 1.34		Total Area (km²): 612.30			
Water Quality The primary water type in the Adamboerskraal GRU is Na-CI, mainly attributed to deposition of marine aerosols and recharge through coastal rainfall, displaying a typical CI signature. However, elevated salinity levels suggest that boreholes in this GRU intersect the underlying basement aquifer, serving as the likely reason for the presence of the pre	Groundwater Use	groundwater. The primary sectors contributing to groundwater use are Agriculture (Irrigation) and Industry, constituting 62.9% and 37.1%, respectively, of the total annual groundwater	Agriculture: Irrigation Industry (Urban)	Primary / Intergranular Aquifer	1.34 0.79
	Water Quality	Key 100 100 1 - Ca-HCO3 type 2 - Na-Cl type 3 - Ca-Na-HCO2 type 4 - Ca-Mg-Cl type 6 - Na-HCO3 type 7 40 40 50 60 50 60 50 60 60 60 60 60 60 60 60 60 60 60 60 60	deposition of marine aerosc CI signature. However, ele intersect the underlying bas Na-CI waters and a high cor Out of the 2 samples collect quality category is B, indice	ols and recharge through coastated salinity levels suggest the sement aquifer, serving as the sunt of exceedances for EC and coted, 1 sample exceeded the Focating that, although some love	al rainfall, displaying a typical Nathat boreholes in this GRU may likely reason for the presence of SO ₄ . RQO for EC. The adjusted water w levels of contamination exist,
The GRU is considered to have a Groundwater Availability Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Status Category of 'B' indicating localised, low levels of contamination, but no negative impacts apparent (see table below). Recharge Volume	Aquifer Stress	Category of 'B' indicating localised, low levels of contamination, but no negative impacts apparent of the contamination of the contami	rent (see table below). Ground	lwater Availability Present G Status Category	Froundwater Quality Present Status Category



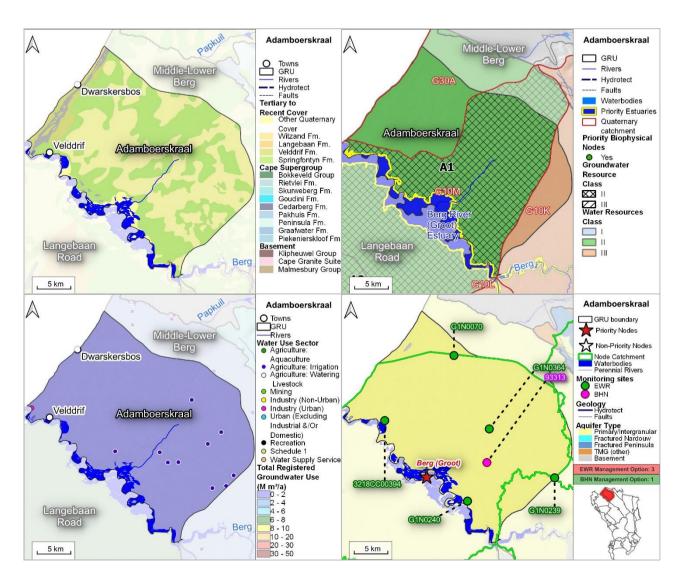
	GRU Name: Ad	damboerskraal										
GRU	Main Towns: V											
5.13												
Groundwater Reserve	The groundwat and 2) the Gro Aquifer Unit Primary / Intergranular Aquifer Groundwater C	Parameter Sulphate Electrical conductivit pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium Potassium Chloride Quantity Component ter quantity component	Unit mg/I y mS/m mg/I mg/I mg/I mg/I mg/I mg/I mg/I m	No. BHs	No. Samples	Baseline Conc. 52.20 499.10 7.00 0.19 0.10 0.31 0.24 42.00 73.80 874.90 11.28 1540.00	Min Conc. 52.2 499.1 6.5 0.18 0.02 0.3 0.036 42 73.8 874.9 9.34 1540	Max Conc. 164 823.2 7 0.62 0.1 0.5 0.243 67.4 145.1 1374.9 11.28 2513.3	Median Conc. 143.3 752 6.6 0.19 0.02 0.31 0.051 58 140.7 1367.8 10.95 2442.1	95 th Percentile Conc. 161.93 816.08 6.96 0.57 0.092 0.48 0.224 66.46 144.66 1374.19 11.23 2506.18	Groundwater Quality Reserve 161.93 816.08 7.00 0.57 0.1 0.48 0.24 66.46 144.66 1374.19 11.28 2506.18	Groundwat Quality BH Reserve
	Recharge ((Mm³/a) EWR	Reserve (Mm³/a) 6.00	BHN Reser	,	GW Reserve (l	Mm³/a)	Total Allocable Volu (Mm³/a) 15.60	me W	ater Use (Mm³/a) 2.13		able (Mm³/a 3.47
Future Scenario 2050 (Scenario 7b)	factors directly in recharge fro	, which projects condinfluenced the parar m 21.61 to 20.83 M implementation of g	neters used to de m³/a, influenced	etermine the G by both climate	roundwater Res change and th	serve, specifica e elimination o	ally the ground of IAPs. Additi anditions, the	dwater contributionally, groundwa	on to the BHN ater use incre ory did not ch	I and EWR. The ased from 2.13 t	scenario involvo 3.69 M m ³ /a	red a decre due to sect



GRU	GRU Name: Adamboerskraal Main Towns: Velddrif Total Area (km²): 612.30 The Adamboerskraal GRU was assigned a Management Option 3 for monitoring the groundwater contribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the BHN. A total of 5 monitoring sites for the EWR and 1 for the BHN were selected strategically within the Adamboerskraal GRU (see Figure 3-6 and the table below). Site Name Data Source Monitoring Monitoring Area Objective Latitude Longitude Monitoring Description										
					E	WR Management	Option 3				
	G1N0070	HYDSTRA	Berg (Groot)	EWR	-32.70555556	18.32083333	Frequency: Monthly or Quarterly 2) Groundwater level:				
	G1N0364	HYDSTRA	Berg (Groot)	EWR	-32.80504	18.374	 Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems. Groundwater Quality: 				
	G1N0239	HYDSTRA	Berg (Groot)	EWR	-32.87268	18.476	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹: 				
Monitoring Programme	G1N0240	HYDSTRA	Berg (Groot)	EWR	-32.901	18.33653	Bxi1 (Berg Groot Estuary): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorgani				
	3218CC00394	NGA	Berg (Groot)	EWR	-32.79027	18.20829	Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); Syster Variables (Temperature, pH, Dissolved Oxygen, Secchi Depth).				
		ı				BHN Management					
	93313	WMS	GRU & Berg (Groot)	вни	-32.85	18.368889	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level:				



¹⁹ Contributing catchments to the river or estuary node may extend across multiple GRUs (see DWS, 2023a), however they are still included as important RQO sites to monitor.



A series of maps for the Adamboerskraal GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2. Fractured Table Mountain Group GRUs

3.2.1. Cape Peninsula GRU

	GRU Name: Cape Pe	ninsula							
GRU	GRU Main Towns: Hout Bay, Kommetjie and Fish Hoek								
	Total Area (km²): 292								
GRU Boundary Description	The Cape Peninsula Malmesbury Group ur by the Atlantic coastlir wetlands and streams	GRU is defined by the extenderlies the City Bowl and Define, while the eastern boundal around the Fish Hoek and N	vils Peak, incorporating scree ry is marked by the False Bay	e aprons on the n coastline. In the Although deep g	nountain slopes, particularly Fish Hoek Valley, Cenozoi roundwater flows are not e	he CGS throughout the Cape y around the Table Mountain a c sands are present, contributi xpected to be significant, some	rea. The westerr ing to high-water	extent is bordere tables that suppo	
Quaternary Catchments	G22A, G22B, G22C a	nd G22D (Figure 3-7)							
Resource Unit			Fracti	ured Table Moun	tain Group Aquifer				
Description	composed of the CGS descending from approach the Peninsula Fm ex	 Under the City Bowl and De oximately 400 meters in the hibits varying thickness, range 	evils Peak, the basement is connorth around the city to below	onstituted by the v sea level south	Malmesbury Group. An und of Fish Hoek (see Figure	ssula Fm. The basement rock conformity/nonconformity, gent 3-7 and DWS, 2022d and 202 ne Table Mountain National Pa	tly dipping to the 23a).	south, is observe	
Surface Water System						located at the centre of the 07 and DWS, 2022d and 2023a		7). Additionally, tl	
Water Resource Classes & RQOs	G22C) is assigned a	Groundwater Resource Clas	s of II, while no Groundwater priority biophysical nodes – 1 Quaternary Catchment	Resource Class estuary node (V	is designated for the portion Wildevöelvlei) with a TEC on Resource Name	The segment of the GRU with ons within IUA E11 (catchmen of C and 2 river nodes (see Fig Biophysical Node	ts G22A and G2: jure 3-7 TEC in t	2B). This IUA doe able below).	
	G22C) is assigned a contain any EWR	Groundwater Resource Classites; however, it includes 3 Water Resource Class	s of II, while no Groundwater priority biophysical nodes – 1 Quaternary Catchment G22B	Resource Class estuary node (V	is designated for the portion wildevöelvlei) with a TEC of Resource Name Hout Bay	ons within IUA E11 (catchmen f C and 2 river nodes (see Fig Biophysical Node Bviii6	ts G22A and G2: jure 3-7 TEC in t	2B). This IUA do able below). nMAR 97	
	G22C) is assigned a onot contain any EWR	Groundwater Resource Classites; however, it includes 3	s of II, while no Groundwater priority biophysical nodes – 1 Quaternary Catchment	Resource Class estuary node (V	is designated for the portion Wildevöelvlei) with a TEC on Resource Name	ons within IUA E11 (catchmen f C and 2 river nodes (see Fig Biophysical Node	ts G22A and G2: jure 3-7 TEC in t	2B). This IUA do able below).	



GRU	GRU Name: Cape Peninsula Main Towns: Hout Bay, Kommetjie and Fish Ho Total Area (km²): 292.53	pek					
Recharge	Recharge in the GRU primarily comes from rain higher than in the surrounding areas, its thickn seeps that feed mountain streams and wetland cascading off the steep cliffs. Various springs of Newlands areas combined (Figure 3-7 ;GEOSS An estimated recharge of 10.99 M m³/a was defor the Aquifer Stress assessments. The average below and DWS (2022e) for further details.	ess results in low aquifer storage, often causing ls. Scree aprons, found on the slopes of the Permanating from the scree aquifers, ultimately (3, 2015). Determined from first-order recharge calculations	ng recharge to be discharged as eninsula-formed mountain, espec dependent on the Peninsula Aqu s using the Map-Centric Simulati	springs in a short time frame cially around Table Mountain ifer, cumulatively discharge of on method and was chosen	e. Some of these are permanent itself, are recharged by streams over 100 l/s to the City Bowl and as the estimated recharge value		
	Method	Area (km²)	Recharge Volume	Av	verage Recharge Rate		
	Map Centric Simulation Method	292.53	(M m ³ /a) 10.99		(mm/a) 37.57		
	Map Centric Simulation Method	292.55	10.99		37.37		
			\M-4	NI= -f.I	T-4-1 \/-1: (84 : 3/-)		
			Water Use Sector	No. of Users Fractured TMG Aquifer (Nardouv	Total Volume (M m³/a)		
			Agriculture: Aquaculture	Fractured TMG Aquifer (Nardouv	0.01		
	In this GRU, there are 8 registered groundwat	er users collectively utilizing 0.73 M m ³ /a of		Fractured TMG Aquifer (Peninsula			
	groundwater. The predominant sectors in groundwater.	indwater use are Agriculture (Irrigation) and	Agriculture: Irrigation	1	0.02		
Groundwater Use	Agriculture (Livestock Watering), accounting		Agriculture: Watering Livestock	<u></u>	0.02		
Groundwater Use			Industry (Urban)	1	0.01		
	groundwater use volume (Figure 3-7 and the ta	tble on the right).	industry (Orban)	Primary / Intergranular Aquifer	0.01		
			Agriculture: Irrigation 2 0.02				
			Industry (Urban) Total	<u>2</u> 8	0.0003 0.073		
			Iolai	8	0.073		
Water Quality	Kery Cape Pen 100.10 1 - Ca-HCO3 Type 2 - Na-Ct Upto 3 - Can-Na-HCO3 Type 4 - Ca-HO9 Ct Vyos 5 - Ca-God Cype 6 - Na-HCO3 Type 6 - Na-HCO3 Type 7 - Cape Pen 100.10 100.10 100.0 80 20 40 40 40 66 40 66 40 66 40 66		result from the deposition of maca-Mg-Cl type waters arise fro and Mg ²⁺ ions in the lithology. Approximately 50% of the sampent in the lithology in the sampent in the lithology.	arine aerosols and recharge to make cation exchange between solles collected exceeded basel anized areas being potential ry is B, indicating that preduncerns arise from natural factors.	in-Cl and Ca-Mg-Cl. Na-Cl waters through coastal rainfall, whereas een Na-Cl type waters and Ca ² + tines for sulphate, EC, and nitrate sources of contamination. The ominantly natural water quality tors such as acidic pH, elevated and 2023a for detail).		



GRU	GRU Name: Cape Peninsula Main Towns: Hout Bay, Kommetjie and Fish Hoek Total Area (km²): 292.53												
Aquifer Stress	The GRU is considered to have a Groundwater Availability Present Status Category of 'A', indicating an unmodified, pristine conditions aquifer, and a Groundwater Quality Present Stategory of 'B' indicating localised, low levels of contamination, but no negative impacts apparent (see table below).												
	Recharge Volume Gr			dwater Use		Stress Inde	X				roundwater Availability Present		
	(M m ³ / 10.99	9		(M m³/a) 0.073		0.01		Status Category A			Status Category B		
	Groundwater Quality The groundwater quand 2) the Groundwater Aquifer Unit	ality component of th			ble below and	described in S Baseline Conc.	ection 2.3 & 2. Min Conc.	4, is determined Max Conc.	as two comp Median Conc.	95 th Percentile	roundwater Qu Groundwater Quality Reserve	Groundwa Quality BI Reserve	
Groundwater Reserve											Reserve	Reserv	
oundwater Reserve	Fractured Table Mountain Group Aquifer (Peninsula)	Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium Potassium Chloride	mg/l mS/m mg/l mg/l mg/l mg/l mg/l mg/l mg/l m	12	11	12.20 25.80 6.96 0.02 0.07 0.26 1.02 3.60 3.50 31.30 1.79 54.70	12.20 25.80 6.54 0.02 0.02 0.05 0.01 3.60 3.50 31.30 0.83 54.70	107.40 119.00 7.57 2.51 10.89 0.33 1.08 109.60 31.40 115.40 46.71 207.10	72.20 89.80 7.10 0.02 0.32 0.15 0.02 30.70 16.70 89.10 5.95 147.20	99.60 107.80 7.54 1.74 10.55 0.30 1.05 100.40 28.30 114.30 36.78 198.45	99.60 107.80 7.54 1.74 10.55 0.30 1.05 100.40 28.30 114.30 36.78 198.45	Reserv	
oundwater Reserve	Fractured Table Mountain Group Aquifer	Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium Potassium Chloride ity Component lantity component of Reserves.	mS/m mg/l mg/l mg/l mg/l mg/l mg/l mg/l m		table below an	25.80 6.96 0.02 0.07 0.26 1.02 3.60 3.50 31.30 1.79 54.70	25.80 6.54 0.02 0.02 0.05 0.01 3.60 3.50 31.30 0.83 54.70	119.00 7.57 2.51 10.89 0.33 1.08 109.60 31.40 115.40 46.71 207.10	89.80 7.10 0.02 0.32 0.15 0.02 30.70 16.70 89.10 5.95 147.20 d by consider	107.80 7.54 1.74 10.55 0.30 1.05 100.40 28.30 114.30 36.78 198.45	99.60 107.80 7.54 1.74 10.55 0.30 1.05 100.40 28.30 36.78 198.45		



GRU	GRU Name: Cap Main Towns: Hou Total Area (km²):	ut Bay, Komme	tjie and Fish Hoek	(
Future Scenario 2050 (Scenario 7b)	factors directly influenced the recharge from 10.99 to 9.19 and the implementation of gi		arameters used to n³/a, influenced by ndwater developm	determine the or both climate cleent schemes in Allocation Cate	Groundwater Res hange and the eli the area. Further	serve, specifically imination of IAPs rmore, the groun	se' for the GRU, the analysis focused on two key factors: Recharge and Water Use. These by the groundwater contribution to the BHN and EWR. The scenario involved a decrease in s. Additionally, groundwater use increased from 0.07 to 0.15 M m³/a due to sectoral growth adwater contribution to the BHN Reserve rose from 0.09 to 0.16 M m³/a, primarily attributed by D (refer to Section 2.5 and the table below). Mm³/a			
			of 4 monitoring sit	es for the EWR			ter contribution to the EWR and a Management Option 2 for monitoring the groundwater cally selected within the Cape Peninsula GRU (see Figure 3-7 and the table below).			
	Site Name Data Source		Monitoring Area	Monitoring Objective			Monitoring Description			
						EWR Management				
Monitoring Programme	3418AB00024	NGA	Wildevöelvlei	EWR	-34.14185	18.34929	Frequency: Monthly or Quarterly 1) Groundwater level: o Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems.			
	G2N0048	HYDSTRA	Bviii6	EWR	-34.0008	18.379366	2) Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄ Site specific additions for EWR: NO ₂ , NO ₃ , NH ₄ Site specific additions as per RQO ¹⁹ :			
	Proposed BH		GRU	EWR	-34.10991286	18.40487755	Bxi14 (Wildevöelvlei): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen).			
	96073	WMS	GRU	EWR	-34.222778	18.410833	Bviii6: Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen).			
						BHN Management				
	96069	WMS	GRU	BHN	-34.132222	18.380833	Frequency: Quarterly 1) Groundwater level:			



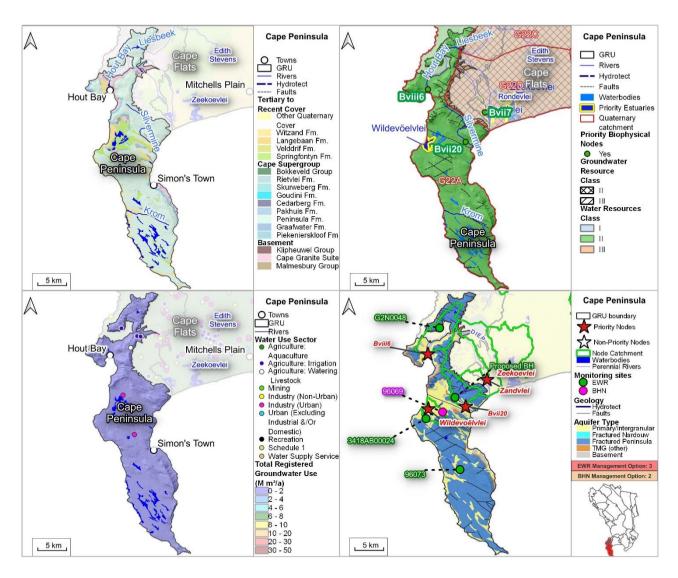


Figure 3-7 A series of maps for the Cape Peninsula GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.2. Steenbras-Nuweberg GRU

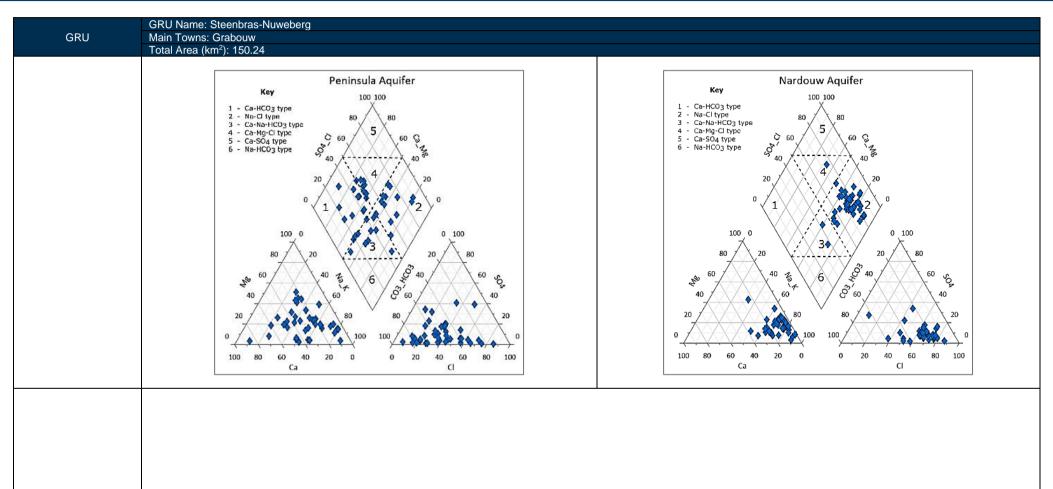
3.2.2. 3166	and as-naweberg GRO
GRU	GRU Name: Steenbras-Nuweberg Main Towns: Grabouw
	Total Area (km²): 150.24
GRU Boundary Description	The aquifer model boundary outlined by CoCT (2021) defines the extent of the Steenbras-Nuweberg GRU. The boundaries of the GRU include the TMG outcrop in the Steenbras and Theewaterskloof areas. The northern recharge area is demarcated by the La Motte Fault (DWAF, 2008a; CoCT, 2004), while the eastern margin is defined by the Kogelberg and Stettyns anticlines, encompassing sections of the G40A surface water catchment boundary. To the north, the GRU's extent is determined by interpolated basement lithologies, specifically the Malmesbury Group and the CGS Suite outcrop, extending to the False Bay coastline in the west. (refer to Figure 3-8 and DWS, 2022d and 2023a).
Quaternary Catchments	G40C, G40A, G40D, G22J, G22K, H60A and G40B (Figure 3-8)
Resource Unit	Fractured Table Mountain Group Aquifer
Description	The TMG Super aquifer in this region comprises the larger Peninsula Aquifer, ranging in apparent thickness from approximately 600 to 700 meters, and the smaller Nardouw Aquifer, which includes its sub-aquifers with an estimated thickness ranging from approximately 700 to 800 meters (Figure 3-8). The TMG has undergone folding, forming a syncline that exposes the Peninsula Fm in the limbs and along the steep mountainsides in the valley. On the elevated synclinal/anticlinal limbs in the mountainous regions near the dam area, the Peninsula, Pakhuis, Cedarberg, and Goudini Fms are visible (refer to DWS, 2022d and 2023a). Within the syncline valley, the Nardouw sub-group is exposed as the Goudini, Skuwerberg, and Rietvlei Fms, with the Nardouw Aquifer formed by the Skuwerberg and Rietvlei Fms (see Figure 3-8 and the cross section below). The confining unit separating the Peninsula Aquifer from the overlying Nardouw Aquifer is characterized by a conformable package of three aquitard units: Goudini, Cedarberg, and Pakhuis. Collectively, these aquitated units are referred to as the Winterboek Mega-aquitard. Hydrogeologically, the entire Pakhuis-Goudini Sequence effectively functions as an aquitard. despite the Goudini Fm being considered part of the Nardouw Subgroup (refer to DWS, 2022d and 2023a). Within this aquifer system, the Peninsula Aquifer and the Skurweberg Sub-aquifer are identified as the primary deep aquifer targets (refer to DWS, 2022d and 2023a).



GRU	GRU Name: Steenbras-Nuweberg Main Towns: Grabouw							
	Total Area (km²): 150.24							
Surface Water System	The surface water bodies within this GRU er (see Figure 3-8). Surface water runoff aligns within this GRU er (see Figure 3-8).	ncompass the Steenbras Dam, ir ith the topography, coursing from i	ntegral to the north-east to	WCWSS, and the Eikenhof south-west, primarily via the S	and Nuweberg D teenbras River (re	Dams, in conjunct fer to DWS, 2022	tion with t	he Palmiet River 3a).
Water Resource Classes & RQOs	Only a portion of the GRU is located within the segments of the GRU within the D7 IUA (catchr however, it does host 1 priority biophysical site	nents G40A and G22K) have a Wa	ater Resource	Class of II and no Groundwat	ter Resource Class	pands outside of t s. This GRU does	the Berg \s not includ	WMA (2004). The le any EWR sites
Oldooco d Maco	IUA Water Resource Class	Quaternary Catchment	RU	Resource Name	Biophysical No	ode T	EC	nMAR
	D7 Sir Lowry's II	G40A	D7-R20	Steenbras	Bvii22		3/C	23
Recharge	Stress assessments. The average recharge rat DWS (2022e) for further details. Method	e is 391.11 mm/a based on the to	otal GRU area	a. Additional recharge estimati Recharge Volume (M m³/a)			e Recharge (mm/a)	
	After (CoCT, 2022) hydrogeological technical assessment for IWULA						391.11	
Groundwater Use	In this GRU, Water Supply Services stand as total annual groundwater use of 8 M m³/a. How the Peninsula Aquifer and 6.5 M m³/a in the Na	ever, this usage is divided into 1.5	Water Use Sector Water Supply Service Water Supply Service Total	No. of U Fractured TMG Aq 0.5 Fractured TMG Aq 0.5 1	uifer (Peninsula) 5 quifer (Nardouw)	Total Vol	ume (M m³/a) 1.5 6.5 8	
Water Quality	The primary water types in the Peninsula Aquife CI waters are a result of the deposition of m rainfall. Ca-HCO3 type waters arise from the di HCO3 type waters are due to ion exchange be in the lithology. Exceedances of baseline concentrations were arsenic, chromium, lead, and mercury, with 50% and EC. The adjusted water quality category is quality conditions prevail. However, there are acidic pH, elevated iron, and manganese in the for detail).	arine aerosols and recharge throssolution of carbonate minerals, vitween Ca+ ions from Ca-HCO3 a observed for all parameters excell of samples exceeding baselines B, indicating that predominantly roncerns related to natural facto	ough coastal while Ca-Na- nd Na+ ions opt dissolved for sulphate natural water rs, including	The primary water types in t HCO ₃ and Ca-Mg-Cl types. and recharge through coasts are lower than in the Penins of humic compounds from acid) in recharge water, and Aquifer) to buffer acidic water Exceedances of baseline coorthophosphate, dissolved on B, indicating that predominate persist regarding natural far water (refer to DWS 2022d,	The Na-Cl waters all rainfall. Compara sula Aquifer. The roverlying plants, the limited preservers. Inconcentrations were chromium, and mently natural water octors such as acid	result from the deatively, the EC and more acidic pH is he dissolution of name of basic ions de observed for all ercury. The adjusting pH, elevated in pH, elevated in the street of the	eposition of d pH in the attributed CO ₂ (whice (compared parameter ed water of prevail. H	f marine aerosols Nardouw Aquife to the dissolutior forms carbonid to the Peninsula se except fluoride quality category is owever, concerns

²⁰ Rainfall recharge value is from the first order GRAII Spatial Distribution (modified after CoCT, 2022).





Aquifer Stress

The GRU is considered to have a Groundwater Availability Present Status Category of 'B, indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Status Category of 'B' indicating localised, low levels of contamination, but no negative impacts apparent (see table below).

	Recharge Volume (M m³/a)	Groundwater Use (M m³/a)	Stress Index	Groundwater Availability Present Status Category	Groundwater Quality Present Status Category
l	58.76	8	0.14	В	В



GRU	GRU Name: Stee Main Towns: Gra Total Area (km²):											
		ality Component r quality component of the adwater Quality BHN Re			able below and	described in S	ection 2.3 & 2.	4, is determined	d as two comp	ponents 1) the G	iroundwater Qu	uality Reserve,
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwater Quality BHN Reserve
		Sulphate	mg/l		53	1.49	0.20	61.00	4.20	21.92	21.92	
		Electrical conductivity	mS/m		58	14.00	2.47	38.00	13.00	28.50	28.50	
		pН			54	7.18	4.87	9.35	6.80	8.88	8.88	
		Ammonia	mg/l		58	0.12	0.00	12.00	0.10	1.37	1.37	
	Fractured	Nitrate + nitrite	mg/l		38	1.05	0.00	1.20	0.10	0.20	1.05	
	Table Mountain	Fluoride	mg/l	16	54	0.28	0.10	0.76	0.50	0.55	0.55	
	Group Aquifer	Orthophosphate	mg/l	10	27	0.32	0.00	0.97	0.10	0.47	0.47	
	(Peninsula)	Calcium	mg/l		4	2.78	0.50	50.10	5.20	25.20	25.20	
		Magnesium	mg/l		38	1.83	0.20	7.60	1.30	7.03	7.03	
I		Sodium	mg/l		27	6.60	3.70	79.20	8.15	24.50	24.50	
		Potassium	mg/l		34	0.64	0.20	15.30	2.50	11.96	11.96	
		Chloride	mg/l		27	18.01	1.40	31.00	13.25	18.06	18.06	
Groundwater Reserve	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwater Quality BHN Reserve
		Sulphate	mg/l		54	6.50	0.40	17.70	3.35	8.34	8.34	
		Electrical conductivity	mS/m	1	38	10.00	2.00	24.20	9.00	19.40	19.40	
		pH	2,	1	27	5.91	4.63	8.61	5.57	7.13	7.13	
		Ammonia	mg/l	1	56	2.88	0.01	12.22	0.10	1.71	2.88	
	Fractured	Nitrate + nitrite	mg/l	1	61	0.20	0.00	3.66	0.20	1.07	1.07	
			7	1			1			1	1	

54

56

38

27

38

27

34

Groundwater Quantity Component

Table Mountain

Group Aquifer

(Nardouw)

The groundwater quantity component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is calculated by considering the total groundwater contribution to both the EWR and BHN Reserves.

0.50

0.20

5.10

5.35

11.13

1.00

19.95

0.05

0.00

0.32

0.20

2.10

0.09

1.00

0.50

0.20

7.41

6.60

21.90

14.10

37.80

0.10

0.10

1.00

1.10

9.30

0.93

17.00

0.50

0.20

4.47

1.74

16.86

7.18

30.60

Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
58.76 ²¹	1.16	0.02	1.18	57.58	8.00 ²²	49.58

²¹ Rainfall recharge value is from the first order GRAII Spatial Distribution (modified after CoCT, 2022).

Fluoride

Orthophosphate

Calcium

Magnesium

Sodium

Potassium

Chloride

mg/l

mg/l

mg/l

ma/l

mg/l

mg/l

mg/l

16



0.50

0.20

5.10

5.35

16.88

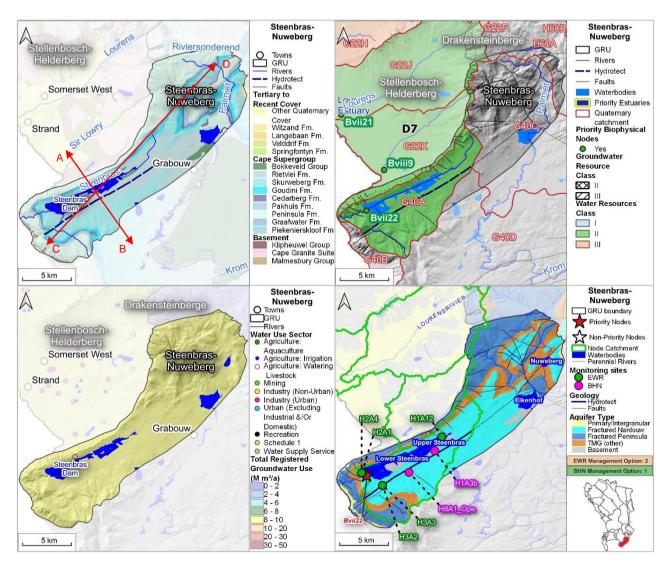
7.18

30.60

²² Includes city municipal abstraction of 8 Mm³/a in development (phase 1) as per NWA Section 21(a).

GRU	GRU Name: Ste Main Towns: Gr Total Area (km²)	abouw	veberg				
Future Scenario 2050 (Scenario 7b)	factors directly in recharge from 5	nfluenced the 8.76 to 57.9	ie parameters used to 97 M m³/a, influence	o determine tl d by both clin	ne Groundwater F nate change and	Reserve, specificathe elimination of	e' for the GRU, the analysis focused on two key factors: Recharge and Water Use. The ally the groundwater contribution to the BHN and EWR. The scenario involved a decrease IAPs. Additionally, groundwater use increased from 8.00 to 24.52 M m³/a due to secto see changes, the Allocation Category shifted from B to C (refer to Section 2.5 and the talk
,	Recharge (M	/lm³/a)	EWR Reserve (Mm³/	a) BHN	Reserve (Mm³/a)	GW Reserve	(Mm³/a) Total Allocable Volume (Mm³/a) Water Use (Mm³/a) Still Allocable (Mm³/a)
	57.97		1.16		0.02	1.18	56.79 24.52 32.26
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude EWR Manageme	
		Data	1	Monitoring			gically selected within the Steenbras-Nuweberg GRU (see Figure 3-8 and the table below Monitoring Description
		1	T	EWR	1	EWR Manageme	nt Option 2 Frequency: Quarterly
	H1A12	CoCT	Bvii22 & GRU	(Nardouw Aquifer)	-34.15341755	18.93619208	Groundwater level
	H2A1	CoCT	Bvii22 & GRU	EWR (Nardouw Aquifer)	-34.18480149	18.84681274	 Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. Groundwater Quality:
	H2A4	CoCT	Bvii22 & GRU	EWR (Peninsula Aquifer)	-34.18503396	18.84628454	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹:
Monitoring Programme	H3A2	CoCT	Bvii22 & GRU	EWR (Peninsula Aquifer)	-34.19704511	18.86919689	Bvii22 Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical
	НЗАЗ	CoCT	Bvii22 & GRU	EWR (Nardouw Aquifer)	-34.19697736	18.86914539	Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature pH, Dissolved Oxygen); Toxins (Iron, Manganese).
						BHN Manageme	
	H1A3b	CoCT	Bvii22 & GRU	BHN (Nardouw Aguifer)	-34.16604336	18.92808478	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level:
				, iquii 01)			o Manual groundwater level measurements





A series of maps for the Steenbras-Nuweberg GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.3. Drakensteinberge GRU

	GRU Name: Drakensteinberge									
GRU	Main Towns: None									
GRU										
	Total Area (km²): 164.95									
GRU Boundary Description	The Drakensteinberge GRU is delimited by the TMG outcrop, primarily consisting of the Peninsula Fm. Portions of the Skurweberg, Goudini, Cedarberg, and Pakhuis Fm, along with the Lourens River in the southwest, contribute to the southern and southwestern boundaries of the GRU. The southern extent is specifically marked by the La Motte Fault, as indicated by the DWAF (2008a) and CoCT (2004) reports. Refer to Figure 3-9 and DWS, 2022d and 2023a).									
Quaternary Catchments	G10A, G10C, G22F, G22J, H60A and H60B (Fig	ure 3-9)								
Resource Unit	Fractured Table Mountain Group Aquifer									
Description	The TMG Super aquifer in this area is composed Aquifer, which includes its component sub-aquife Sub-aquifer are recognized as the primary deep a In the southeastern part of this GRU, the Goudin situated as the western limb of a syncline. The Nathickness of the Nardouw Aquifer can vary between	rs, measuring approximately aquifer targets (refer to DWS, ii, Skuwerberg, and minor se ardouw Aquifer in this region	150 to 300 meter 2022d and 2023a ections of the Riet is predominantly	rs in thickness. Within this s a). Vlei Fm, belonging to the Namade up of the Skuwerberg	uper aquifer system, the Fardouw Sub-group, are pr	Peninsula Aquifer a resent. This geologi	nd the Skurweberg cal configuration is			
Surface Water System	Tributaries of the Berg River, specifically the Wolwekloof and Dwars rivers, have their origins in this GRU and constitute the primary surface water systems within this region. Additionally, the Berg River Dam, situated just east of the GRU, serves as the eastern boundary of the GRU (refer to (see Figure 3-9 and DWS, 2022d and 2023a).									
Water Resource Classes & RQOs	Only a portion of the GRU is located within the Ee area, specifically the former Berg WMA (2004). T The part of the GRU within the D6 IUA (catchment Class of II. The GRU includes 1 priority biophysic	he segments of the GRU with t G22F) is assigned a Ground al site with a TEC of A (see F Quaternary Catchment	nin the D6 and D8 water Resource Ciigure 3-9 and the	IUAs (catchments G10A an class of III, and the portion witable below). Resource Name	d G22F) have a Water Re thin the D8 IUA (catchment Biophysical Node	esource Class of III ant G10A) has a Gro	and II, respectively. undwater Resource			
	D8 Upper Bergs II	G10A	D8-R01	Berg	Bvii13	A	98			
Recharge	An estimated recharge of 27.6 M m³/a was deterr the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method	nined from first-order recharg charge rate is 167.32 mm/a b Area (km²) 164.95	ge calculations usi pased on the total	ng the Map-Centric Simulati GRU area. Additional recha Recharge Volume (M m³/a) 27.6	arge estimations are availa	en as the estimated able in the literature Average Recharg (mm/a) 167.32	. Refer to the table			



	GRU Name: Drakensteinbe	erge								
GRU	Main Towns: None									
	Total Area (km²): 164.95									
Groundwater Use	In this GRU, there are 2 Livestock) sector, collective right).	registered groundwater us ely utilizing 0.05 M m³/a (sers within the Agricultural see Figure 3-9 and the tal	(Watering ble on the	tering on the Water Use Sector No. of Users Fractured TMG Add Agriculture: Watering Livestock 2 Total 2			er	Total Volume (M m³/a) 0.05 0.05	
Water Quality			<u>N</u>	o water qua	ity data availal	<u>ble</u>				
Aquifer Stress	The GRU is considered to have a Groundwater Availability Present Status Category of 'A', indicating an unstressed or slightly stressed aquifer, and the Groundwater Qualicategory cannot be determined due to limited data availability (see table below).								•	
	Recharge Volume (M m³/a)		ndwater Use (M m³/a)	Stres	s Index		er Availability Present atus Category	*		
	27.6		0.05	(.00	Sic	A		-	
Groundwater Reserve	The groundwater quantity of the EWR and BHN Reserved Recharge (Mm³/a) 27.6		BHN Reserve (Mm³/a) 0.00	GW Rese	rve (Mm³/a)	2.3 & 2.4, is calcula Total Allocable Vo (Mm³/a) 24.72		(Mm³/a)	Still Allocable (Mm³/a) 24.67	
Future Scenario 2050 (Scenario 7b)	In Scenario 7b, which projectors directly influenced to recharge from 27.86 to 26.8 and the implementation of to population growth. Under Recharge (Mm³/a) 26.86	the parameters used to det 86 M m³/a, influenced by bo groundwater development	termine the Groundwater Re oth climate change and the schemes in the area. Furthe	eserve, spece elimination of ermore, the hange from	ifically the grou f IAPs. Additio groundwater co	undwater contributionally, groundwater upontribution to the BH	on to the BHN and EW use increased from 0.0 IN Reserve rose from (and the table below).	R. The scer 5 to 1.21 M 0.00 to 0.01 (Mm³/a)	nario involved a decrease ir m³/a due to sectoral growth	



GRU	GRU Name: Dra Main Towns: No Total Area (km²)	ne					
Monitoring Programme					and 1 for the BH		ter contribution to the EWR and a Management Option 1 for monitoring the groundwater cally selected within the Drakensteinberge GRU (see Figure 3-9 and the table below). Monitoring Description
		ı		l .		BHN Management	
	G1N0499 HYDSTRA Bviii1 BHN	BHN	BHN -33.9371		Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level:		
				I.		l	,



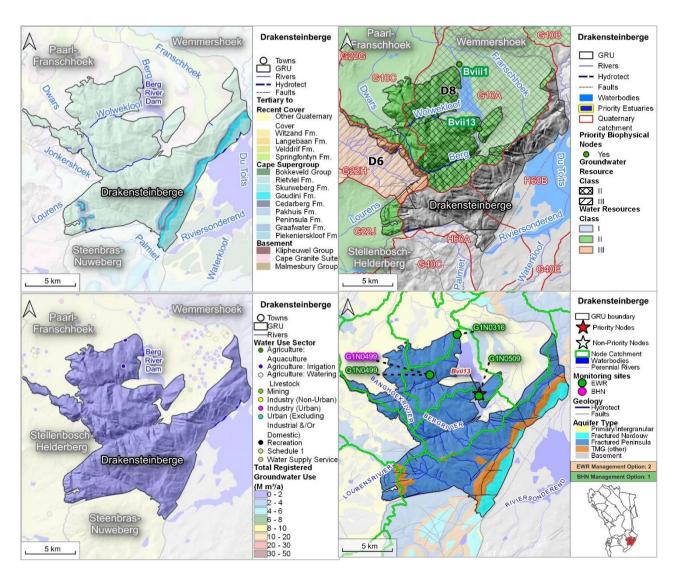


Figure 3-9 A series of maps for the Drakensteinberge GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.4. Wemmershoek GRU

	GRU Name: Wemmershoek									
GRU	Main Towns: None									
	Total Area (km²): 229.13									
GRU Boundary Description	along the Stettyns anticline to the east. To the	The Wemmershoek GRU is defined by the extent of the TMG and its contact with the basement lithologies, specifically the CGS and the Malmesbury Group, in the Franschhoek valley and along the Stettyns anticline to the east. To the north, the GRU is bounded by the Du Toits/Wellington fault, as indicated in the DWAF (2008a) report. The southern boundary is marked by the La Motte fault and the basement aquitard (refer to Figure 3-10 and DWS, 2022d and 2023a).								
Quaternary Catchments	G10B, G10A, G10C, H10J, H60B and H10K (Fi	igure 3-10)								
Resource Unit		Fractured Table Mountain Group Aquifer								
Description	functions as an unconfined aquifer, transitioning metasediments. The contact between the Pen Cenozoic sediments extensively fill the valley, or In the surrounding Wemmershoek valley, the evident in the south-western section of the GRU	g to a confined aquifer at greater depths. The Finsula Fm and the underlying basement is visoverlaying the basement geology (refer to Figu Goudini, Skuwerberg, and Rietvlei Formations J, extending into portions of the north-east. The almesbury Group and the CGS are exposed, along the confidence of	reninsula Fm overlays the Malmesbury Group lible at the base of the mountain slopes and re 3-10 and DWS, 2022d and 2023a). In part of the Nardouw Sub-group, outcrop proepthickness of these formations ranges from appropriate that fill the properties of the second statements of the second	0 to 1000 meters within the TMG. This formation and CGS basement, composed of granites and is exposed in the valley. Additionally, younger minently. This geological feature is particularly proximately 150 to 300 meters. the valleys. This geological setting contributes to						
Surface Water System	Wemmershoek Dam, a component of the WCWSS, is situated within this GRU. This GRU features several rivers, including the Hugos, Elands, Holsloot, and Du Toits rivers. Moreover, the Drakenstein and Olifants rivers contribute to the flow into the Wemmershoek Dam (refer to Figure 3-10 and DWS, 2022d and 2023a).									
Water Resource Classes & RQOs	Only a portion of the GRU is located within the Upper Berg (D8) IUA, while the remaining part extends beyond the D8 IUA, as the GRU expands outside of the Berg WMA (2004). The segments of the RU within the D8 IUA (catchments G10A and G10B) have a Water Resource Class of II and a Groundwater Resource Class of II. The GRU does not include any EWR sites nor any priority biophysical nodes (Figure 3-10).									
Recharge	An estimated recharge of 26.83 M m³/a was defor the Aquifer Stress assessments. The average below and DWS (2022e) for further details. Method Map Centric Simulation Method	etermined from first-order recharge calculations te recharge rate is 117.10 mm/a based on the to Area (km²) 229.13	s using the Map-Centric Simulation method an otal GRU area. Additional recharge estimations Recharge Volume (M m³/a) 26.83	Average Recharge Rate (mm/a) 117.10						



In the 0.73 and A groundwater Use Groundwater Use In the 0.09 (Irrigation of the context)	Towns: None al Area (km²): 229.13 The Peninsula Aquifer RU, there are 11 registered groundwater users collectively utilizing the Peninsula Aquifer RU, there are 11 registered groundwater use are Agriculture (Irrigation). Agriculture (Aquaculture), contributing 58.9% and 41.1%, respectively, to the total annual undwater use volume. The Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing to M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). The Nardouw Aquifer RU, there are 4 registered groundwater use volume (see Figure 3-10 the table on the right).	Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na+ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	dissolution of carbonate min ange between Na-Cl type wa oncentrations were observed and mercury. The adjusted wa water quality conditions pr	0.43 douw) 0.01 0.08
In the 0.73 and A groundwater Use In the 0.09 (Irrigal and the first term)	ne Peninsula Aquifer RU, there are 11 registered groundwater users collectively utilizing 8 M m³/a of groundwater. The main sectors for groundwater use are Agriculture (Irrigation) Agriculture (Aquaculture), contributing 58.9% and 41.1%, respectively, to the total annual undwater use volume. The Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing 9 M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). **Wemmershoek** 1	Agriculture: Irrigation Agriculture: Irrigation Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na ⁺ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	Fractured TMG Aquifer (Penin 10 Fractured TMG Aquifer (Nardo 2 2 Primary / Intergranular Aquif 15 15 15 15 15 15 15 15 15 15 15 15 15	nsula) 0.43 douw) 0.01 0.08 ifers 0.30 0.82 c Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions in the corevail. However, concerns personal concerns personal double of the con
Groundwater Use 0.73 and A groundwater Use In the 0.09 (Irrigated and the following states and the following states are	8 M m³/a of groundwater. The main sectors for groundwater use are Agriculture (Irrigation) Agriculture (Aquaculture), contributing 58.9% and 41.1%, respectively, to the total annual undwater use volume. The Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing of M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). **Wemmershoek**	Agriculture: Irrigation Agriculture: Irrigation Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na ⁺ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	Fractured TMG Aquifer (Penin 10 Fractured TMG Aquifer (Nardo 2 2 Primary / Intergranular Aquif 15 15 15 15 15 15 15 15 15 15 15 15 15	nsula) 0.43 douw) 0.01 0.08 ifers 0.30 0.82 c Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions in the corevail. However, concerns personal concerns personal double of the con
Groundwater Use 0.73 and A groundwater Use In the 0.09 (Irrigated and the following states and the following states are	8 M m³/a of groundwater. The main sectors for groundwater use are Agriculture (Irrigation) Agriculture (Aquaculture), contributing 58.9% and 41.1%, respectively, to the total annual undwater use volume. The Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing of M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). **Wemmershoek**	Agriculture: Irrigation Agriculture: Irrigation Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na ⁺ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	Fractured TMG Aquifer (Penin 10 Fractured TMG Aquifer (Nardo 2 2 Primary / Intergranular Aquif 15 15 15 15 15 15 15 15 15 15 15 15 15	nsula) 0.43 douw) 0.01 0.08 ifers 0.30 0.82 c Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions in the corevail. However, concerns personal concerns personal double of the con
Groundwater Use 0.73 and A groundwater Use In the 0.09 (Irrigated and the following states and the following states are	8 M m³/a of groundwater. The main sectors for groundwater use are Agriculture (Irrigation) Agriculture (Aquaculture), contributing 58.9% and 41.1%, respectively, to the total annual undwater use volume. The Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing of M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). **Wemmershoek**	Agriculture: Irrigation Agriculture: Irrigation Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na ⁺ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	Fractured TMG Aquifer (Penin 10 Fractured TMG Aquifer (Nardo 2 2 Primary / Intergranular Aquif 15 15 15 15 15 15 15 15 15 15 15 15 15	nsula) 0.43 douw) 0.01 0.08 ifers 0.30 0.82 c Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions in the corevail. However, concerns personal concerns personal double of the con
and A groundwater Use In the 0.09 (Irrigar and the first term)	Agriculture (Aquaculture), contributing 58.9% and 41.1%, respectively, to the total annual undwater use volume. The Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing of M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). **Wemmershoek** 1 - Ca+ICCO_Stype 2 - ICCO_Stype 3 - Ca+ICCO_Stype 3 - Ca+ICCO_Stype 3 - Ca-ICCO_Stype 3 - Ca-ICCO_S	Agriculture: Irrigation Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in t type waters arise from the result from Na+ cation excha lithology. Exceedances of baseline co arsenic, lead, manganese, a that predominantly natural regarding natural factors su	The Wemmershoek GRU are dissolution of carbonate min ange between Na-Cl type was water quality conditions pr	0.43 douw) 0.01 0.08 ifers 0.30 0.82 a Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions i
Groundwater Use ground In the 0.09 (Irrigar and the second	ne Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). Key Wemmershoek 1 - Ca-HCO3 type 2 - Mac Clays 30 - Ca-HCO3 type 3 - Ca-HCO3 typ	Agriculture: Irrigation Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in t type waters arise from the result from Na+ cation excha lithology. Exceedances of baseline co arsenic, lead, manganese, a that predominantly natural regarding natural factors su	Fractured TMG Aquifer (Nardon 2 2 2 2 2 Primary / Intergranular Aquifer 1 1 15 15 15 15 15 15 15 15 15 15 15 15	douw) 0.01 0.08 ifers 0.30 0.82 e Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions i
In the 0.09 (Irriga and t	ne Nardouw Aquifer RU, there are 4 registered groundwater users collectively utilizing 0 M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). Key Wemmershoek 1 - Ca-HCO3 type 2 - Ha-GO3 type 3 - Ca-HC-HCO3 type 3 - Ca-HC	Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na+ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	Primary / Intergranular Aquif 1 15 the Wemmershoek GRU are dissolution of carbonate min ange between Na-Cl type was procentrations were observed and mercury. The adjusted was water quality conditions principle of the primary of t	0.01 0.08 ifers 0.30 0.82 e Ca-HCO ₃ and Ca-Mg-Cl. Ca-herals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions i
0.09 (Irriga and t	M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). Key Wemmershoek 1 - Ca-HCO3 type 2 - MR-GO type 2 - MR-GO type 3 - Ca-HG-HCO3 type 3 - Ca-HG-HCO3 type 3 - Ca-HG-HCO3 type 3 - Ca-HG-HCO3 type 5 - Ca-HG-HCO3 t	Industry (Non-Urban) Agriculture: Aquaculture Total The primary water types in type waters arise from the result from Na+ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	Primary / Intergranular Aquifular Intergranular Aquifular Intergranular Intergranular Interpretation Interpreta	0.08 ifers 0.30 0.82 c Ca-HCO ₃ and Ca-Mg-Cl. Canerals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions If for all parameters except dissipater quality category is A, indicorevail. However, concerns p
0.09 (Irriga and t	M m³/a of groundwater. The predominant sector for groundwater use is Agriculture gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). Key Wemmershoek 1 - Ca-HCO3 type 2 - MR-GO type 2 - MR-GO type 3 - Ca-HG-HCO3 type 3 - Ca-HG-HCO3 type 3 - Ca-HG-HCO3 type 3 - Ca-HG-HCO3 type 5 - Ca-HG-HCO3 t	Agriculture: Aquaculture Total The primary water types in t type waters arise from the result from Na+ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, a that predominantly natural regarding natural factors su	the Wemmershoek GRU are dissolution of carbonate min ange between Na-Cl type was concentrations were observed and mercury. The adjusted was water quality conditions pr	ifers 0.30 0.82 Ca-HCO ₃ and Ca-Mg-Cl. Canerals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions If for all parameters except dissivater quality category is A, indicorevail. However, concerns p
(Irrigand t	gation), constituting 89% of the total annual groundwater use volume (see Figure 3-10 the table on the right). New Wemmershoek 100,100	The primary water types in to type waters arise from the result from Na+ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, at that predominantly natural regarding natural factors su	the Wemmershoek GRU are dissolution of carbonate min ange between Na-Cl type was concentrations were observed and mercury. The adjusted was water quality conditions pr	e Ca-HCO ₃ and Ca-Mg-Cl. Ca- nerals, while Ca-Mg-Cl type w aters and Ca ²⁺ and Mg ²⁺ ions If for all parameters except diss vater quality category is A, indic prevail. However, concerns p
and t	the table on the right). Ney Wemmershoek 100,100	The primary water types in t type waters arise from the result from Na ⁺ cation excha- lithology. Exceedances of baseline co- arsenic, lead, manganese, a that predominantly natural regarding natural factors su	the Wemmershoek GRU are dissolution of carbonate min ange between Na-Cl type wa concentrations were observed and mercury. The adjusted wa water quality conditions pr	e Ca-HCO ₃ and Ca-Mg-Cl. Ca- nerals, while Ca-Mg-Cl type w aters and Ca ²⁺ and Mg ²⁺ ions I for all parameters except diss vater quality category is A, indic prevail. However, concerns p
	Ney Wemmershoek 100 100 1 - CAHCO] type 2 - NAHCO] type 80 80 80 80 80 80 80 8	type waters arise from the result from Na ⁺ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	dissolution of carbonate min ange between Na-Cl type wa oncentrations were observed and mercury. The adjusted wa water quality conditions pr	nerals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions I for all parameters except dissivater quality category is A, indicorevail. However, concerns p
Water Quality	Key 100,100 1 - Ca+HCO3, type 100,100 2 - He-G13pp 3 - Ca-Ha-HCO3, type 80 80 4 - Ca-Mp-G1ype 5 Go 5 60 C	type waters arise from the result from Na ⁺ cation exchalithology. Exceedances of baseline coarsenic, lead, manganese, athat predominantly natural regarding natural factors su	dissolution of carbonate min ange between Na-Cl type wa oncentrations were observed and mercury. The adjusted wa water quality conditions pr	nerals, while Ca-Mg-Cl type waters and Ca ²⁺ and Mg ²⁺ ions in the standard of the standard
	20 80 80 20		ich as acidic ph and eievate	ed fron in the water (refer to L
	GRU is considered to have a Groundwater Availability Present Status Category of 'A', inegory of 'A' indicating unmodified, pristine conditions (see table below). Recharge Volume Groundwater Use	Ground	htly stressed aquifer, and a G	Groundwater Quality Present S
	Recnarge volume Groundwater Use Stress (M m³/a) (M m³/a)	s Index Ground	Status Category	Status Category
		.03	A	A
	V.			



G	D	п
J	г	ι

GRU Name: Wemmershoek Main Towns: None

Total Area (km²): 229.13

Groundwater Quality Component

The groundwater quality component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is determined as two components 1) the Groundwater Quality Reserve,; and 2) the Groundwater Quality BHN Reserve (to be confirmed).

Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwater Quality BHN Reserve
	Sulphate	mg/l		19	3.45	0.20	20.90	0.72	10.24	10.24	
	Electrical conductivity	mS/m		31	9.27	4.66	16.00	8.10	13.95	13.95	
	рН			31	8.26	6.40	10.01	7.30	9.60	9.60	
	Ammonia	mg/l		28	0.45	0.01	0.66	0.05	0.45	0.45	
Fractured	Nitrate + nitrite	mg/l		24	0.53	0.00	1.27	0.02	0.62	0.62	
Table Mountain	Fluoride	mg/l	_	4	0.16	0.05	0.39	0.11	0.36	0.36	
Group Aquifer	Orthophosphate	mg/l	5	22	0.05	0.00	0.43	0.02	0.33	0.33	
(Peninsula)	Calcium	mg/l		28	4.39	0.20	10.83	3.15	6.37	6.37	
	Magnesium	mg/l		28	0.46	0.20	7.00	0.60	6.63	6.63	
	Sodium	mg/l		26	10.44	2.20	11.00	5.75	9.23	10.44	
	Potassium	mg/l		20	8.20	0.10	8.43	0.75	8.39	8.39	
	Chloride	ma/l		28	13.77	6.00	17.62	8.05	12.67	13.77	

Groundwater Reserve

Groundwater Quantity Component

The groundwater quantity component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is calculated by considering the total groundwater contribution to both the EWR and BHN Reserves.

Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
26.83	3.59	0.00	3.59	23.24	0.82	22.43

Future Scenario 2050 (Scenario 7b) In Scenario 7b, which projects conditions for the year 2050 and considers the 'Most-Likely Case' for the GRU, the analysis focused on two key factors: Recharge and Water Use. These factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a decrease in recharge from 26.83 to 25.60 M m³/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 0.81 to 1.56 M m³/a due to sectoral growth and the implementation of groundwater development schemes in the area. Under these conditions, the Allocation Category did not change from category B (refer to Section 2.5 and the table below).

Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
25.60	3.59	0.00	3.59	22.01	1.56	20.45



GRU	GRU Name: Wer Main Towns: Nor						
	Total Area (km²):	229.13					
	The Wemmersho contribution to th	pek GRU was e BHN. A total Data Source	assigned a Ma of 3 monitoring Monitoring Area	anagement Opti sites for the E\ Monitoring Objective	on 2 for monitori VR and 1 for the	ng the groundvBHN were strate	rater contribution to the EWR and a Management Option 1 for monitoring the groundwegically selected within the Wemmershoek GRU (see Figure 3-10 and the table below). Monitoring Description
		000.00	71100	00,000		EWR Managen	ent Option 2
	Proposed BH		Biii2	EWR	-33.83659818	19.11174645	Frequency: Quarterly 1) Groundwater level:
	G1N0500	HYDSTRA	Biii2	EWR	-33.8466	19.0493	 Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. Groundwater Quality:
Monitoring Programme	G1N0501	HYDSTRA	Biii2	EWR	-33.81001	19.07955	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for EWR: NO₂, NO₃, NH₄
						BHN Managem	
	W7D1	CoCT	GRU	BHN	-33.81629	19.06087	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level:



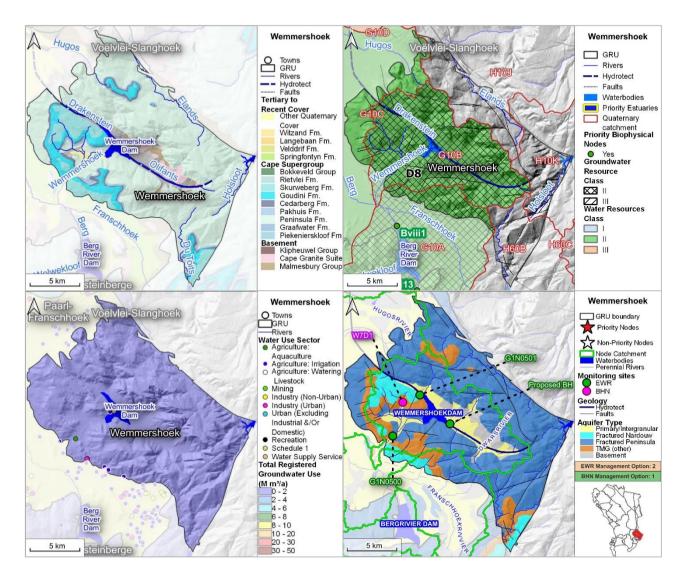


Figure 3-10 A series of maps for the Wemmershoek GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.5. Voëlvlei-Slanghoek GRU

GRU	GRU Name: Voëlvlei-Slanghoek Main Towns: None						
GRU	Total Area (km ²): 184.26						
GRU Boundary Description	The Voëlvlei-Slanghoek GRU is constrained by the western and eastern/north-eastern edges of fringe is demarcated by the Stettyns and Koue	of the GRU. To the north, the	GRU is separate	ed from the Groot Winte	erhoek GRU by the Room	dezandspas Fault. 1	The eastern/south-eastern
Quaternary Catchments	G10E, G10J, G10D, G10F, H10E, H10F and H	10J (Figure 3-11)					
Resource Unit		Frac	ctured Table Mou	untain Group Aquifer			
Description	The TMG Super aquifer within this GRU is prir within the GRU, with an average thickness ran between these formations is visible at the base The Goudini, Skuwerberg, and Rietvlei Format Skuwerberg and Rietvlei Formations, with an hydrogeological characteristics of the GRU, infl	aging from approximately 600 of the mountain slopes. This cutions, part of the Nardouw Staverage thickness of approximately 600 of the Mardouw Staverage thickness of 600 of the Mardouw Staverage thickness of 600	to 1500 meters. contact is further ub-group, are al mately 200 to 30	The Peninsula Aquifer exposed in the valley or so present along the slow meters and 150 to 2	overlies the Malmesbury the eastern edge of the opes of this GRU. With 00 meters, respectively	Group and CGS be GRU (Figure 3-11) on these formations	assement, and the contact. The individual i
Surface Water System	The GRU is located immediately to the west of from the reservoir, sourced from a weir located						esigned to distribute water
Water Resource Classes & RQOs	Only a portion of the GRU is located within the expands outside of the Berg catchment area, s Resource Class of III, and the portions within the Resource Class designation. This site includes IUA Water Resource Class C5 Berg Tributaries II	pecifically the former Berg WN e C5 IUA have a Water Resource	MA (2004). The sce Class of II, wit	egments of the GRU wi ha corresponding Grour	thin the D9 and B4 IUAs ndwater Resource Class	of II. The rest of the	and G10F) have a Water
Recharge	An estimated recharge of 14.1 M m³/a was dete the Aquifer Stress assessments. The average below and DWS (2022e) for further details. Method Map Centric Simulation Method				recharge estimations ar Volume (3/a)	e available in the lit Average	



	GRU Name: Voëlvlei-Slan	ghoek									
GRU	Main Towns: None										
	Total Area (km ²): 184.26										
	In the Peninsula Aquifer R	RU, there are 3 registered	groundwater users collecti	velv utilizina	Wate	er Use Sector	No. of Users	Total Volume (M r	m ³ /a)		
	0.14 M m ³ /a of groundwa	ater (see Figure 3-11 and	d the table on the right).	The primary	******		Fractured TMG Aguifer	rotal volume (m.	τω		
Groundwater Use	groundwater use sectors i				Agricu	Ilture: Irrigation	2	0.04			
	(Irrigation), contributing 73	.1% and 26.9%, respective	ely, to the total annual grou	ndwater use	Agriculture:	Watering Livestock	1	0.10			
	volume.		,,			Total	3	0.14			
Water Quality			٨	lo water quality	⁄ data availal	ole					
Aquifer Stress		nined due to limited data a	ability Present Status Cate vailability (see table below) indwater Use (M m³/a) 0.14		Index	Groundwater A	•	Groundwater Quality Presen Groundwater Quality Presen Category N/A			
Groundwater Reserve	The groundwater quantity	Quality Component No water quality data available Groundwater Quantity Component The groundwater quantity component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is calculated by considering the total groundwater contribution to both the EWR and BHN Reserves.									
	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserv	ve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm	n³/a) Still Allocable (l	Mm³/a)		
	14.1	1.62	0.01	1.6	3	12.47	0.14	12.34			
Future Scenario 2050 (Scenario 7b)	In Scenario 7b, which proj factors directly influenced trecharge from 14.1 to 12.8 and the implementation of below).	the parameters used to det 7 M m³/a, influenced by bo	termine the Groundwater R	eserve, specifi	cally the grou APs. Addition	undwater contribution to nally, groundwater use i	the BHN and EWR. Thereased from 0.13 to	he scenario involved a de 0.31 M m³/a due to secto	ecrease in oral growth		
	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserv	re (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm	3/a) Still Allocable (Mm³/a)		
	12.87	1.62	0.01	1.6	3	11.24	0.31	10.93			
	• , ,	, ,	, ,		,	(Mm³/a)	`	Still A	,		



GRU	GRU Name: Voë		ek				
GRU	Main Towns: Nor Total Area (km²):						
	The Voëlvlei-Slar	nghoek GRU					
Monitoring Programme	3319AC00039	NGA	Biii4	EWR	-33.31689	19.08263	Frequency: Quarterly 1) Groundwater level:
						BHN Managen	
	3319AC00040	NGA	Biv3	BHN	-33.28911	19.06541	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level:



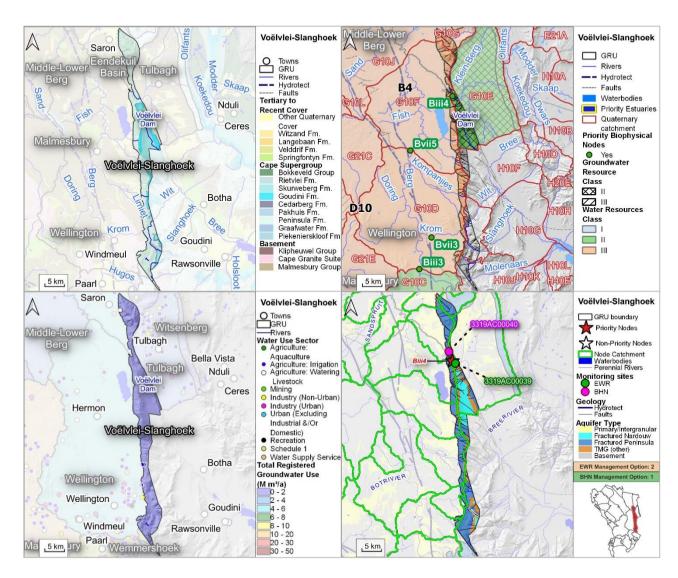


Figure 3-11 A series of maps for the Voëlvlei-Slanghoek GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.6. Witzenberg GRU

	GRU Name: Witzenberg				
GRU	Main Towns: None				
GRU	Total Area (km²): 39.95				
	Total Area (KIII). 59.95				
GRU Boundary Description	The Witzenberg GRU is defined by the western Malmesbury Group. The eastern and southern the water quaternary catchment divide (refer to Figure 1) and the western statement of the western statement	coundaries are determined by the extent of the			
Quaternary Catchments	G10E (Figure 3-12)				
Resource Unit		Fractured Table Mou	ıntain Group Aquifer		
Description	The Peninsula Fm, characterized by thickly bedd of the Peninsula Fm varies within the range of dynamics of the GRU (refer to Figure 3-12 and Within this GRU, components of the Nardouw Su and Rietvlei Fm, with an average thickness of ap characteristics of the GRU, impacting groundward.	approximately 550 to 1500 meters. The prop DWS, 2022d and 2023a). b-group, namely the Goudini, Skuwerberg, and proximately 200 to 300 meters and 150 to 200	erties of the Peninsula Fm play a d Rietvlei Formations, are present. d meters, respectively. These geolo	pivotal role in shaping the	e hydrogeology and groundwater stream of the
Surface Water System	There are no major surface water systems in this	s RU except for a tributary of the Klein-Berg R	iver (refer to Figure 3-12 and DW	S, 2022d and 2023a).	
Water Resource Classes & RQOs	The GRU falls entirely within the Berg Tributarie biophysical nodes (Figure 3-12).	s (C5) IUA and is assigned a Water Resource	Class of II and a Groundwater Re	esource Class of II. There a	are no EWR sites nor any priority
Recharge	An estimated recharge of 2.78 M m³/a was determined the Aquifer Stress assessments. The average rebelow and DWS (2022e) for further details. Method Map Centric Simulation Method	rmined from first-order recharge calculations u echarge rate is 69.59 mm/a based on the tota Area (km²) 39.95	sing the Map-Centric Simulation n I GRU area. Additional recharge of Recharge Volume (M m³/a) 2.78	estimations are available ir	the estimated recharge value for a the literature. Refer to the table verage Recharge Rate (mm/a) 69.59
	.,		-	•	
Groundwater Use	In this GRU, there are 3 registered groundwater groundwater. The primary groundwater use secto (Irrigation), constituting 100% of the total annual and the table on the right).	ors are Agriculture (Watering) and Agriculture	Water Use Sector Agriculture: Irrigation Total	No. of Users Fractured TMG Aquifer 3 3	Total Volume (M m³/a) 0.08 0.08



	GRU Name: Witzenberg						
GRU	Main Towns: None						
	Total Area (km²): 39.95						
Water Quality			<u> </u>	o water quality data availal	<u>ble</u>		
A 7 0	The GRU is considered to l cannot be determined due	nave a Groundwater Availato limited data availability (ability Present Status Cate see table below).	gory of 'A', indicating an uns	stressed or slightly stressed	aquifer, and the Ground	water Quality Present Status
Aquifer Stress	Recharge Volume		ndwater Use	Stress Index	Groundwater Availab		water Quality Present Status
	(M m ³ /a) 2.78		M m ³ /a) 0.08	0.03	Status Cate	gory	Category N/A
	2.70	L	0.00	0.03			IN/A
Groundwater Reserve	Groundwater Quantity Com The groundwater quantity of the EWR and BHN Reserve	component of the Reserve		o water quality data availal	ble 2.3 & 2.4, is calculated by c	onsidering the total grou	ndwater contribution to both
	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
	2.78	0.18	0.00	0.18	2.60	0.08	2.52



	GRU Name: Witz	zenberg					
GRU	Main Towns: Nor	ne					
	Total Area (km²):	39.95					
	The Witzenberg (to the BHN. A tot	GRU was assigr al of 1 monitorir	ng sites for the E	WR and 1 for th	monitoring the s	groundwater col trategically sele	ntribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the Witzenberg GRU (see Figure 3-12 and the table below).
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
						EWR Managen	
Monitoring Programme	3319AC00012	NGA	Biii4	EWR	-33.358	19.24152	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level:
		ı				BHN Managen	
	3319AC00012	NGA	Biii4	вни	-33.358	19.24152	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level:



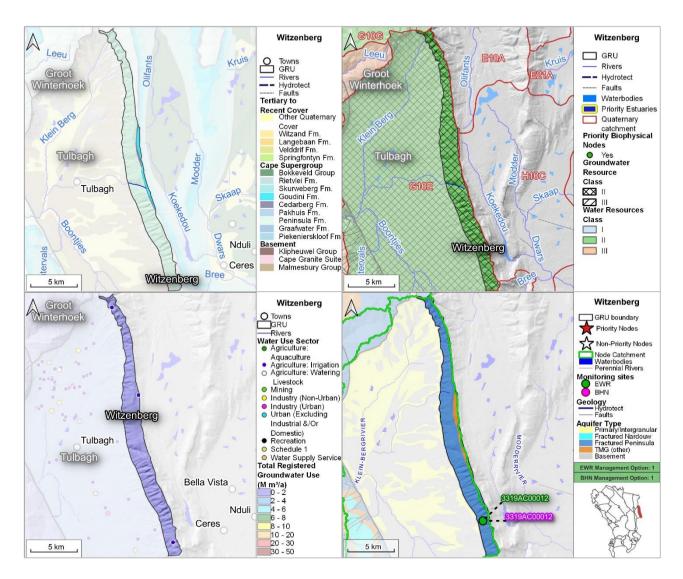


Figure 3-12 A series of maps for the Witzenberg GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.7. Groot Winterhoek GRU

GRU	GRU Name: Groot Win Main Towns: None	terhoek						
GRU	Total Area (km ²): 379.2	6						
GRU Boundary Description	The Groot Winterhoek (GRU is delineated by the m the Voëlvlei-Slangho r quaternary catchment	ek and Witzenberg GRU divide. The north-easte	Us, is defined by the Ro ern edge of the GRU is	odezandspas Fault lin	ally the Malmesbury Grou e, the contact with the Ma the E10C surface water of	almesbury Group baser	ment, and segments of
Quaternary Catchments	G10J, G10E, G10H, E1	0C and G10G (Figure	3-13)					
Resource Unit				Fractured Table Mou	untain Group Aquifer			
Description	super-mature quartzite, Peninsula Fm ranges fr features of the Groot W Centrally located within The Groot-Kliphuis Rive	and quartz sandstones om approximately 600 to interhoek GRU (refer to the syncline are the Ger closely follows the axed c sandstone with minor	s. The Peninsula Fm is to 1000 meters. The syncon DWS, 2022d and 2023 coudini, Skuwerberg, and its of the syncline. Within shales. The geological for the syncline of the syncline.	prominently visible in the cline structure and the dala). d Rietvlei Formations, be n these formations, the	ne steep limbs to the earlistinct characteristics of the longing to the Nardou aquifers include the S	sulted in the exposure of ast and west of the GRU. If the Peninsula Fm play a suw Sub-group and having kuwerberg, characterized quifer formations, play a contract of the sub-group and having have been sub-group and having the sub-group and having have been sub-group and having ha	Within this specific are significant role in shaping a thickness ranging from the by thickly bedded qua	om 150 to 300 meters. rtzite, and the Rietvlei,
Surface Water System	The Olifants River, orig principal surface waters in the area follows the g	system in this GRU is th	e Olifants River itself, when the contract of	hich flows directly through	gh the northern and nor	ries such as the Klein Klip theastern edges of the G d and 2023a).	phuis River and the Vie RU. The course of most	r-en-Twintig River. The surface water features
Water Resource Classes & RQOs	Berg catchment area, s portions of the GRU wit	specifically the former E hin the C5 IUA (catchmond the portions within the	Berg WMA (2004). The ent G10G and G10E) ha e C5 IUA (catchment G	segments of the RU wilve a Water Resource C	ithin the B4 IUA (catch lass of II. The segment	ning part extends beyond iments G10H and G10J) to of the GRU within the El. This site includes 1 price. Biophysical Node Bi1	have a Water Resource 34 IUA (catchment G10)	ce Class of III, and the H) have a Groundwater



0.511	GRU Name: Groot Winterhoek								
GRU	Main Towns: None								
	Total Area (km²): 379.26								
Recharge	An estimated recharge of 22.5 Nother Aquifer Stress assessments Refer to DWS (2022e) for further Method	(see table below). T			sed on the total G				ilable in the literatu
	Map Centric Simulation M	lethod	379.26			22.5		59.33	
Groundwater Use	In the Peninsula Aquifer RU, the 0.19 (M m³/a) of groundwater. In the Nardouw Aquifer RU, the groundwater use of 0.21 M mean Agriculture (Irrigation). Refer to	nere are 7 registered	groundwater users, with undwater use sector in the	a combined	Water Use Se Agriculture: Irrig Industry (Non-L Agriculture: Irrig Total	Fracture (pation (rban) Fracture	No. of Users d TMG Aquifer (Pening) 3 1 d TMG Aquifer (Naro	nsula)	0.18 0.01 1.21 1.39
Water Quality			Δ	lo water quality d	ata available				
	The GRU is considered to have cannot be determined due to lim			gory of 'B', indica	ing an unstressed	or slightly stressed	d aquifer, and the	Groundwater (Quality Present Stat
Aquifer Stress	Recharge Volume (M m³/a) 22.50		ndwater Use M m³/a) 1.39	Stress Inc	ex	Groundwater Availa Status Cat B			Quality Present Status Sategory N/A



GRU	GRU Name: Grown Main Towns: Nor Total Area (km²):	ne									
Future Scenario 2050 (Scenario 7b)	In Scenario 7b, v factors directly in recharge from 22 and the implement	which projects of fluenced the pa 2.5 to 20.11 M notation of groun	arameters used to n ³ /a, influenced by ndwater development	determine the (both climate chent schemes in	Groundwater Res nange and the eli the area. Furthe	serve, specifically mination of IAPs more, the groun	y the ground the street of the	ndwater contribution to the ally, groundwater use incre	BHN and EWR. The scer ased from 1.39 to 3.27 M we rose from 0.02 to 0.03	rge and Water Use. These lario involved a decrease in m³/a due to sectoral growth M m³/a, primarily attributed	
	Recharge (M	m³/a) E¹	WR Reserve (Mm³/a)	BHN Res	erve (Mm³/a)	GW Reserve (M	1m³/a)	Total Allocable Volume (Mm³/a) Water Use (Mm³/a) Still Alloc		Still Allocable (Mm³/a)	
	20.11		0.77		0.03	0.80		19.31	3.27	16.04	
	Site Name Proposed BH	Data Source	of 2 monitoring site Monitoring Area Bi1	Monitoring Objective	Latitude	Longitude EWR Management 19.06101774	Option 1	ency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: O Manual groundwater level measurements			
Monitoring Programme	3219CC00015	NGA	Bi1	EWR	-32.98054	19.07122		 Site specific additions Site specific additions Bi1: Nutrients (Phosphate 	e [PO₄-P] and Total Inorg ty [EC]); Pathogens (Escheri	anic Nitrogen [TIN]); Salts	
						BHN Management					
	3219CC00015	NGA	Bi1	ВНМ	-32.98054	19.07122	1) 2)		level measurements	MAIk, F, CI, PO ₄ , SO ₄	



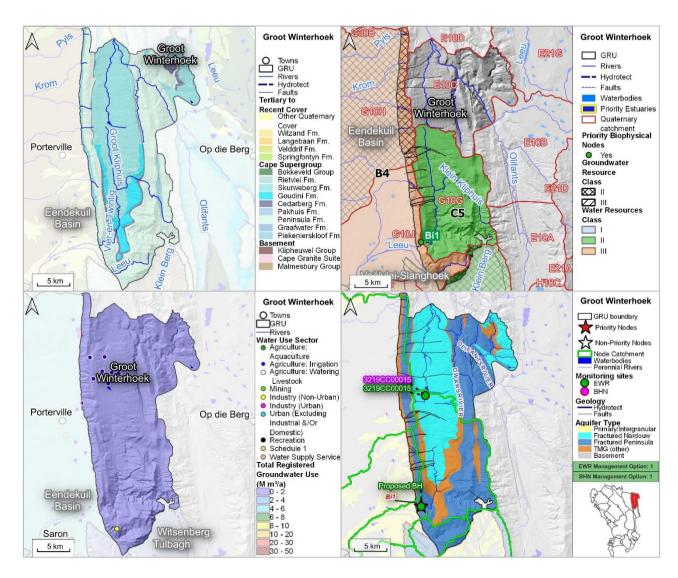


Figure 3-13 A series of maps for the Groot Winterhoek GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.2.8. Piketberg GRU

	aborg orto			
	GRU Name: Piketberg			
GRU	Main Towns: Goedwerwacht			
	Total Area (km²): 298.29			
GRU Boundary Description		extent of the TMG outcrop, primarily composed of basement lithologies, specifically the Malmesb DWS, 2022d and 2023a).		
Quaternary Catchments	G10M, G30D, G10K, G30A and G10H (Figure	3-14)		
Resource Unit		Fractured Table Mour	ntain Group Aquifer	
Description	Sandveld Group overlays flat areas and screes The mountainous area is primarily characterized	pasement itself is situated at the base of the mount st side of the Piketberg GRU, with only minor floor the mountain slopes, covering the TMG and d by the Rietvlei Fm, part of the Nardouw Sub-grandine. In addition to the Rietvlei Fm, flat areas a	untain on the eastern side, outside the boundard low occurring into screes and weathered zon basement to the northwest of the GRU (refer roup. This Fm, consisting of feldspathic sands and screes on the mountain slopes are overlain	aries of this GRU. This basement acts as a no- les of the Malmesbury Group. Additionally, the to DWS, 2022d and 2023a). tone with minor shales and approximately 150- n by the Sandveld Group. The Sandveld Group
Surface Water System	The primary surface water systems in this area a (refer to Figure 3-14 and DWS, 2022d and 202	are the Boesmans and Platkloof Rivers. Surface- 3a).	-water flow is observed originating from the ele	evated Piketberg Mountains of the TMG outcrop
Water Resource Classes & RQOs	Berg catchment area. The segments of the RU have a Water Resource Class of II. The segmen	e Lower Berg (B4) and the Berg Estuary (A1) IU within the B4 IUA (catchments G10K and G10H ats of the GRU within the B4 IUA (catchment G10I), and the portions within catchment G10M hav	I) have a Water Resource Class of III, and the DH) lack a Groundwater Resource Class (exce	e portions within the A1 IUA (catchment G10M) ept for the small portion within catchment G10H,
Recharge	An estimated recharge of 20.33 M m³/a was de for the Aquifer Stress assessments. The averag below and DWS (2022e) for further details. Method Map Centric Simulation Method	etermined from first-order recharge calculations ge recharge rate is 68.16 mm/a based on the total Area (km²) 298.29	using the Map-Centric Simulation method and all GRU area. Additional recharge estimations Recharge Volume (M m³/a) 20.33	d was chosen as the estimated recharge value are available in the literature. Refer to the table Average Recharge Rate (mm/a) 68.16



GRU	GRU Name: Piketberg Main Towns: Goedwerwach	nt					
5.10	Total Area (km²): 298.29						
	region is Agriculture (Irrigat	ion), accounting for 97.5%	of the total annual ground	tively utilizing 5.14 M m ³ /a owater use volume. In the Na region is Agriculture (Irrigatio	rdouw RU, there are 6 regi	istered groundwater us	sers collectively utilizing 0.44
	Wat	er Use Sector		No. of Users		Total Volum	ne (M m³/a)
			F	ractured TMG Aquifer (Peninsula	a)		,
One we do we to a librar		ulture: Irrigation		41		5.0	
Groundwater Use		try (Non-Urban)		<u>2</u> 3		0.05	
	water	Supply Service	F	ractured TMG Aquifer (Nardouw	4)	0.0)
	Agrice	ulture: Irrigation		5		0.4	 14
		.		Primary / Intergranular Aquifers			
	Agrico	ulture: Irrigation		1		0.00	
		Total		46		5.5	58
				gory of 'C', indicating a mode	erately stressed aquifer, ar	nd the Groundwater Qu	uality Present Status canno
Aquifer Stress	determined due to limited of	lata availability (see table t	below).	-			•
Aquifer Stress	Recharge Volume (M m³/a)	lata availability (see table b	ndwater Use M m³/a)	Stress Index	Groundwater Availal Status Cate	bility Present Grou	undwater Quality Present Status Category
Aquifer Stress	determined due to limited of Recharge Volume	lata availability (see table b	below).	-	Groundwater Availal	bility Present Grou	undwater Quality Present Status
Aquifer Stress Groundwater Reserve	Recharge Volume (M m³/a) 20.33 Quality Component Groundwater Quantity Com	ata availability (see table by Ground (below). Indwater Use M m³/a) 5.58	Stress Index	Groundwater Availal Status Cate	bility Present Grou	undwater Quality Present Status Category N/A
	Recharge Volume (M m³/a) 20.33 Quality Component Groundwater Quantity Com The groundwater quantity of	ata availability (see table by Ground (below). Indwater Use M m³/a) 5.58	Stress Index 0.27 lo water quality data available	Groundwater Availal Status Cate	bility Present Grou	undwater Quality Present Status Category N/A



	GRU Name: Pike								
GRU	Main Towns: God								
	Total Area (km²):	298.29							
Future Scenario 2050 (Scenario 7b)	factors directly in recharge from 20 and the implement	fluenced the 0.33 to 19.02 ntation of gro	parameters used M m³/a, influence oundwater develo	d to determine the ed by both climate pment schemes	ne Groundwater F te change and the s in the area. Furt	Reserve, specifice elimination of I hermore, the gro	ase' for the GRU, the analysis focused on two key factors: Recharge and Water Use. The cally the groundwater contribution to the BHN and EWR. The scenario involved a decrease APs. Additionally, groundwater use increased from 5.58 to 9.80 M m³/a due to sectoral groundwater contribution to the BHN Reserve rose from 0.04 to 0.06 M m³/a, primarily attributer to Section 2.5 and the table below).		
	Recharge (M	m³/a)	EWR Reserve (Mr	n³/a) RHN	Reserve (Mm³/a)	GW Reserv	e (Mm³/a) Total Allocable Volume Water Use (Mm³/a) Still Allocable (Mm³/a)		
	• ,	III /a)	`	II /a) DI IIV	, ,		(Mm ³ /a)		
	19.02		2.07		0.06	2.1	3 16.89 9.80 7.09		
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude EWR Managen	Monitoring Description		
	EWR Management Option 3								
	G3N0547	HYDSTRA	Biv2	EWR	-32.73111111	18.52194444	Frequency: Monthly or Quarterly		
	3218DC00011	NGA	Biv2	EWR	-32.80305	18.68729	Groundwater level:		
Monitoring Programme	G1N0404	HYDSTRA	A Biv2	EWR	-32.72257	18.5704	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for EWR: NO₂, NO₃, NH₄ 		
						BHN Managen	nent Option 1		
	3218DA00006	NGA	GRU	BHN	-32.6961	18.53395	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: o Manual groundwater level measurements 2) Groundwater Quality (Background water quality and BHN): o Standard Parameters; pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4		



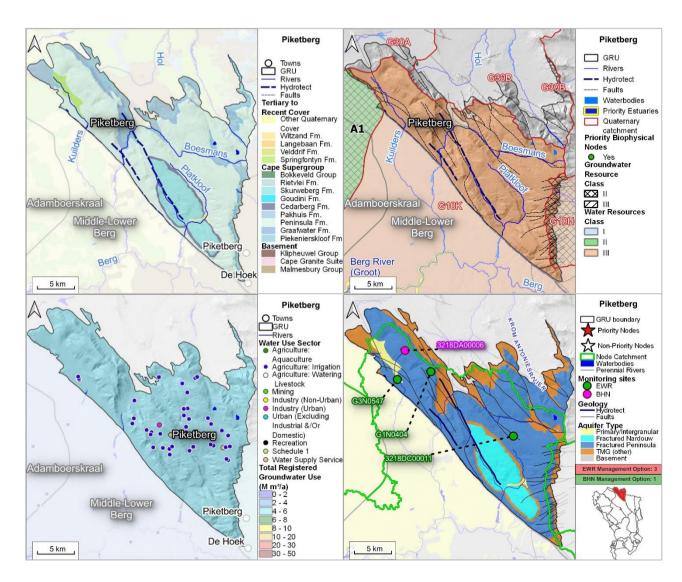


Figure 3-14 A series of maps for the Piketberg GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3. Fractured and Intergranular Basement GRUs

3.3.1. Cape Town Rim GRU

	GRU Name: Cape Town Rim
GRU	Main Towns: Cape Town, Cape Flats and Brackenfell
GRU Boundary Description	Total Area (km²): 826.03 The northern and eastern edges of the Cape Town Rim GRU are defined by portions of the G21F, G21E, G22H, and G22G surface water quaternary catchment divides. The boundary between the Cape Town Rim GRU and the Cape Peninsula GRU is established by the extent of basement lithologies, namely the CGS and the Malmesbury Group, along with their contact with the Table TMG rocks. Quaternary catchments were utilized due to the tendency of groundwater flow to align with topography. The western/north-western fringe of the GRU is bordered by the Table Bay and False Bay coastlines (refer to Figure 3-15 ; DWS, 2022d and 2023a).
Quaternary Catchments	G22C, G22E, G22B and G22D (Figure 3-15)
Resource Unit	Fractured and Intergranular Basement Aquifer
Description	The Cape Town Rim's Basement underlies, as illustrated in the cross-section of the CFA, and surrounds the Cape Flats GRU. The basement geology is composed of Neoproterozoic rocks belonging to the Tygerberg Fm (Malmesbury Group), intruded by the late Neoproterozoic to early Cambrian CGS. The Tygerberg Fm constitutes a relatively uniform succession of deepwater, turbiditic meta-sediments and shale that has undergone Fm into simple folds, typically displaying high weathering characteristics (refer to Figure 3-15 and DWS, 2022d and 2023a). The Cape Town Rim's Basement geology is composed of Neoproterozoic rocks belonging to the Tygerberg Fm constitutes a relatively uniform succession of deepwater, turbiditic meta-sediments and shale that has undergone Fm into simple folds, typically displaying high weathering characteristics (refer to Figure 3-15 and DWS, 2022d and 2023a). The Cape Town Rim's Basement geology is composed of Neoproterozoic rocks belonging to the Tygerberg Fm constitutes a relatively uniform succession of deepwater, turbiditic meta-sediments and shale that has undergone Fm into simple folds, typically displaying high weathering characteristics (refer to Figure 3-15 and DWS, 2022d and 2023a). The Cape Town Rim's Basement geology is composed of Neoproterozoic rocks belonging to the Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of deepwater from the Cape Tygerberg Fm constitutes a relatively uniform succession of the Cape Tygerberg Fm constitutes a relatively uniform succession of the Cape Ty
Surface Water System	The main rivers in the area include the Kuils, Lotus, Liesbeek, and Elsieskraal rivers. It's important to note that the majority of these rivers are situated on the CFA, which overlays the basement rocks in this area (refer to Figure 3-15 and DWS, 2022d and 2023a).



	GRU Name: Cape Town Rim				
GRU	Main Towns: Cape Town, Cape Flats and Brackenfell				
GRU	Total Area (km²): 826.03				
	Total Area (Km²): 826.03				
Water Resource Classes & RQOs	The GRU falls within the Peninsula (E1) and Cape Flats (E12) IUAs and has Water Resour and G22C) has a Groundwater Resource Class of II, and no Groundwater Resource Class sites within this IUA, although portions of 1 estuary node (Rietvlei/ Diep) with a TEC of C fa	for the portions that fall within IUA I	E11 (catchments G22A and G		
Classes a riggs	IUA Water Resource Class Quaternary Catchment RU	Resource Name Bioph	nysical Node TEC	nMAR	
	D10 Diep III G21F D10-E03	Rietvlei/ Diep	Bxi7 C	78	
	310 200	THOUSE STOP			
Recharge	An estimated recharge of 18.6 M m³/a was determined from first-order recharge calculation the Aquifer Stress assessments (see table below). The average recharge rate is 22.83 m Refer to DWS (2022e) for further details. Method Area (km²) Map Centric Simulation Method 298.29		Additional recharge estimation		
			•		
		Agriculture: Irrigation Industry (Non-Urban) Industry (Urban) Schedule 1 Urban (Excluding Industrial And/Or Domestic) Water Supply Service	No. of Users ured And Intergranular Basement 6 2 9 3 1 1 9 Fractured TMG Aquifer (Peninsular	0.07 0.02 0.26 0.004 0.01	
		A 14	12	0.49	
	In this GRU, 169 registered groundwater users access various aquifers, including the	A ariaulturau Matarina I iugataal	12	0.49	
	Fractured and Intergranular Basement Aquifer, the Fractured TMG Aquifer (Peninsula), a	S Industry (Lirban)	1	0.03	
Groundwater Use	well as the Primary/Intergranular Aquifer. Together, they utilize 6.11 M m ³ /a of groundwate	Mater Supply Service	1	0.03	
o.ca.iaiiaic. ccc	(see Figure 3-15 and the table on the right). The leading groundwater use sectors in the	S Primary / Intergranular Δαμ	ifers (At surface but abstracting fro	ce but abstracting from the underlying basement)	
	region are Industry and Agriculture (Irrigation), contributing 43.5% and 39.0%, respectivel	Agriculture: Aquaculture	1	0.004	
	to the total annual groundwater use volume.	Agriculture: Irrigation	22	1.82	
		Agriculture: Watering Livestock	3	0.06	
		Industry (Urban)	9	0.20	
		Industry (Non-Urban)	70	2.37	
		Schedule 1	7	0.02	
		Urban (Excluding Industrial And/Or Domestic)	3	0.02	
		Water Supply Service	9	0.31	
		Total	169	6.11	



GRU Name: Cape Town Rim GRU Main Towns: Cape Town, Cape Flats and Brackenfell Total Area (km²): 826.03 Cape Town Rim Kay 1 - Ca-HCO3 type 2 - Na-Cl type 3 - Ca-Na-HCO3 type 4 - Ca-Mg-Cl type 5 - Ca-SO₄ type 6 - Na-HCO₃ type The main water type in the Cape Town Rim GRU is Na-Cl. The presence of Na-Cl waters is attributed to the saturation of Na and Cl ions due to increased groundwater residence time in the relatively low transmissivity, clay-rich shale, and siltstone basement aguifer. Exceedances of baseline concentrations were observed for EC, pH, ammonia, nitrate + nitrite, and orthophosphate, with 50% of samples exceeding baselines for sulphate and fluoride. Water Quality None of the 19 samples exceeded RQOs for this GRU. The adjusted water quality category is C, indicating the existence of moderate levels of localized contamination. Contaminating 100 0 0 100 activities, including agriculture and industry, contribute to these concerns. However, it's 3 80 20 important to note that naturally elevated concentrations of dissolved ions also play a role in exceeding baseline concentrations (refer to DWS, 2022d, 2022e and 2023a for detail). 0 20 60 80 60 40 20 40 80 CI Ca The GRU is considered to have a Groundwater Availability Present Status Category of 'C', indicating a moderately stressed aquifer, and a Groundwater Quality Present Status Category of 'C' indicating moderate levels of localised contamination, but little or no negative impacts apparent (see table below). Recharge Volume Groundwater Use Groundwater Availability Present Groundwater Quality Present Status **Aquifer Stress** Stress Index (M m³/a) Status Category (M m³/a) Category 18.6 6.11 С С 0.33



	GRU Name: Cape	Town Rim										
GRU		Town, Cape Flats and	Brackenfell									
	Total Area (km²): 8	26.03										
Groundwater Reserve	Groundwater Quali		Unit mg/l mg/l mg/l mg/l mg/l mg/l mg/l mg/	etailed in the tab onfirmed). No. BHs	No. Samples	S Baseline Conc. 8.50 105.10 7.78 0.02 0.28 0.14 0.01 45.50 19.10	Min Conc. 5.50 21.00 7.00 0.02 0.02 0.12 0.00 2.30 1.70	Max Conc. 350.00 659.00 8.62 0.75 6.57 2.60 0.13 259.80 119.10	Median Conc. 34.10 92.00 7.47 0.02 0.13 0.27 0.01 15.80 20.60	95 th Percentile Conc. 169.40 470.00 7.96 0.05 4.31 0.88 0.06 81.10 103.00	Groundwater Quality Reserve 169.40 470.00 7.96 0.05 4.31 0.88 0.06 81.10 103.00 957.70	Groundwate Quality BHI Reserve
	Groundwater Quan	Sodium Potassium Chloride	mg/l mg/l mg/l			142.60 3.05 240.60	28.20 0.87 44.00	1048.00 13.20 2100.00	128.40 3.02 220.00	957.70 7.90 1636.70	7.90 1636.70	
		Sodium Potassium Chloride httity Component uantity component of th Reserves.	mg/l mg/l ne Reserve, c	detailed in the ta		3.05 240.60	0.87 44.00 Section 2.3 & 3	13.20 2100.00	3.02 220.00 ed by conside	7.90 1636.70	7.90 1636.70 sundwater contr	ribution to bo able (Mm³/a) 1.33
Future Scenario 2050	The groundwater q the EWR and BHN Recharge (Mm³ 18.6 In Scenario 7b, wh factors directly influrecharge from 18.6 and the implementa	Sodium Potassium Chloride httity Component quantity component of th Reserves.	mg/l mg/l mg/l ne Reserve, of the (Mm³/a) for the year 2 used to deterniced by both velopment so	BHN Reserve (I 0.20 2050 and considermine the Ground climate change chemes in the ar	ders the 'Mos adwater Rese e and the elim rea. Furtherm	3.05 240.60 and described in S GW Reserve (Mm 1.07	0.87 44.00 Section 2.3 & Total or the GRU, the groundwart Additionally, gwater contribu	13.20 2100.00 2.4, is calculate al Allocable Volun (Mm³/a) 17.54 he analysis foct ter contribution groundwater use tion to the BHN	3.02 220.00 ed by conside wased on two let to the BHN are increased from Reserve rose	7.90 1636.70 ring the total ground ter Use (Mm³/a) 6.21 key factors: Rechard EWR. The scroom 6.21 to 8.71 N	7.90 1636.70 sundwater control Still Alloca 1.7 harge and Watenario involved M m³/a due to s	able (Mm³/a) 1.33 ter Use. The d a decrease sectoral grov
Future Scenario 2050 (Scenario 7b)	The groundwater q the EWR and BHN Recharge (Mm³ 18.6 In Scenario 7b, wh factors directly influrecharge from 18.6 and the implementa	Sodium Potassium Chloride Intity Component quantity component of the Reserves. Play EWR Reserve 0.87 Intity Component of the Reserves. Intity Component	mg/I mg/I mg/I mg/I mg/I mg/I mg/I mg/I	BHN Reserve (I 0.20 2050 and considermine the Ground climate change chemes in the ar	ders the 'Mos adwater Rese e and the elim rea. Furtherm	3.05 240.60 and described in S GW Reserve (Mm 1.07 ast-Likely Case' foreve, specifically inination of IAPs. anore, the grounds	O.87 44.00 Section 2.3 & Inalian Total To	13.20 2100.00 2.4, is calculate al Allocable Volun (Mm³/a) 17.54 he analysis foct ter contribution groundwater use tion to the BHN	3.02 220.00 ed by conside wased on two leto the BHN are increased from Reserve rose ow).	7.90 1636.70 ring the total ground ter Use (Mm³/a) 6.21 key factors: Rechard EWR. The scroom 6.21 to 8.71 N	7.90 1636.70 Still Alloca Analysis and Water and Water and involved M m³/a due to sa 36 M m³/a, prim	able (Mm³/a) 1.33 ter Use. The d a decrease sectoral grov



GRU	GRU Name: Cap Main Towns: Cap Total Area (km²):	e Town, Cape	Flats and Bracke	enfell			
	The Cape Town contribution to the Site Name	Rim GRU was e BHN. A total o	assigned a Mar of 8 monitoring si Monitoring Area	agement Option tes for the EWR Monitoring Objective	2 for monitoring and 3 for the BH Latitude	g the groundwat IN were strategic	ter contribution to the EWR and a Management Option 3 for monitoring the groundwate cally selected within the Cape Town Rim GRU (see Figure 3-15 and the table below). Monitoring Description
			71100	00,000.00		EWR Managemen	t Option 2
	G2N0103	HYDSTRA	Biv9	EWR	-34.010081	18.709376	Frequency: Quarterly
	96058	WMS	Bviii6	EWR	-34.016389	18.382222	Groundwater level:
	96060	WMS	Bvii7	EWR	-34.028056	18.417222	2) Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄ Site specific additions for EWR: NO ₂ , NO ₃ , NH ₄
	96139	WMS	Bviii8	EWR	-33.855556	18.627222	 Site specific additions as per RQO ¹⁹:
Monitoring Programme	G2N0637	HYDSTRA	Biv9	EWR	-33.85839	18.66518	Bviii6: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables
o.me.mg . regiaiimie	G2N0604	HYDSTRA	Bviii8	EWR	-33.90177	18.64386	(Temperature, pH, Dissolved Oxygen).
	3318DC00027	NGA	Biv9	EWR	-33.89189	18.73259	Bvii7: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables
	G2N0112	HYDSTRA	GRU	EWR	-33.980081	18.479369	(Temperature, pH, Dissolved Oxygen).
		<u> </u>		<u> </u>	1	BHN Management	
	3318CD00036	NGA	GRU	BHN	-33.90301	18.41037	Frequency: Monthly or Quarterly 1) Groundwater level:
	3318DC00290	NGA	GRU	BHN	-33.88447	18.70283	 Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems. Groundwater Quality (Background water quality and BHN):
	96211	WMS	GRU	BHN	-33.838611	18.607222	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms
		•		•	•	•	



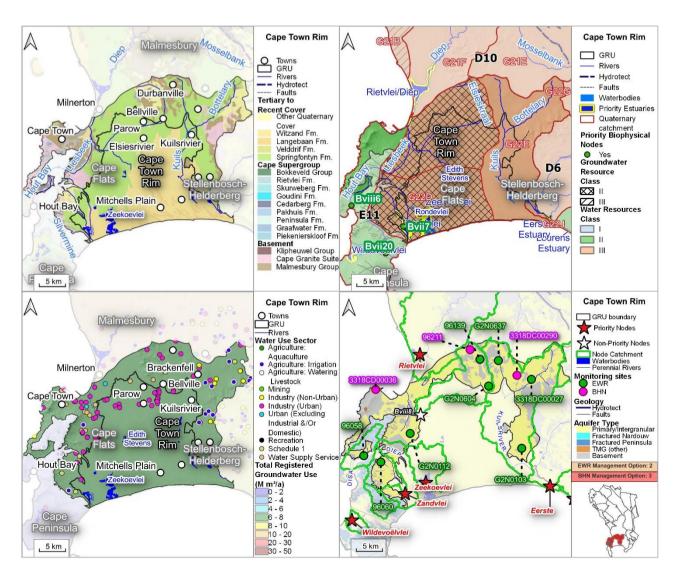


Figure 3-15 A series of maps for the Cape Town Rim GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.2. Stellenbosch-Helderberg GRU

	GRU Name: Stellenbo	Soft Ticluciboly						
GRU	Main Towns: Stellenbo	osch and Somerset West						
	Total Area (km²): 570.	58						
GRU Boundary Description	model boundary outlin of the basement lithological	ed in the CoCT (2018) repo ogy (the CGS and the Malmo stern edge, where the cor	osch-Helderberg GRU are del ort (i.e., the Cape Flats GRU). esbury Group) and the TMG, nsideration of preferential gr	The G10C surfamarks the south	ace water quaternary catchm nern and eastern/south-easte	ent divide, along with the cor rn boundaries of the GRU, re	ntact between an espectively. The f	interpolated extent alse Bay coastline
Resource Unit			Fracture	ed and Intergran	ular Basement Aquifer			
Quaternary Catchments	G22G, G22H, G22F, C	G22J and G22K (Figure 3-1	6)					
Description	lower rolling hills predo	ominantly formed by the Ma	y characterized by the Malme Imesbury Group (Figure 3-16 it has the potential to functio	6). To the east, t	the Peninsula Fm outcrops, s	haping the Stellenbosch and		
								and the District
Surface Water System	Jonkershoek, and Klip	rized by numerous rivers, r opies tributaries. These rive and DWS, 2022d and 2023a	namely the Eerste, Lourens, ers consistently follow the top 1).	Jonkershoek, a oography, strea	and Sir Lowrys Pass rivers. The ming from the elevated mounting from the el	The Eerste River is formed Intainous regions in the nort	by the converger h to the coastal	areas in the south
Surface Water System	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resou	opies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the ri	ers consistently follow the top	source Class III	ming from the elevated mou	ntainous regions in the nort ment of the GRU within IUA is 1 priority EWR site - the I	h to the coastal D6 (catchment G Eerste (Jonkersh	areas in the south 22F) is designated
, , , , , , , , , , , , , , , , , , ,	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resound biophysical river nodes	opies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the rist. Additionally, the Eerste an	ers consistently follow the top a). ry's (D7) IUAs, with Water Re rest of the RU lacks a Groun and Lourens estuaries are pres	source Class III dwater Resource sent in this GRU	ming from the elevated mountains and II, respectively. The segre Class designation. There I, both with a TEC of D (see I	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be	h to the coastal D6 (catchment G Eerste (Jonkersholow).	areas in the south 22F) is designated pek), and 3 priority
Water Resource	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resou	opies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the ri	ers consistently follow the top i). ry's (D7) IUAs, with Water Re- est of the RU lacks a Groun	source Class III	ming from the elevated mou	ntainous regions in the nort ment of the GRU within IUA is 1 priority EWR site - the I	h to the coastal D6 (catchment G Eerste (Jonkersh	areas in the south 22F) is designated
, , , , , , , , , , , , , , , , , , ,	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resound biophysical river nodes	opies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the rist. Additionally, the Eerste an	ers consistently follow the top ny's (D7) IUAs, with Water Re est of the RU lacks a Groun nd Lourens estuaries are pres Quaternary Catchment	source Class III dwater Resource sent in this GRU	and II, respectively. The segret Class designation. There J, both with a TEC of D (see I	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be	D6 (catchment GEerste (Jonkersholow).	areas in the south 22F) is designated oek), and 3 priority
Water Resource	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resound biophysical river nodes	ppies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the rist. Additionally, the Eerste ar	ers consistently follow the top. ry's (D7) IUAs, with Water Re est of the RU lacks a Groun and Lourens estuaries are pres Quaternary Catchment G22F G22G G22H	source Class III dwater Resource sent in this GRU D6-R16 D6-R17 D6-E06	and II, respectively. The segret Class designation. There II, both with a TEC of D (see III	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be Biophysical Node Biil6 Biv8 Bxi3	D6 (catchment GEerste (Jonkershow).	22F) is designated bek), and 3 priority nMAR 93 77 90
Water Resource	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resoubliophysical river nodes IUA D6 Eerste	ppies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the rist. Additionally, the Eerste ar	ers consistently follow the top. ry's (D7) IUAs, with Water Re est of the RU lacks a Groun and Lourens estuaries are pres Quaternary Catchment G22F G22G G22H G22J	source Class III dwater Resource ent in this GRU D6-R16 D6-R17 D6-E06 D7-R18	and II, respectively. The segrec Class designation. There IJ, both with a TEC of D (see IIII) Resource Name Eerste (Jonkershoek) Klippies Eerste Estuary Lourens	ment of the GRU within IUA is 1 priority EWR site - the figure 3-16 and the table be Biophysical Node Biii6 Biv8 Bxi3 Bvii21	D6 (catchment GEerste (Jonkershow).	22F) is designated bek), and 3 priority nMAR 93 77 90 114
Water Resource	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resound biophysical river nodes	ppies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr arce Class of III, while the rist. Additionally, the Eerste ar	ers consistently follow the top). ry's (D7) IUAs, with Water Re rest of the RU lacks a Groun and Lourens estuaries are pressured to the RU lacks a Groun followers of the RU la	source Class III dwater Resource sent in this GRU RU D6-R16 D6-R17 D6-E06 D7-R18 D7-R19	and II, respectively. The segrece Class designation. There II, both with a TEC of D (see III) Resource Name Eerste (Jonkershoek) Klippies Eerste Estuary Lourens Sir Lowry's Pass*	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be Biophysical Node Biii6 Biv8 Bxi3 Bvii21 Bviii9	D6 (catchment GEerste (Jonkersholow).	22F) is designated opek), and 3 priority nMAR 93 77 90 114 84
Water Resource	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resoubliophysical river nodes IUA D6 Eerste	ppies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr rice Class of III, while the ris. Additionally, the Eerste ar	ers consistently follow the top. ry's (D7) IUAs, with Water Re est of the RU lacks a Groun and Lourens estuaries are pres Quaternary Catchment G22F G22G G22H G22J	source Class III dwater Resource ent in this GRU D6-R16 D6-R17 D6-E06 D7-R18	and II, respectively. The segrec Class designation. There IJ, both with a TEC of D (see IIII) Resource Name Eerste (Jonkershoek) Klippies Eerste Estuary Lourens	ment of the GRU within IUA is 1 priority EWR site - the figure 3-16 and the table be Biophysical Node Biii6 Biv8 Bxi3 Bvii21	D6 (catchment GEerste (Jonkershow).	22F) is designated bek), and 3 priority nMAR 93 77 90 114
Water Resource	Jonkershoek, and Klip (refer to Figure 3-16 a The GRU falls within the a Groundwater Resound biophysical river nodes IUA D6 Eerste D7 Sir Lower's An estimated recharge	ppies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr rice Class of III, while the rist. Additionally, the Eerste ar Water Resource Class III II a of 41.52 M m³/a was determessments. The average recommends and the second of the second	ers consistently follow the top). ry's (D7) IUAs, with Water Re rest of the RU lacks a Groun and Lourens estuaries are pressured to the RU lacks a Groun followers of the RU la	source Class III dwater Resource sent in this GRU BU D6-R16 D6-R17 D6-E06 D7-R18 D7-R19 D7-E07 ge calculations u	and II, respectively. The segrec Class designation. There II, both with a TEC of D (see III). Resource Name Eerste (Jonkershoek) Klippies Eerste Estuary Lourens Sir Lowry's Pass* Lourens Estuary Lourens Estuary Lourens Estuary	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be Biophysical Node Biii6 Biv8 Bxi3 Bvii21 Bviii9 Bxi4	D6 (catchment Gerste (Jonkershow).	areas in the south 22F) is designated oek), and 3 priority NMAR 93 77 90 114 84 85
Water Resource Classes & RQOs	Jonkershoek, and Klip (refer to Figure 3-16 at The GRU falls within the a Groundwater Resound biophysical river nodes IUA D6 Eerste D7 Sir Lower's An estimated recharge the Aquifer Stress ass below and DWS (2022)	ppies tributaries. These riverind DWS, 2022d and 2023a The Eerste (D6) and Sir Lown rice Class of III, while the rist. Additionally, the Eerste and Water Resource Class III II II II II II II II II	ers consistently follow the top). ry's (D7) IUAs, with Water Revest of the RU lacks a Groun and Lourens estuaries are present to th	source Class III dwater Resource sent in this GRU BU D6-R16 D6-R17 D6-E06 D7-R18 D7-R19 D7-E07 ge calculations u	and II, respectively. The segret Class designation. There Up both with a TEC of D (see I Resource Name Eerste (Jonkershoek) Klippies Eerste Estuary Lourens Sir Lowry's Pass* Lourens Estuary using the Map-Centric Simula I GRU area. Additional recharge Volumes	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be Biophysical Node Biii6 Biv8 Bxi3 Bvii21 Bviii9 Bxi4 tion method and was chosen arge estimations are available	D6 (catchment GEerste (Jonkershelow). TEC C D D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D D C C D C	22F) is designated oek), and 3 priority NMAR 93 77 90 114 84 85 recharge value for Refer to the table
Water Resource Classes & RQOs	Jonkershoek, and Klip (refer to Figure 3-16 at The GRU falls within the a Groundwater Resound biophysical river nodes IUA D6 Eerste D7 Sir Lower's An estimated recharge the Aquifer Stress assobelow and DWS (2022)	ppies tributaries. These rive and DWS, 2022d and 2023a the Eerste (D6) and Sir Lowr rice Class of III, while the rist. Additionally, the Eerste ar Water Resource Class III II a of 41.52 M m³/a was determessments. The average recommends and the second of the second	ers consistently follow the top ry's (D7) IUAs, with Water Re rest of the RU lacks a Groun and Lourens estuaries are pres Quaternary Catchment G22F G22F G22H G22J G22K G22J mined from first-order recharg	source Class III dwater Resource sent in this GRU BU D6-R16 D6-R17 D6-E06 D7-R18 D7-R19 D7-E07 ge calculations u	and II, respectively. The segrece Class designation. There II, both with a TEC of D (see II) Resource Name Eerste (Jonkershoek) Klippies Eerste Estuary Lourens Sir Lowry's Pass* Lourens Estuary Using the Map-Centric Simular II GRU area. Additional recha	ment of the GRU within IUA is 1 priority EWR site - the Eigure 3-16 and the table be Biophysical Node Biii6 Biv8 Bxi3 Bvii21 Bviii9 Bxi4 tion method and was chosen arge estimations are available	D6 (catchment Gerste (Jonkershelow).	22F) is designated oek), and 3 priority NMAR 93 77 90 114 84 85 recharge value for Refer to the table



	GRU Name: Stellenbosch-Helderberg			
GRU	Main Towns: Stellenbosch and Somerset West			
	Total Area (km²): 570.58			
Groundwater Use	In this GRU, there are 163 registered groundwater users utilizing a total of 8.79 M m³/a, drawing from both the Fractured and Intergranular Basement Aquifer and the Primary/Intergranular Aquifer. The primary groundwater use sectors are Water Supply Services and Agriculture (Irrigation), accounting for 64.3% and 21.9%, respectively, of the total annual groundwater use volume (see Figure 3-16 and the table on the right).	Water Use Sector Fract Agriculture: Aquaculture Agriculture: Irrigation Industry (Non-Urban) Industry (Urban) Schedule 1 Water Supply Service Agriculture: Irrigation Agriculture: Watering Livestock Industry (Non-Urban) Industry (Urban) Recreation Schedule 1 Water Supply Service	No. of Users ured And Intergranular Basen 3 35 8 11 32 Primary / Intergranular Aqu 38 1 11 41 41 41 5 163	0.001 0.87 0.05 0.27 0.003 3.50
Water Quality	Stellenbosch-Helderberg 100 100 100 100 100 100 100 100 100 1	waters is attributed to the depodissolution and saturation of N the relatively low transmissivity. No RQOs have been established targeting the Tygerberg Fm, a sulphate, EC, ammonia, nitrate water quality category is C, indimpact the purpose for which agriculture and industry, contriby naturally elevated salinity, purpose to the purpose for which agriculture and industry, contributed to the purpose for which agriculture and industry, contributed to the purpose for which agriculture and industry, purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the purpose for ph, ammonia, nitrate + nitriticategory is also C, indicating the ph, ammonia, nitrate + nitriticategory is also C, indicating the ph	sistion of marine aerosols, a and Cl ions due to increar granitic and clay-rich shaded for the drainage regions to least 50% of samples eigen + nitrite, and orthophospicating the presence of some groundwater is used bute to these concerns, boosing water quality concerns, at least 50% of sample e, and orthophosphate. For the presence of some local	RU is Na-CI. The presence of Na-CI recharge by coastal rainfall, and the eased groundwater residence time in ale and siltstone basement aquifer. Is in which this GRU falls. In boreholes exceeded baseline concentrations for chate. For this lithology, the adjusted ame localized contamination that may Anthropogenic impacts, likely from out exceedances are also influenced erns. It is exceeded baseline concentrations for this lithology, the final water quality slized contamination that may impact DWS 2022d, 2022e and 2023a for
Aquifer Stress	The GRU is considered to have a Groundwater Availability Present Status Category of 'C', in 'C' indicating moderate levels of localised contamination, but little or no negative impacts app	arent (see table below).	ater Availability Present	Groundwater Quality Present Status
	(M m ³ /a) (M m ³ /a) 41.52 8.79	.21	tatus Category	Category
	0.10			<u> </u>



GRU		nbosch-Helderberg										
Cito	Main Towns: Stelle	enbosch and Somerset V	Vest									
	Total Area (km²): 5											
	Total Alea (Kill). 3	770.30										
	Groundwater Qual	ity Component										
		7 1										
	The groundwater of	quality component of the	Reserve, det	ailed in the tal	ole below and d	escribed in Se	ection 2.3 & 2.4	l, is determined	as two com	ponents 1) the G	roundwater Qu	ality Reser
	and 2) the Ground	water Quality BHN Rese	rve (to be cor	nfirmed).					·	,		•
										•		
						Baseline			Median	95 th Percentile	Groundwater	Groundwat
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Conc.	Min Conc.	Max Conc.	Conc.	Conc.	Quality Reserve	Quality BH Reserve
		Sulphate	mg/l			10.20	7.70	338.40	73.05	282.60	282.60	Reserve
		Electrical conductivity	mS/m	1		197.00	32.70	885.00	203.00	734.75	734.75	
		рН		1		7.08	6.72	7.18	6.98	7.18	7.18	
		Ammonia	mg/l			0.04	0.02	0.09	0.05	0.08	0.08	
	Fractured and	Nitrate + nitrite	mg/l			0.02	0.02	5.61	0.21	4.55	4.55	
	Intergranular	Fluoride	mg/l	15	15	2.35	0.05	2.61	0.67	2.54	2.54	
	Basement Aquifer	Orthophosphate	mg/l		10	0.01	0.01	0.06	0.01	0.05	0.05	
	(Tygerberg)	Calcium	mg/l	4		54.5 28.9	4.30 5.90	200.80 376.90	43.40 56.85	165.05 306.05	165.05 306.5	
		Magnesium Sodium	mg/l mg/l	1		297.3	54.10	1510.20	307.85	1261.70	1261.70	
		Potassium	mg/l	1		6.38	2.98	8.80	3.78	7.60	7.60	
Froundwater Reserve		Chloride	mg/l	1		610.6	86.50	3495.00	586.65	2878.03	2878.03	
				•			•			•		•
						Baseline			Median	95 th Percentile	Groundwater	Groundwat
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples		Min Conc.	Max Conc.			Quality	Quality BH
		Outstants					0.00	000.00				Reserve
				4								
			1113/111	1	•							
			ma/l	1	ŀ							
				1								
		Fluoride	mg/l	6	6	1.25	0.16	2.46	0.41	2.38	2.38	
		Orthophosphate	mg/l	0	в	0.01		0.08	0.01	0.07	0.07	
				4								
				4								
		Chloride	mg/l	1		167.2	34.50	610.60	115.90	373.93	373.93	
		Official	TH9/T			107.2	07.00	010.00	110.00	070.00	070.00	
	Fractured and Intergranular Basement Aquifer (CGS)	Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium Magnesium Sodium Potassium	mg/l mS/m mg/l mg/l mg/l mg/l mg/l mg/l mg/l mg	6	6	0.01 9.6 13.8 95.6 7.07	2.00 17.60 6.41 0.04 0.02 0.16 0.01 1.60 2.90 22.40 0.96	289.80 197.00 7.48 0.11 8.34 2.46 0.08 99.10 35.80 297.30 7.07	0.01 9.60 9.00 66.70 3.15	0.07 67.88 30.97 194.33 6.59		Reserve 138.88 146.32 7.34 0.07 0.24 2.38 0.07 67.88 30.97 194.33 7.07

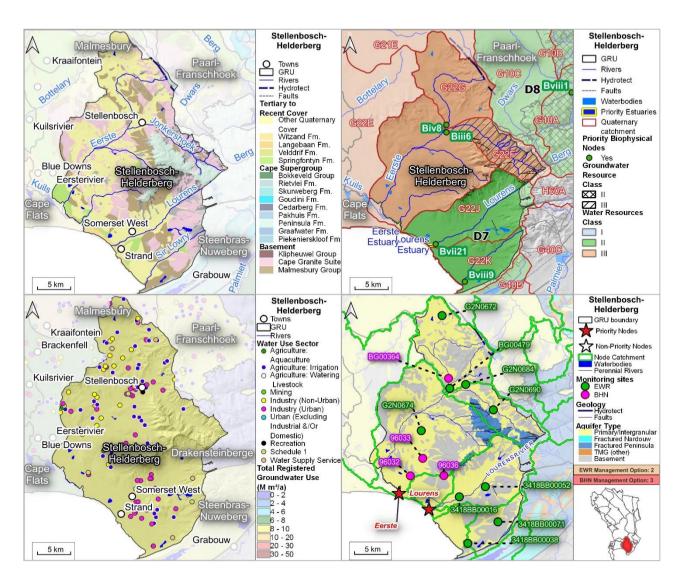


Main Towns: Stellenbosch and Somerset West Total Area (km²): 570.58 Groundwater Quantity Component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is calculated by considering the total groundwater contribution the EWR and BHN Reserves. Recharge (Mm²/a) EWR Reserve (Mm²/a) BHN Reserve (Mm²/a) GW Reserve (Mm²/a) Total Allocable Volume (Mm²/a) Water Use (Mm²/a) Still Allocable (Mm²/a) 41.52 2.34 0.24 2.58 38.94 8.79 30.13 In Scenario 7b, which projects conditions for the year 2050 and considers the "Most-Likely Case" for the GRU, the analysis focused on two key factors: Recharge and Water Use factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a derecharge from 41.52 to 38.49 M m²/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 8.81 to 11.30 M m²/a due to growth and the implementation of groundwater development schemes in the area. Everymency, the groundwater contribution to the BHN and EWR. The scenario involved a derecharge from 41.52 to 38.49 M m²/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 8.81 to 11.30 M m²/a due to growth and the implementation of groundwater development schemes in the area. Everymency, the groundwater contribution to the BHN Reserve rose from 0.24 to 0.46 M m²/a, affection 2.5 and the table below).		GRU Name: Stellenbosch-	-Helderberg					
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		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrei 1.30 M m³/a due to se 24 to 0.46 M m³/a, pri from a category C (re
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decre 1.30 M m³/a due to se 24 to 0.46 M m³/a, pri from a category C (re
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decre 1.30 M m³/a due to se 24 to 0.46 M m³/a, pri from a category C (re
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m³/a due to se 24 to 0.46 M m³/a, pria from a category C (re
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m³/a due to se 24 to 0.46 M m³/a, prin from a category C (re
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to se 24 to 0.46 M m ³ /a, prin from a category C (re
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table by Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to sec 24 to 0.46 M m ³ /a, prin from a category C (red Still Allocable (Mm ³ /a
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to sec 24 to 0.46 M m ³ /a, prin from a category C (red Still Allocable (Mm ³ /a
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m³/a due to sec 24 to 0.46 M m³/a, prin from a category C (ref
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to sec 24 to 0.46 M m ³ /a, prin from a category C (rel
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to sec 24 to 0.46 M m ³ /a, prin from a category C (ref
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to sec 24 to 0.46 M m ³ /a, prin from a category C (red Still Allocable (Mm ³ /a
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decrea 1.30 M m ³ /a due to sec 24 to 0.46 M m ³ /a, prin from a category C (rel
		factors directly influenced to recharge from 41.52 to 38 growth and the implementa attributed to population groups Section 2.5 and the table but the Recharge (Mm³/a)	the parameters used to det 3.49 M m ³ /a, influenced by ation of groundwater develowth. In light of these chancelow). EWR Reserve (Mm ³ /a)	termine the Groundwater Reboth climate change and the opment schemes in the areages, the Allocation Categorian BHN Reserve (Mm³/a)	eserve, specifically the groune elimination of IAPs. Added. Furthermore, the groundry shifted from. Under thes	undwater contribution to the ditionally, groundwater use dwater contribution to the E e conditions, the Allocation Total Allocable Volume (Mm³/a)	BHN and EWR. The sce increased from 8.81 to 1 BHN Reserve rose from 0. Category did not change Water Use (Mm³/a)	nario involved a decre 1.30 M m³/a due to s 24 to 0.46 M m³/a, pr from a category C (r



	GRU Name: Stell	enbosch-Held	lerberg				
GRU	Main Towns: Stel	lenbosch and	Somerset West	t			
	Total Area (km²):	570.58					
	The Stellenbosch contribution to the below).	-Helderberg G e BHN. A tota	GRU was assignal of 9 monitorin	ed a Manageme g sites for the E	ent Option 2 for me EWR and 4 for th	onitoring the gro ne BHN were sti	bundwater contribution to the EWR and a Management Option 3 for monitoring the groundwater rategically selected within the Stellenbosch-Helderberg GRU (see Figure 3-16 and the table
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
						EWR Manager	nent Option 2
	3418BB00038	NGA	Bviii9	EWR	-34.14602	18.87707	Frequency: Quarterly 1) Groundwater level:
	3418BB00071	NGA	Bviii9	EWR	-34.11769	18.92707	automatically recorded level logger. 2) Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄
	G2N0672	HYDSTRA	Biv8	EWR	-33.83622	18.84286	 Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹: Bviii9: Nutrients (Phosphate [PO₄-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical
	G2N0674	HYDSTRA	Eerste	EWR	-33.99185	18.80492	Conductivity [EĊ]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endosulfan) Biv8:
	G2N0684	HYDSTRA	Biii6	EWR	-33.93032	18.87903	Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endosulfan)
Monitoring Programme	G2N0690	HYDSTRA	Biii6	EWR	-33.96561	18.92327	Bxi3 (Eerste): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables
	3418BB00016	NGA	Bvii21	EWR	-34.08269	18.86485	(Temperature, pH, Dissolved Oxygen). Biii6: Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical
	3418BB00052	NGA	Bvii21	EWR	-34.06964	18.90762	Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endosulfan)
	BG00479	NGA	Biv8	EWR	-33.93513	18.8528	Bvii21: Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endosulfan)
					1	BHN Managen	
	96032	WMS	GRU	BHN	-34.052778	18.785556	Frequency: Monthly or Quarterly
	96036	WMS	GRU	BHN	-34.053333	18.840278	2) Groundwater level: O Manual water level measurements and continuous hourly readings from Output to part of the part of t
	BG00364	NGA	GRU	BHN	-33.92159	18.85123	automatically recorded level loggers. Possible need for telemetry systems. 3) Groundwater Quality (Background water quality and BHN): Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄
	96033	WMS	GRU	BHN	-34.029444	18.806389	Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms





A series of maps for the Stellenbosch-Helderberg GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.3. Paarl-Franschhoek GRU

GRU	GRU Name: Paarl-Fra Main Towns: Paarl, Fra Total Area (km2): 368.	anschhoek						
GRU Boundary Description	The Paarl-Franschhoe southern edges. The nand DWS, 2022d and	orthern and western bou	he extent of basement lith undaries of the GRU are d	nologies, specifical efined by portions	ly the CGS and the Malm of the G10D, G21E, and C	nesbury Group, and their of G21D surface water quater	contact with the TMG rnary catchment divid	G along the eastern and les (refer to Figure 3-17
Quaternary Catchments	G10C, G10A and G10	B (Figure 3-17)						
Resource Unit			Fi	ractured and Interg	ranular Basement Aquifer	ſ		
Description	regions of the area. The	ne Peninsula Fm of the	TMG is observed in the m	nountainous southe	ast and along the eastern	ese rocks dominate the oun boundary. Additionally, Cefer to DWS, 2022d and 20	Quaternary cover, inc	ng northern and western cluding Fms such as the
Surface Water System		ater system in the area in Figure 3-17 and DWS,		cludes the Dwars a	and Franschhoek tributario	es. This river flows in a no	rthward direction fron	n the Berg River Dam to
Water Resource						GRU within catchments G' a TEC of C and D (refer to		
Classes & RQOs	IUA	Water Resource Class	Quaternary Catchment	RU	Resource Name	Biophysical Node	TEC	nMAR
	D8 Upper Berg	II	G10A G10C	D8-R02 D8-R03	Berg Berg	Bviii1 Biii3	<u>C</u> D	27 53
						c Simulation method and value frecharge estimations ar		
Recharge	below and DWS (2022	e) for further details.				ge Volume		echarge Rate
		ethod	Area (kr	*	(M)	m ³ /a)	(mr	m/a)
	Map Centric Si	imulation Method	368.50	U .		5.61	72	.21



GRU						
	Main Towns: Paarl, Franschhoek					
	Total Area (km2): 368.50					
				Water Use Sector	No. of Users	Total Volume (M m ³ /a)
					Fractured and Intergranular Base	ement Aquifer
				Agriculture: Aquaculture		0.22
				Agriculture: Irrigation	33	0.90
				Agriculture: Watering lives		0.10
				Industry (Non-urban)	16	0.32
			-	Industry (Urban) Schedule 1	7	0.17
	In this GRU, there are 268 registered of	groundwater users utilizing a combine	ed groundwater	Schedule 1	Primary / Intergranular A	0.01
	volume of 9.84 M m ³ /a, drawing from th			Water Supply service	1	0.004
	Primary/Intergranular Aquifer, and the			Agriculture: Irrigation	1	0.004
Groundwater Use	groundwater use sectors include Agricu	Iture (Irrigation) Industry (Urban) an	nd Water Supply	Agriculture: Imgalion	Fractured TMG Aquifer (Pe	
	Services, contributing 61.1%, 15.1%	and 14.7% respectively to the	e total annual	Agriculture: Irrigation	140	5.04
	groundwater use volume (see Figure 3 ·	. and 14.7%, respectively, to the	e total allitual	Agriculture: Watering Lives		0.08
	groundwater use volume (see Figure 3	Tr and the table on the light).	-	Industry (Non-urban)	5	0.11
			•	Industry (Urban)	34	1.31
				Schedule 1	9	0.06
				Urban (Excluding industr	ial ₁	0.01
				and/or domestic)	<u> </u>	
				Water Supply service	9	1.44
				Total	268	9.84
Water Quality	1 - GALICO 1 Type 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	80 80 80 80 90 100 100 80 80 80 80 80 20	i r s (6 I i s	is attributed to the saturesidence time in the resiltstone basement aquife Only 1 sample exists for the exists for comparison, and Despite agriculture bein indicate that pristine water	ration of Na and Cl ions, relatively low transmissivity of et. his GRU. While this sample of consequently, no water query prevalent within the GRU et quality conditions are likely.	Na-Cl. The presence of Na-Cl waters esulting from increased groundwater if the granite and clay-rich shale and can establish a baseline, no other data uality category has been established. J, the low parameter concentrations . However, a more conclusive present to DWS, 2022d, 2022e and 2023a for
Aquifer Stress	The GRU is considered to have a Ground determined due to limited data availabil Recharge Volume (M m³/a) 26.61		ategory of 'C', indica Stress In 0.37	ndex Gro	ed aquifer, and the Groundwandwater Availability Present Status Category C	Groundwater Quality Present Status Category N/A



GRU	GRU Name: Paarl- Main Towns: Paarl Total Area (km2): 3	, Franschhoek										
		ty Component uality component of the water Quality BHN Rese			ile below and	described in Se	ection 2.3 & 2.	4, is determined	as two comp	ponents 1) the G	roundwater Qu	uality Rese
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundw Quality B Reserv
ļ		Sulphate	mg/l			2.00	2.00	2.00	2.00	2.00	2.00	
ļ		Electrical conductivity	mS/m			14.40	14.40	14.40	14.40	14.40	14.40	
		pН				7.04	7.04	7.04	7.04	7.04	7.04	
		Ammonia	mg/l			0.06	0.06	0.06	0.06	0.06	0.06	
ļ	Fractured	Nitrate + nitrite	mg/l	٦		0.76	0.76	0.76	0.76	0.76	0.76	
ļ	and	Fluoride	mg/l	٦ ,		0.25	0.25	0.25	0.25	0.25	0.25	
	Intergranular	Orthophosphate	mg/l	7 1	1	0.10	0.10	0.10	0.10	0.10	0.10	
oundwater Reserve		Calcium	mg/l	٦		2.80	2.80	2.80	2.80	2.80	2.80	
	ater Reserve Basement Aquifer (CGS)	Magnesium	mg/l	7	1	1.70	1.70	1.70	1.70	1.70	1.70	
				_		18.20	18.20	18.20	18.20	18.20	18.20	
		Sodium	ma/l									
		Sodium Potassium	mg/l mg/l	=						1 75	1 75	
	Groundwater Quan	Potassium Chloride tity Component	mg/l mg/l	detailed in the ta	shle below and	1.75 27.50	1.75 27.50	1.75 27.50	1.75 27.50	1.75 27.50	1.75 27.50	ribution to
	The groundwater q the EWR and BHN	Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l			1.75 27.50 d described in \$	1.75 27.50 Section 2.3 &	1.75 27.50	1.75 27.50 d by conside	27.50 ring the total gro	27.50 undwater conti	
	The groundwater q the EWR and BHN Recharge (Mm³	Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l	BHN Reserve (1.75 27.50 d described in S	1.75 27.50 Section 2.3 &	1.75 27.50 2.4, is calculate al Allocable Volun (Mm³/a)	1.75 27.50 d by conside	27.50 ring the total gro tter Use (Mm³/a)	27.50 undwater conti	able (Mm³/
	The groundwater q the EWR and BHN	Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l			1.75 27.50 d described in \$	1.75 27.50 Section 2.3 &	1.75 27.50 2.4, is calculate	1.75 27.50 d by conside	27.50 ring the total gro	27.50 undwater conti	
uture Scenario 2050 (Scenario 7b)	The groundwater q the EWR and BHN Recharge (Mm³ 26.61 In Scenario 7b, wh factors directly influrecharge from 26.6 growth and the imp	Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l ee Reserve, of the year used to deter uenced by by atter develop	BHN Reserve (0.13 2050 and considermine the Groun outh climate charpment schemes	ders the 'Mos dwater Reser nge and the e in the area. F	1.75 27.50 d described in S GW Reserve (Mn 3.14 st-Likely Case' frve, specifically elimination of IA Furthermore, the	1.75 27.50 Section 2.3 & or the GRU, the groundware groundwater (refer to Section 2.3 & 1.75 Total control of the groundware (refer to Section 2.3 & 1.75 Total control of the groundware (refer to Section 2.3 & 1.75 Total control of the groundware (refer to Section 2.3 & 1.75 Total control of the groundware (refer to Section 2.3 & 1.75 Total control of the groundware (refer to Section 2.3 & 1.75 Total control of the groundware (refer to Section 2.3 & 1.75)	1.75 27.50 2.4, is calculate al Allocable Volun (Mm³/a) 23.47 he analysis foct ter contribution illy, groundwater contribution to	1.75 27.50 d by conside Wa used on two to the BHN a use increas the BHN Rei table below)	z7.50 ring the total gro ter Use (Mm³/a) 9.84 key factors: Recl nd EWR. The sc ed from 9.82 to serve rose from 0	27.50 undwater conti Still Alloca 1 harge and Watenario involved 15.50 M m³/a a	able (Mm³, 3.65
uture Scenario 2050 (Scenario 7b)	The groundwater q the EWR and BHN Recharge (Mm³ 26.61 In Scenario 7b, wh factors directly influrecharge from 26.6 growth and the imp	Potassium Chloride tity Component uantity component of th Reserves. /a) EWR Reserve 3.01 ich projects conditions of the parameters used to 24.60 M m³/a, infludementation of groundwittion growth. In light of the	mg/I mg/I mg/I mg/I mg/I mg/I mg/I mg/I	BHN Reserve (0.13 2050 and considermine the Groun outh climate charpment schemes	ders the 'Mos adwater Reser ange and the e in the area. F an Category shi	1.75 27.50 d described in S GW Reserve (Mn 3.14 st-Likely Case' frve, specifically elimination of IA Furthermore, the	1.75 27.50 Section 2.3 & or the GRU, the groundware groundwater (refer to Section 2.3 & Total and the groundwater (refer to Section 2.3 & Total	1.75 27.50 2.4, is calculate al Allocable Volun (Mm³/a) 23.47 he analysis foct ter contribution illy, groundwater contribution to	1.75 27.50 d by conside Wa used on two to the BHN a use increas the BHN Res table below)	z7.50 ring the total gro ter Use (Mm³/a) 9.84 key factors: Recl nd EWR. The sc ed from 9.82 to serve rose from 0	27.50 undwater continuation of the still Allocation o	able (Mm³/ 3.65 ter Use



GRU	GRU Name: Paa Main Towns: Paa Total Area (km2)	arl, Franschho	**				
							water contribution to the EWR and a Management Option 2 for monitoring the groundwater egically selected within the Paarl-Franschhoek GRU (see Figure 3-17 and the table below). Monitoring Description
	G1N0439	HYDSTRA	Bvii2	EWR	-33.89888889	18.99027778	Frequency: Monthly or Quarterly
	G1N0440	HYDSTRA	Biv5	EWR	-33.92332	19.11257	Groundwater level:
	G1N0502	HYDSTRA	Biii3	EWR	-33.76862	19.01813	o Manual water level measurements and continuous hourly readings from
	G1N0320	HYDSTRA	Biv5	EWR	-33.88316	19.04709	automatically recorded level loggers. Possible need for telemetry systems. 2) Groundwater Quality:
	G1N0322	HYDSTRA	Bvii2	EWR	-33.87951	19.03125	o Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄
	3319CC00104	NGA	Biii2	EWR	-33.85883	19.0303	 Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹:
	G1N0428	HYDSTRA	Biv5	EWR	-33.92333333	19.08166667	Site specific additions as per RQO
Monitoring Programme	G1N0446	HYDSTRA	Biii3	EWR	-33.82835	18.94113	Biii3: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical
	BG00450	NGA	Bvii14	EWR	-33.91134	18.94703	Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature,
	3318DD00243	NGA	Bvii2	EWR	-33.86135	18.99509	pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endusulfan)
	3318DD00235	NGA	Bvii2	EWR	-33.84467	18.99092	
						BHN Managen	
	96019	WMS	GRU	BHN	-33.915556	18.920833	Frequency: Quarterly 1) Groundwater level:
	3318DD00221	NGA	GRU	BHN	-33.82247	18.96593	Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 2) Groundwater Quality (Background water quality and BHN):
	3318DB00090	NGA	GRU	BHN	-33.7197	18.99509	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms
		<u>l</u>	I	l	1	I	



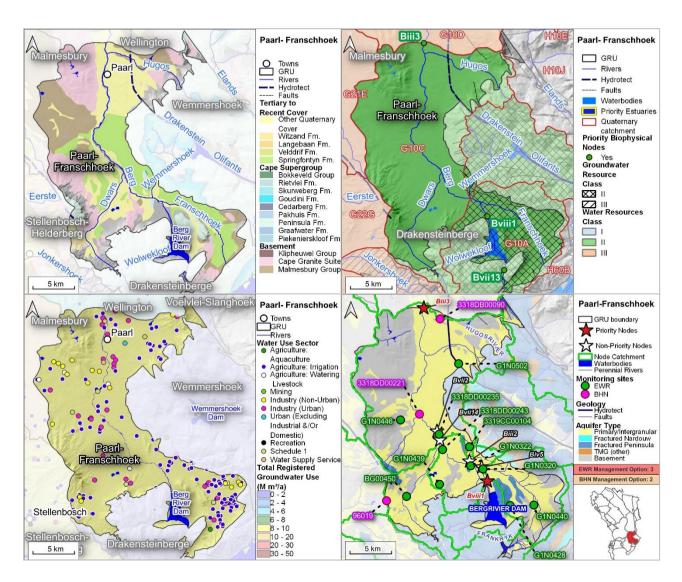


Figure 3-17 A series of maps for the Paarl-Franschoek GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.4. Malmesbury GRU

GRU	GRU Name: Malmest Main Towns: Malmest Total Area (km2): 160	bury and Melkbosstrand						
GRU Boundary Description	G10D, G22C, G22E,	J is defined by a combination G10C, G10J, G10L, G10F, the CoCT (2020) aquifer mo	and G21A surface water qu	aternary catchme	ent divides on its northern,	eastern, and southern edg	ges. The western ex	ong with the G22G, ktent of the GRU is
Quaternary Catchments	G201E, G21C, G21D	, G21F and G21B (Figure 3 -	.18)					
Resource Unit			Fractur	ed and Intergranu	ılar Basement Aquifer			
Description	hills associated with the	underlain by the Malmesburne Malmesbury Group. Group o DWS, 2022d and 2023a).						
Surface Water System	The major surface wa	ter systems in the area cons	ist of the Diep, Sout, and Mo	osselbank rivers (refer to Figure 3-18 and D\	WS, 2022d and 2023a).		
Water Resource	within A3 (catchment	he West Coast (A3) and Die G21B) both have a Ground are 3 priority biophysical node	water Resource Class of II, v	while the rest of th	he GRU has no Groundwat	er Resource Class assigne	ed. There are no EV	
Classes & RQOs	IUA	Water Resource Class	Quaternary Catchment	RU	Resource Name	Biophysical Node	TEC	nMAR
	D. () D. (G21D	D10-R11	Diep	Bv1	D	66
	D10 Diep	III	G21D G21F	D10-R12 D10-E03	Diep Rietvlei/ Diep	Biv6 Bxi7	D C	68 78
Recharge	An estimated recharg for the Aquifer Stress (2022e) for further det	e of 52.65 M m³/a was dete assessments. The average tails.	rmined from first-order recha recharge rate is 32.90 mm/ Area (km²)	arge calculations a based on the to	using the Map-Centric Sim otal GRU area. Additional re Recharge Volu	echarge estimations are av	nosen as the estima vailable in the literat Average Recharg	ture. Refer to DWS



	GRU Name: Malmesbury			
GRU	Main Towns: Malmesbury and Melkbosstrand			
	Total Area (km2): 1600.36			
		Water Use Sector	No. of Users	Total Volume (M m ³ /a)
			Fractured And Intergranular Ba	
		Agriculture: Irrigation	78	5.44
		Agriculture: Watering Livestock	18	0.67
		Industry (Non-Urban)	2	0.002
		Industry (Urban)	19	1.44
		Mining	1	0.003
	In this GRU, there are 245 registered groundwater users collectively utilizing 14.8 M m ³ /a of	Schedule 1	4	0.01
	groundwater. The primary groundwater use sectors are Agriculture (Irrigation), Agriculture		Primary / Intergranular Aqui	fers
Groundwater Use	(Watering Livestock), and Industry (Urban), contributing 67.5%, 17.0%, and 12.4%,	Water Supply Service	1	0.01
Groundwater Ose	respectively, to the total annual groundwater use volume (see Figure 3-18 and the table on	Agriculture: Aquaculture	63	4.51
		Agriculture: Irrigation	28	1.84
	the right).	Agriculture: Watering Livestock		0.13
		Industry (Non-Urban)	20	0.39
		Industry (Urban)	1	0.02
		Urban (Excluding Industrial	6	0.27
		And/Or Domestic)	0	
		Water Supply Service	1	0.01
		Total	245	14.75
Water Quality	1 - Ca-HCO3 type 2 - Na-Clo3 type 3 - Ca-Ha-HCO3 type 4 - Ca-HgO Claye 5 - Ra-HCO3 type 6 - Ra-HCO3 type 20 4 10 0 100 0 100 0 100 0 100 0 100 0 100 0 100 0 100 0 100 0 100 0 100 0 100	attributed to the saturation of time in the relatively low transfer in the relative low trelative low transfer in the relative low transfer in the relative	Na and CI ions, resulting from smissivity clay-rich shale and entertrations were observed bles exceeding the baseline ed the RQO for EC, 1 for played to contamination from agains of dissolved ions. The accontamination exist, but large	The presence of Na-Cl waters is m increased groundwater residence d siltstone basement aquifer. for all parameters except dissolved e for pH. Out of the 149 samples H, and 34 for nitrate + nitrite. These riculture and industry, as well as adjusted water quality category is B, gely natural conditions prevail (see
Aquifer Stress	The GRU is considered to have a Groundwater Availability Present Status Category of 'C', indicating localised, low levels of contamination, but no negative impacts apparent (see table beginning to the contamination). Recharge Volume	elow). Index Groundv	sed aquifer, and a Groundv vater Availability Present Status Category	water Quality Present Status of 'B', Groundwater Quality Present Status Category B



GRU	GRU Name: Malm Main Towns: Malm Total Area (km2):	esbury and Melkbosstra	nd									
	Groundwater Quali The groundwater q and 2) the Ground	ty Component uality component of the water Quality BHN Rese	Reserve, de rve (to be co	etailed in the tabonfirmed).	ole below and	described in Se	ection 2.3 & 2.4	4, is determined	as two com	ponents 1) the G		
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwate Quality BHI Reserve
		Sulphate	ma/l		196	172.57	1.50	360.70	33.30	228.53	228.53	Reserve
			mg/l	=	196	172.57	29.66	2110.00	107.90	752.40	1549.90	
		Electrical conductivity	mS/m	4								
		pH	n	=	197	7.15	1.00	8.60	7.64	8.17	8.17	
	Fractured	Ammonia	mg/l	⊣	195	0.10	0.00	1.27	0.03	0.14	0.14	
	and	Nitrate + nitrite	mg/l		194	503.08	0.02	589.68	0.56	17.24	503.08	
	Intergranular	Fluoride	mg/l	66	191	0.26	0.03	2.94	0.38	1.10	1.10	
roundwater Reserve	Basement Aquifer	Orthophosphate	mg/l	_	195	0.10	0.00	14.00	0.02	0.16	0.16	
Touridwater Reserve	(Tygerberg)	Calcium	mg/l		194	178.18	3.50	219.30	16.98	106.08	178.18	
	1	Magnesium	mg/l		193	66.07	4.30	205.00	18.68	135.78	135.78	
					404	282.03	25.00	1726.90	156.40	931.90	931.90	
		Sodium	mg/l		191							
		Sodium Potassium	mg/l mg/l		192	18.77	1.10	50.31	3.67	17.06	18.77	
	Groundwater Quar	Potassium Chloride										
		Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l	detailed in the to	192 197 able below and	18.77 655.78	1.10 50.00 Section 2.3 &	50.31 2879.60	3.67 257.01 d by conside	17.06 1678.57	18.77 1678.57 undwater conti	
	The groundwater of the EWR and BHN Recharge (Mm ³ 52.65 In Scenario 7b, wh factors directly influrecharge from 52.6 growth and the imp	Potassium Chloride utity Component uantity component of the Reserves.	mg/l mg/l e Reserve, of (Mm³/a) or the year issed to deterenced by botater develop	BHN Reserve (0.34 2050 and consirmine the Grour oth climate charpment schemes	able below and (Mm³/a) iders the 'Mos dwater Reserge and the els in the area. F	18.77 655.78 d described in S GW Reserve (Mn 1.52 t-Likely Case' f ve, specifically imination of IAF furthermore, the	1.10 50.00 Section 2.3 & In	50.31 2879.60 2.4, is calculated al Allocable Volum (Mm³/a) 51.13 The analysis focuter contribution by, groundwater contribution to	3.67 257.01 d by conside wased on two of the BHN ause increase the BHN Reserved.	17.06 1678.57 ring the total gro ter Use (Mm³/a) 14.75 key factors: Reclad EWR. The scale from 14.75 to serve rose from 6	18.77 1678.57 undwater continuous Still Allocation involved 25.12 M m³/a	able (Mm³/a) 6.38 er Use. The
Future Scenario 2050 (Scenario 7b)	The groundwater of the EWR and BHN Recharge (Mm ³ 52.65 In Scenario 7b, wh factors directly influrecharge from 52.6 growth and the imp	Potassium Chloride Itity Component uantity component of the Reserves. It is EWR Reserve 1.18 It is projects conditions for the parameters of the paramete	mg/l mg/l e Reserve, of (Mm³/a) for the year a seed to deter enced by both atter developmese change	BHN Reserve (0.34 2050 and consirmine the Grour oth climate charpment schemes	able below and (Mm³/a) iders the 'Mos adwater Reservage and the else in the area. Fin Category shi	18.77 655.78 d described in S GW Reserve (Mn 1.52 t-Likely Case' f ve, specifically imination of IAF furthermore, the	1.10 50.00 Section 2.3 & n³/a) Tot for the GRU, the groundware Ps. Additionally groundwater D (refer to Section 2.3 &	50.31 2879.60 2.4, is calculated al Allocable Volum (Mm³/a) 51.13 The analysis focuter contribution by, groundwater contribution to	3.67 257.01 d by conside Wa sed on two the BHN a use increase the BHN Res table below)	17.06 1678.57 ring the total gro ter Use (Mm³/a) 14.75 key factors: Reclad EWR. The scale from 14.75 to serve rose from 6	18.77 1678.57 undwater control Still Allocation 3 harge and Watenario involved 25.12 M m³/a 0.34 to 0.64 M	able (Mm³/a) 6.38 er Use. The



GRU	GRU Name: Malı Main Towns: Mal Total Area (km2)	mesbury and	Melkbosstrand				
	to the BHN. A tot				or the BHN were	strategically sele	contribution to the EWR and a Management Option 3 for monitoring the groundwater contribution elected within the Malmesbury GRU (see Figure 3-18 and the table below).
	Site Name	Source	Area	Objective	Latitude	Longitude	Monitoring Description
						EWR Managen	
	G1N0439	HYDSTRA	Bvii2	EWR	-33.89888889	18.99027778	Frequency: Monthly or Quarterly
	G1N0440	HYDSTRA	Biv5	EWR	-33.92332	19.11257	3) Groundwater level:
	G1N0502	HYDSTRA	Biii3	EWR	-33.76862	19.01813	Manual water level measurements and continuous hourly readings from
	G1N0320	HYDSTRA	Biv5	EWR	-33.88316	19.04709	automatically recorded level loggers. Possible need for telemetry systems. 4) Groundwater Quality:
	G1N0322	HYDSTRA	Bvii2	EWR	-33.87951	19.03125	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄
	3319CC00104	NGA	Biii2	EWR	-33.85883	19.0303	 Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹:
	G1N0428	HYDSTRA	Biv5	EWR	-33.92333333	19.08166667	
Monitoring Programme	G1N0446	HYDSTRA	Biii3	EWR	-33.82835	18.94113	Biii3: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical
	BG00450	NGA	Bvii14	EWR	-33.91134	18.94703	Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature,
	3318DD00243	NGA	Bvii2	EWR	-33.86135	18.99509	pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endusulfan)
	3318DD00235	NGA	Bvii2	EWR	-33.84467	18.99092	
						BHN Managem	ement Option 2
	96019	WMS	GRU	BHN	-33.915556	18.920833	Frequency: Quarterly 3) Groundwater level:
	3318DD00221	NGA	GRU	BHN	-33.82247	18.96593	 Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. Groundwater Quality (Background water quality and BHN):
	3318DB00090	NGA	GRU	BHN	-33.7197	18.99509	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms
				•			



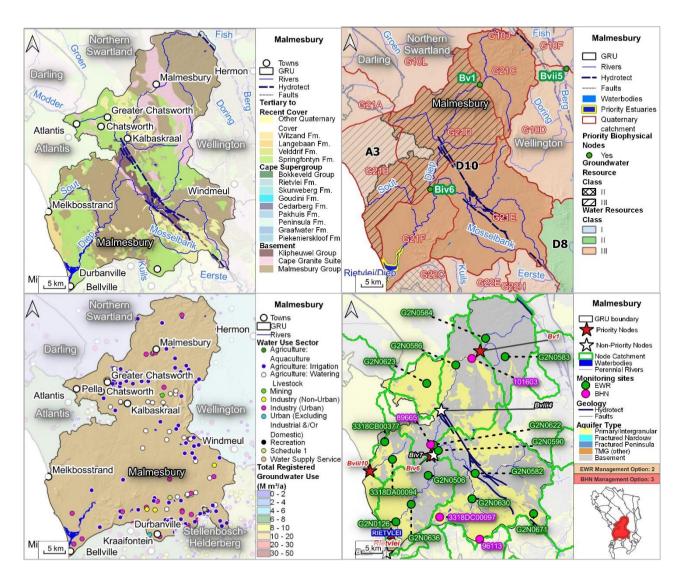


Figure 3-18 A series of maps for the Malmesbury GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.5. Wellington GRU

GRU	GRU Name: Wellingtor Main Towns: Wellingto							
	Total Area (km ²): 1068	.81						
GRU Boundary Description	is bounded by the G21	E, G21C, G10C, and G1	0J surface water quaterna	ary catchment divide	es, incorporating sections	S and Malmesbury Group. of the Berg River. The ea efer to Figure 3-19 and D	stern edge is defined	by the contact between
Quaternary Catchments	G10D and G10F (Figu	re 3-19)						
Resource Unit			F	ractured and Intergr	anular Basement Aquifer	•		
Description	with the Malmesbury 0 Within the GRU, relativ	Group. Groundwater flow ely thin and laterally disc	v is mainly restricted to w	reathered zones, de Sandveld Group are	eper structures, or grani	hills, in contrast to the gen te scree slopes on the plu primarily discharges to str	uton flanks, with little	regional flow expected.
Surface Water System	The primary surface wa is home to the second- DWS, 2022d and 2023	largest reservoir of the \	s the Berg River, which en NCWSS, the Voëlvlei Dar	ncompasses various m. Several smaller o	tributaries such as the F lams, including the Kersf	ish, Kompanjies, Limiet, D ontien Dam, are also loca	oring, and Krom rive ted within this GRU (rs. Additionally, the GRU refer to Figure 3-19 and
Water Resource	There are no priority E	WR sites within this IUA	however, there are 2 prices	ority biophysical noc	les (refer to the Figure 3-	. The GRU does not have -19 and the TECs in the ta	able below).	
Classes & RQOs	IUA	Water Resource Class	Quaternary Catchment	RU	Resource Name	Biophysical Node	TEC	nMAR
	D9 Middle Berg	III	G10D G10D	D9-R05 D9-R06	Kromme Berg	Bvii3 Bvii5	D D	89 49
			etermined from first-order	recharge calculation				



	GRU Name: Wellington					
GRU	Main Towns: Wellington					
	Total Area (km²): 1068.81					
	, ,					
				Water Use Sector	No. of Users	Total Volume (M m ³ /a)
					tured And Intergranular Base	
				Agriculture: Aquaculture	1	0.16
				Agriculture: Irrigation	70	3.08
				Agriculture: Watering Livestock	5	0.26
				Industry (Non-Urban)	2	0.00
	In this GRU, there are 117 registered of			Industry (Urban)	11	0.12
Groundwater Use	groundwater. The primary groundwater	use sectors are Agriculture (Irrigation)	and Agriculture	Recreation	1	0.00
Groundwater Osc	(Livestock Watering), contributing a c		roundwater use	Schedule 1	6	0.01
	volume (see Figure 3-19 and the table	to the right).		Water Supply Service	3	0.04
					Primary Intergranular Aq	
				Agriculture: Watering Livestock	14	0.63
				Industry (Non-Urban)	1	0.06
				Industry (Urban) Total	3 117	0.12
				างเลเ	117	4.48
Water Quality	5 - Ca-sóg type 6 - Na-HCO3 type 100 0 80 20 100 80 60 40 Ca	3 0 100 20 40 60 80 100 20 0 20 40 60 80 100		time in the relatively low trans Exceedances of baseline cor No RQOs have been establis contamination from agricultur	missivity clay-rich shale and centrations were observations from this GRU. The report of the adjusted water questions and control of the adjusted water questions.	from increased groundwater residence and siltstone basement aquifer. red for ammonia and orthophosphate. nutrient exceedances are attributed to uality category is B, indicating that low ditions prevail (refer to DWS, 2022d,
Aquifer Stress	The GRU is considered to have a Gro of 'B', indicating localised, low levels o Recharge Volume (M m³/a) 39.49			able below). ndex Groundw	y stressed aquifer, and a ater Availability Present status Category B	Groundwater Quality Present Status Groundwater Quality Present Status Category B



Aquifer Unit	CDII	GRU Name: Wellin	J										
Groundwater Quality Component The groundwater quality component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is determined as two components 1) the Groundwater Quality Read of the Groundwater Rea	GKU												
The groundwater quality component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is determined as two components 1) the Groundwater Quality Reserve (to be confirmed). Aquifer Unit		Total Area (Km²). T	J00.0 I										
Recharge (Mm³/a) EWR Reserve (Mm³/a) BHN Reserve (Mm³/a) GW Reserve (Mm³/a) Total Allocable Volume (Mm³/a) Still Allocable (Mm³/a) 39.49 6.75 0.24 6.99 32.51 4.48 28.03 In Scenario 7b, which projects conditions for the year 2050 and considers the 'Most-Likely Case' for the GRU, the analysis focused on two key factors: Recharge and Water Use. factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a decreation of the parameters used to determine the Groundwater development schemes in the area. Furthermore, the groundwater contribution to the BHN Reserve rose from 0.24 to 0.39 M m³/a due to sectoral and the implementation of groundwater development schemes in the area. Furthermore, the groundwater contribution to the BHN Reserve rose from 0.24 to 0.39 M m³/a, primarily attored to population growth. Under these conditions, the Allocation Category did not change from a category C (refer to Section 2.5 and the table below). Recharge (Mm³/a) EWR Reserve (Mm³/a) BHN Reserve (Mm³/a) GW Reserve (Mm³/a) Total Allocable Volume (Mm³/a) Still Allocable (Mm³/a)		The groundwater q and 2) the Groundwater q and 2) the Groundwater quifer Unit Fractured and Intergranular Basement Aquifer	Parameter Sulphate Electrical conductivity pH Ammonia Nitrate + nitrite Fluoride Orthophosphate Calcium	Unit mg/I mS/m mg/I mg/I mg/I mg/I mg/I mg/I mg/I m	No. BHs	No. Samples	Baseline Conc. 118.00 202.00 7.56 0.14 1.39 1.09 0.01 42.30 78.10	Min Conc. 4.30 25.60 7.03 0.05 1.26 0.22 0.01 1.90 4.20	Max Conc. 118.00 202.00 7.56 0.21 1.39 1.09 0.14 42.30 78.10	Median Conc. 4.30 29.70 7.40 0.14 1.28 0.26 0.01 9.70 7.30	95 th Percentile Conc. 106.63 184.77 7.54 0.20 1.38 1.01 0.12 39.04 71.02	Groundwater Quality Reserve 118.00 202.00 7.56 0.20 1.39 1.09 0.12 42.30 78.10	Groundwa Quality Bi Reserve
In Scenario 7b, which projects conditions for the year 2050 and considers the 'Most-Likely Case' for the GRU, the analysis focused on two key factors: Recharge and Water Use. factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a decreated from 39.49 to 33.07 M m³/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 4.48 to 8.79 M m³/a due to sectoral and the implementation of groundwater development schemes in the area. Furthermore, the groundwater contribution to the BHN Reserve rose from 0.24 to 0.39 M m³/a, primarily att to population growth. Under these conditions, the Allocation Category did not change from a category C (refer to Section 2.5 and the table below). Recharge (Mm³/a) EWR Reserve (Mm³/a) BHN Reserve (Mm³/a) GW Reserve (Mm³/a) Total Allocable Volume (Mm³/a) Water Use (Mm³/a) Still Allocable (Mm	roundwater Reserve	Groundwater Quan	Sodium Potassium Chloride tity Component uantity component of th	mg/l mg/l mg/l	detailed in the ta	able below and	4.09 551.60	1.39 51.90	4.09 551.60	2.68 64.50	3.95 502.89	4.09 551.60	ribution to b
In Scenario 7b, which projects conditions for the year 2050 and considers the 'Most-Likely Case' for the GRU, the analysis focused on two key factors: Recharge and Water Use. factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a decreating from 39.49 to 33.07 M m³/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 4.48 to 8.79 M m³/a due to sectoral and the implementation of groundwater development schemes in the area. Furthermore, the groundwater contribution to the BHN Reserve rose from 0.24 to 0.39 M m³/a, primarily att to population growth. Under these conditions, the Allocation Category did not change from a category C (refer to Section 2.5 and the table below). Recharge (Mm³/a) EWR Reserve (Mm³/a) BHN Reserve (Mm³/a) GW Reserve (Mm³/a) Total Allocable Volume (Mm³/a) Water Use (Mm³/a) Still Allocable (Mm	roundwater Reserve	Groundwater Quan The groundwater q the EWR and BHN	Sodium Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l mg/l			4.09 551.60 d described in \$	1.39 51.90 Section 2.3 & 3	4.09 551.60 2.4, is calculate	2.68 64.50 d by conside	3.95 502.89 ering the total gro	4.09 551.60 undwater cont	
factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a decrease from 39.49 to 33.07 M m³/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 4.48 to 8.79 M m³/a due to sectoral and the implementation of groundwater development schemes in the area. Furthermore, the groundwater contribution to the BHN Reserve rose from 0.24 to 0.39 M m³/a, primarily att to population growth. Under these conditions, the Allocation Category did not change from a category C (refer to Section 2.5 and the table below). Recharge (Mm³/a) EWR Reserve (Mm³/a) BHN Reserve (Mm³/a) GW Reserve (Mm³/a) Water Use (Mm³/a) Still Allocable (Mm²/a) Still Allocabl	roundwater Keserve	Groundwater Quan The groundwater q the EWR and BHN Recharge (Mm³	Sodium Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l mg/l	BHN Reserve (4.09 551.60 d described in S	1.39 51.90 Section 2.3 & 3	4.09 551.60 2.4, is calculate al Allocable Volum (Mm³/a)	2.68 64.50 d by conside	3.95 502.89 ering the total gro ater Use (Mm³/a)	4.09 551.60 sundwater cont	able (Mm³/a)
	roundwater Reserve	Groundwater Quan The groundwater q the EWR and BHN Recharge (Mm³	Sodium Potassium Chloride tity Component uantity component of th Reserves.	mg/l mg/l mg/l	BHN Reserve (4.09 551.60 d described in S	1.39 51.90 Section 2.3 & 3	4.09 551.60 2.4, is calculate al Allocable Volum (Mm³/a)	2.68 64.50 d by conside	3.95 502.89 ering the total gro ater Use (Mm³/a)	4.09 551.60 sundwater cont	able (Mm³/a)
33.07 6.75 0.39 7.14 25.92 8.79 17.13	uture Scenario 2050	Groundwater Quan The groundwater q the EWR and BHN Recharge (Mm³ 39.49 In Scenario 7b, wh factors directly influ recharge from 39.4 and the implementa to population growt	Sodium Potassium Chloride tity Component uantity component of th Reserves. (a) EWR Reserve 6.75 (ch projects conditions tenced the parameters upone of the parameters upone	mg/I mg/I mg/I mg/I mg/I mg/I mg/I mg/I	2050 and consrmine the Grourh climate chang chemes in the aation Category	iders the 'Most ndwater Resen- ge and the elimitrea. Furthermodid not change	4.09 551.60 d described in S GW Reserve (Mr 6.99 t-Likely Case' f ve, specifically ination of IAPs. ore, the ground e from a catego	1.39 51.90 Section 2.3 & 7 or the GRU, the groundwar Additionally, gwater contributy C (refer to S	4.09 551.60 2.4, is calculate al Allocable Volum (Mm³/a) 32.51 ne analysis focular contribution or contribution or contribution or contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and al Allocable Volume analysis focular contribution to the BHN Section 2.5 and allocable Volume analysis focular contribution to the BHN Section 2.5 and all Allocable Volume analysis focular contribution to the BHN Section 2.5 and all Allocable Volume analysis focular contribution to the BHN Section 2.5 and all Allocable Volume analysis focular contribution to the BHN Section 2.5 and all Allocable Volume analysis focular contribution to the BHN Section 2.5 and all Allocable Volume analysis focular contribution to the BHN Section 2.5 and all Allocable Volume analysis focular contribution and all Allocab	2.68 64.50 d by consider the Water that the BHN at a increased from the BHN at a increased from the table be the beautiful to the BHN at a increased from the table beautiful to the BHN at a increased from the table beautiful to the BHN at a increased from the table beautiful to the BHN at a increased from the table beautiful to the BHN at a increased from the table beautiful to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a increase at a second to the BHN at a second to the BHN at a increase at a second to the BHN a	3.95 502.89 ering the total gro ater Use (Mm³/a) 4.48 key factors: Rec and EWR. The so from 4.48 to 8.79 se from 0.24 to 0.3 low).	4.09 551.60 Still Alloc harge and Wa enario involve M m³/a due to 39 M m³/a, prir	able (Mm³/a) 18.03 ter Use. The d a decreas sectoral gro narily attribu



	GRU Name: Wellington
GRU	Main Towns: Wellingtor
	Total Area (km ²): 1068.

The Wellington GRU was assigned a Management Option 3 for monitoring the groundwater contribution to the EWR and a Management Option 2 for monitoring the groundwater contribution to the BHN. A total of 17 monitoring sites for the EWR and 4 for the BHN were strategically selected within the Wellington GRU (see **Figure 3-19** and the table below).

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
					EWR Managen	nent Option 3
3319CA00018	NGA	Bvii10	EWR	-33.69466	19.00487	
3319CA00056	NGA	Bvii3	EWR	-33.62661	19.02652	Frequency: Monthly or Quarterly
Proposed BH		Bvii4	EWR	-33.49244285	19.08339959	Groundwater level:
G1N0432	HYDSTRA	Bvii4	EWR	-33.5285	19.04005	Manual water level measurements and continuous hourly readings from
G1N0434	HYDSTRA	Bvii5	EWR	-33.44024	18.93324	automatically recorded level loggers. Possible need for telemetry systems.
G1N0429	HYDSTRA	Bvii11	EWR	-33.37518	18.88481	2) Groundwater Quality:
G1N0447	HYDSTRA	Bvii11	EWR	-33.39082	18.99627	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for EWR: NO₂, NO₃, NH4
G1N0448	HYDSTRA	Bvii15	EWR	-33.52897	18.85041	 Site specific additions as per RQO ¹⁹:
G1N0453	HYDSTRA	Bvii5	EWR	-33.59839	18.97863	
G1N0454	HYDSTRA	Bvii10	EWR	-33.6605	18.95209	Bvii3:
3318BD00196	NGA	Biv1	EWR	-33.28495	18.9912	Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature,
3318BD00182	NGA	Bvii4	EWR	-33.49301	18.9837	pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine and Endusulfan).
3318BD00185	NGA	Bvii5	EWR	-33.46384	18.92232	
Proposed BH		Bviii11	EWR	-33.62228308	19.08690413	Bvii5:
3318DB00329	NGA	Bvii10	EWR	-33.63912	18.99648	Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature,
3318DB00328	NGA	Bvii10	EWR	-33.6369	18.96593	pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine and Endusulfan).
G1N0551	HYDSTRA	Biv1	EWR	-33.29367	18.87805	1 / /3. // /
					BHN Managem	
3318DB00358	NGA	GRU	BHN	-33.67853	18.95396	Frequency: Quarterly
3318DB00083	NGA	GRU	BHN	-33.68082	18.99092	Groundwater level: a. Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger.
3318BD00169	NGA	GRU	BHN	-33.34884	18.87482	2) Groundwater Quality (Background water quality and BHN): Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄
96016	WMS	GRU	BHN	-33.691944	18.901667	o Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms



Monitoring Programme

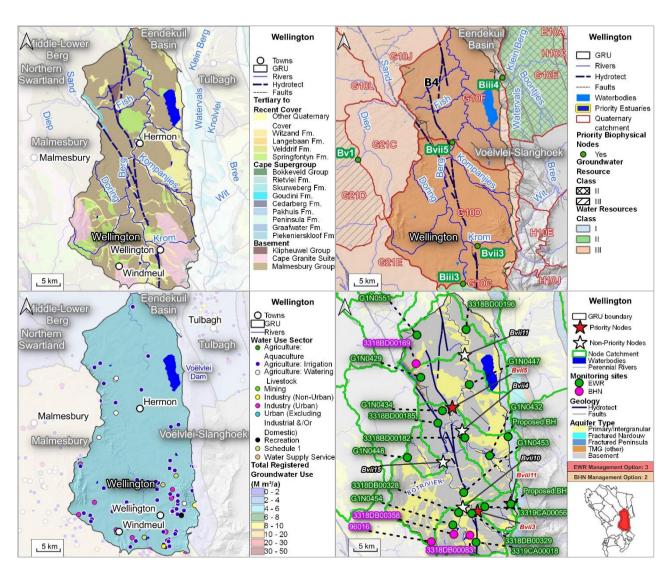


Figure 3-19 A series of maps for the Wellington GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.6. Tulbagh GRU

	GRU Name: Tulbagh				
GRU	Main Towns: Tulbagh				
CINO	Total Area (km²): 291.38				
	Total Area (Kill). 291.30				
GRU Boundary	The Tulbagh GRU is confined by the extent of the b	pasement lithology, specifically the Malmes	sbury Group, and its contact wit	th the TMG on its northern, e	eastern, and western edges. Th
Description	southern boundary is defined by the Berg catchment				
Description	Southern boundary is defined by the Berg edichment	i, opcomodny ine rrior surface water quate	onary outerment divide (refer to	7 1 1guil 0 20 and 5 110, 202	2d and 2020a).
Quaternary Catchments	G10E and G10G (Figure 3-20)				
	0.02 and 0.00 (1.1 ga :00 20)				
Resource Unit		Fractured and Intergran	ular Basement Aquifer		
Description	The Tulbagh GRU is primarily underlain by the Malm the Klein Berg catchment. In the east of the GRU, the of the Tulbagh Valley, represented by the Waterval N 2023a).	e Tulbagh Valley is bounded on the east, w	est, and north by slopes of the T	TMG, predominantly the Peni	nsula Fm. The western boundar
Surface Water System	The primary surface water system in this GRU is th Figure 3-20 and DWS, 2022d and 2023a).	ne Klein-Berg River, which is complemente	ed by its tributaries including the	e Boontjies, Waterval, Brakk	loof, and Knolvlei rivers (refer
Water Resource Classes & RQOs	The GRU falls entirely within the Berg Tributaries (C Class of II, while the remainder of the GRU has no G	C5) IUA and is assigned a Water Resource Groundwater Resource Class assigned. Th	e Class II. The segments of the ere are no EWR sites or priority	GRU within catchment G10l biophysical nodes in this GR	E have a Groundwater Resourd RU (see Figure 3-20).
	The GRU falls entirely within the Berg Tributaries (Class of II, while the remainder of the GRU has no General An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received and DWS (2022e) for further details.	Groundwater Resource Class assigned. The inned from first-order recharge calculations	ere are no EWR sites or priority using the Map-Centric Simulation	on method, and was chosen	RU (see Figure 3-20). as the estimated recharge value
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average recombelow and DWS (2022e) for further details.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot	using the Map-Centric Simulatial GRU area. Additional recharg	on method, and was chosen ge estimations are available i	as the estimated recharge value in the literature. Refer to the tab
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determited for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²)	using the Map-Centric Simulatial GRU area. Additional recharge	on method, and was chosen ge estimations are available i	as the estimated recharge value in the literature. Refer to the tab
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average recombelow and DWS (2022e) for further details.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot	using the Map-Centric Simulatial GRU area. Additional recharg	on method, and was chosen ge estimations are available i	as the estimated recharge value in the literature. Refer to the tab
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determited for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²)	using the Map-Centric Simulatial GRU area. Additional recharge Volume (M m³/a) 10.87	on method, and was chosen ge estimations are available i	as the estimated recharge valuenthe literature. Refer to the tab verage Recharge Rate (mm/a) 37.31
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determited for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²)	using the Map-Centric Simulatial GRU area. Additional recharge Volume (M m³/a) 10.87 Water Use Sector	on method, and was chosen ge estimations are available i	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determited for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²)	using the Map-Centric Simulatinal GRU area. Additional recharge Volume (M m³/a) 10.87 Water Use Sector Fractic	on method, and was chosen ge estimations are available i	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determited for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²)	using the Map-Centric Simulatinal GRU area. Additional recharge Volume (M m³/a) 10.87 Water Use Sector Fracting Agriculture: Irrigation	on method, and was chosen ge estimations are available i	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00
Classes & RQOs	Class of II, while the remainder of the GRU has no G An estimated recharge of 10.87 M m³/a was determited for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38	using the Map-Centric Simulatinal GRU area. Additional recharge Volume (M m³/a) 10.87 Water Use Sector Fracti Agriculture: Irrigation Industry (Non-urban)	on method, and was chosen ge estimations are available i No. of Users ured and Intergranular Basement 30 1	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004
Classes & RQOs	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of	using the Map-Centric Simulatial GRU area. Additional recharge Volume (M m³/a) 10.87 Water Use Sector Agriculture: Irrigation Industry (Non-urban) Schedule 1	on method, and was chosen ge estimations are available i No. of Users ured and Intergranular Basement 30 1 1	as the estimated recharge value the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001
Classes & RQOs	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater use groundwater. The dominant groundwater use sectors.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	using the Map-Centric Simulatinal GRU area. Additional recharge Volume (M m³/a) 10.87 Water Use Sector Fracti Agriculture: Irrigation Industry (Non-urban)	non method, and was chosen ge estimations are available in this GR No. of Users ured and Intergranular Basement 30 1 1 1 2	as the estimated recharge value in the literature. Refer to the tab verage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01
Classes & RQOs	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us groundwater. The dominant groundwater use sector accounting for 97.6% of the total annual groundwater.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Agriculture: Irrigation Industry (Non-urban) Schedule 1 Water Supply service	No. of Users ured and Intergranular Basement 30 1 2 Primary / Intergranular Aquifers	as the estimated recharge value in the literature. Refer to the tab verage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01
Classes & RQOs Recharge	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater use groundwater. The dominant groundwater use sectors.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Water Use Sector Agriculture: Irrigation Schedule 1 Water Supply service Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation	No. of Users ured and Intergranular Basement 30 1 2 Primary / Intergranular Aquifers 38	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01 0.01 0.01 0.01 0.0
Classes & RQOs Recharge	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us groundwater. The dominant groundwater use sector accounting for 97.6% of the total annual groundwater.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Water Use Sector Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Watering Livestock	No. of Users ured and Intergranular Basement 30 1 2 Primary / Intergranular Aquifers 38 2	as the estimated recharge value in the literature. Refer to the tab verage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.001
Classes & RQOs Recharge	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us groundwater. The dominant groundwater use sector accounting for 97.6% of the total annual groundwater.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Water Use Sector Agriculture: Irrigation Schedule 1 Water Supply service Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation	No. of Users ured and Intergranular Basement 30 1 2 Primary / Intergranular Aquifers 38	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01 0.01 0.01 0.01 0.0
Classes & RQOs Recharge	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us groundwater. The dominant groundwater use sector accounting for 97.6% of the total annual groundwater.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Water Use Sector Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Irrigation Agriculture: Watering Livestock	No. of Users ured and Intergranular Basement 30 1 2 Primary / Intergranular Aquifers 38 2	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01 0.01 0.01
Classes & RQOs Recharge	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us groundwater. The dominant groundwater use sector accounting for 97.6% of the total annual groundwater.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Water Use Sector Fract: Agriculture: Irrigation Industry (Non-urban) Schedule 1 Water Supply service Agriculture: Watering Livestock Industry (Non-urban)	No. of Users ured and Intergranular Basement 30 1 2 Primary / Intergranular Aquifers 38 2 3	as the estimated recharge value in the literature. Refer to the tab everage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01 c.01 c.01 c.01
Classes & RQOs Recharge	An estimated recharge of 10.87 M m³/a was determined for the Aquifer Stress assessments. The average received below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 81 registered groundwater us groundwater. The dominant groundwater use sector accounting for 97.6% of the total annual groundwater.	Groundwater Resource Class assigned. The ined from first-order recharge calculations charge rate is 37.31 mm/a based on the tot Area (km²) 291.38 sers, collectively utilizing 3.78 M m³/a of r in this region is Agriculture (Irrigation),	water Use Sector Water Use Sector Agriculture: Irrigation Industry (Non-urban) Agriculture: Watering Livestock Industry (Non-urban) Industry (Urban)	No. of Users ured and Intergranular Basement 30 1 1 2 Primary / Intergranular Aquifers 38 2 3 2	as the estimated recharge value in the literature. Refer to the tab verage Recharge Rate (mm/a) 37.31 Total Volume (M m³/a) Aquifer 2.00 0.0004 0.001 0.01 s 1.69 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.0



	GRU Name: Tulbagh						
GRU	Main Towns: Tulbagh						
	Total Area (km²): 291.38						
Water Quality				No water quality data			
	The GRU is considered to be determined due to limite	have a Groundwater Avail ed data availability (see tab	ability Present Status Cate	gory of 'C', indicating a mo	derately stressed aquifer, a	nd the Groundwater Qua	ality Present Status could n
Aquifer Stress	Recharge Volume		ndwater Use	Stress Index	Groundwater Availa		dwater Quality Present Status
	(M m ³ /a) 10.87	(M m ³ /a) 3.78	0.35	Status Cate	egory	Category N/A
	10.07	<u> </u>	3.70	0.33			IVA
Groundwater Reserve	Groundwater Quality Comp Groundwater Quantity Com The groundwater quantity of the EWR and BHN Reserve	nponent component of the Reserve	, detailed in the table below	No water quality data w and described in Section GW Reserve (Mm³/a)	2.3 & 2.4, is calculated by	considering the total grou Water Use (Mm³/a)	undwater contribution to bo
	10.87	1.28	0.02	1.30	(Mm³/a) 9.57	3.78	5.79
Future Scenario 2050 (Scenario 7b)	In Scenario 7b, which projectors directly influenced to recharge from 10.87 to 9.3 and the implementation of to population growth. In light Recharge (Mm³/a) 9.34	the parameters used to det 4 M m ³ /a, influenced by bo groundwater development	ermine the Groundwater R th climate change and the schemes in the area. Furth	eserve, specifically the group elimination of IAPs. Addition permore, the groundwater co	undwater contribution to the nally, groundwater use incre ontribution to the BHN Rese	BHN and EWR. The sce eased from 3.78 to 6.66 M	enario involved a decrease Il m³/a due to sectoral grow



GRU	GRU Name: Tulba Main Towns: Tulba Total Area (km²): 2	agh					
		of 5 monitor	ring sites for the	EWR and 2 for			ribution to the EWR and a Management Option 1 for monitoring the groundwater contribution cted within the Tulbagh GRU (see Figure 3-20 and the table below).
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
						EWR Managen	nent Option 3
	3319AA00001	NGA	Biii4	EWR	-33.23078	19.13263	Frequency: Monthly or Quarterly 1) Groundwater level:
	3319AC00001	NGA	Biii4	EWR	-33.38355	19.21597	 Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems. Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄
	3319AC00043	NGA	Biii4	EWR	-33.32106	19.11874	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ Site specific additions for EWR: NO₂, NO₃, NH₄ Site specific additions as per RQO ¹⁹:
Monitoring Programme	3319AA00005	NGA	Biii4	EWR	-33.24188	19.15487	Biii4: Nutrients (Phosphate [PO ₄ -P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables
	3319AA00009	NGA	Biii4	EWR	-33.23356	19.10763	(Temperature, pH, Dissolved Oxygen); Toxins (Ammonia, Atrazine, Endusulfan)
						BHN Managem	
	3319AC00028	NGA	GRU	BHN	-33.28355	19.14096	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: O Manual groundwater level measurements County department of PUNI):
	89812	WMS	GRU	BNH	-33.376667	19.168889	2) Groundwater Quality (Background water quality and BHN): Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄ Site specific additions for BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms



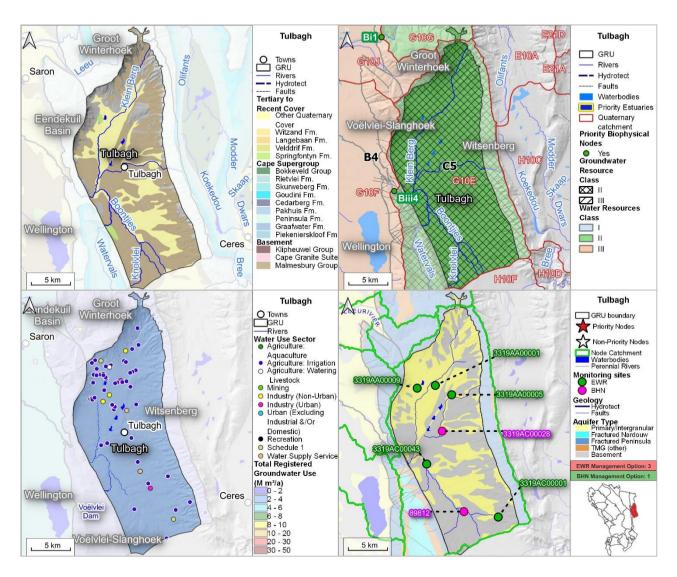


Figure 3-20 A series of maps for the Tulbagh GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.7. Eendekuil Basin GRU

001111 5 11 110 1				
Total Area (km²): 939.94				
the north, portions of the Aurora-Piketberg fault	zone contribute to the boundary. The Berg ar	nd Klein Berg rivers serve as the	south/south-western bounda	aries. The definition of the GRU
G10H, G10J, G10F and G10K (Figure 3-21)				
	Fractured and Intergran	ular Basement Aquifer		
	. rabtarea ana morgian			
Dam, supplied by several rivers originating from	n the mountainous areas of the Groot Winterh			
The GRU falls entirely within the Lower Berg (B ² III, while the rest of the GRU has no Groundwate	I) and is assigned a Water Resource Class III. er Resource Class designated. There are no E	For the portions of the GRU within WR sites within this IUA, nor are	n catchment G10H, it has a 0 there any priority biophysical	Groundwater Resource Class of nodes (Figure 3-21).
Method	Aron (km²)	Recharge Volume	Ave	erage Recharge Rate
	` '	(M m³/a)		(mm/a)
Map Centric Simulation Method	936.94	21.88		23.35
groundwater. The primary groundwater use Agriculture (Irrigation), contributing 61.9% and	sectors are Water Supply Services and 36.7%, respectively, to the total annual	Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban)	19 3 3	Total Volume (M m³/a) ent 1.52 0.06 0.01 0.26 3.00 4.85
	the north, portions of the Aurora-Piketberg fault also takes into account the preferential groundw G10H, G10J, G10F and G10K (Figure 3-21) The Eendekuil Basin GRU is primarily composed recent sediment deposits resulting from the weat areas (refer to DWS, 2022d and 2023a). The western boundary of the GRU is defined by Dam, supplied by several rivers originating from Twintig rivers (refer to Figure 3-21 and DWS, 20 III, while the rest of the GRU has no Groundwate An estimated recharge of 21.88 M m³/a was det for the Aquifer Stress assessments. The average below and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 33 registered groundwater use Agriculture (Irrigation), contributing 61.9% and	Main Towns: Porterville and Piketberg Total Area (km²): 939.94 The Eendekuil Basin GRU is defined by the extent of the basement lithologies, specifically the the north, portions of the Aurora-Piketberg fault zone contribute to the boundary. The Berg at also takes into account the preferential groundwater flow direction and inferred discharge direct G10H, G10J, G10F and G10K (Figure 3-21) Fractured and Intergran The Eendekuil Basin GRU is primarily composed of the Malmesbury Group, with some outcrops recent sediment deposits resulting from the weathering of the TMG mountains to the east of the areas (refer to DWS, 2022d and 2023a). The western boundary of the GRU is defined by the Berg River, serving as the primary surfact Dam, supplied by several rivers originating from the mountainous areas of the Groot Winterf Twintig rivers (refer to Figure 3-21 and DWS, 2022d and 2023a). The GRU falls entirely within the Lower Berg (B4) and is assigned a Water Resource Class III. III, while the rest of the GRU has no Groundwater Resource Class designated. There are no E An estimated recharge of 21.88 M m³/a was determined from first-order recharge calculations for the Aquifer Stress assessments. The average recharge rate is 23.35 mm/a based on the to below and DWS (2022e) for further details.	Main Towns: Porterville and Piketberg Total Area (km²): 939.94 The Eendekuil Basin GRU is defined by the extent of the basement lithologies, specifically the Malmesbury Group, and its content the north, portions of the Aurora-Piketberg fault zone contribute to the boundary. The Berg and Klein Berg rivers serve as the also takes into account the preferential groundwater flow direction and inferred discharge directions toward both the north and services are self-self-self-self-self-self-self-self-	Main Towns: Porterville and Piketberg Total Area (km²): 939.94 The Eendekuil Basin GRU is defined by the extent of the basement lithologies, specifically the Malmesbury Group, and its contact with the TMG outcrop on the north, portions of the Aurora-Piketberg fault zone contribute to the boundary. The Berg and Klein Berg rivers serve as the south/south-western boundar also takes into account the preferential groundwater flow direction and inferred discharge directions toward both the north and south (refer to Figure 3-21 and G10H, G10J, G10F and G10K (Figure 3-21)) Fractured and Intergranular Basement Aquifer The Eendekuil Basin GRU is primarily composed of the Malmesbury Group, with some outcrops of the Klipheuwel Group making up the basement lithology. Ad recent sediment deposits resulting from the weathering of the TMG mountains to the east of the GRU, which are transported by the Vier-en-Twintig River and areas (refer to DWS, 2022d and 2023a). The western boundary of the GRU is defined by the Berg River, serving as the primary surface water system in this region. Additional surface water system Dams, supplied by several rivers originating from the mountainous areas of the Groot Winterhoek, including the Krom, Pyls, Assegaaibosspruit, Jakkalsklot Twintig rivers (refer to Figure 3-21 and DWS, 2022d and 2023a). The GRU falls entirely within the Lower Berg (B4) and is assigned a Water Resource Class III. For the portions of the GRU within catchment G10H, it has a CIII, while the rest of the GRU has no Groundwater Resource Class designated. There are no EWR sites within this IUA, nor are there any priority biophysical. An estimated recharge of 21.88 M m³/a was determined from first-order recharge calculations using the Map-Centric Simulation method and was selected a for the Aquifer Stress assessments. The average recharge rate is 23.35 mm/a based on the total GRU area. Additional recharge estimations are available in below and DWS (2022e) for further details. Method Map Centric Simulation Method Area (



GRU Name: Fendekuil Basin GRU Main Towns: Porterville and Piketberg Total Area (km2): 939.94 Fondakuil Basin - Ca-HCO2 type Na-Cl type Ca-Na-HCO3 type Ca-Mg-Cl type The primary water type in Fendekuil Basin GRU is Na-Cl. The presence of Na-Cl waters is attributed to the saturation of Na and Clions, resulting from increased groundwater residence time in the relatively low transmissivity clay-rich shale and siltstone basement aquifer. Exceedances of baseline concentrations were observed for multiple parameters, with more Water Quality than 50% of samples exceeding baselines for sulphate, EC, nitrate + nitrite, and fluoride. Two of the four samples collected exceed the RQO for pH. The adjusted water quality category is C. indicating that moderate levels of contamination exist in the Eendekuil Basin GRU (see DWS, 2022d, 2022e and 2023a for detail). The GRU is considered to have a Groundwater Availability Present Status Category of 'C', indicating a moderately stressed aguifer, and a Groundwater Quality Present Status of 'C'. indicating moderate levels of localised contamination, but little or no negative impacts apparent (see table below). **Aquifer Stress** Recharge Volume Groundwater Use Groundwater Availability Present Groundwater Quality Present Status Stress Index Status Category (M m³/a) (M m³/a)Category 21.88 4 85 0.22 **Groundwater Quality Component** The groundwater quality component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is determined as two components 1) the Groundwater Quality Reserve, and 2) the Groundwater Quality BHN Reserve (to be confirmed). Groundwater Groundwater 95th Percentile Baseline Median No. BHs Min Conc. Max Conc. Aguifer Unit Parameter Unit No. Samples Quality Quality BHN Conc. Conc. Conc. Reserve Reserve 7.30 219.00 187.05 52.60 79.55 187.05 Sulphate ma/l Electrical conductivity 205.00 42.10 583.00 233.00 524.05 524.05 mS/m 7.86 8.14 8.42 pН 8.20 8.45 8.42 Groundwater Reserve 0.02 0.05 0.02 0.04 0.04 Ammonia ma/l 0.02 Fractured Nitrate + nitrite mg/l 0.84 0.04 5.39 0.85 4.68 4.68 and Fluoride mg/l 0.94 0.20 1.87 1.01 1.55 1.55 Intergranular 10 10 0.01 0.02 0.01 0.02 0.02 Orthophosphate ma/l 0.01 Basement Aquifer Calcium mg/l 25.50 10.60 151.00 20.85 140.25 140.25 (Tygerberg) 58.20 18.40 342.00 55.05 249.39 249.39 Magnesium mg/l Sodium mg/l 323.20 41.70 967.10 444.10 877.24 877.24 Potassium ma/l 11.27 1.28 44.80 4.22 36.74 36.74 543.60 1873.40 664.90 1702.27 Chloride ma/l 92 80 1702.27



GRU	GRU Name: Een Main Towns: Por Total Area (km²):	terville and Pil	ketberg							
	Groundwater Qua		nent							
		,								
	The groundwater the EWR and BH		ponent of the Res	erve, detailed in	the table below	and described i	n Section 2	2.3 & 2.4, is calculated by o	considering the total grou	ndwater contribution to both
	Recharge (Mi	m³/a) E	EWR Reserve (Mm³/a	a) BHN Res	serve (Mm³/a)	GW Reserve (I	Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
	21.88		6.95		0.09	7.04		14.84	4.85	9.99
Future Scenario 2050 (Scenario 7b)	factors directly in recharge from 21 and the implemen	fluenced the p .88 to 17.31 M ntation of grou	parameters used to I m ³ /a, influenced I ndwater developm	o determine the open both climate of the climate of	Groundwater Reschange and the ethe area. Further	serve, specifical limination of IAF more, the groun	ly the grou Ps. Addition dwater cor	ndwater contribution to the ally, groundwater use increttribution to the BHN Reser 2.5 and the table below).	BHN and EWR. The sce eased from 4.85 to 6.57 N	arge and Water Use. These nario involved a decrease in I m³/a due to sectoral growth 5 M m³/a, primarily attributed
	Recharge (Mi	m³/a) E	EWR Reserve (Mm³/a	a) BHN Res	serve (Mm³/a)	GW Reserve (I	Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
	17.31		6.95		0.16	7.11		10.21	6.57	3.64
	contribution to the	e BHN. A total	of 9 monitoring si	tes for the EWR	and 3 for the Bh	IN were strategi	cally selec	ition to the EVVR and a M ted within the Eendekuil B	lanagement Option 2 for asin GRU (see Figure 3- 2	monitoring the groundwater 21 and the table below).
	contribution to the	e BHN. A total	of 9 monitoring si Monitoring Area	Monitoring Objective	and 3 for the BE	IN were strategi	cally selec	ted within the Eendekuil Ba	lanagement Option 2 for asin GRU (see Figure 3-2 Monitoring Description	21 and the table below).
	Site Name	Data Source	of 9 monitoring si Monitoring Area	tes for the EWR Monitoring Objective	and 3 for the BE	Longitude EWR Managemen	cally select	ted within the Eendekuil Ba	asin GRU (see Figure 3-2	21 and the table below).
	Site Name G1N0193	e BHN. A total	of 9 monitoring si Monitoring Area Biii5	tes for the EWR Monitoring	and 3 for the BE	Longitude EWR Managemen 18.999392	cally select	ted within the Eendekuil Bank No. No. 1999. Sy: Monthly or Quarterly Groundwater level:	asin GRU (see Figure 3-2 Monitoring Description	21 and the table below).
	Site Name	Data Source	of 9 monitoring si Monitoring Area	Monitoring Objective	Latitude -32.960132	Longitude EWR Managemen	t Option 3 Frequence	by: Monthly or Quarterly Groundwater level: Manual water level n	asin GRU (see Figure 3-2	21 and the table below). s hourly readings from
	Site Name G1N0193 Proposed BH	Data Source HYDSTRA	Monitoring si Monitoring Area Biii5 Biv3	Monitoring Objective EWR EWR	-32.960132 -33.21410414	Longitude EWR Managemen 18.999392 18.95370508	t Option 3 Frequence	y: Monthly or Quarterly Groundwater level: Manual water level n automatically records Groundwater Quality:	Assin GRU (see Figure 3-2 Monitoring Description neasurements and continuou ed level loggers. Possible nea	21 and the table below). s hourly readings from ed for telemetry systems.
	Site Name G1N0193 Proposed BH G1N0059	Data Source HYDSTRA HYDSTRA	Monitoring Area Biii5 Biv3 Biii5	Monitoring Objective EWR EWR EWR	-32.960132 -32.99013	Longitude EWR Managemen 18.999392 18.95370508 18.849388	t Option 3 Frequence 1)	cy: Monthly or Quarterly Groundwater level: Manual water level automatically recorde Groundwater Quality: Standard Parameter: Site specific addition	Assin GRU (see Figure 3-2 Monitoring Description measurements and continuou ed level loggers. Possible new s: pH, EC, Ca, Mg, Na, K, Pa ss for EWR: NO ₂ , NO ₃ , NH ₄	21 and the table below). s hourly readings from ed for telemetry systems.
Monitoring Programme	Site Name G1N0193 Proposed BH G1N0059 3318BB00057	Data Source HYDSTRA HYDSTRA NGA	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4	Monitoring Objective EWR EWR EWR EWR EWR	-32.960132 -33.21410414 -32.99013 -33.18023	Longitude EWR Managemer 18.999392 18.95370508 18.849388 18.95732	t Option 3 Frequence 1)	y: Monthly or Quarterly Groundwater level: Manual water level nautomatically records Groundwater Quality: Standard Parameter: Site specific addition	Assin GRU (see Figure 3-2 Monitoring Description measurements and continuou ed level loggers. Possible new s: pH, EC, Ca, Mg, Na, K, Pa ss for EWR: NO ₂ , NO ₃ , NH ₄	21 and the table below). s hourly readings from ed for telemetry systems.
Monitoring Programme	G1N0193 Proposed BH G1N0059 3318BB00057 3318BB00038	Data Source HYDSTRA HYDSTRA NGA NGA	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4 Bvii16	Monitoring Objective EWR EWR EWR EWR EWR EWR EWR	-32.960132 -32.960132 -33.21410414 -32.99013 -33.18023 -33.1444	Longitude EWR Managemen 18.999392 18.95370508 18.849388 18.95732 18.92009	t Option 3 Frequence 1)	y: Monthly or Quarterly Groundwater level: Manual water level nautomatically records Groundwater Quality: Standard Parameter: Site specific addition Svii6:	Assin GRU (see Figure 3-2 Monitoring Description measurements and continuou ed level loggers. Possible new s: pH, EC, Ca, Mg, Na, K, Pa ss for EWR: NO ₂ , NO ₃ , NH ₄	s hourly readings from ed for telemetry systems. lk, MAlk, F, Cl, PO ₄ , SO ₄
Monitoring Programme	G1N0193 Proposed BH G1N0059 3318BB00057 3318BB00038 3319AA00063	Data Source HYDSTRA HYDSTRA NGA NGA NGA	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4 Bvii16 Bvii16	Monitoring Objective EWR EWR EWR EWR EWR EWR EWR EWR EWR	-32.960132 -32.960132 -33.21410414 -32.99013 -33.18023 -33.1444 -33.05716	Longitude EWR Managemen 18.999392 18.95370508 18.849388 18.95732 18.92009 19.01653	t Option 3 Frequence 1)	sy: Monthly or Quarterly Groundwater level: Manual water level nautomatically records Groundwater Quality: Standard Parameter: Site specific addition Bvii6: Nutrients (Phosphate (Electrical Conductive)	Annitoring Description Monitoring Description measurements and continuou ed level loggers. Possible new s: pH, EC, Ca, Mg, Na, K, Pa is for EWR: NO2, NO3, NH4 is as per RQO 19: e [PO4-P] and Total Inorganic fity [EC]); Pathogens (Escheri	and the table below). s hourly readings from ed for telemetry systems. lk, MAlk, F, Cl, PO ₄ , SO ₄ Nitrogen [TIN]); Salts chia Coli); System Variables
Monitoring Programme	G1N0193 Proposed BH G1N0059 3318BB00057 3318BB00038 3319AA00063 3318BB00066	Data Source HYDSTRA HYDSTRA NGA NGA NGA	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4 Bvii16 Bvii16 Bvii8	Monitoring Objective EWR EWR EWR EWR EWR EWR EWR EW	-32.960132 -32.960132 -33.21410414 -32.99013 -33.18023 -33.1444 -33.05716 -33.10245 -33.1905 -33.28355	Longitude EWR Managemen 18.999392 18.95370508 18.849388 18.95732 18.92009 19.01653 18.88343 19.0243 19.05208	toption 3 Frequence 1) 2)	sy: Monthly or Quarterly Groundwater level: Manual water level nautomatically records Groundwater Quality: Standard Parameter: Site specific addition Bvii6: Nutrients (Phosphate (Electrical Conductive)	Annitoring Description Monitoring Description measurements and continuou ed level loggers. Possible news: pH, EC, Ca, Mg, Na, K, Pa is for EWR: NO ₂ , NO ₃ , NH ₄ is as per RQO ¹⁹ : e [PO ₄ -P] and Total Inorganic	and the table below). s hourly readings from ed for telemetry systems. lk, MAlk, F, Cl, PO ₄ , SO ₄ Nitrogen [TIN]); Salts chia Coli); System Variables
Monitoring Programme	G1N0193 Proposed BH G1N0059 3318BB00057 3318BB00038 3319AA00063 3319AA00013	Data Source HYDSTRA HYDSTRA NGA NGA NGA NGA NGA NGA	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4 Bvii16 Bvii16 Bvii8 Biv3	Monitoring Objective EWR EWR EWR EWR EWR EWR EWR EW	-32.960132 -32.960132 -33.21410414 -32.99013 -33.18023 -33.1444 -33.05716 -33.10245 -33.1905 -33.28355	Longitude EWR Managemen 18.999392 18.95370508 18.849388 18.95732 18.92009 19.01653 18.88343 19.0243	t Option 3 Frequence 1) 2)	y: Monthly or Quarterly Groundwater level: Manual water level nautomatically records Groundwater Quality: Standard Parameter: Site specific addition Bvii6: Nutrients (Phosphate (Electrical Conductiv (Temperature, pH, D	Annitoring Description Monitoring Description measurements and continuou ed level loggers. Possible new s: pH, EC, Ca, Mg, Na, K, Pa is for EWR: NO2, NO3, NH4 is as per RQO 19: e [PO4-P] and Total Inorganic fity [EC]); Pathogens (Escheri	and the table below). s hourly readings from ed for telemetry systems. lk, MAlk, F, Cl, PO ₄ , SO ₄ Nitrogen [TIN]); Salts chia Coli); System Variables
Monitoring Programme	G1N0193 Proposed BH G1N0059 3318BB00057 3318BB00038 3319AA00063 3319AA00013	Data Source HYDSTRA HYDSTRA NGA NGA NGA NGA NGA NGA	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4 Bvii16 Bvii16 Bvii8 Biv3	Monitoring Objective EWR EWR EWR EWR EWR EWR EWR EW	-32.960132 -32.960132 -33.21410414 -32.99013 -33.18023 -33.1444 -33.05716 -33.10245 -33.1905 -33.28355	Longitude EWR Managemen 18.999392 18.95370508 18.849388 18.95732 18.92009 19.01653 18.88343 19.0243 19.05208	t Option 3 Frequence 1) 2)	ked within the Eendekuil Barby: Note: Yey: Monthly or Quarterly Groundwater level: Manual water level note automatically records Groundwater Quality: Standard Parameter: Site specific addition Bvii6: Nutrients (Phosphate (Electrical Conductive (Temperature, pH, Decry: Quarterly) Groundwater level:	Annitoring Description Monitoring Description measurements and continuoused level loggers. Possible news: pH, EC, Ca, Mg, Na, K, Pass for EWR: NO2, NO3, NH4 is as per RQO 19: te [PO4-P] and Total Inorganic rity [EC]); Pathogens (Escheribissolved Oxygen); Toxins (Attack)	s hourly readings from ed for telemetry systems. Ik, MAIk, F, CI, PO ₄ , SO ₄ Nitrogen [TIN]); Salts chia Coli); System Variables razine and Endusulfan).
Monitoring Programme	G1N0193 Proposed BH G1N0059 3318BB00057 3318BB00038 3319AA00063 3319AA00013 3319AC00042	HYDSTRA HYDSTRA NGA NGA NGA NGA NGA NGA NGA N	Monitoring si Monitoring Area Biii5 Biv3 Biii5 Biv4 Bvii16 Bvii16 Bvii8 Biv3 Biv3 Biv3	EWR	-32.960132 -32.960132 -33.21410414 -32.99013 -33.18023 -33.1444 -33.05716 -33.10245 -33.1905 -33.28355	Longitude EWR Managemen 18.999392 18.95370508 18.849388 18.95732 18.92009 19.01653 18.88343 19.0243 19.05208 BHN Managemen	t Option 2 Trequence t Option 2 Frequence	ked within the Eendekuil Bareleted within the Eendekuil Bareleted within the Eendekuil Bareleted with a water level: Manual water level: Manual water level nautomatically records Groundwater Quality: Standard Parameter: Site specific addition Brii6: Nutrients (Phosphate (Electrical Conductiv (Temperature, pH, D) Sty: Quarterly Groundwater level: Manual groundwater from automatically refrom automatically refroundwater Quality (Backet)	Annitoring Description Monitoring Description Measurements and continuoused level loggers. Possible newspapers of EWR: NO2, NO3, NH4 as as per RQO 19: The Potential Potential Inorganic rity [EC]); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (Escheribissolved Oxygen); Toxins (Attraction of the Potential Inorganic rity (EC)); Pathogens (ESC)	and the table below). s hourly readings from ed for telemetry systems. lk, MAlk, F, Cl, PO ₄ , SO ₄ Nitrogen [TIN]); Salts chia Coli); System Variables razine and Endusulfan). as average daily reading



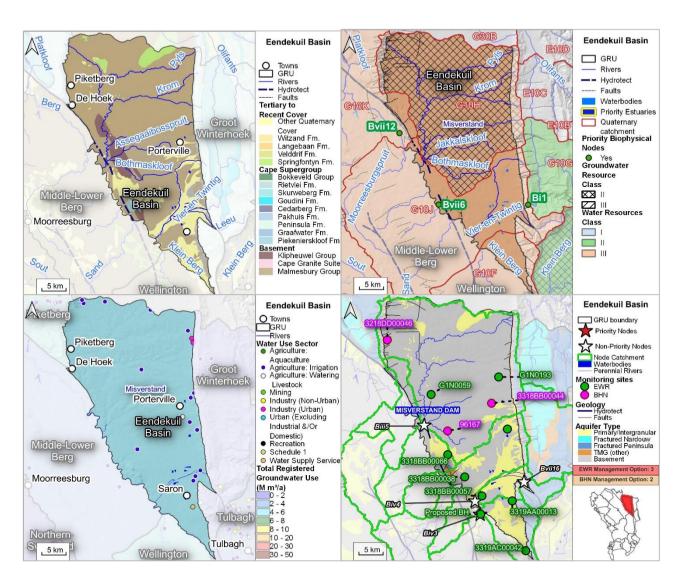


Figure 3-21 A series of maps for the Eendekuil Basin GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.8. Middle-Lower Berg GRU

GRU	GRU Name: Middle-Lo Main Towns: Moorrees Total Area (km²): 1485	sburg and Aurora									
GRU Boundary Description	The Middle-Lower Berg GRU is enclosed by portions of the G21C, G10L, and G10F surface water quaternary catchment divides on its south-western to south-eastern edge. The eastern edge is defined by portions of the Aurora-Piketberg fault zone and the Berg and Klein Berg rivers. On the north-eastern border, the GRU is separated from the Piketberg GRU by the contact between the TMG and interpolated basement lithologies of the Malmesbury Group, as well as portions of the Berg catchment boundary. The north/north-western boundary is formed by the Adamboerskraal aquifer model boundary (SRK, 2004) and the St Helena Bay coastline (refer to Figure 3-22 and DWS, 2022d and 2023a).										
Quaternary Catchments	G10J, G30A, G10K an	G10J, G30A, G10K and G10M (Figure 3-22)									
Resource Unit			F	ractured and Intergr	anular Basement Aquife	r					
Description		The Middle-Lower Berg GRU is primarily composed of the Malmesbury Group, which serves as the basement lithology. Additionally, there are Quaternary-recent sediment deposits in the area. Towards the north-west, the GRU is dominated by laterally continuous Sandveld Group sediments (refer to DWS, 2022d and 2023a).									
Surface Water System		ating from the mountain				stem. Contributing to the le part of the water syster					
Water Resource	a Groundwater Resour	rce Class of II, while the les, both with a TEC of D	rest of the GRU has no), as well as portions of the	Groundwater Resounce Berg (Groot) prior	rce Class designated. T ity estuary (see Figure 3	ively. Only portions of the Archere are no priority EWR:	sites within this IUA;	however, there are two			
Classes & RQOs	IUA	Water Resource Class	Quaternary Catchment G10J	RU B4-R09	Resource Name Berg	Biophysical Node Bvii6	TEC D	nMAR 52			
	B4 Lower Berg	III	G10K	B4-R09 B4-R10	Berg	Bvii12	<u></u> D	51			
	A1 Berg Estuary	II	G10M	A1-E01	Berg (Groot)	Bxi1	C	52			



In this GRU, there are 32 registered groundwater users collectively utilizing 2.23 M m ³ /a of groundwater. The primary groundwater use sector in this region is Agriculture (Irrigation). constituting 97.5% of the total annual groundwater use sector in this region is Agriculture (Irrigation). constituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table on the right). Water Quality Water Quality Water Quality Water Quality The primary water type in the Middle-Lower Berg GRU is Na-CL. The presence waters is attributed to the saturation of Na and Cl ions, resulting from increased groresidence time in the relatively low transmissivity clay-rich shale and siltstone be aquifer. Exceedances of baseline concentrations were observed for multiple parameters, with samples exceeding the baseline for pH, ammonia, fluoride, and orthophosphate. Cd samples collected, 4 samples exceeded here of dissolved ions. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations of dissolved ions. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations of dissolved ions. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations of dissolved ions. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations of dissolved ions. The adjusted water quality caterial indicating that moderate levels of contamination from agriculture, all raturally elevated concentrations of dissolved ions. The adjusted water	Groundwater Use In this groun const on the	nis GRU, there are 32 registered groundwater users collectively utilizing 2.23 M m³/a of undwater. The primary groundwater use sector in this region is Agriculture (Irrigation), stituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table the right). Middle-Lower Berg 100 100 1 - Cs-HiCO3 type 2 - NN-C1 type 80 80 80 80	Agriculture: Irrigation Industry (Urban) Water Supply Service Agriculture: Irrigation Total The primary water type in the waters is attributed to the satura residence time in the relatively	red And Intergranular Basement 5 1 1 Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, resul	0.09 0.0003 0.06 s 2.08 2.23 s Na-Cl. The presence of Nating from increased groundy
Groundwater Use In this GRU, there are 32 registered groundwater users collectively utilizing 2.23 M m³/a of groundwater. The primary groundwater use sector in this region is Agriculture (Irrigation), constituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table on the right). Water Quality Water Quality Water Quality The GRU is considered to have a Groundwater Availability Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Cyc., indicating moderate levels of localised contamination, but little or no negative impacts appearent (see table below). Recharge Volume The GRU is considered to have a Groundwater Availability Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B'). Indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B'). Indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present (status Category of 'B'). Indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Category of 'C', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Category of 'C', indicating an unstressed or slightly str	Groundwater Use In this groun const on the	nis GRU, there are 32 registered groundwater users collectively utilizing 2.23 M m³/a of undwater. The primary groundwater use sector in this region is Agriculture (Irrigation), stituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table he right). Middle-Lower Berg Key 100 100 1 - Cs-HiCO3 type 2 - NN-Cl type 3 - Ca-Nh-HCO3 type	Agriculture: Irrigation Industry (Urban) Water Supply Service Agriculture: Irrigation Total The primary water type in the waters is attributed to the satura residence time in the relatively	red And Intergranular Basement 5 1 1 Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, resul	Aquifer 0.09 0.0003 0.06 S 2.08 2.23 S Na-Cl. The presence of Nating from increased groundy
Groundwater Use In this GRU, there are 32 registered groundwater uses collectively utilizing 2.23 M m²/a of groundwater. The primary groundwater use sector in this region is Agriculture (trigation), constituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table on the right). Water Quality Water Quality Water Quality Water Quality The primary water type in the Middle-Lower Barg GRU is Na-Cl. The presence waters is attributed to the saturation of Na and Cl ions, resulting from increased groundwater in the relatively low transmissivity clay-rich shale and sittsone to aquifer. Exceedances of baseline concentrations were observed for multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples and sampl	Groundwater Use groun const on the	undwater. The primary groundwater use sector in this region is Agriculture (Irrigation), stituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table he right). Middle-Lower Berg Key 1 - Cs-HCO3 type 2 - NN-C1 type 3 - Ca-N3-HCO3 type	Agriculture: Irrigation Industry (Urban) Water Supply Service Agriculture: Irrigation Total The primary water type in the waters is attributed to the satura residence time in the relatively	red And Intergranular Basement 5 1 1 Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, resul	Aquifer 0.09 0.0003 0.06 S 2.08 2.23 S Na-Cl. The presence of Nating from increased groundy
Groundwater Use In this GRU, there are 32 registered groundwater uses collectively utilizing 2.23 M m²/a of groundwater. The primary groundwater use sector in this region is Agriculture (trigation), constituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table on the right). Water Quality Water Quality Water Quality Water Quality The primary water type in the Middle-Lower Barg GRU is Na-Cl. The presence waters is attributed to the saturation of Na and Cl ions, resulting from increased groundwater in the relatively low transmissivity clay-rich shale and sittsone to aquifer. Exceedances of baseline concentrations were observed for multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples exceeded the RQO for EC, 12 for pH, and 3 for 15 multiple parameters, with samples and sampl	Groundwater Use groun const on the	undwater. The primary groundwater use sector in this region is Agriculture (Irrigation), stituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table he right). Middle-Lower Berg Key 1 - Cs-HCO3 type 2 - NN-C1 type 3 - Ca-N3-HCO3 type	Agriculture: Irrigation Industry (Urban) Water Supply Service Agriculture: Irrigation Total The primary water type in the waters is attributed to the satura residence time in the relatively	red And Intergranular Basement 5 1 1 Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, result	Aquifer 0.09 0.0003 0.06 S 2.08 2.23 S Na-Cl. The presence of Nating from increased groundy
In this GRU, there are 32 registered groundwater users collectively utilizing 2.23 M m/s of groundwater users search in this region is Agriculture (frigation) in clinicity (Utban) 1 0.0003 (Industry (Utban) 1 0	Groundwater Use groun const on the	undwater. The primary groundwater use sector in this region is Agriculture (Irrigation), stituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table he right). Middle-Lower Berg Key 1 - Cs-HCO3 type 2 - NN-C1 type 3 - Ca-N3-HCO3 type	Agriculture: Irrigation Industry (Urban) Water Supply Service Agriculture: Irrigation Total The primary water type in the waters is attributed to the satura residence time in the relatively	5 1 Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, resul	0.09 0.0003 0.06 s 2.08 2.23 s Na-Cl. The presence of Nating from increased groundy
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Groundwater Use on the right). Water Quality The primary water type in the Middle-Lower Berg GRU is Na-Cl. The presence waters is attributed to the saturation of Na and Cl ions, resulting from increased groresidence time in the relatively low transmissivity clay-rich shale and siltstone be adjusted. Exceedances of baseline concentrations were observed for multiple parameters, with samples exceeding the baseline for pH, ammonia, fluonde, and orthophosphate. C samples collected, 4 samples exceeded the ROO for EC, 12 or pH, and 3 for infirite. These exceedances are attributed to contamination from agriculture, all notice indicating that moderate levels of contamination exist in the Middle-Lower Berg G DWS, 2022d, 2022e and 2023a for detail). The GRU is considered to have a Groundwater Availability Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present of 'C', indicating moderate levels of localised contamination, but little or no negative impacts apparent (see table below). Aquifer Stress Recharge Volume Groundwater Availability Present Groundwater Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Status Category of 'B', indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Pre	Groundwater Use groun const on the	undwater. The primary groundwater use sector in this region is Agriculture (Irrigation), stituting 97.5% of the total annual groundwater use volume (see Figure 3-22 and the table he right). Middle-Lower Berg Key 1 - Cs-HCO3 type 2 - NN-C1 type 3 - Ca-N3-HCO3 type	The primary water type in the waters is attributed to the satura residence time in the relatively	1 Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, resul	s Na-Cl. The presence of Nating from increased grounds
The grain of the considered to have a Groundwater Availability Present Status Category of 15°, indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Groundwater Value (see Figure 3-22 and the table on the right). Water Stress Recharge Volume The GRU is considered to have a Groundwater Availability Present Status Category of 15°, indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Groundwater Status Category of 15°, indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Groundwater Availability Present Groundwater Status Category of 15°, indicating an unstressed or slightly stressed aquifer, and a Groundwater Quality Present Groundwater Quality Present Groundwater Availability Present Groundwater Quality Present Groundwater Availability Present Groundwater Quality Present Groundwater Availability Present Groundwater Quality Present Groundwater Quality Present Groundwater Availability Present Groundwater Quality Prese	const on the	Middle-Lower Berg Key 100 100 1 - Ca-HiCO3 type 2 - Na-Cl type 3 - Ca-Na-HCO4 type	Agriculture: Irrigation Total The primary water type in the waters is attributed to the satura residence time in the relatively	Primary / Intergranular Aquifers 25 32.00 Middle-Lower Berg GRU is ation of Na and Cl ions, resul	s 2.08 2.23 s Na-Cl. The presence of Nating from increased grounds
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Water Quality Water Quality Water Quality Water Quality The primary water type in the Middle-Lower Berg GRU is Na-Cl. The presence waters is attributed to the saturation of Na and Cl ions, resulting from increased grown residence time in the relatively low transmissivity clay-rich shale and slitstone because it is applied to the saturation of Na and Cl ions, resulting from increased grown residence time in the relatively low transmissivity clay-rich shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na shale and slitstone because of the saturation of Na and Cl ions, residence time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low transmissivity clay-rich shale and slitstone because time in the relatively low tr	Water Quality	Key 100 100 1 - Ca-HCO3 type 2 - Na-Cl type 80 80 3 - Ca-Na-HCO3 type 80	The primary water type in the waters is attributed to the satura residence time in the relatively	Middle-Lower Berg GRU is ation of Na and Cl ions, resul	s Na-Cl. The presence of Nation
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of 'C', indicating moderate levels of localised contamination, but little or no negative impacts apparent (see table below). Aquifer Stress Recharge Volume (M m³/a) Groundwater Use (M m³/a) Stress Index Groundwater Availability Present Stress Index		80 20 3 20 80 60 40 20 0 0 20 40 60 80 100	Exceedances of baseline concer samples exceeding the baseline 46 samples collected, 4 sample nitrite. These exceedances are naturally elevated concentrations indicating that moderate levels	e for pH, ammonia, fluoride, es exceeded the RQO for E re attributed to contaminations of dissolved ions. The adju of contamination exist in the	, and orthophosphate. Out of C, 12 for pH, and 3 for nitrion from agriculture, along usted water quality category
42.49 2.25 0.05 B	of 'C',		s apparent (see table below). Groundwate	er Availability Present Gr	roundwater Quality Present Stati Category
		Recharge Volume (M m³/a) C, indicating moderate levels of localised contamination, but little or no negative impacts Recharge Volume (M m³/a) Street		B	



G	R	1

GRU Name: Middle-Lower Berg Main Towns: Moorreesburg and Aurora Total Area (km²): 1485 40

Groundwater Quality Component

The groundwater quality component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is determined as two components 1) the Groundwater Quality Reserve,; and 2) the Groundwater Quality BHN Reserve (to be confirmed).

Groundwater Reserve

Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Groundwater Quality BHN Reserve
	Sulphate	mg/l		58	342.80	3.52	799.60	196.90	431.35	431.35	
	Electrical conductivity	mS/m		60	841.00	20.68	1212.00	636.00	1073.75	1073.75	
	pН			60	7.63	3.11	8.71	7.70	8.35	8.35	
Forestoned	Ammonia	mg/l	46	58	0.02	0.02	1.37	0.04	0.33	0.33	
Fractured	Nitrate + nitrite	mg/l		58	6.16	0.02	24.96	1.24	18.00	18.00	
and Intergranular	Fluoride	mg/l		58	0.57	0.17	2.22	0.67	1.59	1.59	
Basement Aquifer	Orthophosphate	mg/l		58	0.01	0.00	0.13	0.01	0.08	0.08	
(Tygerberg)	Calcium	mg/l		58	166.30	4.70	218.40	63.36	181.85	181.85	
(Tygorborg)	Magnesium	mg/l		58	204.00	2.85	353.00	135.16	329.04	329.04	
	Sodium	mg/l		57	1345.50	75.00	2376.10	930.60	1897.00	1897.00	
	Potassium	mg/l		57	22.53	1.73	79.19	24.37	48.81	48.81	
	Chloride	mg/l		58	2627.50	25.52	4393.30	1972.70	3375.43	3375.43	

Groundwater Quantity Component

The groundwater quantity component of the Reserve, detailed in the table below and described in Section 2.3 & 2.4, is calculated by considering the total groundwater contribution to both the EWR and BHN Reserves.

Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
42.49	11.15	0.09	11.24	31.26	2.23	29.03

Future Scenario 2050 (Scenario 7b)

In Scenario 7b, which projects conditions for the year 2050 and considers the 'Most-Likely Case' for the GRU, the analysis focused on two key factors: Recharge and Water Use. These factors directly influenced the parameters used to determine the Groundwater Reserve, specifically the groundwater contribution to the BHN and EWR. The scenario involved a decrease in recharge from 42.49 to 36.88 M m³/a, influenced by both climate change and the elimination of IAPs. Additionally, groundwater use increased from 2.23 to 5.09 M m³/a due to sectoral growth and the implementation of groundwater development schemes in the area. Furthermore, the groundwater contribution to the BHN Reserve rose from 0.09 to 0.16 M m³/a, primarily attributed to population growth. Under these conditions, the Allocation Category did not change from category C (refer to Section 2.5 and the table below).

Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
36.88	11.15	0.16	11.31	25.57	5.09	20.48



GRU	GRU Name: Mido Main Towns: Moo Total Area (km²):	orreesburg and	Aurora							
					R and 1 for the B	HN were strateg	ater contribution to the EWR and a Management Option 2 for monitoring the groundward spically selected within the Middle-Lower Berg GRU (see Figure 3-22 and the table below Monitoring Description			
						EWR Managemen	t Option 3			
	G1N0203	HYDSTRA	Biv2	EWR	-32.97013	18.569379				
	BG00369	NGA	Bvii8	EWR	-33.09141	18.8334	Frequency: Monthly or Quarterly			
	96095	WMS	GRU	EWR	-33.0925	18.710833				
	96152	WMS	Bvii8	EWR	-33.138889	18.805556	Groundwater level:			
	G3N0546	HYDSTRA	Biv2	EWR	-32.79555556	18.51277778	 Manual water level measurements and continuous hourly readings from 			
	G1N0548	HYDSTRA	Bvii17	EWR	-33.18139	18.87706	automatically recorded level loggers. Possible need for telemetry systems.			
	G1N0531	HYDSTRA	Bvii17	EWR	-33.34023	18.80592	2) Groundwater Quality:			
Ionitoring Programme	3318BA00042	NGA	Bvii18	EWR	-33.14467	18.70759	 Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO₄, SO₄ 			
ioimoimig i rogiaiimio	3218CB00140	NGA	GRU	EWR	-32.68957	18.45493	 Site specific additions for EWR: NO₂, NO₃, NH₄ 			
	G1N0195	HYDSTRA	Biv2	EWR	-32.96013	18.499377				
	G1N0534	HYDSTRA	Bvii17	EWR	-33.25757	18.80806				
	BHN Management Option 2									
	3318BA00046	NGA	GRU	BHN	-33.13496	18.66871	Frequency: Quarterly 1) Groundwater level:			



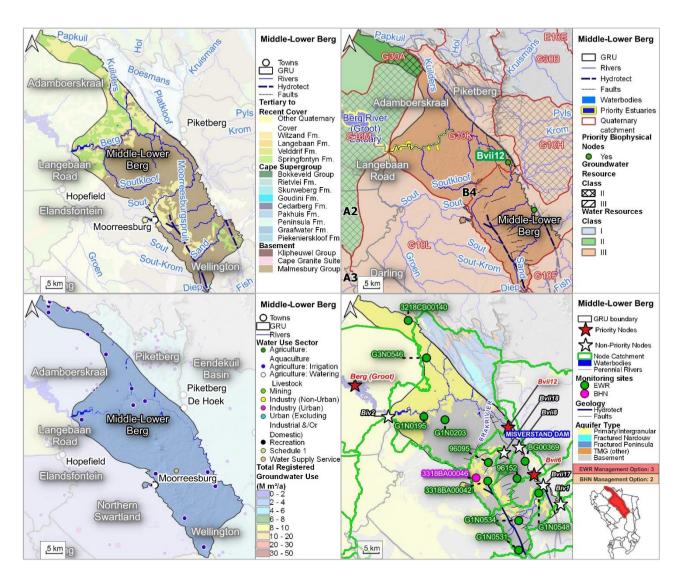


Figure 3-22 A series of maps for the Middle-Lower Berg GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.9. Northern Swartland GRU

GRU	GRU Name: Northern Swartland Main Towns: None Total Area (km²): 1262.65								
GRU Boundary Description	The Northern Swartland GRU is defined by a combination of an interpolated basement lithology extent, including the CGS and the Malmesbury Group, and portions of the G21C, G21D G10J, and G10K surface water quaternary catchment divides on its northern, eastern, and southern borders. Along the western edge of the GRU, the boundary is characterized by the Colenso Fault, portions of the Modder River, and the contact between the Springfontyn Fm and the basement lithologies, creating the south-western/western edge. The western/north-western border is marked by the Sout River (refer to Figure 3-23 and DWS, 2022d and 2023a).								
Quaternary Catchments	G10L (Figure 3-23)								
Resource Unit		Fra	actured and Intergr	anular Basement Aquifer					
Description	This GRU is formed by a combination of basem sediments from ephemeral streams, are predor				aterally continuous Sandv	veld Group sedimen	ts, as well as fluvial		
Surface Water System	The predominant surface water flow direction in River, ultimately contributing to the Berg River (cluding the Sout, Sout-Kro	om, and Groen rivers	s, converge into the Sout		
Water Resource Classes & RQOs	The GRU falls almost entirely within the Lower the G21D catchment, which has a Groundwate a TEC of C (see Figure 3-23 and the table below the fall of the fall of the second of the fall of the GRU fall of	r Resource Class of III. Th	ter Resource Class nere are no priority RU A1-E01	of III. For most of the GR EWR sites within this IUA Resource Name Berg (Groot)	Biophysical Node Bxi1	ter Class, except for ritions of the priority I	the small portions within Berg (Groot) estuary with		
Recharge	An estimated recharge of 31.85 M m³/a was defor the Aquifer Stress assessments. The average below and DWS (2022e) for further details. Method Map Centric Simulation Method		nm/a based on the		al recharge estimations are Volume (3/a)	e available in the lite Average R (n			



In Groundwater Use	20 20 0	Agriculture: Irrigation	f Na and Cl ions, resulting low transmissivity clay-rich s trations were observed for mu	0.65 0.65 0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen ultiple parameters, with 500
Groundwater Use In groundwater Use	In this GRU, there are 19 registered groundwater users, collectively utilizing 1.8 M m³/a of groundwater. The primary groundwater use sectors are Agriculture (Irrigation) and Industry (Urban), contributing 72.3% and 19%, respectively, to the total annual groundwater use volume (see Figure 3-23 and the table on the right). Northern Swartland 1 - Ca-HiCO ₃ type 2 - Na-HiCO ₃ type 3 - Ca-Na-HiCO ₃ type 5 - Ca-So ₄ type 5 - Na-HiCO ₃ type 6 - Na-HiCO ₃ type 7 - Na-H	Agriculture: Irrigation Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively leaduifer. Exceedances of baseline concent	d And Intergranular Basement Ad 3 Primary / Intergranular Aquifer 6 5 5 19 rn Swartland GRU is Na-CI. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mutations.	Quifer 0.65 0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen ultiple parameters, with 500
Groundwater Use groundwater Use (U vo	groundwater. The primary groundwater use sectors are Agriculture (Irrigation) and Industry (Urban), contributing 72.3% and 19%, respectively, to the total annual groundwater use volume (see Figure 3-23 and the table on the right). Northern Swartland 1 - Ca-HCO3 type 2 - Na-Cl type 3 - Ca-Na-Cl type 3 - Ca-Na-Cl type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Na-HCO3 type 6 - Na-HCO3 type 6 - Na-HCO3 type 7 - Na-HC	Agriculture: Irrigation Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively leaduifer. Exceedances of baseline concent	d And Intergranular Basement Ad 3 Primary / Intergranular Aquifer 6 5 5 19 rn Swartland GRU is Na-CI. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mutations.	Quifer 0.65 0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen ultiple parameters, with 500
Groundwater Use groundwater Use (U vo	groundwater. The primary groundwater use sectors are Agriculture (Irrigation) and Industry (Urban), contributing 72.3% and 19%, respectively, to the total annual groundwater use volume (see Figure 3-23 and the table on the right). Northern Swartland 1 - Ca-HCO3 type 2 - Na-Cl type 3 - Ca-Na-Cl type 3 - Ca-Na-Cl type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Na-HCO3 type 6 - Na-HCO3 type 6 - Na-HCO3 type 7 - Na-HC	Agriculture: Irrigation Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively leaduifer. Exceedances of baseline concent	d And Intergranular Basement Ad 3 Primary / Intergranular Aquifer 6 5 5 19 rn Swartland GRU is Na-CI. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mutations.	Quifer 0.65 0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen ultiple parameters, with 500
Groundwater Use groundwater Use (U vo	groundwater. The primary groundwater use sectors are Agriculture (Irrigation) and Industry (Urban), contributing 72.3% and 19%, respectively, to the total annual groundwater use volume (see Figure 3-23 and the table on the right). Northern Swartland 1 - Ca-HCO3 type 2 - Na-Cl type 3 - Ca-Na-Cl type 3 - Ca-Na-Cl type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Na-HCO3 type 6 - Na-HCO3 type 6 - Na-HCO3 type 7 - Na-HC	Agriculture: Irrigation Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively leaquifer. Exceedances of baseline concent	3 Primary / Intergranular Aquifer 6 5 5 19 Trn Swartland GRU is Na-CI. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mu	0.65 0.65 0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen ultiple parameters, with 500
Groundwater Use groundwater Use (U vo	groundwater. The primary groundwater use sectors are Agriculture (Irrigation) and Industry (Urban), contributing 72.3% and 19%, respectively, to the total annual groundwater use volume (see Figure 3-23 and the table on the right). Northern Swartland 1 - Ca-HCO3 type 2 - Na-Cl type 3 - Ca-Na-Cl type 3 - Ca-Na-Cl type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Ca-SOa type 5 - Na-HCO3 type 6 - Na-HCO3 type 6 - Na-HCO3 type 7 - Na-HC	Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively leaguifer. Exceedances of baseline concent	Primary / Intergranular Aquifer 6 5 5 19 Trn Swartland GRU is Na-Cl. If Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mu	0.65 0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen
Groundwater Use (U vo	(Urban), contributing 72.3% and 19%, respectively, to the total annual groundwater use volume (see Figure 3-23 and the table on the right). Northern Swartland 100 100 1 - Ca-IICO3 type 2 - Na-CI type 3 - Ca-Na-IICO3 type 4 - Ca-Na-CI type 5 - Ca-SCa type 5 - Ca-SCa type 5 - Na-IICO3 type 5 - Na-IICO3 type 5 - Na-IICO3 type 6 - Na-IICO3 type 6 - Na-IICO3 type 7 - 100 Type 7 - 10	Agriculture: Irrigation Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively laquifer. Exceedances of baseline concent	6 5 5 19 rn Swartland GRU is Na-Cl. f Na and Cl ions, resulting low transmissivity clay-rich s	0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone basen ultiple parameters, with 500
(U vo	Northern Swartland Northern Swartland Level 1 - Ca-HC3 type 2 - Na-Cl type 3 - Ca-Na-HC3 type 4 - Ca-HS-Cl type 5 - Ca-SCa type 6 - Na-HC3 type 7 - Ca-HC3 type 9 - Ca-SCa type 10 - Ca-HC3 type 11 - Ca-HC3 type 12 - Ca-HC3 type 13 - Ca-HC3 type 14 - Ca-HC3 type 15 - Ca-SCa type 16 - Na-HC3 type 17 - Ca-HC3 type 18 - Ca-HC3 type 19 - Ca-HC3 type 10 - Ca-HC3 typ	Agriculture: Watering Livestock Industry (Urban) Total The primary water type in Norther is attributed to the saturation of residence time in the relatively laquifer. Exceedances of baseline concent	5 5 19 rn Swartland GRU is Na-Cl. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mu	0.16 0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone baser ultiple parameters, with 50'
	Northern Swartland 1 - Ca-HCO3 type 100 100 100 100 100 100 100 100	The primary water type in Norther is attributed to the saturation of residence time in the relatively laquifer. Exceedances of baseline concent	5 19 rn Swartland GRU is Na-Cl. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mu	0.34 1.80 The presence of Na-Cl way from increased groundw shale and siltstone baser ultiple parameters, with 50
Water Quality	Ca-HCO3 type	Total The primary water type in Norther is attributed to the saturation of residence time in the relatively laquifer. Exceedances of baseline concent	rn Swartland GRU is Na-Cl. f Na and Cl ions, resulting low transmissivity clay-rich strations were observed for mu	The presence of Na-Cl way from increased groundw shale and siltstone baser ultiple parameters, with 50
Water Quality	Ca-HCO3 type	is attributed to the saturation of residence time in the relatively laquifer. Exceedances of baseline concent	f Na and Cl ions, resulting low transmissivity clay-rich s trations were observed for mu	g from increased groundw shale and siltstone baser ultiple parameters, with 50
	100 0 80 20 3 3 20 80 80 60 60 60	5 samples exceeded the RQO for are attributed to contaminatio concentrations of dissolved ions. moderate levels of contamination 2022e and 2023a for detail).	EC, 1 for pH, and 3 for nitrate on from agriculture, couple. The adjusted water quality	te + nitrite. These exceeda bled with naturally elever category is C, indicating
	The GRU is considered to have a Groundwater Availability Present Status Category of 'B', ind of 'C', indicating moderate levels of localised contamination, but little or no negative impacts ap Recharge Volume (M m³/a) (M m³/a) 31.85 1.8 O.0	pparent (see table below). Groundwater a Status	•	ndwater Quality Present St undwater Quality Present State Category C
	31.00 1.0 0.0	00	D	C

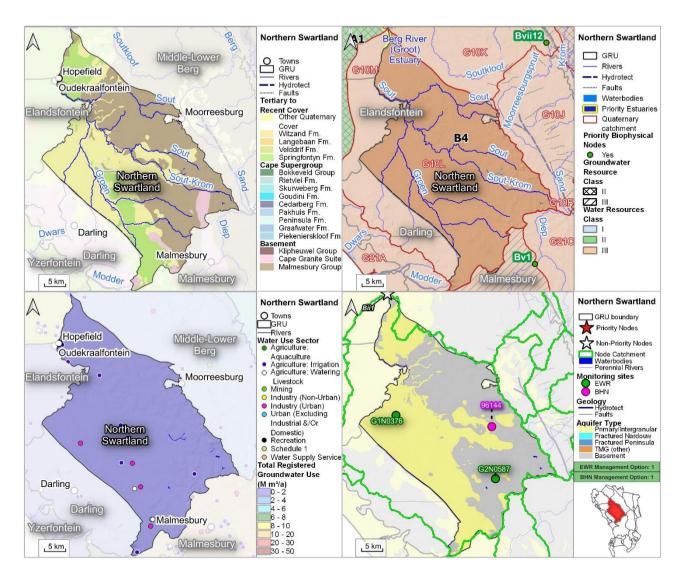


22.11	GRU Name: North											
GRU	Main Towns: None Total Area (km²): 1											
	- Potar Area (MIP). 1											
	Groundwater Quali	ty Component										
		juality component of the water Quality BHN Rese			ole below and o	described in Se	ction 2.3 & 2.4	4, is determined	as two comp	onents 1) the Gr	roundwater Qu	ality Res
	Aquifer Unit	Parameter	Unit	No. BHs	No. Samples	Baseline Conc.	Min Conc.	Max Conc.	Median Conc.	95 th Percentile Conc.	Groundwater Quality Reserve	Ground Quality Rese
ļ		Sulphate	mg/l			114.70	7.90	484.70	114.70	363.70	363.70	
ļ	1	Electrical conductivity	mS/m			532.00	49.70	1175.50	400.00	1094.00	1094.00	
ļ	1	рН	ļ			7.59	5.55	8.13	7.70	8.01	8.01	
ļ	Frankling	Ammonia	mg/l			0.02	0.02	0.52	0.02	0.33	0.33	
ļ	Fractured and	Nitrate + nitrite	mg/l			0.87	0.02	21.53	0.96	16.56	16.56	
	Intergranular	Fluoride	mg/l	31	31	0.72	0.15	1.25	0.70	1.05	1.05	
undwater Reserve	Basement Aquifer	Orthophosphate	mg/l		31	0.01	0.00	0.11	0.01	0.06	0.06	
unuwalei Keserve	(Tygerberg)	Calcium	mg/l			35.70	3.80	286.50	52.40	213.55	213.55	
	(Tygerberg)	Magnesium	mg/l			81.00	9.90	437.30	76.50	350.25	350.25	
							65.50	2133.50	614.00	1840.80	1840.80	Ĩ
		Sodium	mg/l	_		984.70						
	Groundwater Quar	Sodium Potassium Chloride ntity Component	mg/l mg/l	detailed in the tr	ahla halaw ara	23.46 1643.10	1.48 135.10	116.34 4123.90	14.00 1121.80	58.54 3976.25	58.54 3976.25	ibution
		Sodium Potassium Chloride ntity Component	mg/l mg/l	detailed in the ta	able below and	23.46 1643.10	1.48 135.10 Section 2.3 &	116.34 4123.90 2.4, is calculate	14.00 1121.80 d by conside	58.54 3976.25	58.54 3976.25	ibution
	The groundwater of	Sodium Potassium Chloride ntity Component quantity component of the Reserves.	mg/l mg/l	detailed in the ta		23.46 1643.10	1.48 135.10 Section 2.3 &	116.34 4123.90 2.4, is calculate	14.00 1121.80 d by conside	58.54 3976.25	58.54 3976.25	
	The groundwater of the EWR and BHN	Sodium Potassium Chloride ntity Component quantity component of the Reserves.	mg/l mg/l ne Reserve, c			23.46 1643.10 d described in \$	1.48 135.10 Section 2.3 &	116.34 4123.90 2.4, is calculate	14.00 1121.80 d by conside	58.54 3976.25 ring the total grou	58.54 3976.25 undwater contr	
ture Scenario 2050	The groundwater of the EWR and BHN Recharge (Mm ³ 31.85 In Scenario 7b, wh factors directly influrecharge from 31.8 and the implement	Sodium Potassium Chloride ntity Component quantity component of th Reserves.	mg/l mg/l mg/l ne Reserve, co e (Mm³/a) for the year 2 used to deter enced by both velopment so	BHN Reserve (0.05 2050 and consirmine the Groun h climate change chemes in the all	ders the 'Most adwater Resent e and the eliminate. Furthermo	23.46 1643.10 d described in S GW Reserve (Mm 0.25 t-Likely Case' for the company of the comp	1.48 135.10 Section 2.3 & Tot or the GRU, ti the groundwa Additionally, g water contribu	116.34 4123.90 2.4, is calculate al Allocable Volun (Mm³/a) 31.60 he analysis focuter contribution groundwater use tion to the BHN	14.00 1121.80 d by conside Wa seed on two lo the BHN a cincreased free Reserve rose	ter Use (Mm³/a) 1.79 key factors: Rechand EWR. The screen 1.79 to 2.29 le from 0.05 to 0.05	58.54 3976.25 undwater contr Still Alloca 29 harge and Watenario involved M m³/a due to s	able (Mm 9.81 ter Use. d a decre
uture Scenario 2050 (Scenario 7b)	The groundwater of the EWR and BHN Recharge (Mm ³ 31.85 In Scenario 7b, wh factors directly influrecharge from 31.8 and the implement	Sodium Potassium Chloride htity Component quantity component of the Reserves. 3/a) EWR Reserve 0.20 hich projects conditions are the parameters of the p	mg/l mg/l mg/l ne Reserve, of the year 2 used to deterenced by both velopment sons, the Alloca	BHN Reserve (0.05 2050 and consirmine the Groun h climate change chemes in the all	ders the 'Most adwater Reserve e and the elimi rea. Furthermodid not change	23.46 1643.10 d described in S GW Reserve (Mm 0.25 t-Likely Case' for the company of the comp	1.48 135.10 Section 2.3 & Tot or the GRU, tithe groundwa Additionally, gwater contribu B (refer to Se	116.34 4123.90 2.4, is calculate al Allocable Volun (Mm³/a) 31.60 he analysis foculate contribution is groundwater use tion to the BHN	14.00 1121.80 d by conside Wa seed on two loo the BHN as increased free rose table below	ter Use (Mm³/a) 1.79 key factors: Rechand EWR. The screen 1.79 to 2.29 le from 0.05 to 0.05	58.54 3976.25 undwater contr Still Alloca 29 harge and Watenario involved M m³/a due to s	able (Mm ² 9.81 ter Use. d a decre sectoral narily attr



GRU	GRU Name: No Main Towns: No Total Area (km²						
			of 2 monitoring si	ites for the EWR			undwater contribution to the EWR and a Management Option 1 for monitoring the groundwate ategically selected within the Northern Swartland GRU (see Figure 3-23 and the table below)
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
		1	7.000	0.0,000		EWR Manage	ement Option 1
	G2N0587	HYDSTRA	Bii1	EWR	EWR -33.35619 18.64199 1) Groundwater level: • Manual groundwater level measurements	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level:	
Monitoring Programme	G1N0376	HYDSTRA	Bii1	EWR	-33.21675	18.39426	2) Groundwater Quality: o Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 o Site specific additions for EWR: NO2, NO3, NH4
						BHN Manage	ement Option 1
	96144	WMS	GRU	вни	-33.245556	18.635556	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: o Manual groundwater level measurements 2) Groundwater Quality (Background water quality and BHN): o Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 o Site specific additions for BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms





A series of maps for the Northern Swartland GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.10. Darling GRU

	ODII Nama o Barilla n					
ODL	GRU Name: Darling					
GRU	Main Towns: Darling and Mamre					
	Total Area (km²): 408.82					
GRU Boundary Description	The eastern flank of the Darling GRU is delimited by Elandsfontein and Yzerfontein GRUs is defined by the surface water quaternary catchment divide and the C	ne extent of the Springfontyn Fm and its	contact with the CGS. In the south	, the Darling GRU is dema	rcated by portions of the G21B	
Quaternary Catchments	G10L and G21A (Figure 3-24)					
Resource Unit		Fractured and Intergran	nular Basement Aquifer			
Description	This GRU is dominantly composed of the CGS plu depositing fluvial sediments to the north-east of the C		Group shales. Several ephemeral	streams emanate from the	e granite hills after heavy rain,	
Surface Water System	The surface water systems in this area exhibit dual fluthe coast, while the tributaries in the northern part of					
Water Resource Classes & RQOs	The GRU falls within the Lower Berg (B4) and West IUA, nor are there any priority biophysical nodes (refe			ater Class designated. The	re are no EWR sites within this	
Recharge	An estimated recharge of 9.95 M m³/a was determined the Aquifer Stress assessments. The average recharge below and DWS (2022e) for further details.					
-	Method	Area (km²)	Recharge Volume (M m³/a)	Ave	erage Recharge Rate (mm/a)	
	Map Centric Simulation Method	408.82	9.95		24.34	
	Map Certific Simulation Method	408.82	9.90		24.04	
Groundwater Use	In this GRU, there are 9 registered groundwater us groundwater. The predominant groundwater use		Water Use Sector Fractured Agriculture: Irrigation	No. of Users d And Intergranular Basement <i>I</i> 5	Total Volume (M m³/a) Aquifer 0.71	



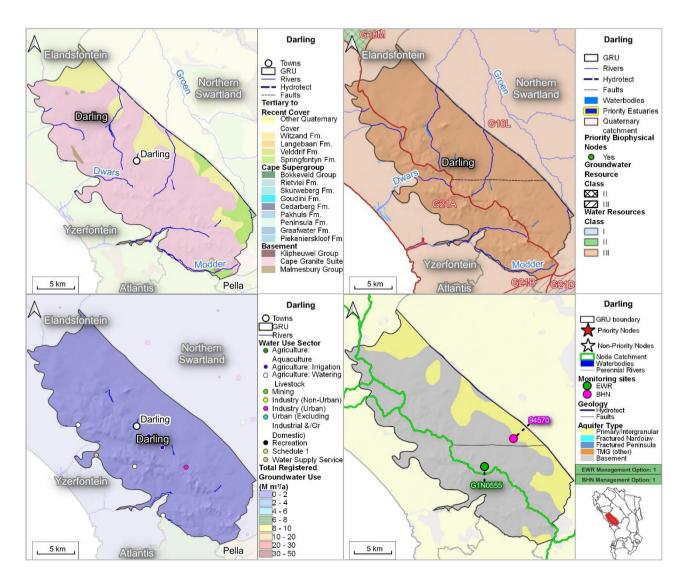
	GRU Name: Darlin	y										
GRU	Main Towns: Darlin											
	Total Area (km ²): 4	08.82										
Water Quality		1 - Ca+HCO3 type 2 - Ma-Cl type 3 - Ca+HCO4 type 3 - Ca+HCO4 type 3 - Ca+HCO4 type 5 - Ca-SO4 type 6 - No-HCO3 type 7 - 40	Darling 100 100 80 80 80 5 60 6 6 6 6 6 6 6 6 80 100 100 100 0 20 40	100 80 60 20 60 80 100	The primary water type in Darling GRU is Na-Cl. The presence of Na-Cl waters is att to the saturation of Na and Cl ions, resulting from increased groundwater residence the relatively low transmissivity granitic basement aquifer. Exceedances of baseline concentrations were observed for multiple parameters, with samples exceeding the baseline for EC, pH, and fluoride. Out of the 9 samples colle sample exceeded the RQO for EC. These exceedances are attributed to contaminating agriculture, along with naturally elevated concentrations of dissolved ions. The adjuste quality category is C, indicating that moderate levels of contamination exist in Darling to DWS, 2022d, 2022e and 2023a for detail).							ers, with 50% or les collected, 1 tamination from adjusted water
Aquifer Stress	of 'C', indicating mo		ed contaminat Groundw	ion, but little or			ent (see table b	pelow).	tressed aquifo		ndwater Quality	
	9.9		(M n			0.08	•	Statu	s Category B		Category C	
	9.9	95					•	Statu				
	9.9 Groundwater Quali The groundwater q	ty Component uality component of the vater Quality BHN Rese	Reserve, deterve (to be con	ailed in the tabl	le below and de	0.08 escribed in Se	ection 2.3 & 2.4 Min Conc.	4, is determined Max Conc.	B d as two comp	95 th Percentil Conc.	Groundwater Question Quality Reserve	1
Groundwater Reserve	Groundwater Quali The groundwater q and 2) the Groundwater q	ty Component uality component of the	0.: Reserve, detailerve (to be con	ailed in the tabl		0.08 escribed in Se	ection 2.3 & 2.4	4, is determined	B d as two comp	95 th Percentil	Groundwater Quelity	uality Reserve,



GRU	GRU Name: Da Main Towns: Da		e						
	Total Area (km²)	: 408.82							
	Groundwater Qu	uantity Compon	ent						
	The groundwate the EWR and BI		oonent of the Reso	erve, detailed in	the table below	and described in S	Section 2.3 & 2.4, is calculated by	considering the total grour	ndwater contribution to b
	Recharge (N	/lm³/a) E	WR Reserve (Mm³/a	,	serve (Mm³/a)	GW Reserve (Mm	/ (IVIM³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)
	9.95		0.03		0.02	0.05	9.91	0.76 ²³	9.15
uture Scenario 2050 (Scenario 7b)	factors directly in recharge from 9 and the implement	offluenced the page 1.95 to 8.02 M mentation of group owth. Under the	arameters used to ³ /a, influenced by ndwater developm	o determine the 0 both climate ch nent schemes in a Allocation Cate	Groundwater Re ange and the eli the area. Furthe	eserve, specifically to imination of IAPs. A ermore, the groundy	or the GRU, the analysis focused the groundwater contribution to the Additionally, groundwater use increwater contribution to the BHN Res B (refer to Section 2.5 and the tal	e BHN and EWR. The scer eased from 0.76 to 1.40 M erve rose from 0.02 to 0.03	nario involved a decreas m³/a due to sectoral gro
	Pooborgo (N	4m3/a)					[⁹ /d] (3.4 a)		Sull Allocable (William)
		J was assigned	0.03 a Management C	Option 1 for moni	0.03	0.06 dwater contribution	7.97	1.40 Option 1 for monitoring the	6.56
	8.02 The Darling GRI	J was assigned	0.03 a Management C sites for the EWI	Option 1 for moni	0.03	0.06 dwater contribution	n to the EWR and a Management of the Darling GRU (see Figure 3	1.40 Option 1 for monitoring the	6.56
	8.02 The Darling GRI the BHN. A total	J was assigned of 1 monitoring	0.03 a Management C	Option 1 for moni	0.03 itoring the groun BHN were strate Latitude	0.06 dwater contribution gically selected with	n to the EWR and a Management of thin the Darling GRU (see Figure 3	1.40 Option 1 for monitoring the 3-24 and the table below).	6.56
onitoring Programme	8.02 The Darling GRI the BHN. A total	J was assigned of 1 monitoring	0.03 a Management C sites for the EWI	Option 1 for moni	0.03 itoring the groun BHN were strate Latitude	0.06 dwater contribution gically selected with Longitude EWR Management O	7.97 In to the EWR and a Management of thin the Darling GRU (see Figure in the Darling GRU (1.40 Option 1 for monitoring the 3-24 and the table below). Monitoring Description	6.56 groundwater contributio
onitoring Programme	8.02 The Darling GRI the BHN. A total Site Name	J was assigned of 1 monitoring	a Management C sites for the EWR Monitoring Area	Option 1 for moni R and 1 for the E Monitoring Objective	itoring the groun BHN were strate	0.06 dwater contribution gically selected with Longitude EWR Management O 18.463889 BHN Management O	7.97 n to the EWR and a Management of thin the Darling GRU (see Figure : Deption 1 Frequency: Quarterly or Biannual (Sur 2) Groundwater level: Manual groundwater Groundwater Quality: Standard Paramete Site specific additio	1.40 Option 1 for monitoring the 3-24 and the table below). Monitoring Description Inmer & Winter) Per level measurements Pers: pH, EC, Ca, Mg, Na, K, Pallins for EWR: NO ₂ , NO ₃ , NH ₄	6.56 groundwater contributio



²³ The WARMS dataset places Yzerfontein's municipal abstraction of 0.26 Mm³/a in the Darling GRU. It has been updated to reflect for the Yzerfontein GRU.



A series of maps for the Darling GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



3.3.11. Vredenburg GRU

	CDII Namas Vandankuun				
OBIL	GRU Name: Vredenburg				
GRU	Main Towns: Vredenburg, Paternoster and Saldanha	1			
	Total Area (km²): 376.18				
GRU Boundary Description	The Vredenburg GRU is defined by the CGS outcrop extent of CGS outcrops and the Bok River. The north respectively (refer to Figure 3-25 and DWS, 2022d at	hern, western, and southern extents of the			
Quaternary Catchments	G10M (Figure 3-25)				
Resource Unit		Fractured and Intergran	ular Basement Aquifer		
Description	The West Coast region is formed by basement Malm reaches significant thicknesses (refer to DWS, 2022d	nesbury Group and various plutons of the		Group, which is laterally contir	nuous over large areas and als
Surface Water System	Following heavy rain, numerous ephemeral streams towards the coastal areas in the west (refer to Figure		flow of these rivers adheres to the	he topography, moving from t	the elevated regions in the eas
Water Resource Classes & RQOs	The GRU falls within the Langebaan (A2) and Berg E nor are there any priority biophysical nodes (refer to			roundwater Class II. There ar	re no EWR sites within this IU/
Recharge	An estimated recharge of 7.43 M m³/a was determined the Aquifer Stress assessments. The average recharge below and DWS (2022e) for further details.	ed from first-order recharge calculations urge rate is 19.75 mm/a based on the tota	sing the Map-Centric Simulation I GRU area. Additional recharge	method and was chosen as to e estimations are available in	he estimated recharge value for the literature. Refer to the table
Recharge	the Aquifer Stress assessments. The average rechabelow and DWS (2022e) for further details.	arge rate is 19.75 mm/a based on the tota	I GRU area. Additional recharge Recharge Volume	e estimations are available in	the literature. Refer to the table
Recharge	the Aquifer Stress assessments. The average rechabelow and DWS (2022e) for further details. Method	arge rate is 19.75 mm/a based on the tota Area (km²)	I GRU area. Additional recharge Recharge Volume (M m³/a)	e estimations are available in	the literature. Refer to the table terage Recharge Rate (mm/a)
Recharge	the Aquifer Stress assessments. The average rechabelow and DWS (2022e) for further details.	arge rate is 19.75 mm/a based on the tota	I GRU area. Additional recharge Recharge Volume	e estimations are available in	the literature. Refer to the tab
Recharge	the Aquifer Stress assessments. The average recharbelow and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 6 registered groundwater use groundwater. The primary groundwater use sectors.	Area (km²) 376.18 ers, collectively utilizing 1.16 M m³/a of ors are Urban (excluding Industrial or	Recharge Volume (M m³/a) 7.43 Water Use Sector	No. of Users red And Intergranular Basement A	the literature. Refer to the tab rerage Recharge Rate (mm/a) 19.75 Total Volume (M m³/a)
Recharge Groundwater Use	the Aquifer Stress assessments. The average recharbelow and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 6 registered groundwater use groundwater. The primary groundwater use secto Domestic volume), Agriculture (Irrigation), and Indus	Area (km²) 376.18 ers, collectively utilizing 1.16 M m³/a of ors are Urban (excluding Industrial or etry (Urban), contributing 65.4%, 21.8%,	Recharge Volume (M m³/a) 7.43 Water Use Sector Industry (Urban)	No. of Users red And Intergranular Basement / 1 Primary / Intergranular Aquifers	rerage Recharge Rate (mm/a) 19.75 Total Volume (M m³/a) Aquifer 0.15
	In this GRU, there are 6 registered groundwater use groundwater. The primary groundwater use secto Domestic volume), Agriculture (Irrigation), and Indus and 12.8%, respectively, to the total annual groundw	Area (km²) 376.18 ers, collectively utilizing 1.16 M m³/a of ors are Urban (excluding Industrial or etry (Urban), contributing 65.4%, 21.8%,	Recharge Volume (M m³/a) 7.43 Water Use Sector Fractu Industry (Urban) Agriculture: Irrigation	No. of Users red And Intergranular Basement / Primary / Intergranular Aquifers	the literature. Refer to the take terage Recharge Rate (mm/a) 19.75 Total Volume (M m³/a) Aquifer 0.15
	the Aquifer Stress assessments. The average recharbelow and DWS (2022e) for further details. Method Map Centric Simulation Method In this GRU, there are 6 registered groundwater use groundwater. The primary groundwater use secto Domestic volume), Agriculture (Irrigation), and Indus	Area (km²) 376.18 ers, collectively utilizing 1.16 M m³/a of ors are Urban (excluding Industrial or etry (Urban), contributing 65.4%, 21.8%,	Recharge Volume (M m³/a) 7.43 Water Use Sector Fractu Industry (Urban) Agriculture: Irrigation Schedule 1	No. of Users red And Intergranular Basement / 1 Primary / Intergranular Aquifers 1	rerage Recharge Rate (mm/a) 19.75 Total Volume (M m³/a) Aquifer 0.15 0.25 0.0002
	In this GRU, there are 6 registered groundwater use groundwater. The primary groundwater use secto Domestic volume), Agriculture (Irrigation), and Indus and 12.8%, respectively, to the total annual groundw	Area (km²) 376.18 ers, collectively utilizing 1.16 M m³/a of ors are Urban (excluding Industrial or etry (Urban), contributing 65.4%, 21.8%,	Recharge Volume (M m³/a) 7.43 Water Use Sector Fractu Industry (Urban) Agriculture: Irrigation	No. of Users red And Intergranular Basement / Primary / Intergranular Aquifers	the literature. Refer to the tab erage Recharge Rate (mm/a) 19.75 Total Volume (M m³/a) Aquifer 0.15



	GRU Name: Vredenburg							
GRU	Main Towns: Vredenburg,	Paternoster and Saldanha						
	Total Area (km ²): 376.18							
Water Quality	No water quality data							
Aquifer Stress		have a Groundwater Availa data availability (see table l		egory of 'B', indicating an uns	tressed or slightly stressed	aquifer, and the Grou	undwater Quality Present Sta	
7.1945. 5.1.555	Recharge Volume		ndwater Use	Stress Index	Groundwater Present		Final Groundwater Quality Present	
	(M m ³ /a) 7.43		(M m³/a) 1.16	0.16	(after WRC,	2007)	Status Category N/A	
	7.40		1.10	0.10	D		IVA	
Groundwater Reserve	the EWR and BHN Reserv	component of the Reserve			2.3 & 2.4, is calculated by o		groundwater contribution to be Still Allocable (Mm³/a)	
	Recharge (Mm³/a)	EWR Reserve (Mm³/a)	BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	(Mm³/a)	Water Use (Mm³/a)	, , ,	
	7.43	0.00	0.01	0.01	7.42	1.16	6.26	



GRU	GRU Name: Vredenburg Main Towns: Vredenburg, Paternoster and Saldanha Total Area (km²): 376.18											
	The Vredenburg GRU was assigned a Management Option 1 for monitoring the groundwater contribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the BHN. A total of 2 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Vredenburg GRU (see Figure 3-25 and the table below).											
	Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description					
						EWR Manager	ment Option 1					
	3217DD00034	NGA	GRU	EWR	-32.76058	17.95753	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: O Manual groundwater level measurements					
Monitoring Programme	G1N0024	HYDSTRA	GRU	EWR	-32.950127	17.91936	2) Groundwater Quality: Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO ₄ , SO ₄ Site specific additions for EWR: NO ₂ , NO ₃ , NH ₄					
		BHN Management Option 1										
	46113	NGA	GRU	вни	-32.98103	17.96632	Frequency: Quarterly or Biannual (Summer & Winter): 2) Groundwater level:					
		•	ı	1	1	1						



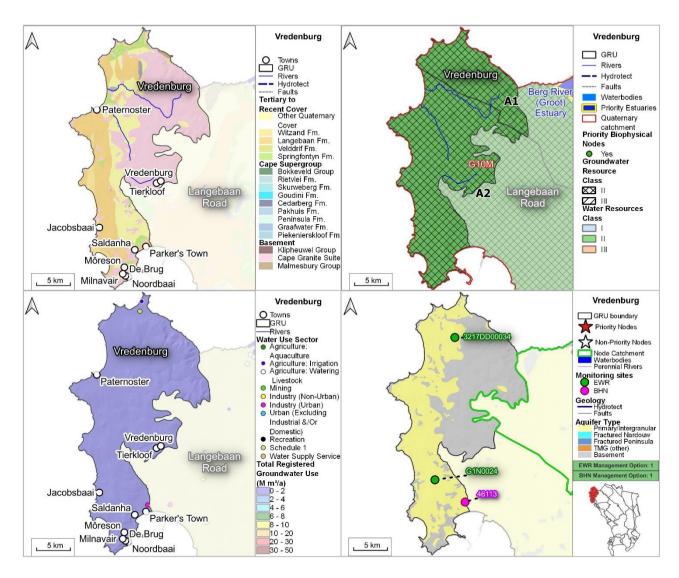


Figure 3-25 A series of maps for the Vredenberg GRU: Top-left displays the GRU extent with geology and structural features; Top-right displays IUAs, WRCs, and Groundwater Classes; Bottom-left indicates total registered groundwater use with boreholes and water use sectors; Bottom-right depicts EWR and BHN monitoring sites per GRU based on Management Options.



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