High Confidence Groundwater Reserve Determination Study in the Berg Catchment

WP11398
Monitoring Programme Report

Report Number: RDM/WMA19/02/CON/COMP/0423

January 2024

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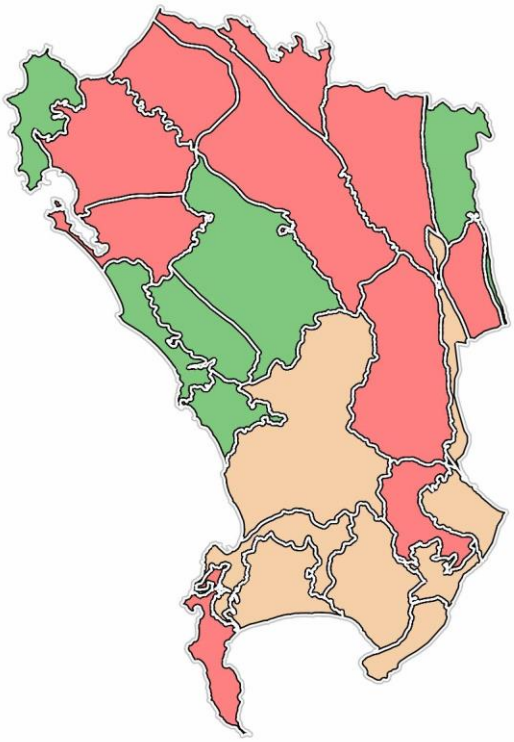

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Prepared for:

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Chief Directorate: Water Ecosystems Management

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3.9	RDM/WMA19/02/CON/COMP/0324	Gazette Template

Executive Summary

In response to the rising number of Water Use Licence Applications (WULAs) in the Berg catchment and their potential impact on the Reserve, 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 goal of this study was to offer insights into the catchment's groundwater resources and facilitate well-informed management decisions regarding water resources under stress or experiencing excessive utilization.

In South Africa, the National Water Act (NWA, No. 36 of 1998) establishes a legal framework for the management and protection of all significant water resources. Within this framework, the Resource Directed Measures (RDM), as defined by Regulation 2(4) of Act 36 of 1998, plays a pivotal role as a management tool. It establishes appropriate protection strategies for the water resource and consists of three important components: 1) the Classification, 2) the Reserve, and 3) Resource Quality Objectives (RQOs). Notably, the Reserve, which is the water set aside for Basic Human Needs (BHN) and the Ecological Water Requirements (EWR), is the only right to water in the NWA and takes precedence over all other use in the catchment.

The Reserve determination process for the Berg catchment followed the eight-step procedure outlined in the RDM manuals (WRC, 2013). This report (Step 7) focused on designing a Monitoring Programme 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, to determine their suitability for monitoring site-specific parameters. This effort built upon insights gained from the Berg catchment's Water Resource Classes and Resource Quality Objectives study conducted by the DWS in 2016.

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 the previous steps of this study, 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 1** and **Table 1**).

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 also 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 a specific node’s catchment area, aquifer type, and GRU. This approach identified node catchments with the most significant influence on baseflow and therefore allowed for more representative monitoring site selection (**Figure 2**).

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**).

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 Reserves 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 are provided to the DWS.

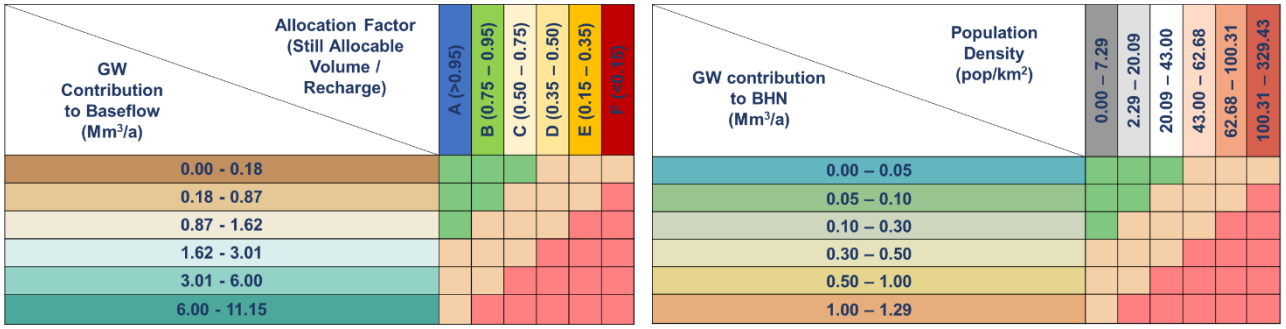

Figure 1 **The Impact vs. Influence Matrix for groundwater contribution to the Ecological Water Requirements (EWR) Reserve (left) and for groundwater contribution to the Basic Human Needs (BHN) Reserve (right).**

Table 1: **Summary table of the Management Options per Groundwater Resource Unit (GRU) for groundwater contribution to both the Ecological Water Requirements (EWR) and Basic Human Needs (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
Adamboerskraal	0.53	6.00	3	0.01	2.50	1
Atlantis	0.84	0.08	1	0.05	20.09	1
Cape Flats	0.36	0.51	2	1.29	329.43	3
Cape Peninsula	0.38	5.43	3	0.16	56.44	2
Cape Town Rim	0.39	0.87	2	0.36	100.31	3
Darling	0.82	0.03	1	0.03	7.72	1
Drakensteinberge	0.85	2.88	2	0.01	3.94	1
Eendekuil Basin	0.21	6.95	3	0.16	18.16	2
Elandsfontein	0.31	6.39	3	0.01	1.97	1
Groot Winterhoek	0.80	0.77	1	0.03	7.68	1
Langebaan Road	0.18	5.52	3	0.03	4.00	1
Malmesbury	0.39	1.18	2	0.64	43.46	3
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
Paarl-Franschhoek	0.24	3.01	3	0.21	62.68	2
Piketberg	0.37	2.07	3	0.06	17.57	1
Steenbras- Nuweberg	0.56	1.16	2	0.02	13.11	1
Stellenbosch-Helderberg	0.63	2.34	2	0.46	87.79	3
Tulbagh	0.14	1.28	3	0.05	17.74	1
Voëlvlei-Slanghoek	0.85	1.62	2	0.01	6.11	1
Vredenburg	0.70	0.00	1	0.02	6.24	1
Wellington	0.52	6.75	3	0.39	39.70	2
Wemmershoek	0.80	3.59	2	0.00	1.27	1
Witzenberg	0.87	0.18	1	0.00	11.22	1
Yzerfontein	0.70	0.02	1	0.02	5.84	1
TOTAL		**69.98**		**4.27**		

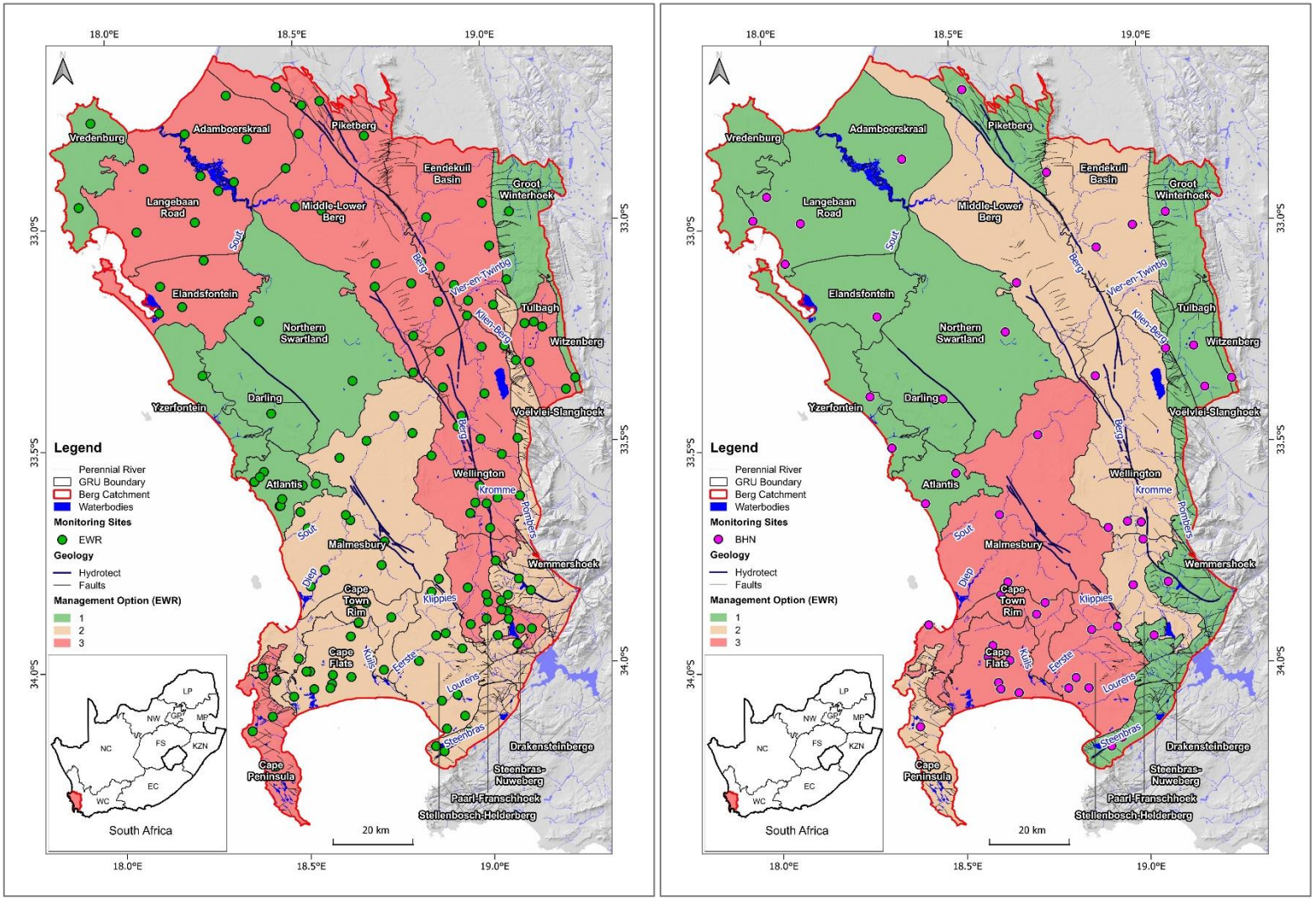

Figure 2 **Summary maps (left) illustrating Management Options for the groundwater contribution to the Ecological Water Reserve (EWR) and associated monitoring locations (left); and (right) illustrating Management Options for the groundwater contribution to Basic Human Needs (BHN) Reserve and associated monitoring locations.**

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List of abbreviations, acronyms, symbols and units of measurement

~	Approximately
<	Less than
a	annum
BHN	Basic Human Needs
BOCMA	Breede-Olifants Catchment Management Agency
BWQ	Background Water Quality
CD: WEM	Chief Directorate: Water Ecosystems Management
CMA	Catchment Management Agency
CoCT	City of Cape Town
CS	Community Survey
CoCT	City of Cape Town
DWA	Department of Water
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
DALRRD	Department of Agriculture, Land Reform and Rural Development
DFFE	Department of Forestry Fisheries and the Environment
NGMS	National Geomatics Management Service
SPLUM	Spatial Planning and Land Use Management
APAC	Agricultural Produce Agents Council
ARC	Agricultural Research Council
DFFE	Department of Forestry, Fisheries, and the Environment
EP	Environmental Programme
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
EPWP	Expanded Public Works Programmes
EPIP	Environmental Protection & Infrastructure Programmes
IMSC	Information Management & Sector Coordination
NRM	Natural Resource Management
NEMA	National Environmental Management Act
IGDP	Integrated Growth and Development Plan
e.g.	For example
Et al.	and others
etc.	etcetera
EWR	Ecological Water Requirement
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GRDM	Groundwater Resource Directed Measure
GRU	Groundwater Resource Unit
GW	Groundwater
GWC	Groundwater Resource Class
i.e.	That is.
IUA	Integrated Unit of Analysis
IWRM	Integrated Water Resource Management
km	Kilometres
ℓ/p/d	Litres per person per day
Ltd.	Limited Liability
m	Metres
M m^3	Million Cubic Metres
m^3	Cubic Metres

mm	Millimetres
mm/a	Millimetres per annum
N	North
NGA	National Groundwater Archive
WMS	Water Management System
NWA	National Water Ac
NWRS	National Water Resource Strategy
pg.	Page
PS	Present Status
PSP	Professional Service Provider
Pty.	Proprietary
RDM	Resource Directed Measure
Ref	Reference
RQO	Resource Quality Objective
RU	Resource Unit
SAWS	South African Weather Service
Sc	Scenario
SDS	Source Directed Studies
SWSA	Strategic Water Source Aras
TEC	Target Ecological Category
TOR	Terms of Reference
WC	Western Cape
WMA	Water Management Area
WQ	Water Quality
WRC	Water Research Commission
WRCS	Water Resource Classification System
WRCs	Water Resource Classes
WULA	Water Use Licence Application
WWTW	Wastewater Treatment Works

1. INTRODUCTION

1.1. Background

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 initiative aimed to conclude the Resource Directed Measures (RDM) process for the 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').

The primary objective of this study was to provide insights into the groundwater resource systems within the Berg catchment, considering the both the conservation status of priority water resources, as well as the intricate geological and hydrogeological features of the study area. The ultimate goal was to provide high confidence information to facilitate well-informed management decisions regarding stressed or over-utilized groundwater resources.

In the Berg catchment, Integrated Units of Analysis (IUAs), 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 Gazette incorporated both the WRCs (in accordance with Section 13(4)(a)(i)(aa) of the National Water Act (NWA) of 1998) and the RQOs for prioritized Resource Units (RUs) (in accordance with Section 13(4)(a)(i)(bb) of the NWA of 1998). A summary of the information outlined in the Gazette is provided below:

Integrated Units of Analysis (IUAs)

IUAs are areas that contain a set of “biophysical nodes” which represent inlets to estuaries and monitoring locations along rivers (also referred to as “river nodes” or “estuary nodes”). These IUAs provide input to both the management criteria and the Target Ecological Category (TEC) to be achieved or maintained for each RU within each IUA (**Figure 1-1**).

Water Resource Classes (WRCs)

WRCs were established for all RUs based on the vision for the catchment and are defined as:

- Class I (high environmental protection and minimal utilization)
- Class II (moderate protection and moderate utilization)
- Class III (sustainable minimal protection and high utilization)

Resource Quality Objectives (RQOs)

- RQOs were established for surface water RUs (**Figure 1-1**) for water quantity, habitat and biota, and water quality for rivers, estuaries, dams and wetlands.
- RQOs were also established for groundwater RUs (**Figure 1-1**) for groundwater quantity (i.e., abstraction, low flow in river, discharge, and groundwater level) and groundwater quality (i.e., nutrients, salts, pathogens and various system variables).

In summary, this study aimed to align with gazetted requirements and sought to achieve high-confidence results in determining the necessary groundwater contribution to the Reserve. Specifically, the groundwater contribution to the Basic Human Needs (BHN) and the Ecological Water Requirements (EWR).

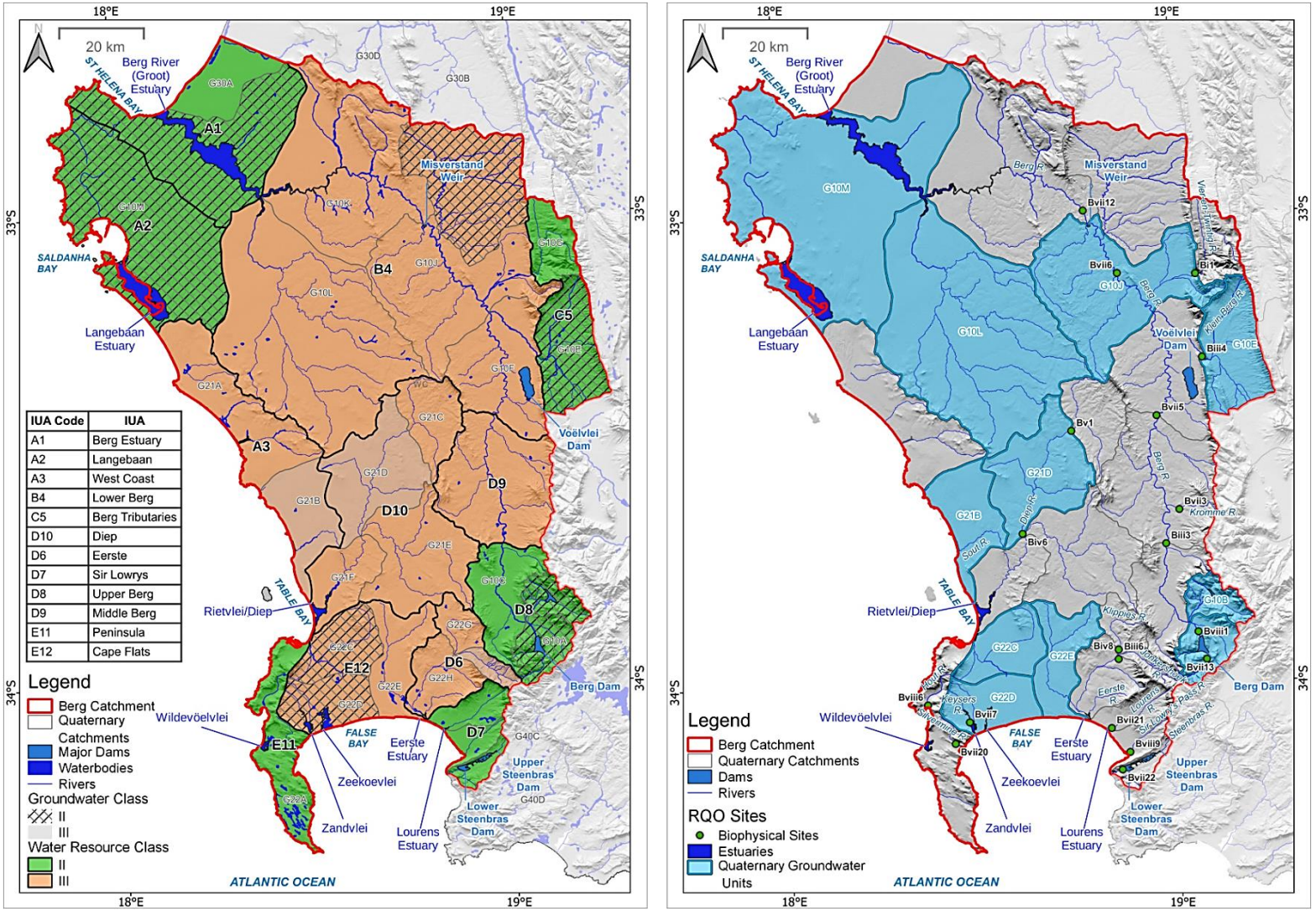


Figure 1-1 **Left: A map of the Integrated Units of Analysis (IUAs), Water Resource Classes (WRCs) and Groundwater Classes for the Berg catchment; Right: A Map of priority quaternary catchments, river and estuary nodes, and dams with gazetted Resource Quality Objectives (RQOs) (after DWS, 2019b: 121).**

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 site-specific 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. Aim of this Report

The aim of this report was to design an appropriate Monitoring Programme for the Berg catchment's groundwater Reserve, i.e., Step 7 of the eight-step RDM Reserve determination procedure (**Figure 1-2**), which involves developing a comprehensive monitoring network with well-defined monitoring objectives, including specific activities, monitoring frequency, and data to be collected at each site.

To achieve this, the report assessed existing monitoring sites from various national databases, considering both their spatial distribution and their relevance to the target aquifer unit. This evaluation aimed to determine their suitability for monitoring site-specific parameters, building upon insights gained from The Berg Catchment WRCs and RQOs Study (DWS, 2016).

Therefore, monitoring objectives were established separately for both the groundwater contribution to the EWR and BHN[1], tailored to each Groundwater Resource Unit (GRU) and its defined 'Management Option' (see **Section 3** and **Section 3.2**). These 'Management Options' were determined using an Impact vs. Influence Matrix incorporating various hydrogeological variables and outcomes from previous steps in the Reserve determination process.

This report presents a Monitoring Programme for the entire Berg catchment (refer to **Section 4**). This Monitoring Programme is specific for groundwaters contribution to the Reserve and therefore does not supersede or negate additional monitoring programmes required for individual users or strategic water sources. In cases where existing boreholes are inactive or no longer effective for monitoring the groundwater contribution to the Reserve (e.g., due to inaccessibility or targeting the wrong aquifer unit, etc), recommendations for the locations of proposed new boreholes are provided. Additionally, the report provides recommendations for certain aspects of the monitoring procedure to ensure the successful implementation of the programme (**Section 5**). The **Monitoring Programme Report** constitutes **Deliverable 3.6** of Phase 3 in this study. The study's scope of work was outlined in the project's Inception Report (DWS, 2022a), and summarised in **Table 1-1**.

[1] In the context of this report, it is crucial to clarify that the baseflow results, derived from earlier stages in this study, have been calculated using flow data modelled to align with EWRs predicted to sustain the TEC of river nodes and priority estuaries (please refer to the BHN and EWR Requirement Report for details; DWS, 2023a). Therefore, when discussing terms such as 'the groundwater contribution to baseflow', 'the EWR component dependent on groundwater discharge', 'the groundwater component of the EWR', or 'the groundwater contribution to the EWR', these phrases can be used interchangeably. To prevent confusion and maintain consistency, the term 'the groundwater contribution to the EWR' will be used henceforth.

Table 1-1 **Summary of project phases, tasks, and associated deliverables for the High Confidence Groundwater Reserve Determination Study in the Berg Catchment (Reserve Determination' Steps after WRC, 2013).**

Phase 1	**Project Inception**		
Task 1	Inception		Deliverable 1: Inception Report
Phase 2	**Review of 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 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	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 Scenarios Report
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

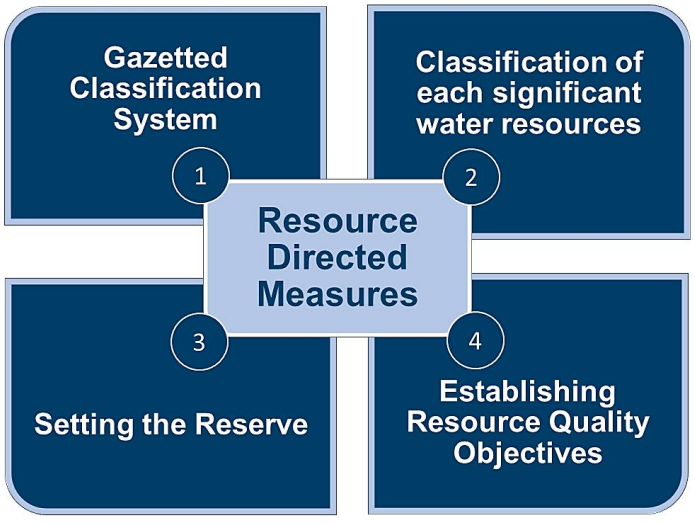


Figure 1-2 **The four components of the Resource Directed Measures (RDM) as defined by Regulation 2(4) of the National Water Act (NWA; No. 36 of 1998).**

2. PROJECT OVERVIEW AND RELEVANT INFORMATION

The following section of the report aims to briefly summarize the current status of the Reserve determination process and the relevant information used to design the Monitoring Programme for the Berg catchment. This breakdown includes three important subsections that provide an overview of the information, this includes 1) National Policy, 2) Existing Monitoring Requirements, and 3) the outcomes of Steps 1-6 of the Reserve determination.

2.1. National Policy

The Constitution, serving as the supreme law of the country, forms the basis for all legislation in South Africa, including that of national water management. The National Water Act (i.e., Act No. 36 of 1998) plays a critical role as it focuses on the effective water resource management for BHN, EWR, and national economic progress, emphasizing the interconnectedness of all elements in the water cycle. The NWA therefore established the framework for national water policy in the country.

Recognizing water as a shared natural resource, the DWS, entrusted with overseeing water resources to ensure sustainable use, has developed the National Water Resource Strategy (NWRS) to fulfil the NWA's mandate. Over time, responsibility for water resource management has been decentralized to more local authorities (**Table 2-1**), guided by the various DWS policies related to the NWRS. As part of the NWRS regulatory framework, which includes references to the RDM and its associated resource management components (i.e., the WRCs, the Reserve, and the RQOs), the Reserve holds precedence as the **only** right to water in the NWA.

In terms of the Monitoring Programme, which specifically relates to safeguarding the groundwater contribution to the Reserve, the focus is on measuring groundwater systems' behaviour and response to varying hydrogeological parameters. However, other factors beyond that of the RDM may impact a resource, which is currently only monitored using a single set of RQOs. While various management policies set clear objectives for water resource managers, integrating the practical aspects of monitoring the groundwater contribution to the Reserve and reconciling the RDM with other Source Directed Studies (SDS) programmes, is an important consideration when implementing programme and evaluating its efficacy (**Figure 2-1**).

The Integrated Water Resources Management (IWRM) initiative, also highlighted in the NWRS, aims to optimize economic and social well-being while ensuring the sustainability of vital ecosystems. This approach departs from outdated and fragmented "sectoral" monitoring efforts, which historically led to subpar service delivery and unsustainable water resource utilization. The IWRM recognizes water resources as integral components of important ecosystems, as well as social and economic assets, seeking to replace the conventional sector-specific approach with a more holistic strategy (**Figure 2-1**).

Table 2-1 An overview of the multi-tiered management approach, with a focus on its integration, for a comprehensive strategy towards resource management in South Africa.

Level	Management		Scientific Focus		Time Frame
1	National	DWS	Referential	Countrywide Status of Water Resources	Long Term
2	Regional	DWS CMA Water Service Authority	Proactive or Reactive Control	Response of GRUs and Supporting Systems	Medium Term
3	Local	Water User Water Use Association Water Service Institution	Auditing	Compliance with WUL Conditions	Short Term

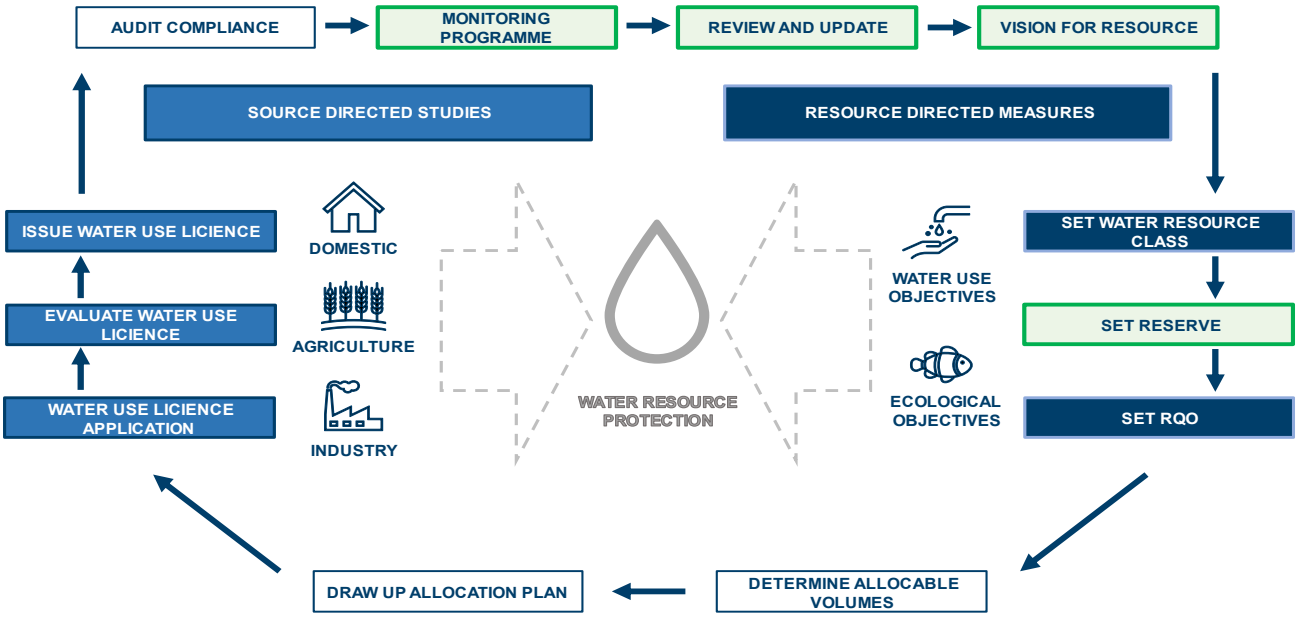


Figure 2-1 **Relation between Resource Directed Measures (RDM) and Source Directed Studies (SDS) in the context of the groundwater Reserve and the Integrated Water Resource Management (IWRM) initiative.**

While the DWS holds a direct mandate for water resource management, various institutions also share a similar responsibility in overseeing natural resources. The governance of these resources involves multiple national departments, including the Department of Agriculture, Land Reform and Rural Development (DALRRD)[2] and the Department of Forestry, Fisheries, and the Environment (DFFE)[3]. Each department maintains a distinct resource management focus and employs varying management strategies (refer to **Table 2-2** and the national departmental websites for detailed policy information).

At the regional and local levels of water resource management, collaboration between the DWS, DALRRD, and DFFE is crucial. Additionally, public entities such as Cape Nature, Catchment Management Agencies (CMAs) and Water Use Associations (WUAs) play key roles in the management and planning of water resources in the Western Cape (WC) and the Berg catchment. This collaborative effort underscores the IWRM initiative and illustrates how its implementation addresses challenges associated with water, land, and natural resources.

[2] The Department of Agriculture, Land Reform and Rural Development (DALRRD) was established in June 2019 by the merger of the Department: Agriculture, Forestry and Fisheries (DAFF) and the Department: Rural Development and Land Reform (DRDLR).
[3] The Department of Forestry Fisheries and the Environment (DFFE) was renamed in April 2021 form the Department of Environment, Forestry and Fisheries (DEFF) which had been established in 2019 by incorporating the forestry and fisheries functions from the previous DAFF into the Department of Environmental Affairs (DEA).

Table 2-2 Relevant legislation, policy and public entities reporting to the Department of Agriculture, Land Reform and Rural Development (DALRRD), the Department of Forestry Fisheries and the Environment (DFFE) and the Department of Water and Sanitation (DWS).

Category	DALRRD	DFFE	DWS
Legislation	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	National Environmental Management Act (NEMA), 1998, with amendments (Act No. 107 of 1998)	National Water Act, 1998 (Act No 36 0f 1998)
	Agricultural Research Act, 1990 (Act No. 86 of 1990)	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004),	Water Services Act, 1997 (Act No. 108 of 1997)
	National Forests Act, 1998 (Act No. 84 of 1998)	National Environmental Management: Protected Areas Act, 2003, with amendments (Act No. 57 of 2003)	Water Research Act, 1971 (Act No 34 of 1971)
	National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	
Policies	Integrated Growth and Development Plan (IGDP) for Agriculture, Forestry and Fisheries, 2012.	White Paper on National Climate Change Response, 2011	National Water Resource Strategy (NWRS) 3, 2023.
	Food Security Production Programme for South Africa, 2002.	White Paper on Environmental Management, 1998	National Water Resource Strategy 3, 2023.
	Strategic Plan for Supporting Smallholder Producers	White Paper on Conservation and Sustainable Use of Biodiversity, 1997	Overarching policy for Water Quality Management (DWS) 2017
			Overarching policy for WQM (DWS, 2017)
Public entities reporting to Department	Agriculture Research Council (ARC)	South African National Biodiversity Institute (SANBI)	Water Research Commission (WRC)
	Agricultural Produce Agents Council (APAC)	South African National Parks (SANParks)	Catchment Management Agencies (CMA) & Water Boards
		South African Weather Service (SWAS)	
Programmes	Forestry and Natural Resources Management	Working for Water/Wetlands/Fire/Land/ Forests/Coasts/Ecosystems	National Water Resource Strategy (NWRS) 3, 2023.
		National Resource Management (NRM) programmes	National Water Resource Strategy 3, 2023.
			Institutional Establishment with Water Management Areas: Limpopo-Olifants, Inkomati-Usuthu, Pongola-Mtamvuna, Vaal-Orange, Mzimvubu-Tsitsikamma, Breede-Olifants (Revised Water Management Areas 2022)
	Land Care	Oceans and Coasts	

2.2. Existing Monitoring Requirements

To sustain the gazetted WRCs and ensure compliance with Reserve requirements through RQO implementation, an in-depth catchment visioning process and a public review was undertaken as part of 'The Berg Catchment WRCs and RQOs Study' (DWS, 2016). It is important to note, however, that the 7-step procedures related to WRCs and RQOs determination processes do not include a specific step for establishing a “Monitoring Programme”. Nevertheless, Steps 3 and Step 4 within these procedures, involving prioritizing sub-components and assessing the system by setting a baseline, include the selection of “indicator sites” for determining RQOs limits. In this process, a separate framework known as the 'Adaptive Management Cycle' was introduced, incorporating additional steps to facilitate potential adjustments to the overall management criteria (refer to **Figure 2-2**).

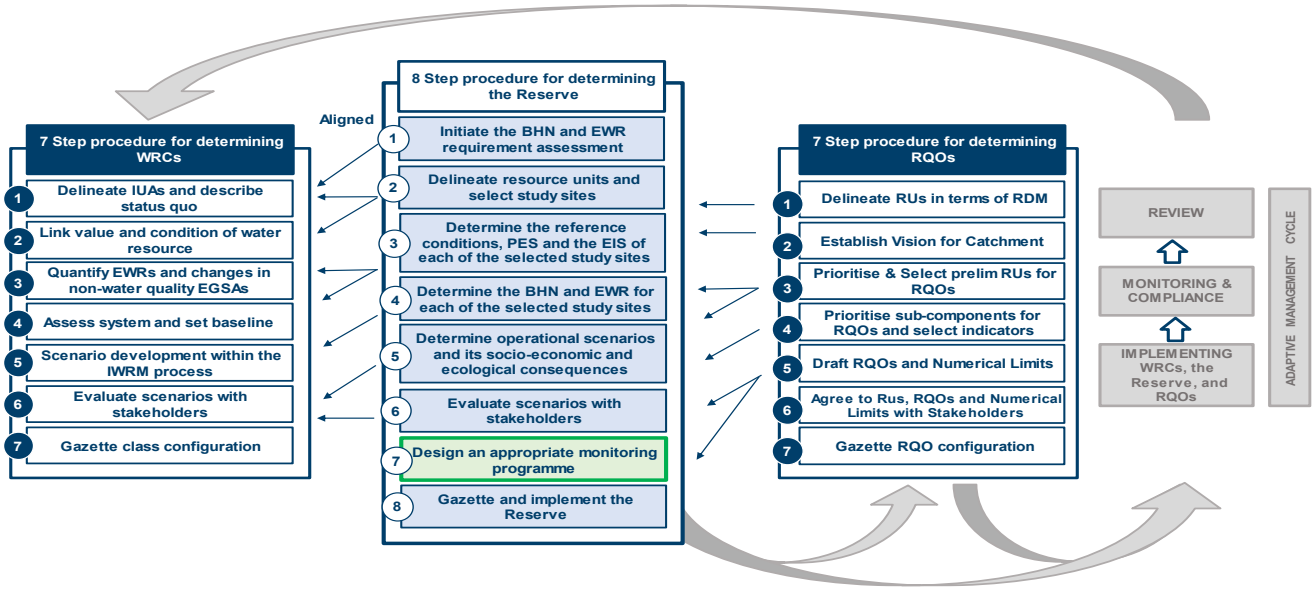


Figure 2-2 **The 8-step procedure for determining the groundwater Reserve (centre) and its alignment with the 7-step Water Resource Classes (WRCs) (left) and the 7-step Resource Quality Objective (RQO) (right) procedures, as defined by Regulation 2(4) of the National Water Act (NWA; No. 36 of 1998) and outlined in WRC (2013). The 3 additional steps of the Adaptive Management Cycle have also been incorporated.**

The analysis presented in this report draws upon insights derived from the DWS (2016) study as well as the study related to the Berg River Monitoring Programme (Ratcliffe et al., 2007a and 2007b), which established a monitoring network specifically related to the Berg River. These two studies adhere to monitoring guidelines outlined by general overarching principles in the GRDM Reports of WRC (2017) and WRC (2012), as well as in the Olifants–Doorn Resource Quality Objectives Reports (DWA 2013a, 2013b, 2013c, and 2013d), which served as general guidelines.

The following information from these studies was considered:

- IUAs, TECs and EWRs for river & estuary nodes, irrespective of whether or not they were officially taken forward in the gazetting process (DWS, 2016 and DWS, 2019b: 121).
- Water Resource Classes (WRCs) and Groundwater Classes (GWC) (DWS, 2019b: 121).
- RQOs for both surface and groundwater resources (after DWS, 2019b: 121).
- Monitoring sites in the Berg River Monitoring Programme (Ratcliffe et al., 2007a and 2007b).

Additional considerations included the Strategic Water Source Areas (SWSA) established by the 2018 study titled 'Strategic Water Source Areas: Management Framework and Implementation Guidelines for Planners and Managers' conducted by the Water Research Commission (WRC), and the Subterranean Government Water Control Area (SGWCA) as referenced in DWS (2022d).

2.3. Outcomes of Steps 1-6 of the Reserve Determination

To fulfil the TORs for this study (**Section 1.2**) and complete the groundwater Reserve determination process, the Monitoring Programme's design and site selection process considered various outcomes from previous steps in the study.

From Step 1, the study considered known groundwater resource models and associated aquifer boundaries, along with information from various databases, including Hydstra, the Water Management System (WMS), the Water Use Authorisation and Registration Management System (WARMS), the National Groundwater Archive (NGA), and City of Cape Town (CoCT) databases. From Steps 2 and 3, the Status Quo per GRU was determined, which incorporated the revised aquifer specific GRU extents, as well as Present Status (PS) which included recharge, groundwater use, discharge, groundwater quality, and aquifer stress.

Steps 4, 5 and 6 determined the groundwater contribution to the BHN and EWR Reserve which included various future scenarios, with the "most likely" case taken forward. Additionally, an 'Allocation Factor' for all GRUs was developed to assess potential impacts on selected water resources, representing the ratio of groundwater that is 'still allocable' after considering the Reserve and groundwater use in relation to the total recharge for the GRU (Refer to **Figure 2-3**, **Figure 2-4**, **Table 2-3** and **Table 2-4** for a summary of outcomes.)

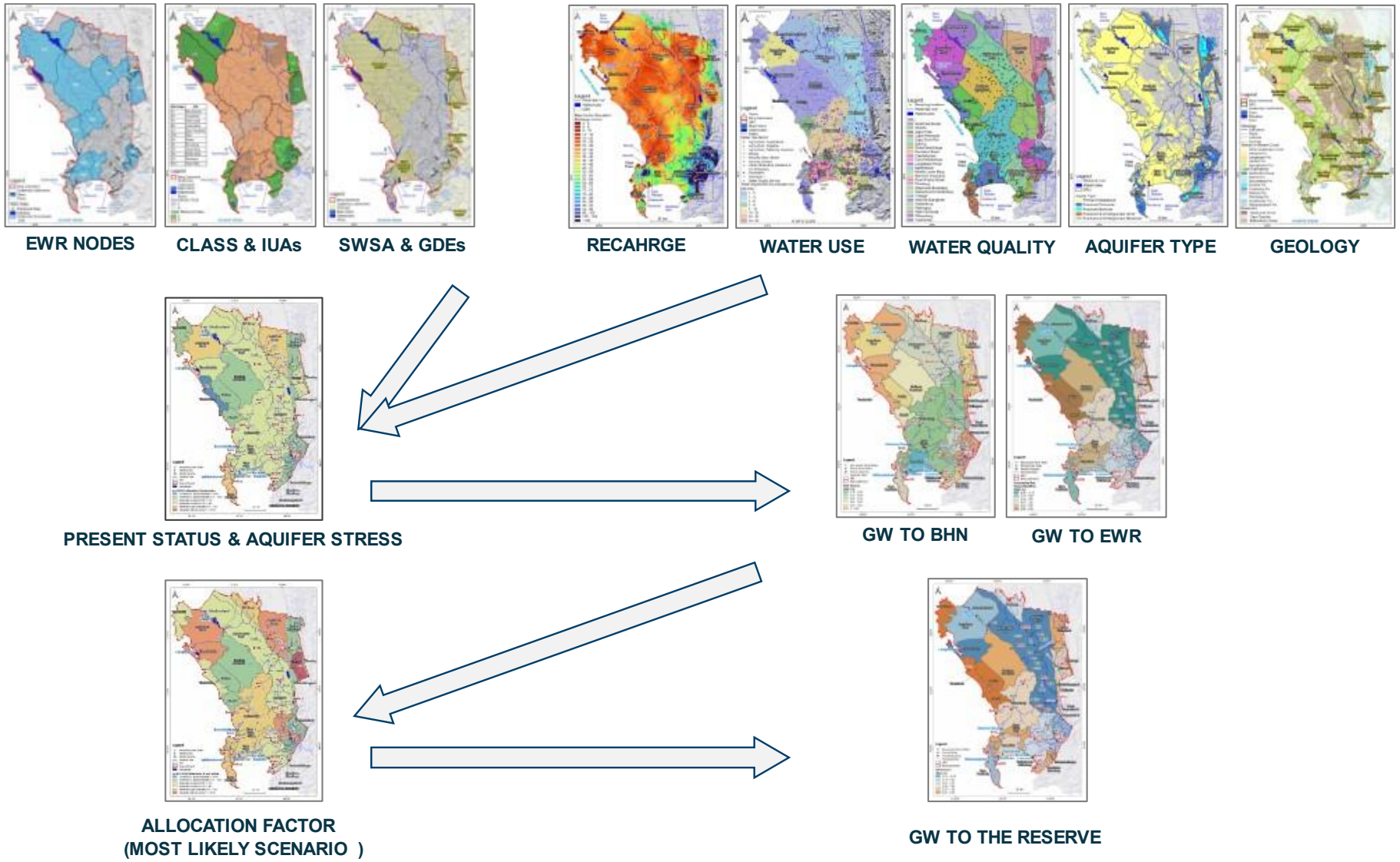


Figure 2-3 **A compilation of project maps presenting a comprehensive overview of various elements within the Berg catchment's groundwater resources (i.e., findings derived from the ongoing study).**

Table 2-3 Guide for determining the Allocation Category.

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

Table 2-4 Overview of projected volumes for the various components of the groundwater Reserve (i.e., the groundwater contribution to EWR and BHN), including groundwater use, and volumes used to determine an Allocation Factor for the Most-Likely Scenario[4] in the Berg catchment (see DWS, 2023d).

GRU	Scenario – Most-Likely Case							
	Recharge (Mm³/a)	Groundwater Contribution to the EWR (Mm³/a)	Groundwater Contribution to the BHN Reserve (Mm³/a)	GW Reserve (Mm³/a)	Total Allocable Volume (Mm³/a)	Water Use (Mm³/a)	Still Allocable (Mm³/a)	Allocable Factor
Adamboerskraal	20.83	6.00	0.01	6.01	14.81	3.69	11.13	0.53
Atlantis	21.63	0.08	0.05	0.13	21.50	3.31	18.19	0.84
Cape Flats	38.70	0.51	1.29	1.80	36.90	23.02	13.88	0.36
Cape Peninsula	9.19	5.43	0.16	5.59	3.60	0.15	3.45	0.38
Cape Town Rim	16.26	0.87	0.36	1.23	15.03	8.71	6.32	0.39
Darling	8.02	0.03	0.03	0.06	7.97	1.40	6.56	0.82
Drakensteinberge	26.86	2.88	0.01	2.89	23.97	1.21	22.77	0.85
Eendekuil Basin	17.31	6.95	0.16	7.11	10.21	6.57	3.64	0.21
Elandsfontein	13.17	6.39	0.01	6.40	6.77	2.70	4.07	0.31
Groot Winterhoek	20.11	0.77	0.03	0.80	19.31	3.27	16.04	0.80
Langebaan Road	20.18	5.52	0.03	5.55	14.63	11.09	3.55	0.18
Malmesbury	44.42	1.18	0.64	1.82	42.61	25.12	17.49	0.39
Middle-Lower Berg	36.88	11.15	0.16	11.31	25.57	5.09	20.48	0.56
Northern Swartland	26.11	0.20	0.09	0.29	25.82	2.92	22.90	0.88
Paarl-Franschhoek	24.60	3.01	0.21	3.22	21.38	15.50	5.88	0.24
Piketberg	19.02	2.07	0.06	2.13	16.89	9.80	7.09	0.37
Steenbras- Nuweberg	57.97	1.16	0.02	1.18	56.79	24.52	32.26	0.56
Stellenbosch-Helderberg	38.49	2.34	0.46	2.80	35.69	11.30	24.39	0.63
Tulbagh	9.34	1.28	0.05	1.33	8.01	6.66	1.35	0.14
Voëlvlei-Slanghoek	12.87	1.62	0.01	1.63	11.24	0.31	10.93	0.85
Vredenburg	6.63	0.00	0.02	0.02	6.61	1.97	4.64	0.70
Wellington	33.07	6.75	0.39	7.14	25.92	8.79	17.13	0.52
Wemmershoek	25.60	3.59	0.00	3.59	22.01	1.56	20.45	0.80
Witzenberg	2.60	0.18	0.00	0.18	2.42	0.16	2.26	0.87
Yzerfontein	7.60	0.02	0.02	0.04	7.56	2.26	5.30	0.70
TOTAL	**557.47**	**69.98**	**4.27**	**74.25**	**483.23**	**181.06**	**302.16**	

[4] *Table values are based on the results calculated in Scenario 7b: Combination Scenario – Most-Likely Case (2050). Refer to the Stakeholder Engagement of Operational Scenarios Report (DWS, 2023d) for further details.*

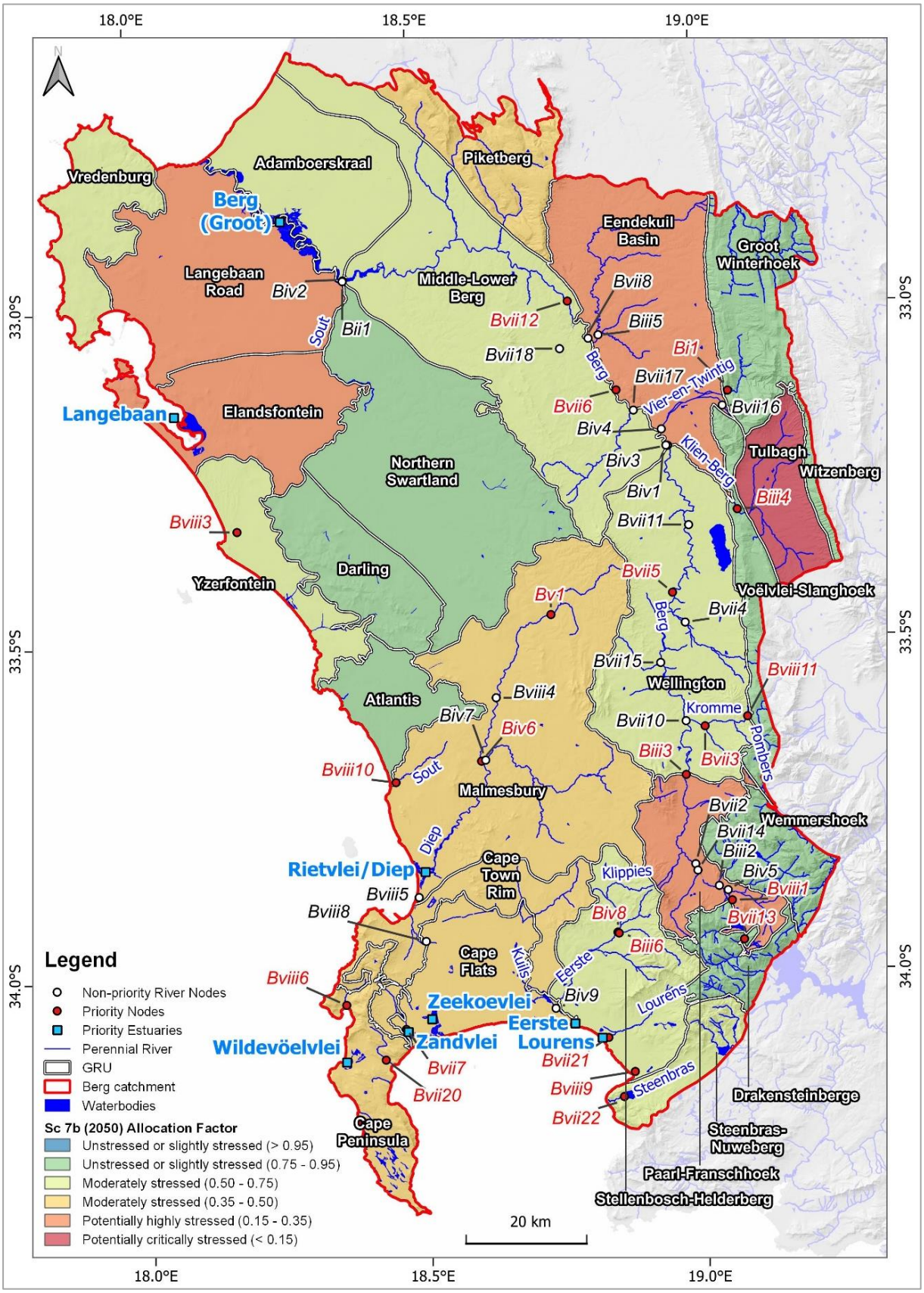


Figure 2-4 **Overview map of the Allocation Factor calculated per GRU based on the Most Likely Scenario for the catchment and the associated projected volumes (2050).**

3. METHODOLOGY

The following section provides a summary of the methodology used in developing the Monitoring Programme for the Berg catchment. It is organized into three subsections: 1) Assigning Management Options, 2) Defining Management Objectives, and 2) Monitoring Site Selection.

3.1. Assigning Management Options

In formulating groundwater Management Options for the contributions to the Reserve, an Impact vs. Influence Matrix was used to prioritize GRUs. It is important to highlight that, at the GRU level, the groundwater contribution to both the BHN and EWR is shaped by distinct yet interconnected factors. Consequently, criteria for determining groundwater Management Options were approached separately.

The Impact vs. Influence Matrix incorporated 'impact' factors, such as the ‘Allocation Factor’ 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’ per GRU. This matrix assisted in visually categorizing GRUs based on various hydrogeological elements, identifying areas of both high impact and influence, as well as areas where influence may be limited despite significant impact.

Management Options for the Groundwater Contribution to EWR:

As outlined in **Section 2.3: Outcomes of Steps 1-6 of the Reserve Determination**, operational scenarios provided valuable insights into the future dynamics and potential impacts on groundwater resources in the Berg catchment. These insights formed the basis for defining Management Options for the groundwater contribution to EWR, considering both the ‘Allocation Factor’ and the ‘Groundwater Contribution to Baseflow’ within the Impact vs. Influence Matrix (**Figure 3-1** and **Figure 3-2**).

The analysis drew upon a comprehensive set of hydrogeological datasets, placing particular emphasis on climate projections, recharge estimations, future groundwater use, and the socio-economic trends associated with the Operational Scenarios (DWS, 2023d). This approach offered an integrated perspective on potential challenges in safeguarding the groundwater Reserve.

Management Options for the Groundwater Contribution to BHN:

To assess the groundwater component of the BHN, the Qualifying Population—comprising individuals lacking access to a formal water source and residing beyond a minimum distance of 500 meters from a perennial river—was utilized to determine the current and potential daily water demand. A fixed value of 25 ℓ/p/d was applied to the qualifying population for each GRU, effectively establishing the groundwater contribution to the BHN Reserve, as detailed in **Section 2.3: Outcomes of Steps 1-6 of the Reserve determination** and the “BHN and EWR Requirement Report” (DWS, 2023d).

These insights formed the basis for defining Management Options for the groundwater contribution to BHN, which considered the ‘Groundwater Contribution to the BHN Reserve’ and the ‘Qualifying Population Density’ within the Impact vs. Influence Matrix (**Figure 3-1** and **Figure 3-2**).

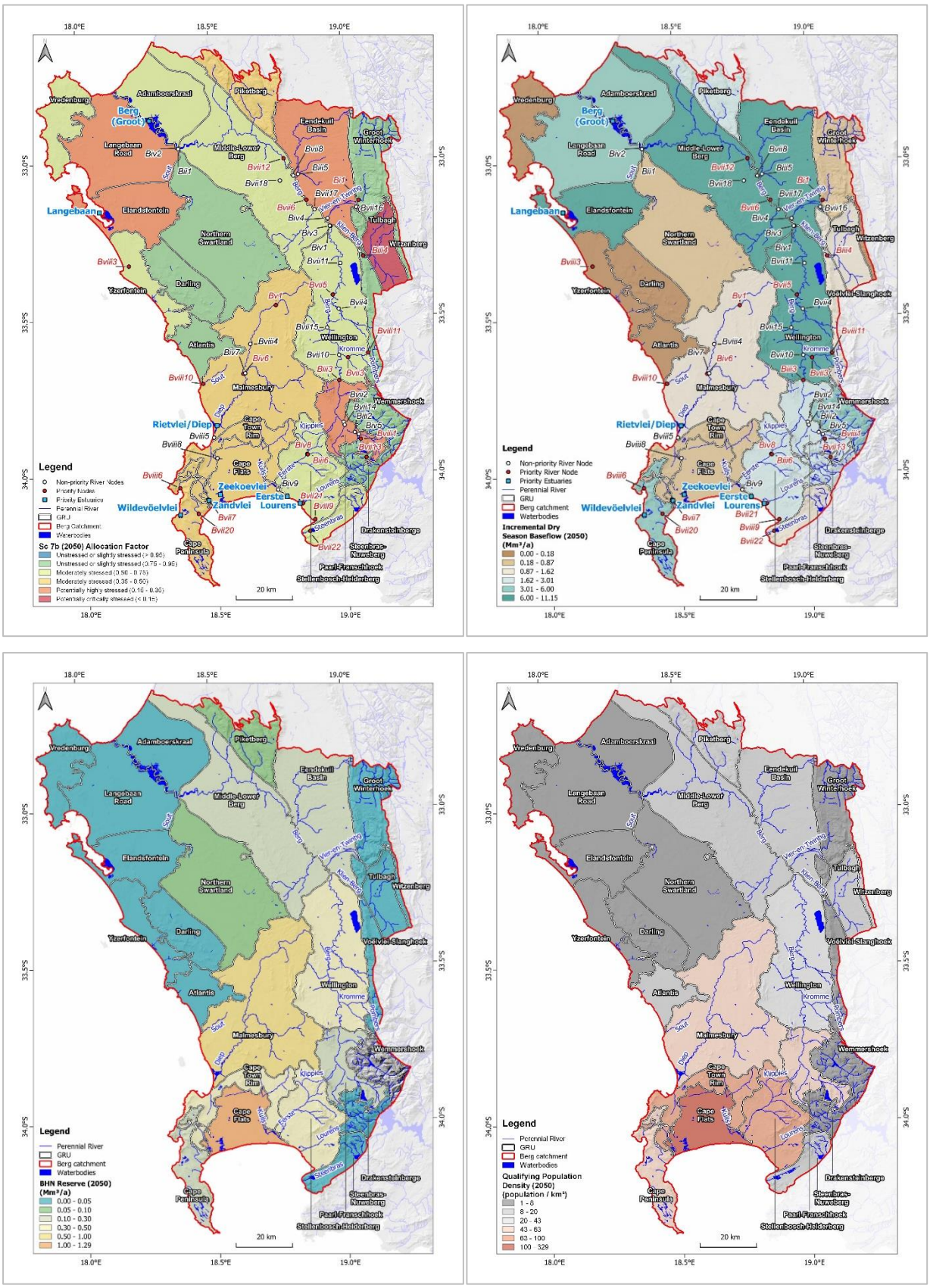
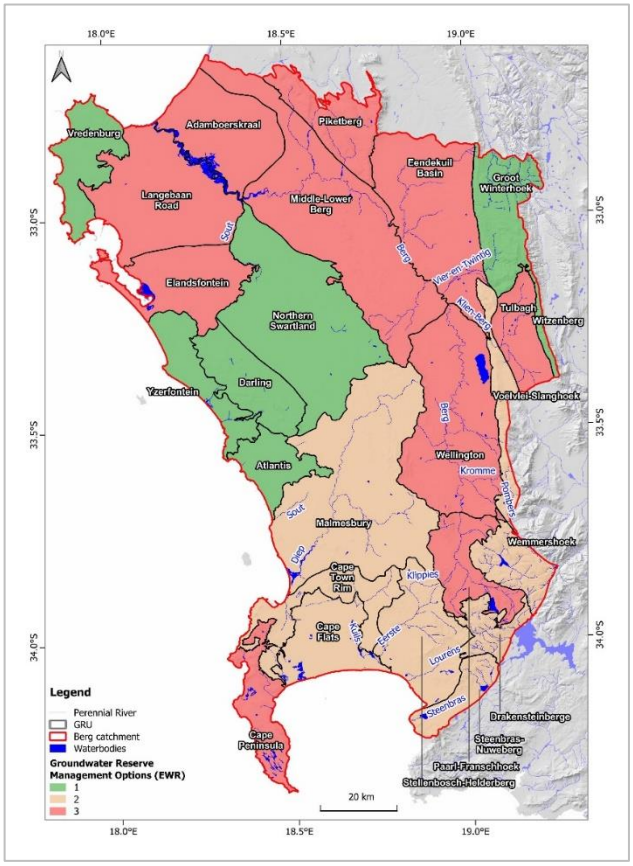


Figure 3-1 **Top Left: Allocation Factor per GRU. Top Right: Groundwater contribution to baseflow per GRU. Bottom Left: Groundwater contribution to the BHN per GRU. Bottom Right: Population Density per GRU. All maps represent Scenario 7b, the most likely case, as detailed in Deliverable 3.5: The Stakeholder Engagement of Operational Scenarios Report (DWS, 2023d).**

GW Contribution to Baseflow (Mm^3/a) \ Allocation Factor (Still Allocable Volume / Recharge)	A (>0.95)	B (0.75 – 0.95)	C (0.50 – 0.75)	D (0.35 – 0.50)	E (0.15 – 0.35)	F (<0.15)
0.00 - 0.18						
0.18 - 0.87						
0.87 - 1.62						
1.62 - 3.01						
3.01 - 6.00						
6.00 - 11.15						

GW contribution to BHN (Mm^3/a) \ Population Density (pop/km^2)	0.00 – 7.29	2.29 – 20.09	20.09 – 43.00	43.00 – 62.68	62.68 – 100.31	100.31 – 329.43
0.00 – 0.05						
0.05 – 0.10						
0.10 – 0.30						
0.30 – 0.50						
0.50 – 1.00						
1.00 – 1.29						



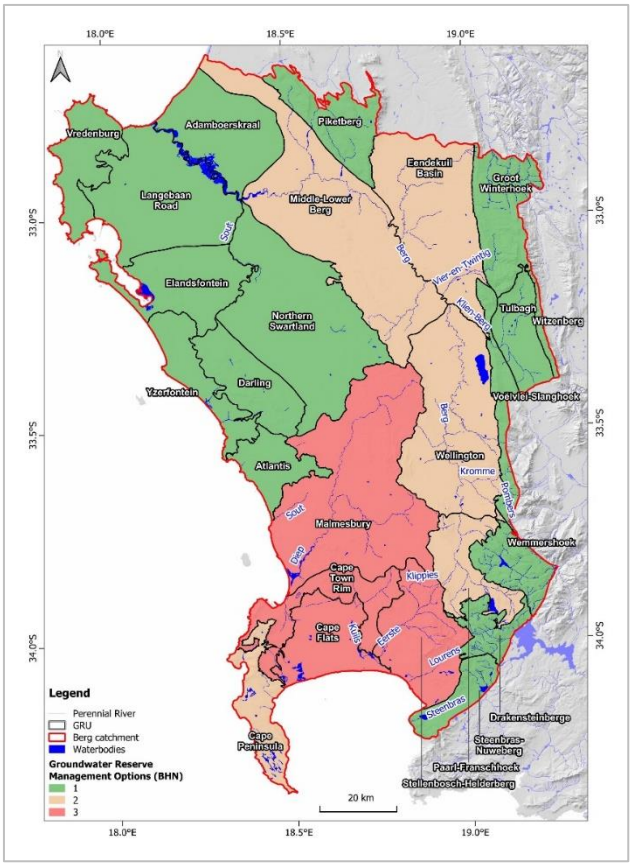


Figure 3-2 **The Impact vs. Influence Matrix for the Groundwater Contribution to the EWR (left), and the Groundwater Contribution to the BHN (right). The figure includes associated Management Option Maps.**

Table 3-1 outlines the high-level structure and description of management options, including the management priority, site selection considerations, and potential monitoring frequency for options 1 to 3 (further detailed in **Section 3.2: Defining Management Objectives**).

Table 3-1 Overview and basic outline of Management Option 1 (Green), Management Option 2 (Orange), and Management Option 3 (Red).

Management Options	Monitoring Description
1	• Low Priority • Limited Selection of Monitoring Sites • Infrequent Monitoring
2	• Low - Moderate Priority • Limited - Moderate Selection of Monitoring Sites • Increased Monitoring Frequency
3	• Medium - High Priority • Moderate - Numerous Selection of Monitoring Sites • High-Frequency Monitoring

Table 3-2 Summary table of the Management Options per GRU for the groundwater contribution to the EWR and BHN in the Berg Catchment, including the associated "impact" and "Influence" variables.

GRU	Allocable Factor per GRU	Groundwater Contribution to Baseflow (M m^3/a)	Management Options for Groundwater Contribution to EWR	Groundwater Contribution to the BHN (M m^3/a)	Qualifying Population Density per GRU (pop/km^2)	Management Options for Groundwater Contribution to BHN
Adamboerskraal	0.53	6.00	3	0.01	2.50	1
Atlantis	0.84	0.08	1	0.05	20.09	1
Cape Flats	0.36	0.51	2	1.29	329.43	3
Cape Peninsula	0.38	5.43	3	0.16	56.44	2
Cape Town Rim	0.39	0.87	2	0.36	100.31	3
Darling	0.82	0.03	1	0.03	7.72	1
Drakensteinberge	0.85	2.88	2	0.01	3.94	1
Eendekuil Basin	0.21	6.95	3	0.16	18.16	2
Elandsfontein	0.31	6.39	3	0.01	1.97	1
Groot Winterhoek	0.80	0.77	1	0.03	7.68	1
Langebaan Road	0.18	5.52	3	0.03	4.00	1
Malmesbury	0.39	1.18	2	0.64	43.46	3
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
Paarl-Franschhoek	0.24	3.01	3	0.21	62.68	2
Piketberg	0.37	2.07	3	0.06	17.57	1
Steenbras-Nuweberg	0.56	1.16	2	0.02	13.11	1
Stellenbosch-Helderberg	0.63	2.34	2	0.46	87.79	3
Tulbagh	0.14	1.28	3	0.05	17.74	1
Voëlvlei-Slanghoek	0.85	1.62	2	0.01	6.11	1
Vredenburg	0.70	0.00	1	0.02	6.24	1
Wellington	0.52	6.75	3	0.39	39.70	2
Wemmershoek	0.80	3.59	2	0.00	1.27	1
Witzenberg	0.87	0.18	1	0.00	11.22	1
Yzerfontein	0.70	0.02	1	0.02	5.84	1
TOTAL		69.98		4.27		

3.2. Defining Management Objectives

In compliance with national policy, existing monitoring requirements, and insights from prior steps in the Reserve determination process (outlined in **Section 2**), the Monitoring Programme was designed as an 'early warning system'. Its primary objective is to prompt action should groundwater usage surpass the potential allocable volume and therefore impact on the Reserve. In such instances, a compulsory licensing process should be triggered, and existing authorisations or use should be reviewed and potentially withdrawn.

Separate monitoring guidelines are outlined for groundwater contributions to EWR and BHN Reserve, providing guidance on the type and frequency of monitoring activities, as well as specifying the data to be collected at each selected monitoring site. These were based on the following considerations:

- The EWR and BHN Management Option per GRU
- Existing groundwater RQO and EWR requirements for the catchment
- The hydroperiod and general climatic conditions of the catchment
- Common chemical parameters to be analysed to provide a holistic view of the water quality

Table 3-3 Overview of Management Options and their corresponding Management Objectives for the groundwater contributing to both the EWR and BHN Reserves.

Management Option	Management Objectives
Management Option 1	1) Quarterly or biannual manual groundwater level measurements at selected monitoring sites. 2) Biannual sampling of the following parameters (summer & winter): a. Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 b. Site specific additions as per RQO: Nutrients, Salts, Toxins, Pathogens, System Variables c. Site specific additions of nutrients (EWR): NO2, NO3, NH4 d. Site specific additions as per BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms
Management Option 2	1) Quarterly manual groundwater level measurements taken at selected monitoring sites, as well as automatically recorded level logger measurement (average daily readings) at selected monitoring sites. 2) Quarterly sampling of the following parameters: a. Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 b. Site specific additions as per RQO: Nutrients, Salts, Toxins, Pathogens, System Variables c. Site specific additions of nutrients (EWR): NO2, NO3, NH4 d. Site specific additions as per BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms
Management Option 3	1) Monthly or Quarterly groundwater level measurements taken at selected monitoring sites, as well as automatically recorded level logger measurement (continuous daily readings) at selected monitoring sites. Possible telemetry systems may be required. 2) Quarterly sampling of the following parameters a. Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO4, SO4 b. Site specific additions as per RQO: Nutrients, Salts, Toxins, Pathogens, System Variables, c. Site specific additions of nutrients (EWR): NO2, NO3, NH4 d. Site specific additions as per BHN (microbiological): E coli, Total Coliforms, Faecal Coliforms

3.3. Monitoring Site Selection

To effectively select monitoring sites, an additional spatial analysis was required to evaluate the impact on the groundwater volume needed for maintaining the EWR and BHN. This was crucial for three reasons: 1) the spatial misalignment between GRUs and surface water catchments, 2) the need to monitor aquifer-specific groundwater contributions, and 3) the uneven distribution of the qualifying population across a GRU.

To address these challenges, the groundwater contribution to baseflow was disaggregated by contributing catchment to the node, aquifer type, and GRU. Similarly, the 'qualifying population per GRU' was disaggregated into "small areas" and used to identify regions with a more concentrated population. This refinement enabled the identification of catchments and specific aquifers with the greatest influence on the groundwater contribution to EWR and BHN and, importantly, enhanced the accuracy of the representation of areas requiring concentrated monitoring efforts (see **Figure 3-3**).

The following information was considered to select monitoring boreholes:

- Geological formation and aquifer type
- Specific aquifers contribution to the node
- Slope and gradient to maintain flow to the node
- Proximity to the contributing node
- Density of qualifying population per small area
- The availability of borehole data from the Hydstra, Water Management System (WMS), and known CoCT databases. Where no data was available, the National Groundwater Archive (NGA) database was utilized.
- Gazetted Water Resource Classes (WRCs) and Groundwater Classes (GWC)
- Strategic Water Source Areas (SWSA)
- Subterranean Government Water Control Area (SGWCA)
- Groundwater Dependent Ecosystems (GDEs)

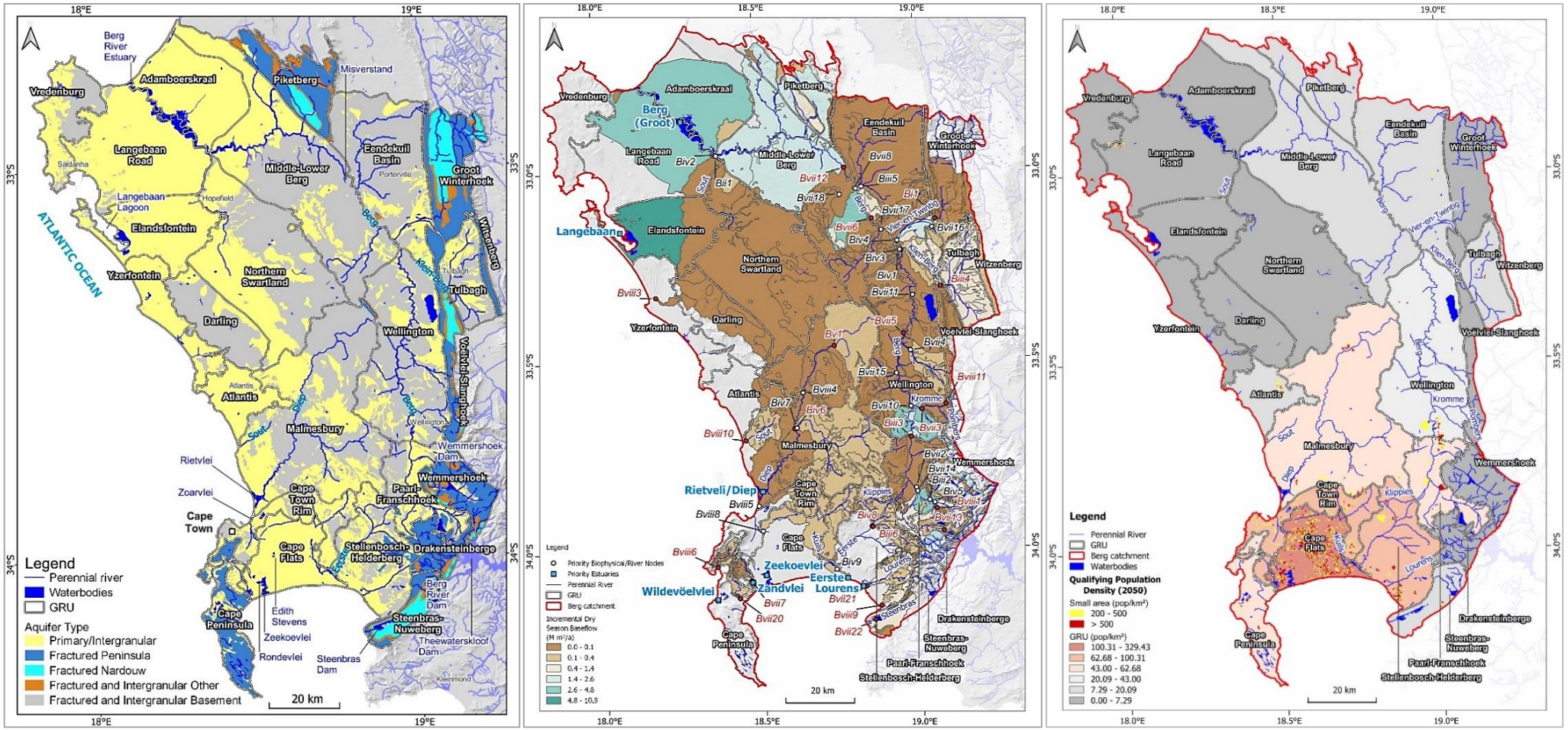


Figure 3-3 **Left: Map of Aquifer Types per GRU, Centre: Map of the groundwater contribution to the baseflow per contributing catchment, per aquifer type, and per GRU, and Right: Map of EWR qualifying population density per small area in the Berg Catchment.**

4. MONITORING PROGRAMME

After conducting a review of national policies and existing monitoring programmes within the Berg catchment (as detailed in **Section 2**), assigning Management Options (**Section 3.1**), and defining Management Objectives (**Section 3.2**), various national datasets, including Hydstra, WMS, NGA, and identified City of Cape Town (CoCT) boreholes, were examined to select suitable monitoring sites for assessing groundwater contributions to both the EWR and BHN (**Section 3.3**).

If the borehole locations documented in these databases were considered unsuitable for the specified Monitoring Objectives of the GRU, new monitoring locations were proposed. The selection of these proposed boreholes was guided by emphasizing the monitoring of aquifer-specific units and placing them in locations where access for monitoring activities was deemed feasible. This approach ensures a targeted and comprehensive assessment of groundwater resources in the Berg catchment, contributing valuable data to the overall understanding of the Berg catchment.

Figure 4-1 provides summary maps of the Management Options for groundwater contributions to the EWR (left) and BHN (right), along with the selected monitoring sites. The site information listed in **Appendix A, Table A-1** for all EWR monitoring sites and **Appendix A, Table A-2** for all BHN monitoring sites, collectively constitutes the Monitoring Programme for the groundwater Reserve in the Berg catchment.

The subsequent sections present GRU-specific monitoring details, including a series of zoomed-in maps of the monitoring area (i.e., the contributing catchment to the node or priority estuary). Furthermore, these sections offer a detailed breakdown of the monitoring actions to be carried out at each site, specifying the type and frequency of data collection necessary for effective monitoring of the groundwater contribution to both EWR and BHN per GRU.

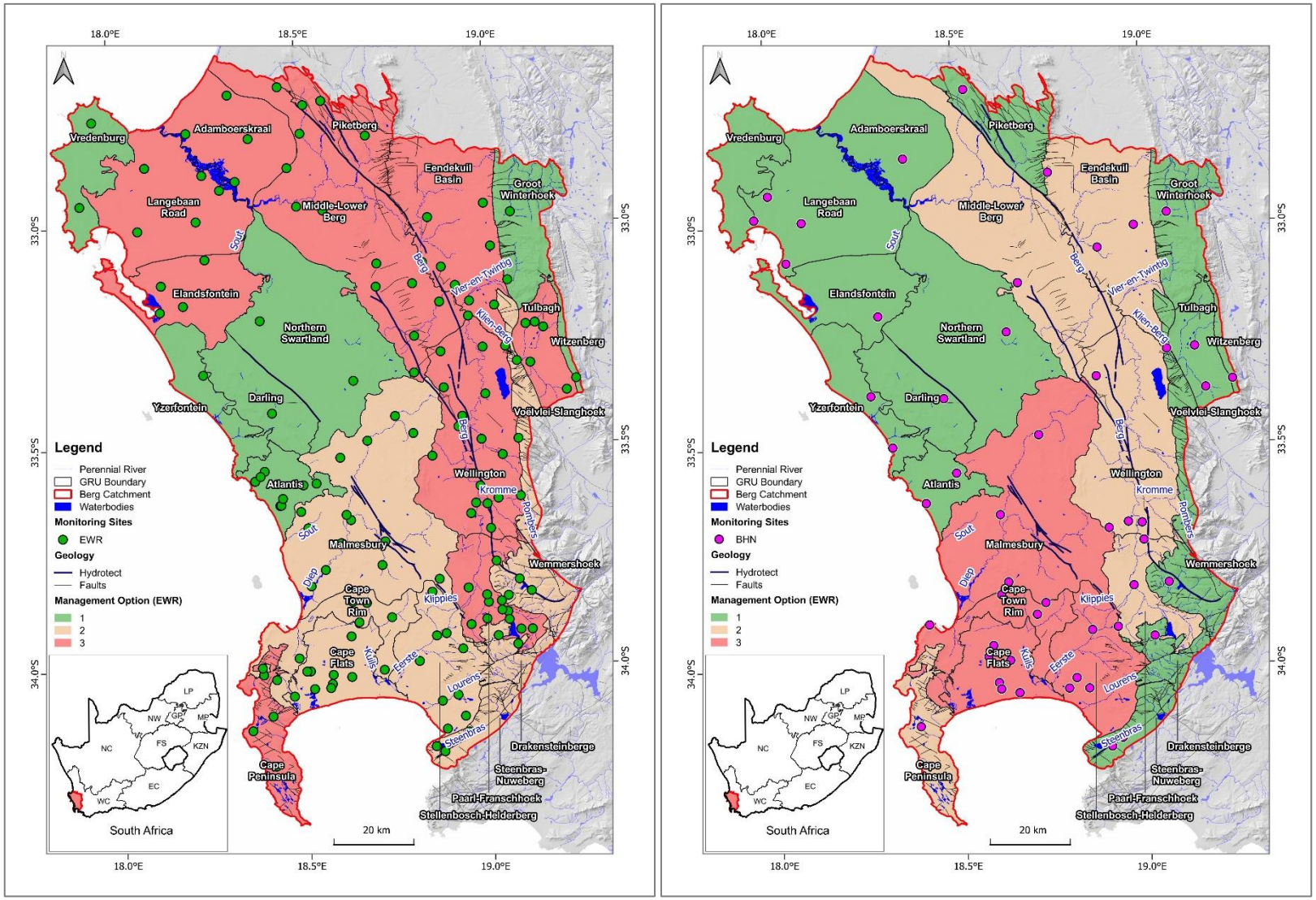


Figure 4-1 **Summary maps of Management Options for groundwater contributions to the EWR (left) and BHN (right) as well as their associated monitoring sites.**

4.1. Adamboerskraal

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 (refer to **Section 3.1** and **Figure 4-2**).

The following hydrogeologic features were considered in site selection: 1) the Berg River Estuary (identified as a priority estuary node); 2) the north-westerly preferential flow direction toward the estuary; 3) the basement lithology extent (i.e., Malmesbury Group and the Cape Granite Suite, overlain by 50 -70 m of the Springfontyn Formation (DWS, 2023a); and 4) the main contributing aquifer is the Primary / Intergranular Aquifer (see DWS, 2023a).

The majority of the Adamboerskraal GRU, excluding a small coastal portion in the northwest, fell within the West Coast Aquifer Strategic Water Source Areas for Groundwater (SWSA-gw). These SWSA-gw areas are recognized for their high groundwater availability and are considered nationally significant water resources (WRC, 2018). The GRU is also part of the Berg River Subterranean Government Water Control Area (SGWCA) (DWS, 2022d).

Considering all these factors, a total of 5 monitoring sites for the EWR and 1 for the BHN were selected within the Adamboerskraal GRU (**Figure 4-2** and **Table 4-1**).

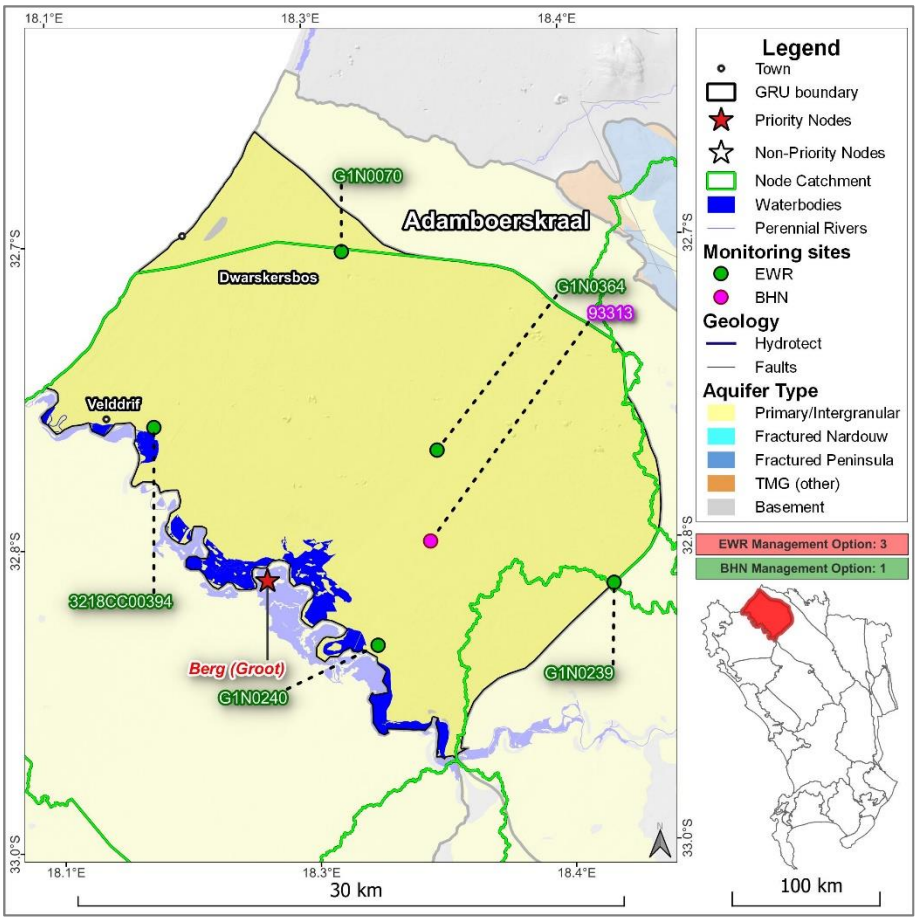


Figure 4-2 **Map depicting the Adamboerskraal GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-1 Summary of monitoring sites for the Adamboerskraal GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G1N0070	HYDSTRA	Berg (Groot)	EWR	-32.70555556	18.32083333	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Bxi1 (Berg Groot Estuary): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen, Secchi Depth).
G1N0364	HYDSTRA	Berg (Groot)	EWR	-32.80504	18.374	
G1N0239	HYDSTRA	Berg (Groot)	EWR	-32.87268	18.476	
G1N0240	HYDSTRA	Berg (Groot)	EWR	-32.901	18.33653	
3218CC00394	NGA	Berg (Groot)	EWR	-32.79027	18.20829	
BHN Management Option 1						
93313	WMS	GRU & Berg (Groot)	BHN	-32.85	18.368889	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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

[5] *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.*

4.2. Atlantis

The Atlantis 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 (refer to **Section 3.1** and **Figure 4-3**).

The following hydrogeologic features were considered in site selection: 1) the Modder and Louwskloof rivers on the northern extent of the GRU; 2) the Sout River in the southwest.; 3) The preferential flow direction toward the coastline; 4) the outcrop extent of the low permeability basement lithologies in the area, namely the Malmesbury Group and the Cape Granite Suite (DWS, 2023a); and 5) the main contributing aquifer is the Primary / Intergranular Aquifer (see DWS, 2023a). The town of Atlantis also has a fairly concentrated population and a high population density (see **Figure 3-3**).

The Atlantis GRU also falls within the West Coast SWSA-gw, recognized for high groundwater availability and considered nationally significant resources. This area is acknowledged as an area of conjunctive water use, incorporating both surface water and groundwater (Silwerstroom and Witzands wellfields) to supplement the water demand. This approach optimizes the overall water resource yield for the town of Atlantis and the Atlantis Industrial area (DWS, 2022d).

Considering all these factors, a total of 9 monitoring sites for the EWR and 2 for the BHN were selected within the Atlantis GRU (**Figure 4-3** and **Table 4-2**).

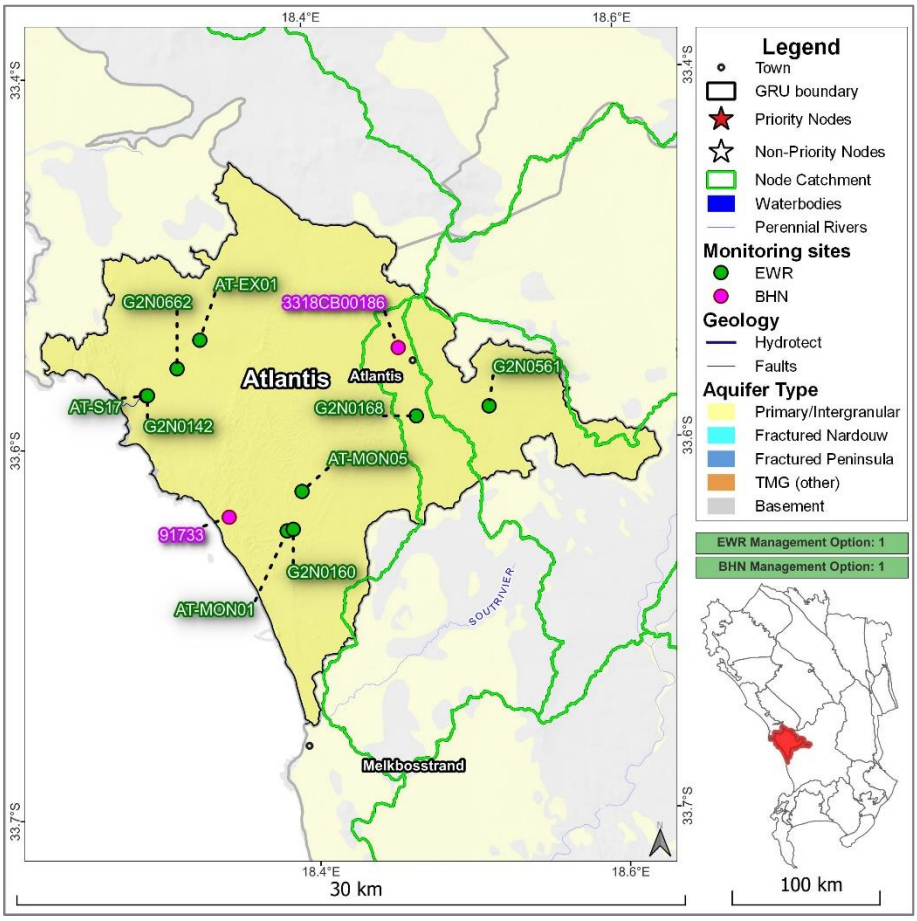


Figure 4-3 **Map depicting the Atlantis GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-2 Summary of monitoring sites for the Atlantis GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
G2N0168	HYDSTRA	Bviii10	EWR	-33.58972222	18.50138889	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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 [5]: Biv6: 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).
G2N0561	HYDSTRA	Biv6	EWR	-33.58638889	18.53666667	
AT-S17	CoCT	Silwerstroom	EWR	-33.57891838	18.37115813	
AT-MON01	CoCT	GRU	EWR	-33.63501833	18.43758444	
AT-EX01	CoCT	GRU	EWR	-33.55694787	18.39766521	
G2N0142	HYDSTRA	Silwerstroom	EWR	-33.57888889	18.37166667	
G2N0662	HYDSTRA	GRU	EWR	-33.5683	18.38632	
G2N0160	HYDSTRA	GRU	EWR	-33.63444444	18.44055556	
AT-MON05	CoCT	GRU	EWR	-33.61920291	18.44525844	
BHN Management Option 1						
91733	WMS	GRU	BHN	-33.628889	18.409722	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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
3318CB00186	NGA	GRU	BHN	-33.5619	18.49342	

4.3. Cape Flats

The Cape Flats GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 3 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-4**).

The following hydrogeologic features were considered in site selection: 1) the Kuils, Lotus and Elsieskraal rivers; 2) additional surface water bodies, such as Zandvlei, Zeekoevlei, Rondevlei, and the Eerste Estuary, along with various wetlands likely to be hydraulically connected to the relatively shallow groundwater; 3) the geological extent of the basement, comprising the Cape Granite Suite and the Malmesbury Group rocks (DWS, 2023a); and 4) the main contributing aquifer is the Primary / Intergranular Aquifer (see DWS, 2023a). The Cape Flats GRU also has a fairly concentrated population in areas such as Mitchells Plain, Khayelitsha, Bellville, etc (see **Figure 3-3**).

The Cape Flats GRU is predominantly located within the Cape Peninsula and Cape Flats SWSA-gw and encompasses several Groundwater Dependent Ecosystems (GDE). Moreover, being part of the SWSA-gw, this GRU will be engaging in conjunctive use in the future, with phase 1 set to be implemented in 2024 (DWS, 2023c and 2023d) for the City of Cape Town.

Considering all these factors, a total of 9 monitoring sites for the EWR and 6 for the BHN were strategically selected within the Cape Flats GRU (**Figure 4-4** and **Table 4-3**).

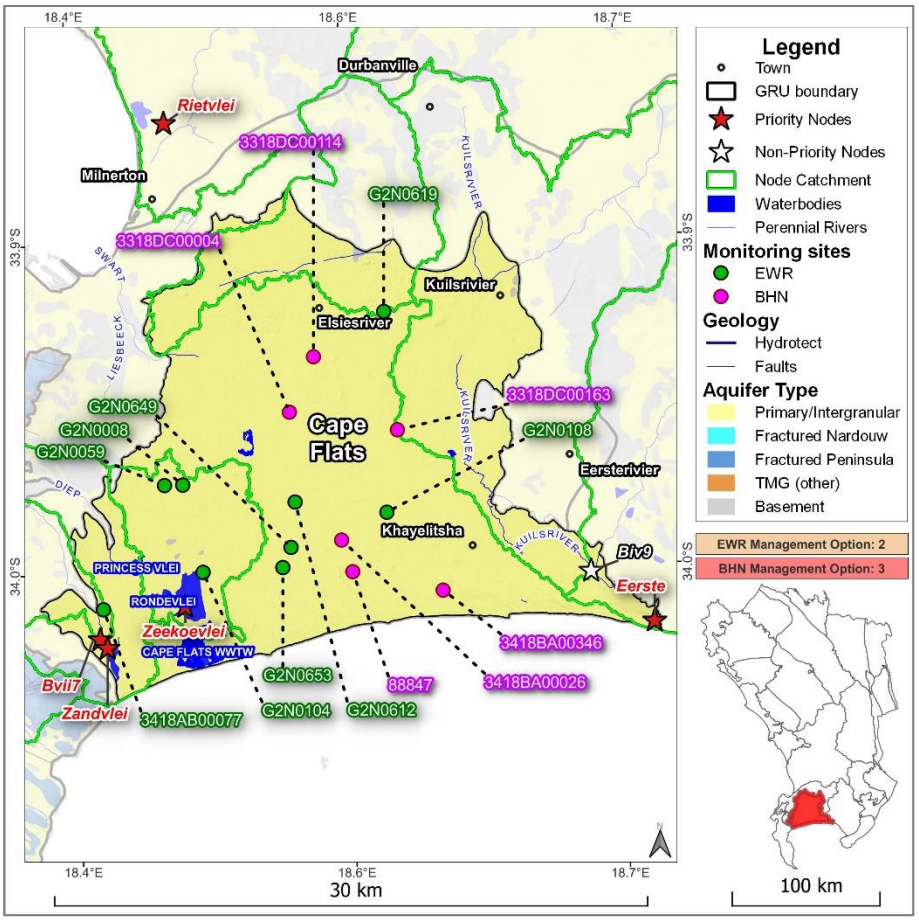


Figure 4-4 **Map depicting the Cape Flats GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-3 Summary of monitoring sites for the Cape Flats GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
G2N0008	HYDSTRA	Zeekoevlei	EWR	-34.01008	18.50937	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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 [5]: Bxi20 (Zeekoevlei): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen, etc)
G2N0104	HYDSTRA	Zeekoevlei	EWR	-34.050078	18.51937	
G2N0612	HYDSTRA	GRU	EWR	-34.01902	18.57068	
G2N0649	HYDSTRA	GRU	EWR	-34.03966	18.56788	
G2N0653	HYDSTRA	GRU	EWR	-34.04875	18.56313	
G2N0108	HYDSTRA	GRU	EWR	-34.02465	18.62082	
G2N0619	HYDSTRA	GRU	EWR	-33.9331	18.62162	
G2N0059	HYDSTRA	Zeekoevlei	EWR	-34.01008	18.49937	
3418AB00077	NGA	Bvii7	EWR	-34.06602	18.46429	
BHN Management Option 3						
3318DC00004	NGA	GRU	BHN	-33.97801	18.56871	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems. 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: E coli, Total Coliforms, and Faecal Coliforms
3318DC00114	NGA	GRU	BHN	-33.95301	18.5826	
3318DC00163	NGA	GRU	BHN	-33.98717	18.6276	
3418BA00026	NGA	GRU	BHN	-34.03686	18.59568	
3418BA00346	NGA	GRU	BHN	-34.06075	18.65068	
88847	WMS	GRU	BHN	-34.051389	18.601389	

4.4. Cape Peninsula

The Cape Peninsula 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 (refer to **Section 3.1** and **Figure 4-5**).

The following hydrogeologic features were considered in site selection: 1) Wildevöelvlei; 2) the Silvermine, Hout Bay, Liesbeek, and Krom rivers; and 4) the extent of the Peninsula Formation outcrop, overlaying the Cape Granite Suite along the length of the Cape Peninsula GRU, and the Malmesbury Group rocks underlying the City Bowl and Devils Peak (DWS, 2023a); and 4) the main contributing aquifer is the Fractured Table Mountain Group Aquifer (see DWS, 2023a). Although deep groundwater flow is unlikely to be significant for sustained groundwater use, drainage from the Cape Peninsula does recharge neighbouring surface water and groundwater resources on the Cape Flats. The Cape Peninsula GRU also has a fairly concentrated population in areas such as Houtbay and Simon's Town (see **Figure 3-3**).

Considering all these factors, a total of 4 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Cape Peninsula GRU (**Figure 4-5** and **Table 4-4**).

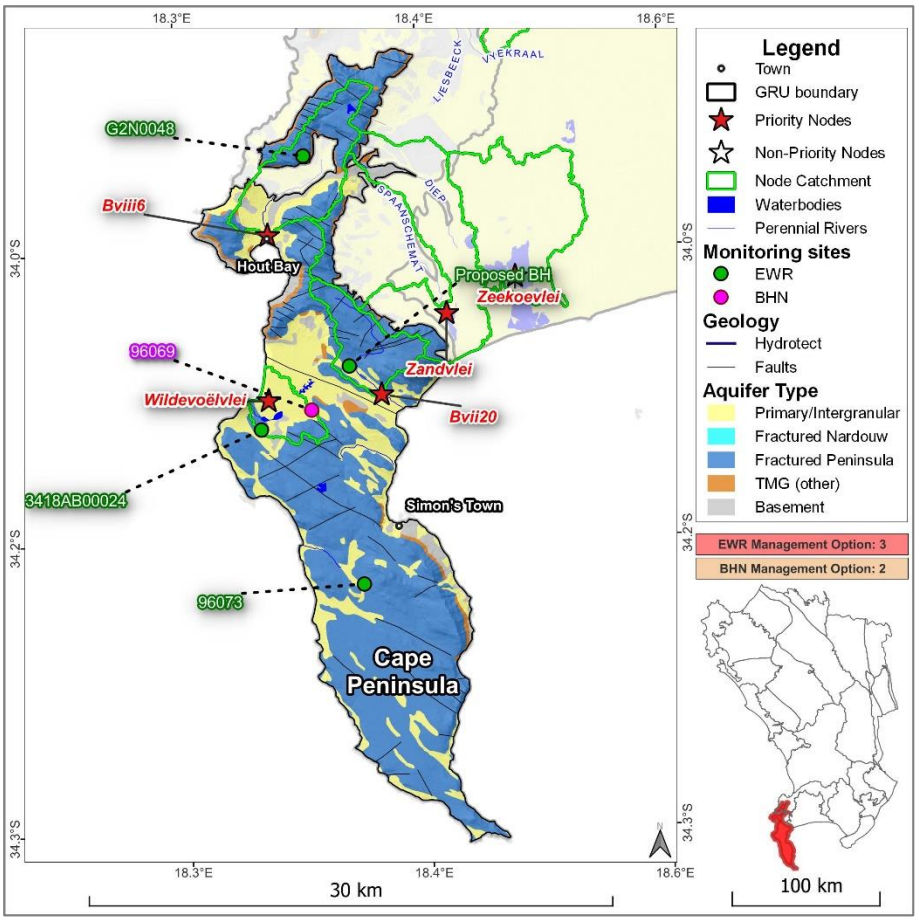


Figure 4-5 **Map depicting the Cape Peninsula GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-4 Summary of monitoring sites for the Cape Peninsula GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
3418AB00024	NGA	Wildevöelvlei	EWR	-34.14185	18.34929	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Bxi14 (Wildevöelvlei): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen). Bviii6: Nutrients (Phosphate [PO_4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen).
G2N0048	HYDSTRA	Bviii6	EWR	-34.0008	18.379366	
Proposed BH		GRU	EWR	-34.10991286	18.40487755	
96073	WMS	GRU	EWR	-34.222778	18.410833	
BHN Management Option 2						
96069	WMS	GRU	BHN	-34.132222	18.380833	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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: E coli, Total Coliforms, and Faecal Coliforms

4.5. Cape Town Rim

The Cape Town Rim GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 3 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-6**).

The following hydrogeologic features were considered in site selection: 1) the Kuils, Lotus and Elsieskraal rivers; 2) surface water bodies, such as Zandvlei, Zeekoevlei, Rondevlei, and the Eerste Estuary; 3) the geological extent of the basement (i.e., the Cape Granite Suite and the Malmesbury Group rocks) on the periphery of the GRU (DWS, 2023a); and 4) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a). It must be noted that most of these features occur in the Cape Flats GRU which overlies the Fractured and Intergranular Basement Aquifer of the Cape Town Rim. This GRU also has a fairly concentrated population in areas such as the City of Cape Town metropolitan, Durbanville, Brackenfell, Eersteriver, etc (see **Figure 3-3**).

The Cape Town Rim GRU is predominantly situated within the Cape Peninsula and Cape Flats SWSA-gw, with only small portions to the east and west of the GRU boundary falling outside the delineated SWSA-gw area.

Considering all these factors, a total of 8 monitoring sites for the EWR and 3 for the BHN were strategically selected within the Cape Town Rim GRU (**Figure 4-6** and **Table 4-5**).

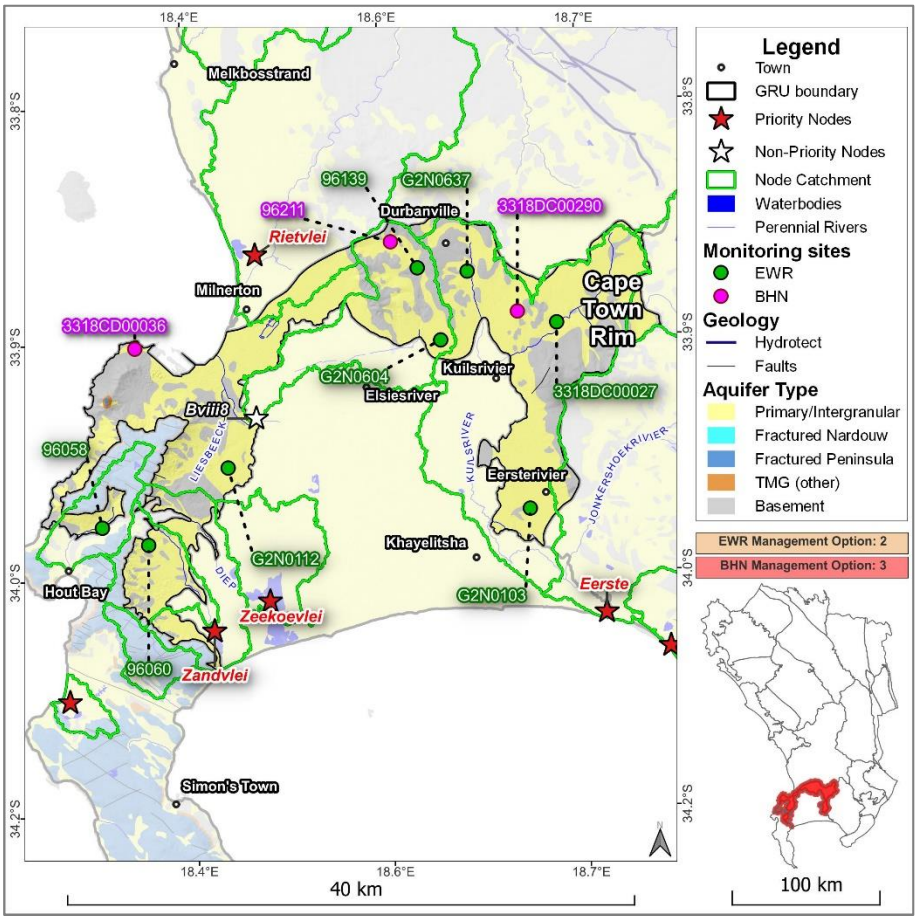


Figure 4-6 **Map depicting the Cape Town Rim GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-5 Summary of monitoring sites for the Cape Town Rim GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
G2N0103	HYDSTRA	Biv9	EWR	-34.010081	18.709376	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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 [5]: Bviii6: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen). Bvii7: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen).
96058	WMS	Bviii6	EWR	-34.016389	18.382222	
96060	WMS	Bvii7	EWR	-34.028056	18.417222	
96139	WMS	Bviii8	EWR	-33.855556	18.627222	
G2N0637	HYDSTRA	Biv9	EWR	-33.85839	18.66518	
G2N0604	HYDSTRA	Bviii8	EWR	-33.90177	18.64386	
3318DC00027	NGA	Biv9	EWR	-33.89189	18.73259	
G2N0112	HYDSTRA	GRU	EWR	-33.980081	18.479369	
BHN Management Option 3						
3318CD00036	NGA	GRU	BHN	-33.90301	18.41037	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems. 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: E coli, Total Coliforms, and Faecal Coliforms
3318DC00290	NGA	GRU	BHN	-33.88447	18.70283	
96211	WMS	GRU	BHN	-33.838611	18.607222	

4.6. Darling

The Darling 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 (refer to **Section 3.1** and **Figure 4-7**).

The following hydrogeologic features were considered in site selection: 1) the Modder, Dwars, and Groen rivers; 2) the Colenso Fault Zone which forms the eastern flank of the GRU; 3) the extent of the Springfontyn Formation and its contact with the Cape Granite Suite forming the boundary between the Elandsfontein and Yzerfontein GRUs; and 4) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a).

Additionally, the Darling GRU is situated within the West Coast Aquifer SWSA-gw and is part of the Swartland SGWCA. For further details, please refer to DWS (2022d).

Considering all these factors, a total of 1 monitoring sites for the EWR and 1 for the BHN were selected within the Darling GRU (**Figure 4-7** and **Table 4-6**).

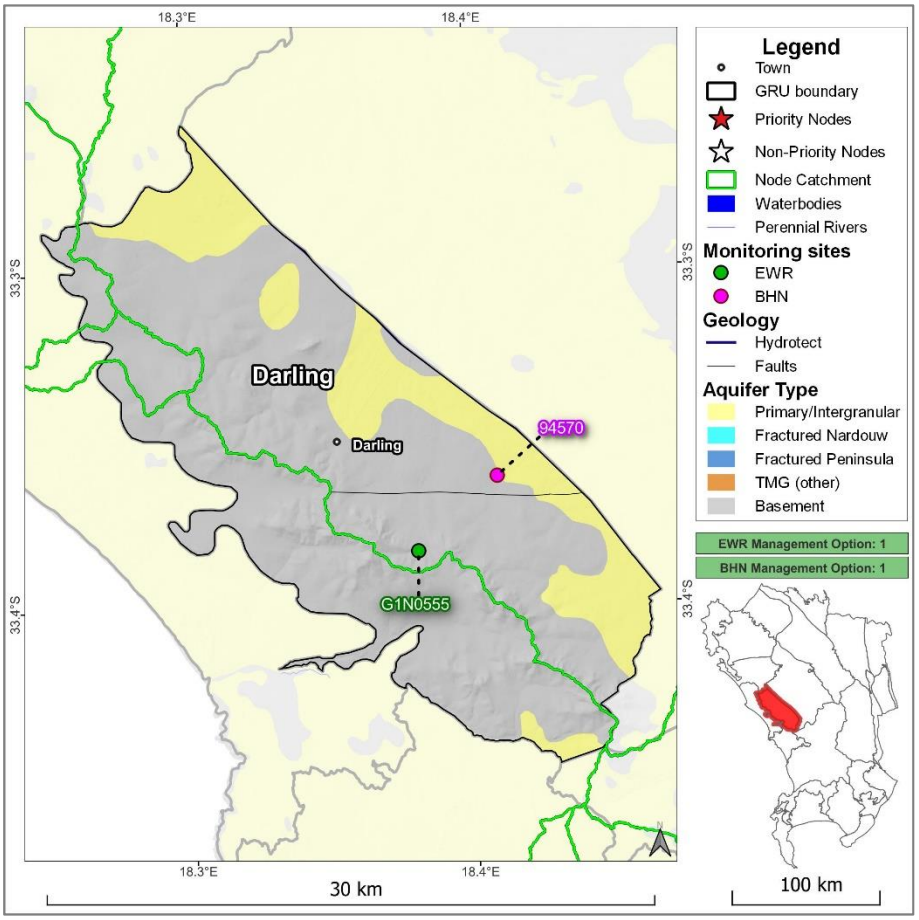


Figure 4-7 **Map depicting the Darling GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-6 Summary of monitoring sites for the Darling GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
G1N0555	HYDSTRA	Bii1	EWR	-33.393056	18.463889	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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						
94570	WMS	GRU	BHN	-33.4259	18.4212	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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

4.7. Drakensteinberge

The Drakensteinberge GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-8**).

The following hydrogeologic features were considered in site selection: 1) tributaries of the Berg River i.e., Wolwekloof and Dwars rivers which originate from this GRU; 2) the Berg River Dam, east of the GRU's northeastern edge (DWS, 2023a); and 3) the main contributing aquifer is the Fractured Table Mountain Group Aquifer (see DWS, 2023a).

The Drakensteinberge GRU is predominantly situated within the Southwestern Cape Ranges SWSA-gw, with only small portions in the north of the GRU falling outside the delineated SWSA-gw boundary. This area is characterized by high groundwater availability and is recognized as a nationally important resource (DWS, 2022d).

Considering all these factors, a total of 3 monitoring sites for the EWR and 1 for the BHN were selected within the Drakensteinberge GRU (**Figure 4-8** and **Table 4-7**).

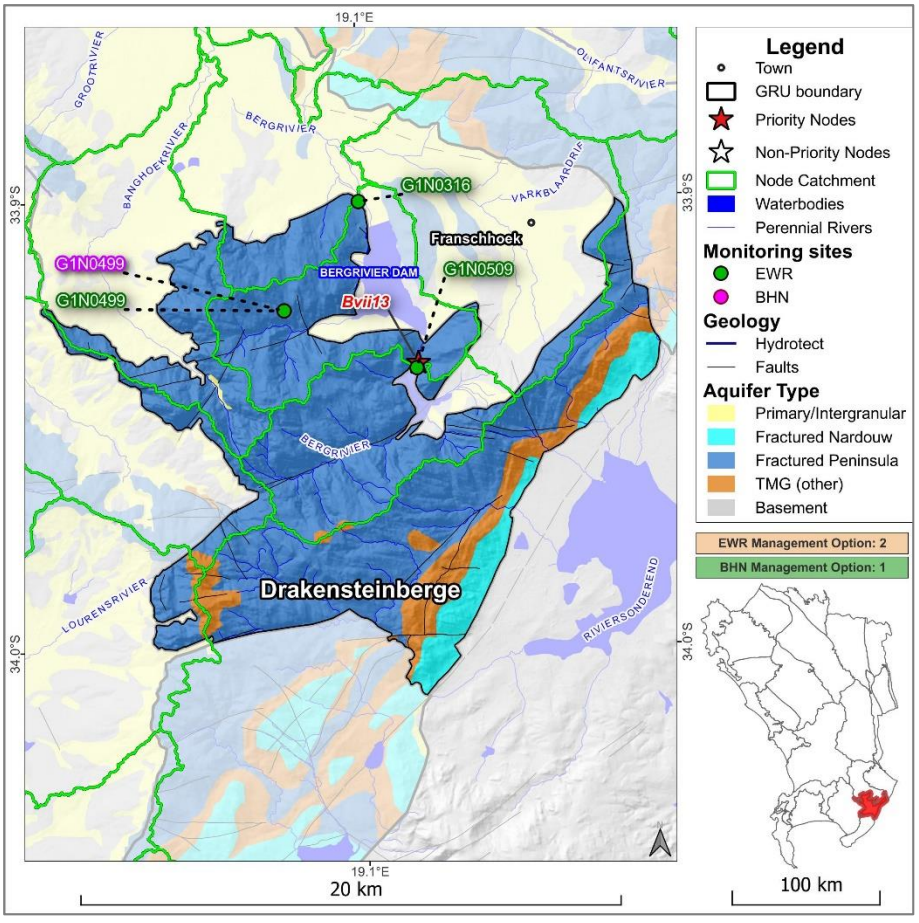


Figure 4-8 **Map depicting the Drakensteinberge GRU and the associated EWR and BHN monitoring sites based on the respective Management.**

Table 4-7 Summary of monitoring sites for the Drakensteinberge GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
G1N0509	HYDSTRA	Bvii13	EWR	-33.95688	19.07258	Frequency: Quarterly 1) Groundwater level ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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 [5]: Bviii1: Nutrients (Phosphate [PO_4-P] and Total Inorganic Nitrogen [TIN])); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen) Bvii13: Nutrients (Phosphate [PO_4-P] and Total Inorganic Nitrogen [TIN])); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen)
G1N0316	HYDSTRA	Bviii1	EWR	-33.90105	19.0503	
G1N0499	HYDSTRA	Bviii1	EWR	-33.9371	19.0198	
BHN Management Option 1						
G1N0499	HYDSTRA	Bviii1	BHN	-33.9371	19.0198	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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

4.8. Eendekuil Basin

The Eendekuil Basin 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 (refer to **Section 3.1** and **Figure 4-9**).

The following hydrogeologic features were considered in site selection: 1) The Berg River (with the main stem forming the eastern boundary of the GRU); 2) the Misverstand Dam; 3) various smaller rivers originating in the mountainous areas of the Groot Winterhoek GRU, including the Krom, Pyls, Assegaaibosspruit, Jakkalskloof, Bothmankloof and Vier-en-Twintig rivers; and 4) the Aurora-Piketberg fault zone in the north (DWS, 2023a); and 5) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a). This GRU also has a fairly concentrated population in the Porterville area (see **Figure 3-3**).

The GRU also encompasses a number of GDEs and is recognized as an area practicing conjunctive use to supply the town of Porterville and optimize the overall water resource yield. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 9 monitoring sites for the EWR and 3 for the BHN were selected within the Eendekuil Basin GRU (**Figure 4-9** and **Table 4-8**).

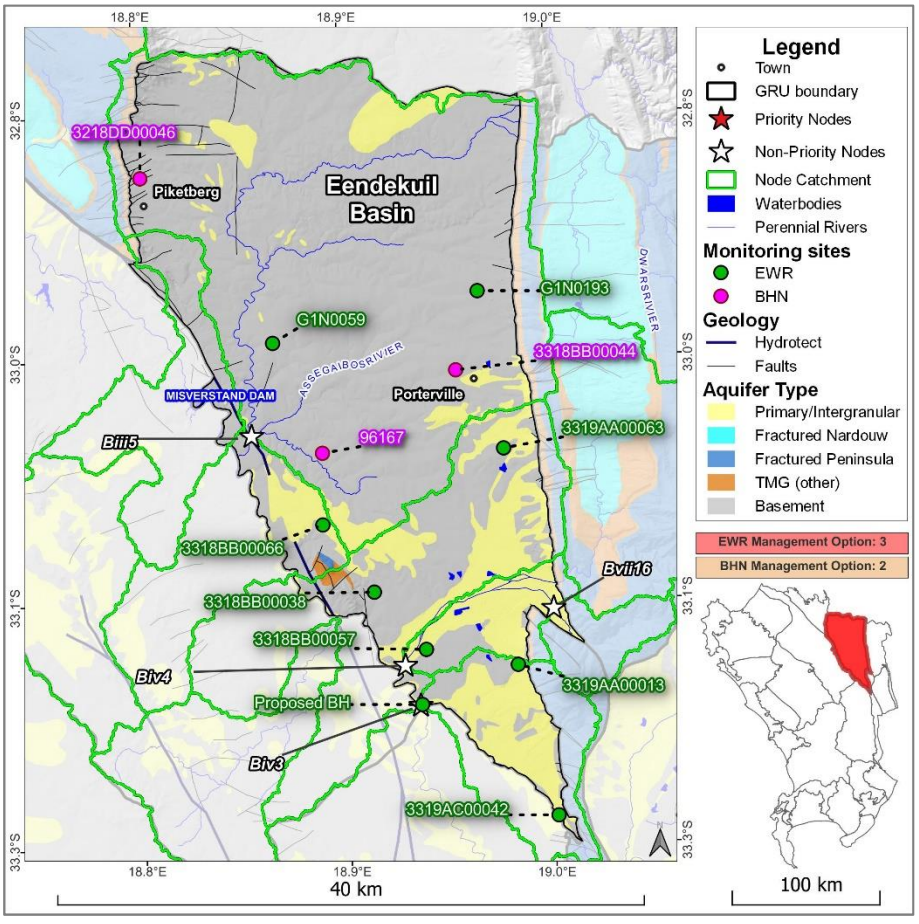


Figure 4-9 **Map depicting the Eendekuil Basin GRU and the associated EWR and BHN monitoring sites based on the respective Management.**

Table 4-8 Summary of monitoring sites for the Eendekuil Basin GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G1N0193	HYDSTRA	Biii5	EWR	-32.960132	18.999392	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Bvii6: 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).
Proposed BH		Biv3	EWR	-33.21410414	18.95370508	
G1N0059	HYDSTRA	Biii5	EWR	-32.99013	18.849388	
3318BB00057	NGA	Biv4	EWR	-33.18023	18.95732	
3318BB00038	NGA	Bvii16	EWR	-33.1444	18.92009	
3319AA00063	NGA	Bvii16	EWR	-33.05716	19.01653	
3318BB00066	NGA	Bvii8	EWR	-33.10245	18.88343	
3319AA00013	NGA	Biv3	EWR	-33.1905	19.0243	
3319AC00042	NGA	Biv3	EWR	-33.28355	19.05208	
BHN Management Option 2						
3218DD00046	NGA	GRU	BHN	-32.88721	18.75511	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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: E coli, Total Coliforms, and Faecal Coliforms
3318BB00044	NGA	GRU	BHN	-33.00858	18.98259	
96167	WMS	GRU	BHN	-33.058333	18.884167	

4.9. Elandsfontein

The Elandsfontein 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 (refer to **Section 3.1** and **Figure 4-10**).

The following hydrogeologic features were considered in site selection: 1) the Langebaan Lagoon (identified as a priority estuary node); 2) the limited number of surface water features in the region, related to low rainfall, subdued topography and the highly permeable sand-dominated geology; 3) the basement 'high' (i.e., Malmesbury Group and Cape Granite Suite) which extends from the eastern edge of the GRU towards the coast and forms the divide between the Elandsfontein and Langebaan Road GRUs (DWS, 2023a); 4) the main contributing aquifer is the Primary / Intergranular Aquifer (see DWS, 2023a).

The Elandsfontein GRU is predominantly located within the West Coast Aquifer SWSA-gw, with only small portions to the west falling outside this delineated area. Additionally, this GRU encompasses a number of GDEs and is included in both the Swartland and Saldanha Bay SGWCA. For further details, please refer to DWS (2022d).

Considering all these factors, a total of 4 monitoring sites for the EWR and 1 for the BHN were selected within the Elandsfontein GRU (**Figure 4-10** and **Table 4-9**).

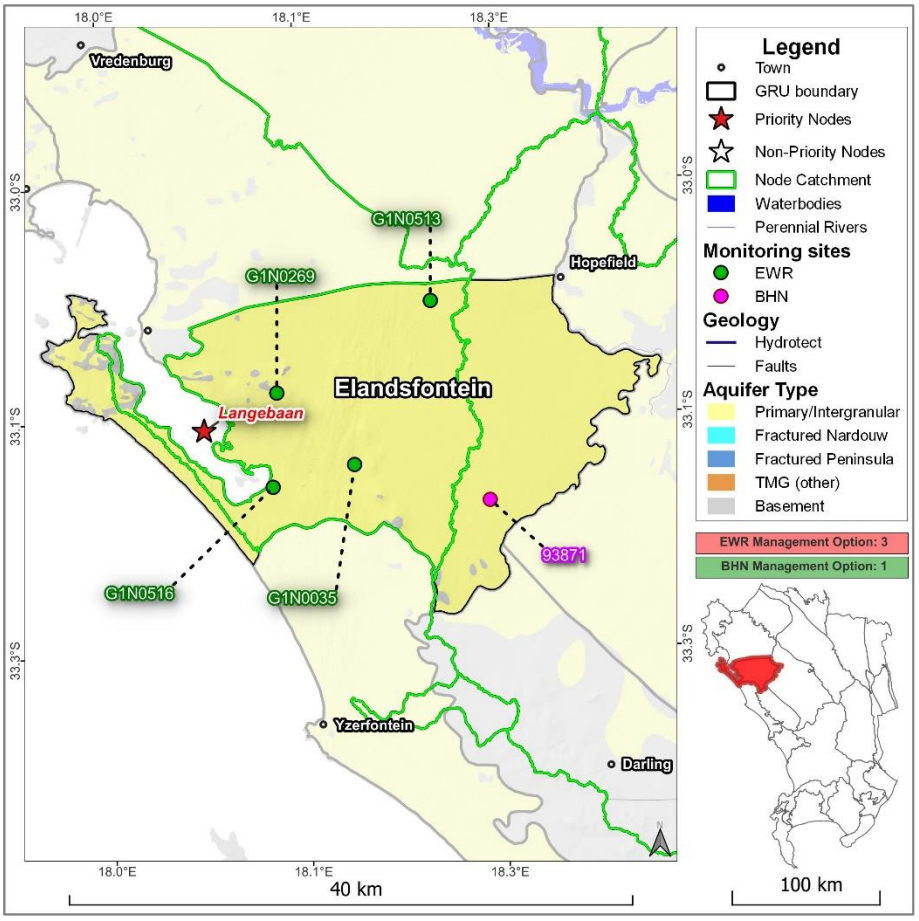


Figure 4-10 **Map depicting the Elandsfontein GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-9 Summary of monitoring sites for the Elandsfontein GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G1N0516	HYDSTRA	Langebaan Lagoon	EWRII	-33.19332	18.1269	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Bxi3 (Langebaan): Nutrients (NO_3); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen, Secchi depth).
G1N0035	HYDSTRA	Langebaan Lagoon	EWR	-33.180118	18.189366	
G1N0513	HYDSTRA	Langebaan Lagoon	EWR	-33.07631	18.2503	
G1N0269	HYDSTRA	Langebaan Lagoon	EWR	-33.13302	18.13159	
BHN Management Option 1						
93871	WMS	GRU	BHN	-33.204722	18.291944	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 3) 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

4.10. Groot Winterhoek

The Groot Winterhoek 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 (refer to **Section 3.1** and **Figure 4-11**).

The following hydrogeologic features were considered in site selection: 1) the Olifants River, originating from the northern extent of the GRU; 2) various tributaries, including the Klein Kliphuis River and the Vier-en-Twintig River; 3) the general topography of the Groot Drakenstein Mountains (DWS, 2023a); and 3) the main contributing aquifer is the Fractured Table Mountain Group Aquifer (see DWS, 2023a).

The Groot Winterhoek GRU is situated within the Northwestern Cape Ranges SWSA-gw and is recognized as a region characterized by high groundwater availability.

Considering all these factors, a total of 2 monitoring sites for the EWR and 1 for the BHN were selected within the Groot Winterhoek GRU (**Figure 4-11** and **Table 4-10**).

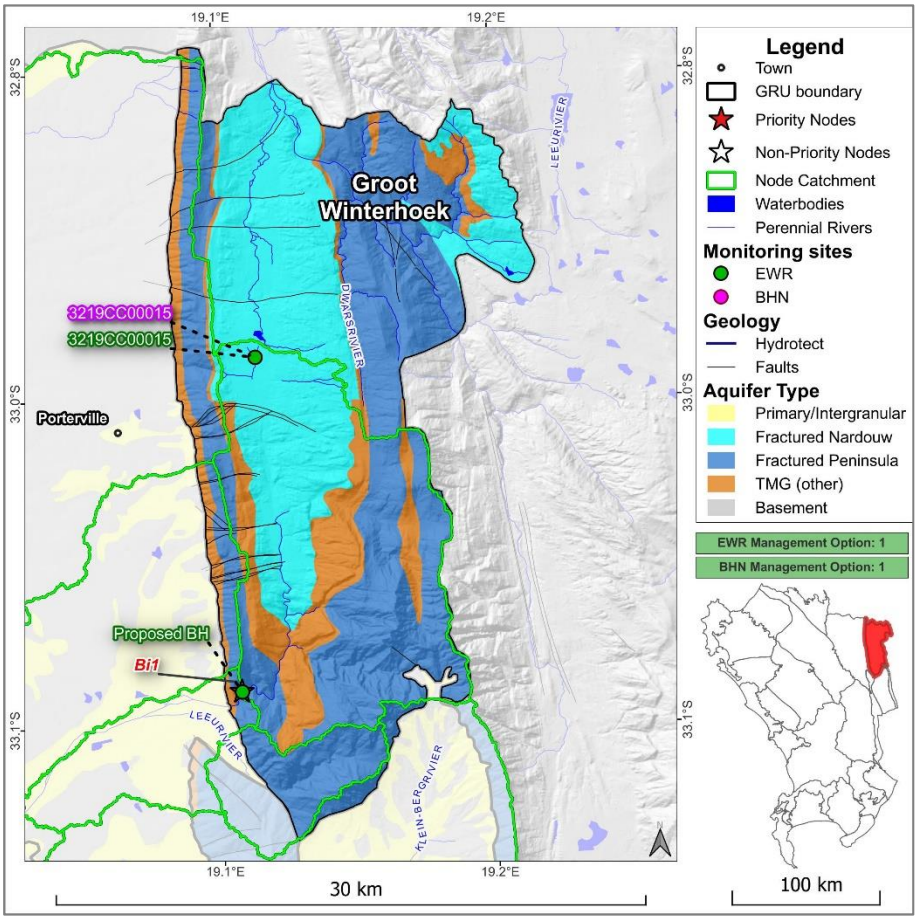


Figure 4-11 **Map depicting the Groot Winterhoek GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-10 Summary of monitoring sites for the Groot Winterhoek GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
Proposed BH		Bi1	EWR	-33.13404333	19.06101774	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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 [5]: Bi1: Nutrients (Phosphate [PO_4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen)
3219CC00015	NGA	Bi1	EWR	-32.98054	19.07122	
BHN Management Option 1						
3219CC00015	NGA	Bi1	BHN	-32.98054	19.07122	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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

4.11. Langebaan Road

The Langebaan Road 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 (refer to **Section 3.1** and **Figure 4-12**).

The following hydrogeologic features were considered in site selection: 1) the Berg River Estuary (identified as a priority estuary node) and the area of the contributing catchment area (DWS, 2023a); and 2) the main contributing aquifer is the Primary / Intergranular Aquifer (see DWS, 2023a).

The Langebaan Road GRU is predominantly situated within the West Coast Aquifer SWSA-gw, with only small portions to the north and west falling outside the delineated SWSA-gw area. It also encompasses a number of GDEs, signifying a region characterized by high groundwater availability and acknowledged as a nationally important resource. Furthermore, this GRU is included in the Berg River and Saldanha Bay SGWCA. For further details, please refer to DWS (2022d).

Considering all these factors, a total of 6 monitoring sites for the EWR and 3 for the BHN were selected within the Langebaan Road GRU (**Figure 4-12** and **Table 4-11**).

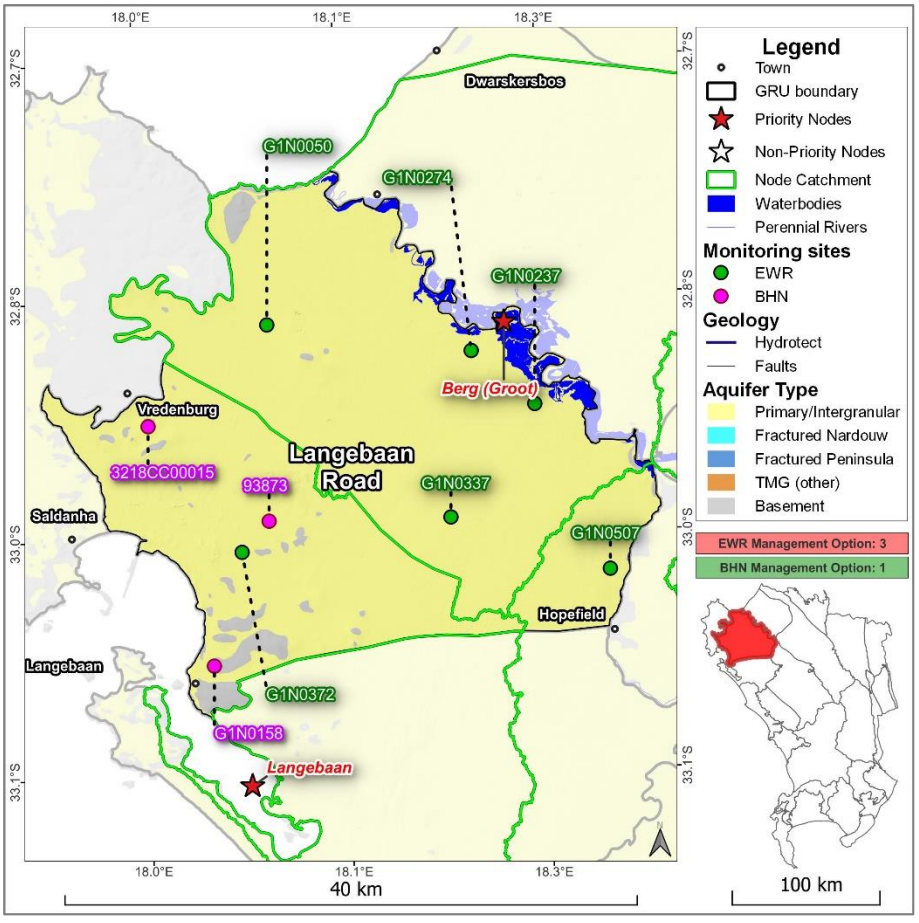


Figure 4-12 **Map depicting the Langebaan Road GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-11 Summary of monitoring sites for the Langebaan Road GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G1N0050	HYDSTRA	Berg (Groot)	EWR	-32.86598	18.09559	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Bxi1 (Berg Groot Estuary): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen, Secchi Depth).
G1N0337	HYDSTRA	Berg (Groot)	EWR	-32.990127	18.229369	
G1N0507	HYDSTRA	Bii1	EWR	-33.02503	18.34761	
G1N0237	HYDSTRA	Berg (Groot)	EWR	-32.91996	18.2942	
G1N0372	HYDSTRA	Langebaan Lagoon	EWR	-33.00888889	18.0725	
G1N0274	HYDSTRA	Berg (Groot)	EWR	-32.88552	18.24774	
BHN Management Option 1						
G1N0158	HYDSTRA	GRU	BHN	-33.080122	18.049363	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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
3218CC00015	NGA	GRU	BHN	-32.92805	18.00483	
93873	WMS	GRU	BHN	-32.989722	18.093333	

4.12. Malmesbury

The Malmesbury GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 3 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-13**).

The following hydrogeologic features were considered in site selection: 1) the Diep, Sout, Mosselbank rivers; 2) the basement geology extent (i.e., the Klipheuwel Group, the Cape Granite Suite and the Malmesbury Group); 3) the Colenso fault zone (DWS, 2023a); and 4) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a). The Malmesbury GRU also has a fairly concentrated population in areas such as Malmesbury, Melkbosstrand, Kraaifontien, etc (see **Figure 3-3**).

Additionally, the Malmesbury GRU borders the boundaries of both the Cape Peninsula and Cape Flats SWSA-gw and the West Coast Aquifer SWSA-gw. However, overall, it is not considered a strategic and nationally important resource. This GRU also encompasses a relatively low number of GDEs. For further details, please refer to DWS (2022d).

Considering all these factors, a total of 14 monitoring sites for the EWR and 4 for the BHN were selected within the Malmesbury GRU (**Figure 4-13** and **Table 4-12**).

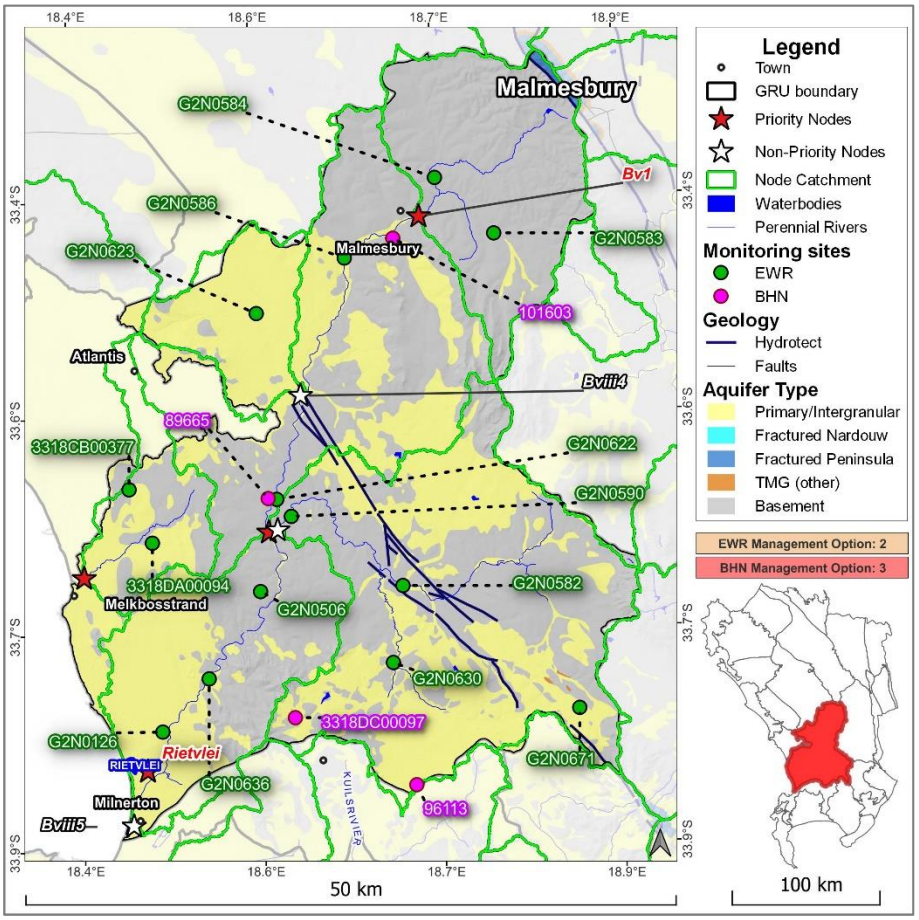


Figure 4-13 **Map depicting the Malmesbury GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-12 Summary of monitoring sites for the Malmesbury GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
G2N0126	HYDSTRA	Bviii5	EWR	-33.81805556	18.51666667	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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 [5]: ○ Bviii5: Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen, etc). Bv1: 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). Biv6: 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).
G2N0671	HYDSTRA	Biv7	EWR	-33.80737	18.86339	
G2N0582	HYDSTRA	Biv7	EWR	-33.72022	18.71882	
G2N0506	HYDSTRA	Bviii5	EWR	-33.72222222	18.60055556	
G2N0583	HYDSTRA	Bv1	EWR	-33.47697	18.80027	
G2N0584	HYDSTRA	Bv1	EWR	-33.43762	18.75223	
G2N0586	HYDSTRA	Biv6	EWR	-33.49216	18.67617	
G2N0590	HYDSTRA	Biv7	EWR	-33.67055556	18.6275	
G2N0630	HYDSTRA	Biv7	EWR	-33.77349	18.70946	
G2N0636	HYDSTRA	Bviii5	EWR	-33.78196	18.55619	
G2N0623	HYDSTRA	Bviii4	EWR	-33.52931	18.60226	
3318DA00094	NGA	Bviii10	EWR	-33.6869	18.51176	
3318CB00377	NGA	Bviii10	EWR	-33.6495	18.49347	
G2N0622	HYDSTRA	Biv6	EWR	-33.65851	18.61567	

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
BHN Management Option 3						
96113	WMS	GRU	BHN	-33.858611	18.726667	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from automatically recorded level loggers. Possible need for telemetry systems. 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: E coli, Total Coliforms, and Faecal Coliforms
101603	WMS	GRU	BHN	-33.479167	18.716667	
3318DC00097	NGA	GRU	BHN	-33.81023	18.62704	
89665	WMS	GRU	BHN	-33.657778	18.608611	

4.13. Middle-Lower Berg

The Middle-Lower Berg 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 (refer to **Section 3.1** and **Figure 4-14**).

The following hydrogeologic features were considered in site selection: 1) the Berg Estuary which starts in the north-western corner of the GRU; 2) the Kuilders, Boesmans and Platkloof rivers, originating in the mountainous Piketberg area and discharging into the Berg River; 3) portions of the Aurora-Piketberg fault zone (DWS, 2023a); and 4) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a).

The north and northwest portion of the Middle-Lower Berg GRU is situated within the West Coast Aquifer SWSA-gw, while the rest of the GRU to the south and southeast falls outside the delineated SWSA-gw area. This GRU also encompasses a number of GDEs, signifying a region characterized by moderate groundwater availability. Furthermore, this GRU is included in the Berg River SGWCA. For further details, please refer to DWS (2022d).

Considering all these factors, a total of 11 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Middle-Lower Berg GRU (**Figure 4-14** and **Table 4-13**).

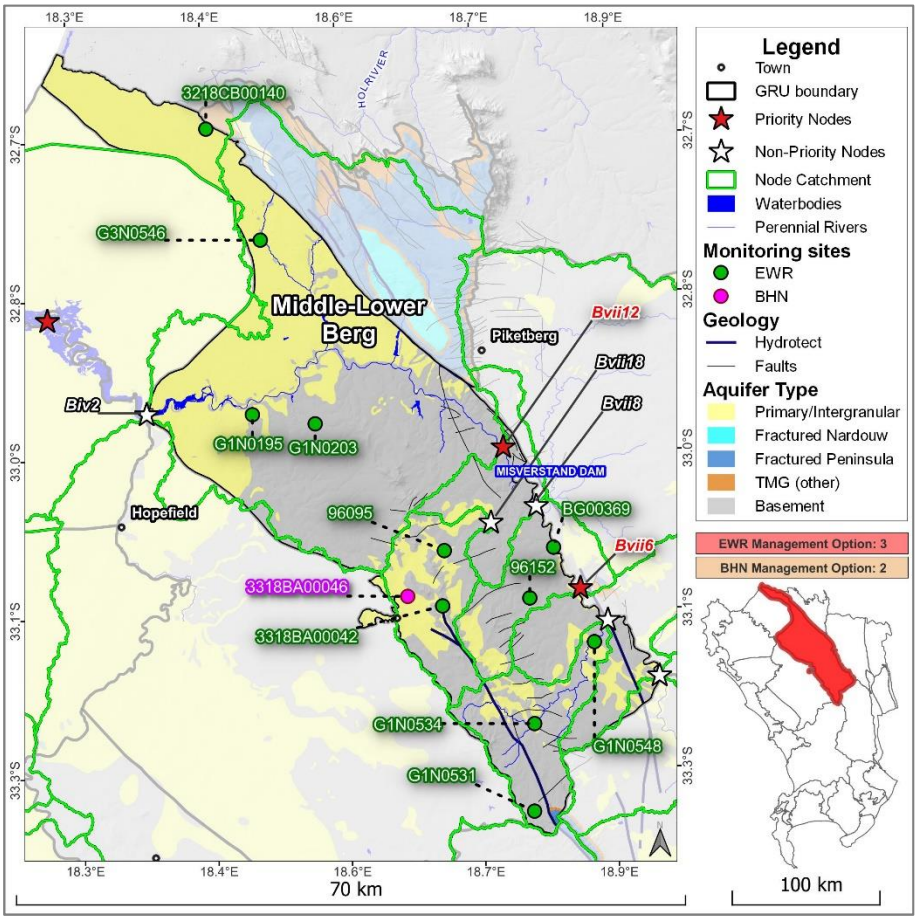


Figure 4-14 **Map depicting the Middle-Lower Berg GRU and the associated EWR and BHN monitoring sites based on the respective Management Options**

Table 4-13 Summary of monitoring sites for the Middle-Lower Berg GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G1N0203	HYDSTRA	Biv2	EWR	-32.97013	18.569379	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4
BG00369	NGA	Bvii8	EWR	-33.09141	18.8334	
96095	WMS	GRU	EWR	-33.0925	18.710833	
96152	WMS	Bvii8	EWR	-33.138889	18.805556	
G3N0546	HYDSTRA	Biv2	EWR	-32.79555556	18.51277778	
G1N0548	HYDSTRA	Bvii17	EWR	-33.18139	18.87706	
G1N0531	HYDSTRA	Bvii17	EWR	-33.34023	18.80592	
3318BA00042	NGA	Bvii18	EWR	-33.14467	18.70759	
3218CB00140	NGA	GRU	EWR	-32.68957	18.45493	
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: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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: E coli, Total Coliforms, and Faecal Coliforms

4.14. Northern Swartland

The Northern Swartland 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 (refer to **Section 3.1** and **Figure 4-14**).

The following hydrogeologic features were considered in site selection: 1) the Sout, Sout-Krom and Groen rivers which converge into the Sout River and feeds into the main stem of the Berg River; 2) the Colenso Fault along the western edge of the GRU (DWS, 2023a); and 3) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a).

Only a small portion to the west of the Northern Swartland GRU is situated within the West Coast Aquifer SWSA-gw, while the rest of the GRU falls outside the delineated SWSA-gw area. Furthermore, this GRU is included in both the Berg River and Swartland SGWCA. For further details, please refer to DWS (2022d).

Considering all these factors, a total of 2 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Northern Swartland GRU (**Figure 4-14** and **Table 4-14**).

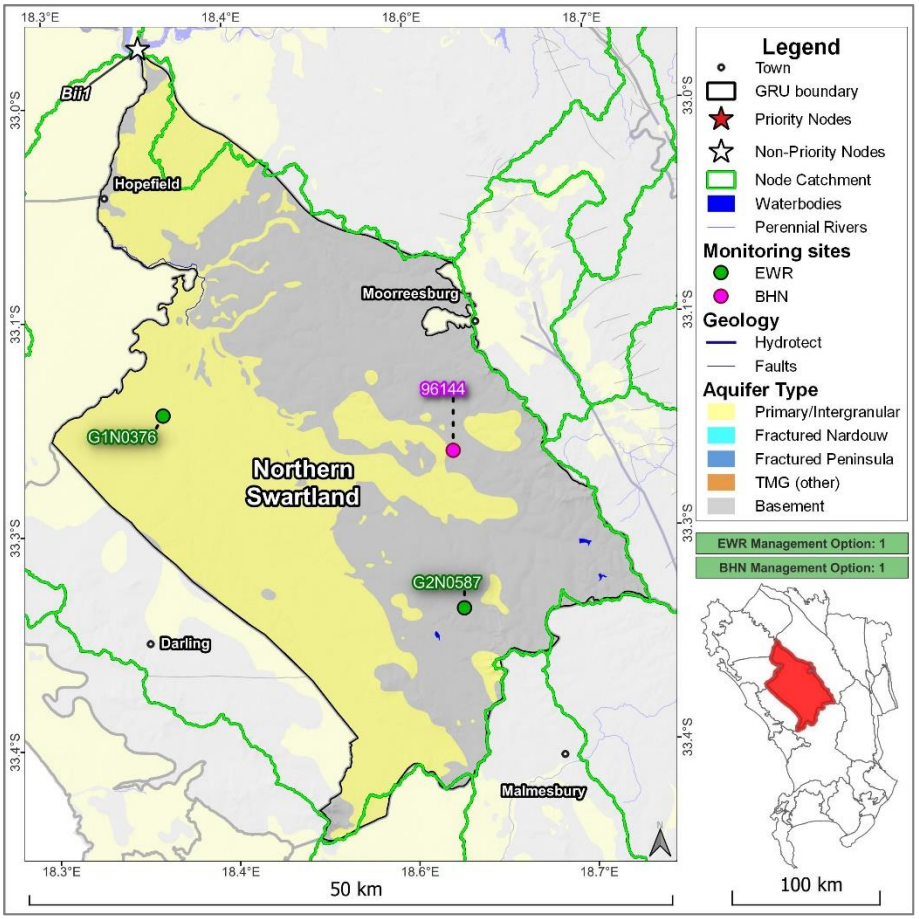


Figure 4-15 **Map depicting the Northern Swartland GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-14 Summary of monitoring sites for the Northern Swartland GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
G2N0587	HYDSTRA	Bii1	EWR	-33.35619	18.64199	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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
G1N0376	HYDSTRA	Bii1	EWR	-33.21675	18.39426	
BHN Management Option 1						
96144	WMS	GRU	BHN	-33.245556	18.635556	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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

4.15. Paarl-Franschhoek

The Paarl-Franschhoek 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 (refer to **Section 3.1** and **Figure 4-16**).

The following hydrogeologic features were considered in site selection: 1) the main stem of the Berg River including the Dwars and Franschhoek tributaries that flow north from the Berg River Dam to St Helena Bay; 2) the sequences of basement rocks (i.e., the Malmesbury Group and the Cape Granite Suite) dominating the outcrop in the undulating northern and western areas of the GRU (DWS, 2023a); and 3) the main contributing aquifer is the Fractured and Intergranular Basement Aquifer (see DWS, 2023a).

Additionally, portions of the Paarl-Franschhoek GRU (towards the eastern boundary) are situated within the Southwestern Cape Ranges SWSA-gw. However, most of the GRU falls outside the SWSA-gw boundary. The majority of this area is recognized for practicing conjunctive use, utilizing both surface water and groundwater supplies for the town of Franschhoek. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 2 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Paarl-Franschhoek GRU (**Figure 4-16** and **Table 4-15)**.

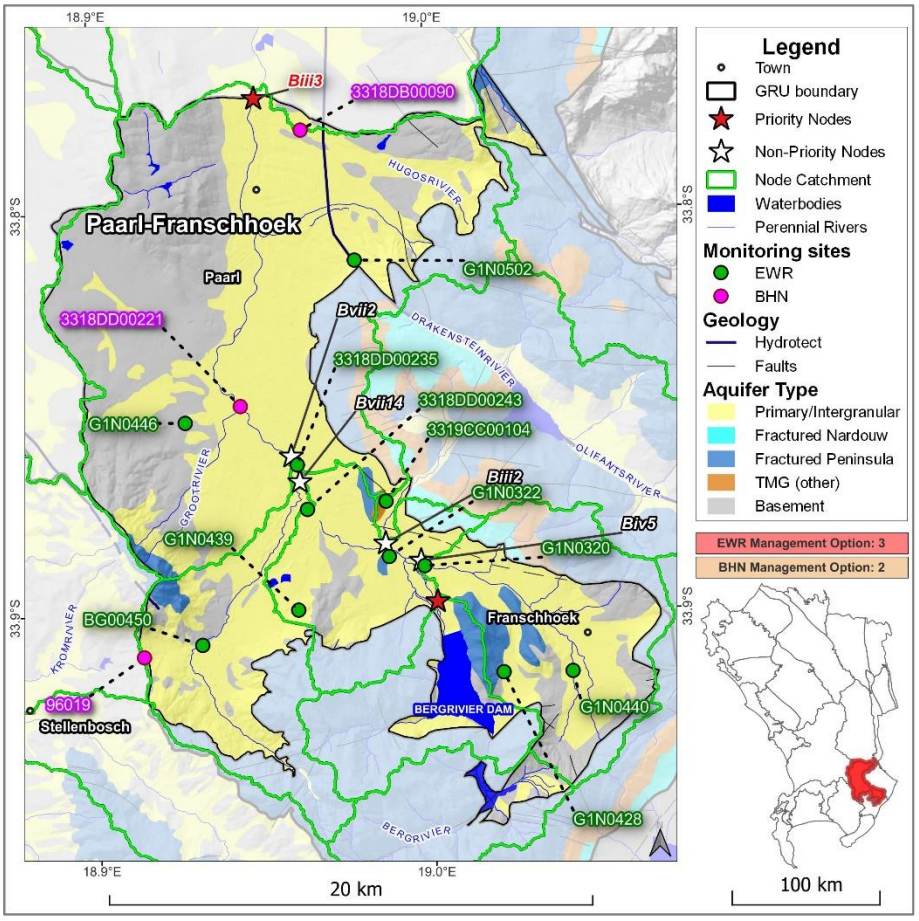


Figure 4-16 **Map depicting the Paarl-Franschhoek GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-15 Summary of monitoring sites for the Paarl-Franschhoek GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G1N0439	HYDSTRA	Bvii2	EWR	-33.89888889	18.99027778	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Biii3: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen), Toxins (Ammonia, Atrazine, Endusulfan)
G1N0440	HYDSTRA	Biv5	EWR	-33.92332	19.11257	
G1N0502	HYDSTRA	Biii3	EWR	-33.76862	19.01813	
G1N0320	HYDSTRA	Biv5	EWR	-33.88316	19.04709	
G1N0322	HYDSTRA	Bvii2	EWR	-33.87951	19.03125	
3319CC00104	NGA	Biii2	EWR	-33.85883	19.0303	
G1N0428	HYDSTRA	Biv5	EWR	-33.92333333	19.08166667	
G1N0446	HYDSTRA	Biii3	EWR	-33.82835	18.94113	
BG00450	NGA	Bvii14	EWR	-33.91134	18.94703	
3318DD00243	NGA	Bvii2	EWR	-33.86135	18.99509	
3318DD00235	NGA	Bvii2	EWR	-33.84467	18.99092	
BHN Management Option 2						
96019	WMS	GRU	BHN	-33.915556	18.920833	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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: E coli, Total Coliforms, and Faecal Coliforms
3318DD00221	NGA	GRU	BHN	-33.82247	18.96593	
3318DB00090	NGA	GRU	BHN	-33.7197	18.99509	

4.16. Piketberg

The Piketberg 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 (refer to **Section 3.1** and **Figure 4-17**).

The following hydrogeologic features were considered in site selection: 1) the Boesmans and Platkloof rivers; 2) the preferential flow direction occurring from the high lying Piketberg Mountains of the TMG outcrop; 3) the Aurora-Piketberg fault zone (DWS, 2023a); and 4) the main contributing aquifer is the Fractured Table Mountain Group Aquifer (see DWS, 2023a).

Additionally, the Piketberg GRU is predominantly situated within the Sandveld SWSA-gw, with only small portions in the east of the GRU falling outside the SWSA-gw boundary. This signifies a region characterized by high groundwater availability and is acknowledged as a nationally important resource. Furthermore, this GRU is included in the Berg SGWCA. Refer to DWS (2022d) for details.

Considering all these factors, a total of 3 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Piketberg GRU (**Figure 4-16** and **Table 4-15**).

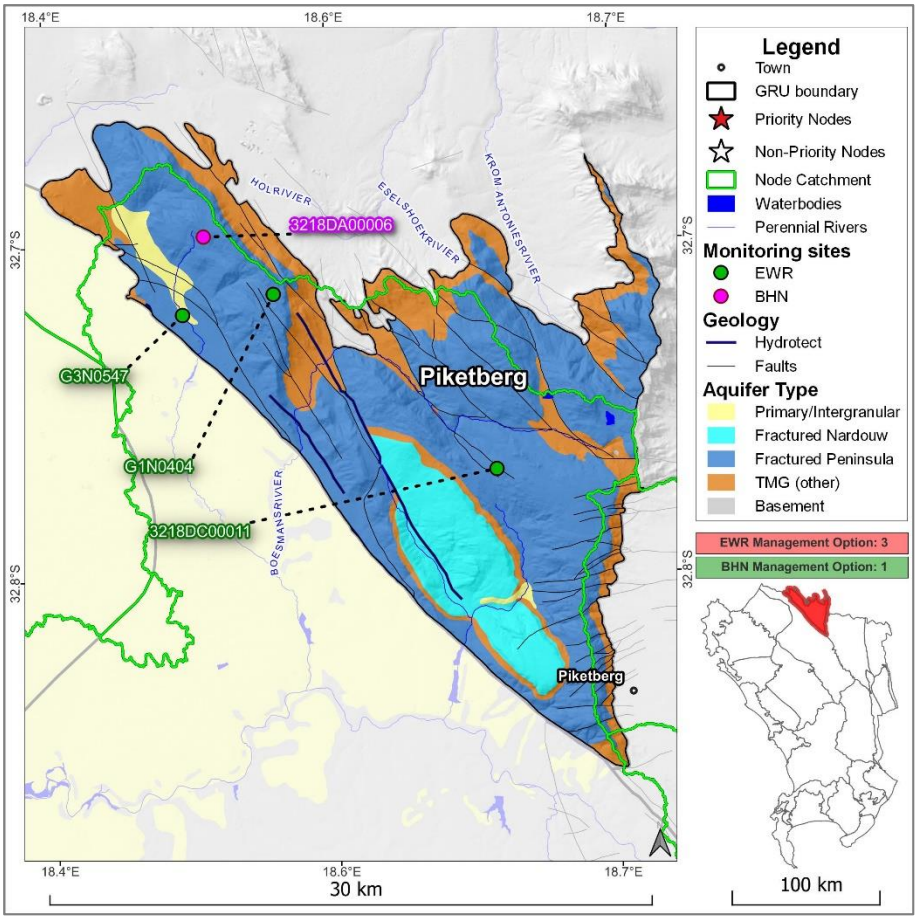


Figure 4-17 Map depicting the Piketberg GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.

Table 4-16 Summary of monitoring sites for the Piketberg GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
G3N0547	HYDSTRA	Biv2	EWR	-32.73111111	18.52194444	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4
3218DC00011	NGA	Biv2	EWR	-32.80305	18.68729	
G1N0404	HYDSTRA	Biv2	EWR	-32.72257	18.5704	
BHN Management Option 1						
3218DA00006	NGA	GRU	BHN	-32.6961	18.53395	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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

4.17. Steenbras-Nuweberg

The Steenbras-Nuweberg GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-18**).

The following hydrogeologic features were considered in site selection: 1) the Steenbras Dam that forms part of the Western Cape Water Supply System (WCWSS); 2) the Eikenhof and Nuweberg Dams along the Palmiet River; 3) the preferential runoff direction which follows the area's topography, generally flowing from a north-east to south-west, into the Steenbras River; 4) the La Motte Fault in the northern recharge area (CoCT, 2004), and the Kogelberg and Stettyns anticlines (DWS, 2023a); and 5) the main contributing aquifer is the Fractured Table Mountain Group Aquifer (see DWS, 2023a).

Additionally, the Steenbras-Nuweberg GRU is predominantly situated within the Southwestern Cape Ranges SWSA-gw, with only small portions in the west falling outside the SWSA-gw boundary. This GRU also encompasses a significant number of GDEs, signifying a region characterized by high groundwater availability and acknowledged as a nationally important resource. Furthermore, this area will be practicing conjunctive use, utilizing both surface water and groundwater supplies for the City of Cape Town (DWS, 2022d; 2023c and 2023d).

Considering all these factors, a total of 5 monitoring sites for the EWR and 2 for the BHN were strategically selected within the Steenbras-Nuweberg GRU (**Figure 4-18** and **Table 4-17**).

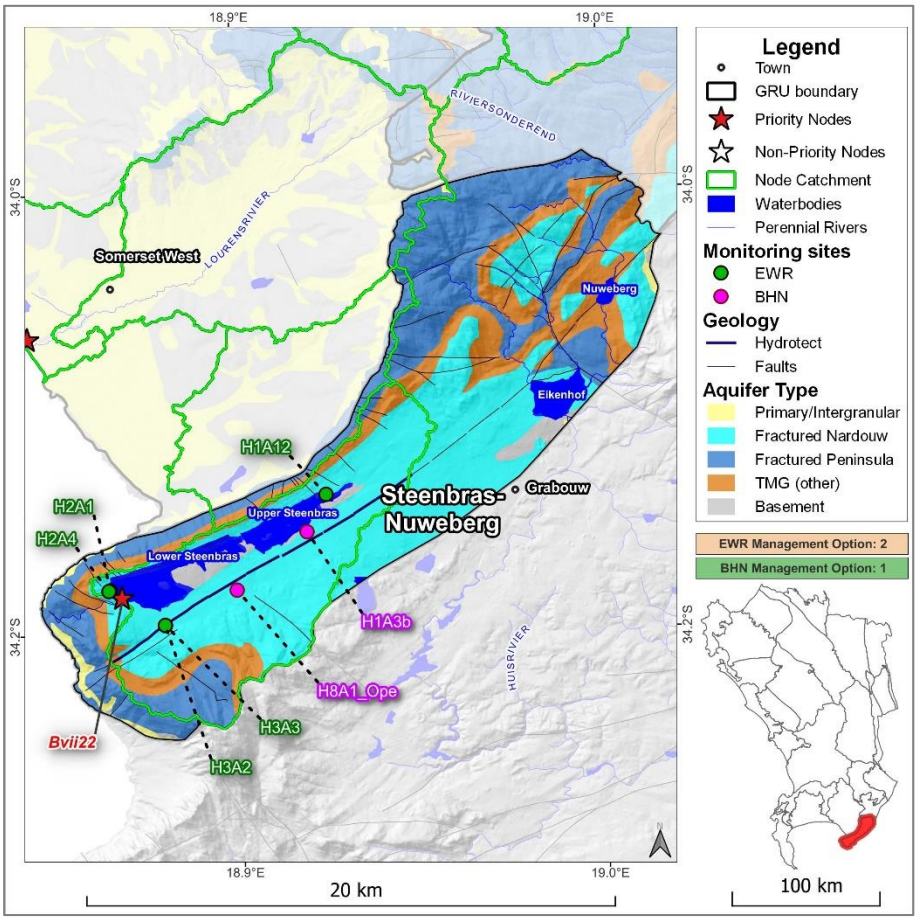


Figure 4-18 **Map depicting the Steenbras-Nuweberg GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-17 Summary of monitoring sites for the Steenbras-Nuweberg GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
H1A12	CoCT	Bvii22 & GRU	EWR (Nardouw Aquifer)	-34.15341755	18.93619208	Frequency: Quarterly 1) Groundwater level ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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 [5]: Bvii22 Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen); Toxins (Iron, Manganese).
H2A1	CoCT	Bvii22 & GRU	EWR (Nardouw Aquifer)	-34.18480149	18.84681274	
H2A4	CoCT	Bvii22 & GRU	EWR (Peninsula Aquifer)	-34.18503396	18.84628454	
H3A2	CoCT	Bvii22 & GRU	EWR (Peninsula Aquifer)	-34.19704511	18.86919689	
H3A3	CoCT	Bvii22 & GRU	EWR (Nardouw Aquifer)	-34.19697736	18.86914539	
BHN Management Option 1						
H1A3b	CoCT	Bvii22 & GRU	BHN (Nardouw Aquifer)	-34.16604336	18.92808478	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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
H8A1_Ope	CoCT	Bvii22& GRU	BHN (Peninsula Aquifer)	-34.18547483	18.89892773	

4.18. Stellenbosch-Helderberg

The Stellenbosch-Helderberg GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 3 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-19**).

The following hydrogeologic features were considered in site selection: 1) the Eerste, Lourens, Jonkershoek and Sir Lowrys Pass rivers; 2) the river's flow path from the higher lying mountainous areas in the north to the coastal in the south (DWS, 2023a); and 3) the main contributing aquifer is the Fractured and Intergranular Basement (see DWS, 2023a). The Stellenbosch-Helderberg GRU also has a fairly concentrated population in the Stellenbosch, Somerset West and Strand areas (see **Figure 3-3**).

Additionally, portions of the Stellenbosch-Helderberg GRU, towards the southeastern boundary, are situated within the Southwestern Cape Ranges SWSA-gw. However, most of the GRU falls outside the SWSA-gw boundary. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 9 monitoring sites for the EWR and 4 for the BHN were strategically selected within the Stellenbosch-Helderberg GRU (**Figure 4-19** and **Table 4-18**).

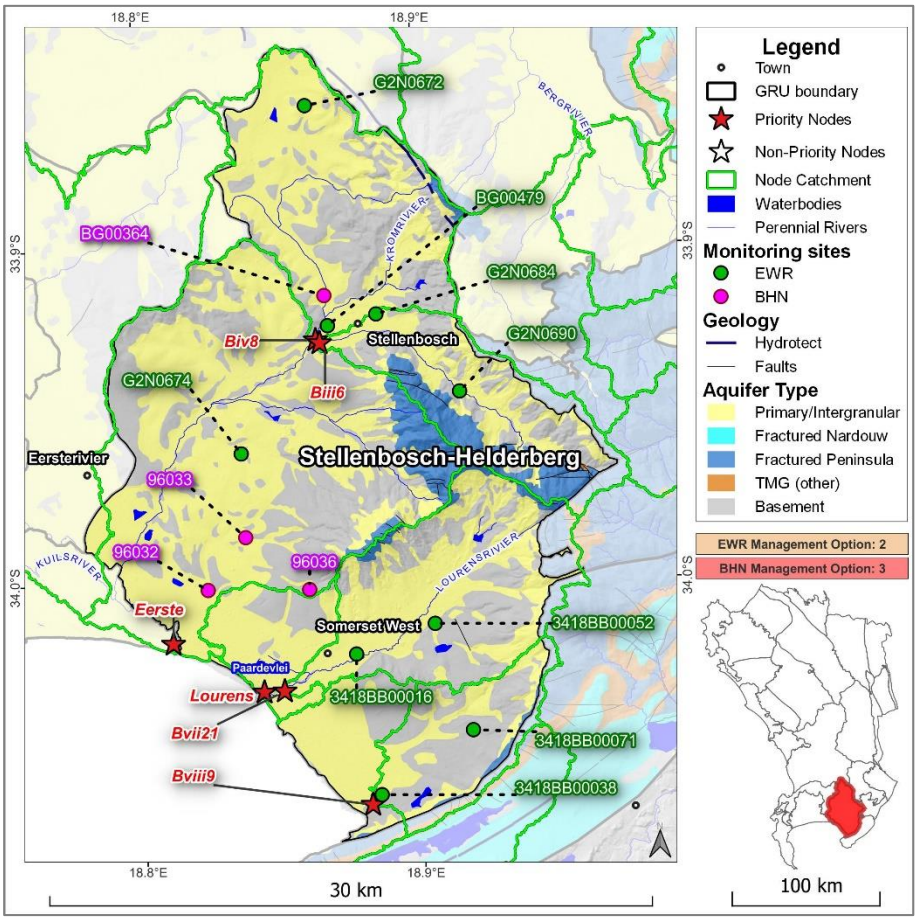


Figure 4-19 **Map depicting the Stellenbosch-Helderberg GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-18 Summary of monitoring sites for the Stellenbosch-Helderberg GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
3418BB00038	NGA	Bviii9	EWR	-34.14602	18.87707	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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 [5]: Bviii9: 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) Biv8: 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) Bxi3 (Eerste): Nutrients (Dissolved Inorganic Nutrients [DIN] and Dissolved Inorganic Phosphate [DIP]); Salts; Pathogens (Enterococci & Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen). Biii6: 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) 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)
G2N0672	HYDSTRA	Biv8	EWR	-33.83622	18.84286	
G2N0674	HYDSTRA	Eerste	EWR	-33.99185	18.80492	
G2N0684	HYDSTRA	Biii6	EWR	-33.93032	18.87903	
G2N0690	HYDSTRA	Biii6	EWR	-33.96561	18.92327	
3418BB00016	NGA	Bvii21	EWR	-34.08269	18.86485	
3418BB00052	NGA	Bvii21	EWR	-34.06964	18.90762	
BG00479	NGA	Biv8	EWR	-33.93513	18.8528	

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
BHN Management Option 3						
96032	WMS	GRU	BHN	-34.052778	18.785556	Frequency: Monthly or Quarterly 2) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for BHN: E coli, Total Coliforms, and Faecal Coliforms
96036	WMS	GRU	BHN	-34.053333	18.840278	
BG00364	NGA	GRU	BHN	-33.92159	18.85123	
96033	WMS	GRU	BHN	-34.029444	18.806389	

4.19. Tulbagh

The Tulbagh 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 (refer to **Section 3.1** and **Figure 4-20**).

The following hydrogeologic features were considered in site selection: 1) the Klein-Berg River and its major tributaries, namely the Boontjies, Waterval, Brakkloof and Knolvlei rivers; 2) the extent of the basement lithology (i.e., the Malmesbury Group) and its contact with the TMG on its northern, eastern and western edge; and 3) the main contributing aquifer is the Fractured and Intergranular Basement (see DWS, 2023a).

Additionally, the Tulbagh GRU is situated within the Northwestern Cape Ranges, Southwestern Cape Ranges, and the Tulbagh-Ashton Valley SWSA-gw, and therefore characterized by high groundwater availability and acknowledged as nationally important resources. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 5 monitoring sites for the EWR and 2 for the BHN were strategically selected within the Tulbagh GRU (**Figure 4-20** and **Table 4-19**).

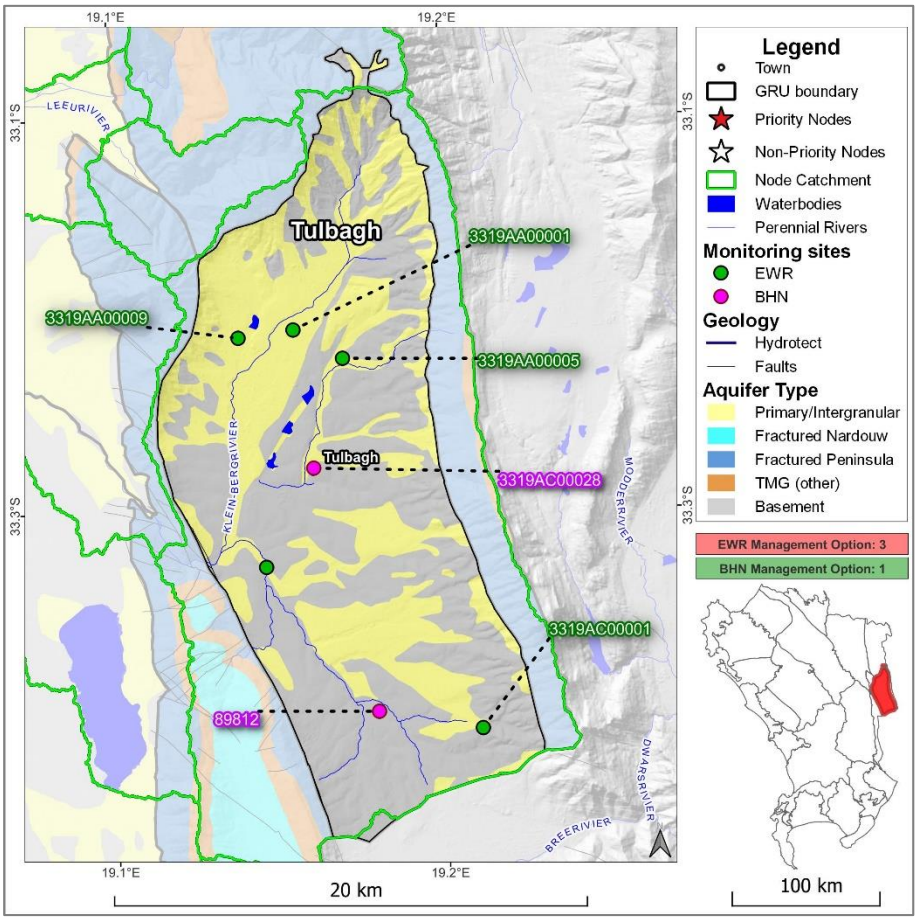


Figure 4-20 **Map depicting the Tulbagh GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-19 Summary of monitoring sites for the Tulbagh GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
3319AA00001	NGA	Biii4	EWR	-33.23078	19.13263	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO_2, NO_3, NH_4 ○ Site specific additions as per RQO [5]: Biii4: 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, Endusulfan)
3319AC00001	NGA	Biii4	EWR	-33.38355	19.21597	
3319AC00043	NGA	Biii4	EWR	-33.32106	19.11874	
3319AA00005	NGA	Biii4	EWR	-33.24188	19.15487	
3319AA00009	NGA	Biii4	EWR	-33.23356	19.10763	
BHN Management Option 1						
3319AC00028	NGA	GRU	BHN	-33.28355	19.14096	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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
89812	WMS	GRU	BNH	-33.376667	19.168889	

4.20. Voëlvlei-Slanghoek

The Voëlvlei-Slanghoek GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-21**).

The following hydrogeologic features were considered in site selection: 1) the Voëlvlei Dam which includes a canal that can supply water from the reservoir via a weir in the Nuwekloof Pass on the Klein Berg River; 2) the Roodezandspas Fault; 3) the Stettyns and Koue Bokkeveld anticline as well as certain portions of the Du Toits/Wellington fault which bounds the eastern/south-eastern fringe of the GRU; and 4) the main contributing aquifer is the Fractured Table Mountain Group Aquifers (see DWS, 2023a).

Additionally, the Voëlvlei-Slanghoek GRU is situated within the Northwestern Cape Ranges, Southwestern Cape Ranges, and the Tulbagh-Ashton Valley SWSA-gw, characterized by high groundwater availability and acknowledged as nationally important resources. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 1 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Voëlvlei-Slanghoek GRU (**Figure 4-21** and **Table 4-19**).

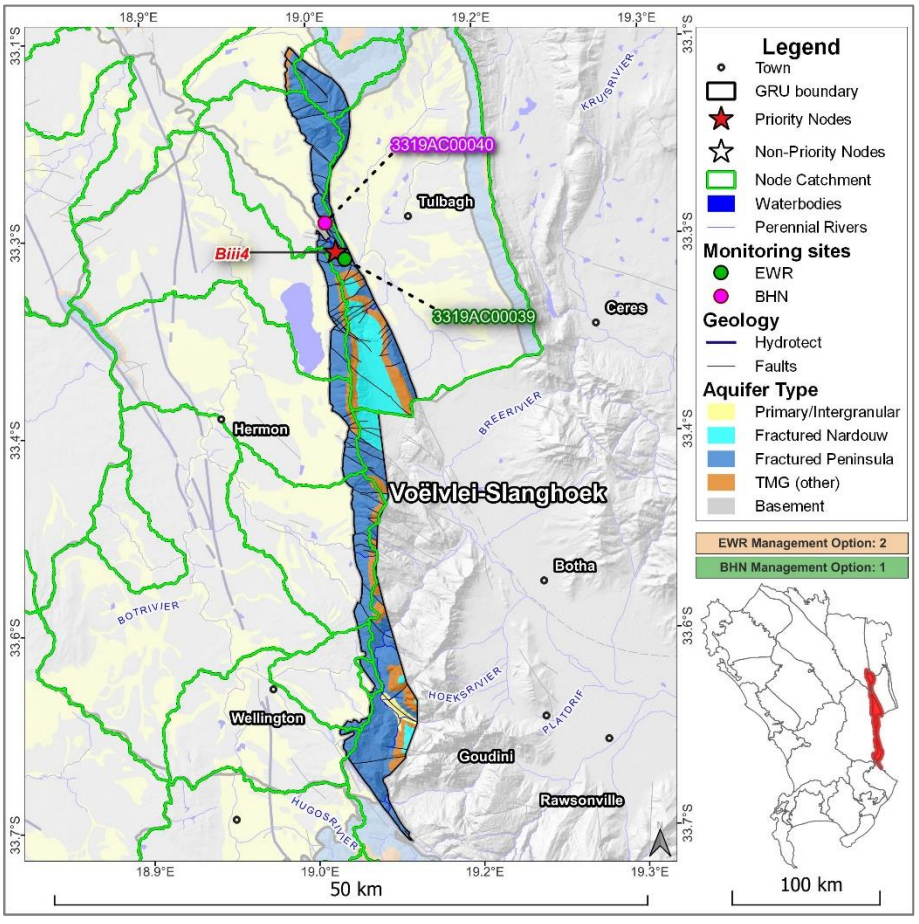


Figure 4-21 **Map depicting the Voëlvlei-Slanghoek GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-20 Summary of monitoring sites for the Voëlvlei-Slanghoek GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
3319AC00039	NGA	Biii4	EWR	-33.31689	19.08263	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 2) Groundwater Quality: ○ Standard Parameters: pH, EC, Ca, Mg, Na, K, Palk, MAlk, F, Cl, PO_4, SO_4 ○ Site specific additions for EWR: NO2, NO3, NH4 ○ Site specific additions as per RQO [5]: Biii4: 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, Endusulfan)
BHN Management Option 1						
3319AC00040	NGA	Biv3	BHN	-33.28911	19.06541	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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

4.21. Vredenburg

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 (refer to **Section 3.1** and **Figure 4-22**).

Various hydrogeologic features were considered for the GRU including several ephemeral streams which originate from the Cape Granite Suite hills, all of which follow the topography, flowing from the higher lying areas in the east to the coast in the west; as well as the main contributing aquifer is the Primary / Intergranular Aquifers (see DWS, 2023a).

Additionally, only a small portion to the east of the Vredenburg GRU is situated within the West Coast Aquifer SWSA-gw, while the rest of the GRU falls outside the delineated SWSA-gw area. This area is recognized for practicing conjunctive use, utilizing both surface water and groundwater supplies for the town of Saldanha, to maximize the overall water resource yield. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 2 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Vredenburg GRU (**Figure 4-22** and **Table 4-21**).

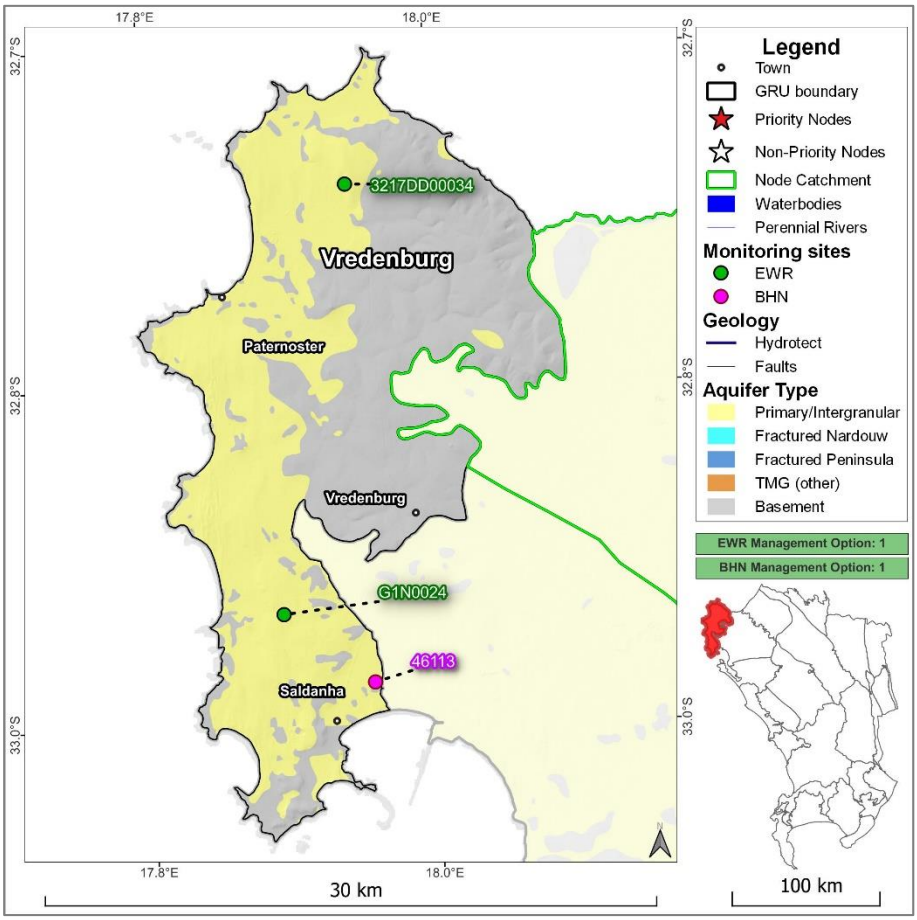


Figure 4-22 **Map depicting the Vredenburg GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-21 Summary of monitoring sites for the Vredenburg GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
3217DD00034	NGA	GRU	EWR	-32.76058	17.95753	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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
G1N0024	HYDSTRA	GRU	EWR	-32.950127	17.91936	
BHN Management Option 1						
46113	NGA	GRU	BHN	-32.98103	17.96632	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 2) Groundwater Quality: ○ 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

4.22. Wellington

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 (refer to **Section 3.1** and **Figure 4-23**).

The following hydrogeologic features were considered in site selection: 1) The Berg River (including many tributaries such as the Fish, Kompanjies, Limiet, Doring and Krom); 2) the Voëlvlei Dam; 3) the Piketberg-Wellington Fault Zone; and 4) the main contributing aquifer is the Fractured and Intergranular Basement Aquifers (see DWS, 2023a).

Additionally, portions of the Wellington GRU, towards its eastern boundary, are situated within the Southwestern and Northwestern Cape Ranges SWSA-gw. However, most of the GRU falls outside the SWSA-gw delineated area, making it less important in terms of national significance as a water resource. Nevertheless, the GRU does have some GDEs present. For additional details, please refer to DWS (2022d).

Considering all these factors, a total of 17 monitoring sites for the EWR and 4 for the BHN were strategically selected within the Wellington GRU (**Figure 4-23** and **Table 4-22**).

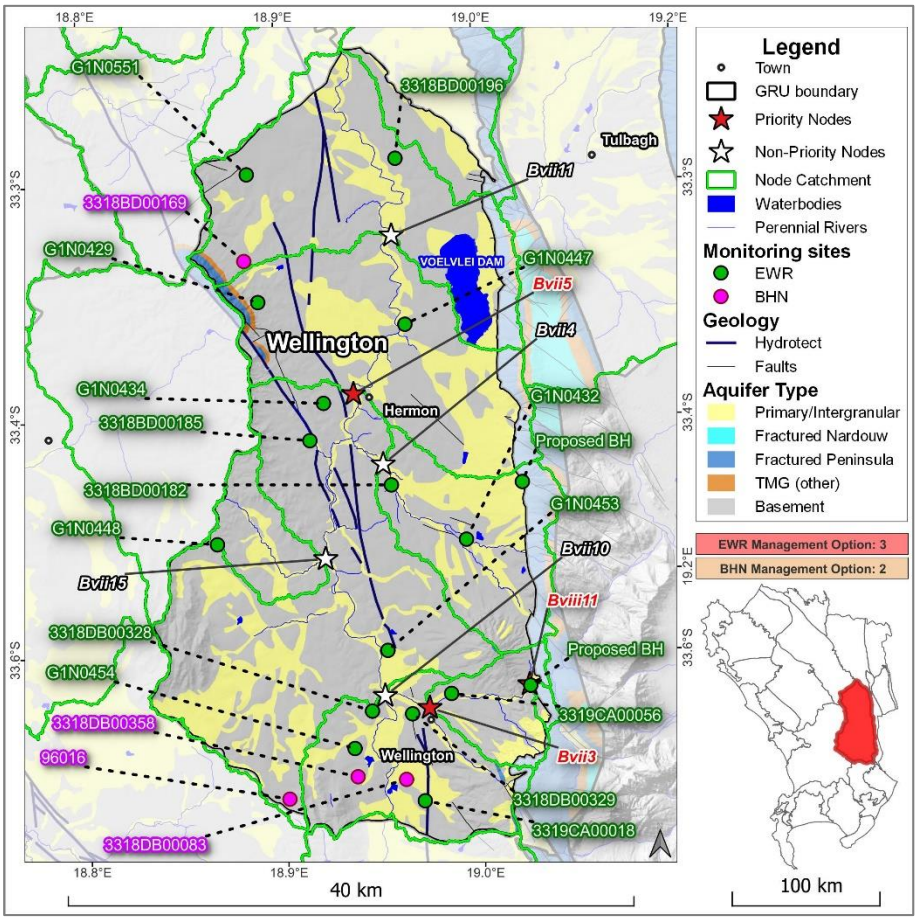


Figure 4-23 **Map depicting the Wellington GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-22 Summary of monitoring sites for the Wellington GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 3						
3319CA00018	NGA	Bvii10	EWR	-33.69466	19.00487	Frequency: Monthly or Quarterly 1) Groundwater level: ○ Manual water level measurements and continuous hourly readings from 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 ○ Site specific additions for EWR: NO2, NO3, NH4 ○ Site specific additions as per RQO [5]: Bvii3: 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 and Endusulfan). Bvii5: 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 and Endusulfan).
3319CA00056	NGA	Bvii3	EWR	-33.62661	19.02652	
Proposed BH		Bvii4	EWR	-33.49244285	19.08339959	
G1N0432	HYDSTRA	Bvii4	EWR	-33.5285	19.04005	
G1N0434	HYDSTRA	Bvii5	EWR	-33.44024	18.93324	
G1N0429	HYDSTRA	Bvii11	EWR	-33.37518	18.88481	
G1N0447	HYDSTRA	Bvii11	EWR	-33.39082	18.99627	
G1N0448	HYDSTRA	Bvii15	EWR	-33.52897	18.85041	
G1N0453	HYDSTRA	Bvii5	EWR	-33.59839	18.97863	
G1N0454	HYDSTRA	Bvii10	EWR	-33.6605	18.95209	
3318BD00196	NGA	Biv1	EWR	-33.28495	18.9912	
3318BD00182	NGA	Bvii4	EWR	-33.49301	18.9837	
3318BD00185	NGA	Bvii5	EWR	-33.46384	18.92232	
Proposed BH		Bviii11	EWR	-33.62228308	19.08690413	
3318DB00329	NGA	Bvii10	EWR	-33.63912	18.99648	
3318DB00328	NGA	Bvii10	EWR	-33.6369	18.96593	
G1N0551	HYDSTRA	Biv1	EWR	-33.29367	18.87805	

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
BHN Management Option 2						
3318DB00358	NGA	GRU	BHN	-33.67853	18.95396	Frequency: Quarterly 1) Groundwater level: a. Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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: E coli, Total Coliforms, and Faecal Coliforms
3318DB00083	NGA	GRU	BHN	-33.68082	18.99092	
3318BD00169	NGA	GRU	BHN	-33.34884	18.87482	
96016	WMS	GRU	BHN	-33.691944	18.901667	

4.23. Wemmershoek

The Wemmershoek GRU was assigned a Management Option 2 for monitoring the groundwater contribution to the EWR and a Management Option 1 for monitoring the groundwater contribution to the BHN (refer to **Section 3.1** and **Figure 4-24**).

The following hydrogeologic features were considered in site selection: 1) the Wemmershoek Dam which forms part of the WCWSS; 2) several rivers that flow through this GRU including the Hugos, Elands, Holsloot, Du Toits, as well as the Drakenstein and Olifants rivers which flow into the Wemmershoek Dam; 3) various faults and the Stettyns anticline in the east, the Du Toits/Wellington fault in the north, and the La Motte fault/basement aquitard in the south; and 4) the main contributing aquifer is the Fractured Table Mountain Group Aquifers (see DWS, 2023a).

Additionally, the Wemmershoek GRU is predominantly situated within the Southwestern Cape Ranges SWSA-gw, with only small portions to the west falling outside the SWSA-gw boundary.

Considering all these factors, a total of 3 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Wemmershoek GRU (**Figure 4-24** and **Table 4-23**).

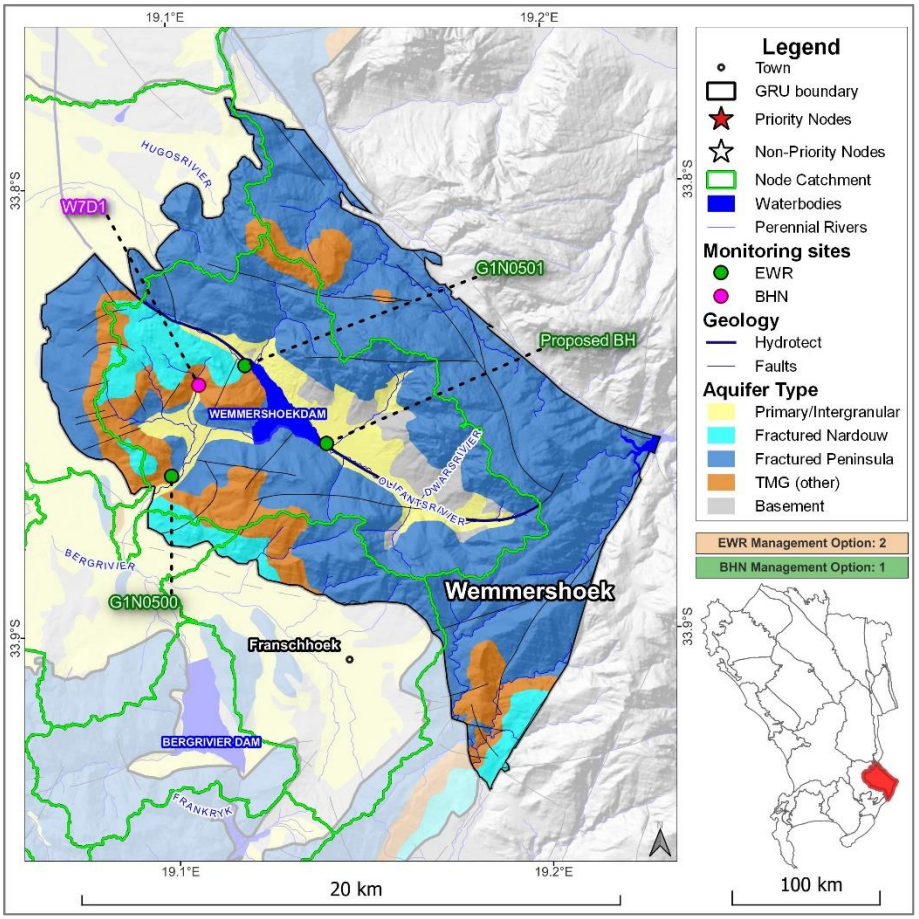


Figure 4-24 **Map depicting the Wemmershoek GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-23 Summary of monitoring sites for the Wemmershoek GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 2						
Proposed BH		Biii2	EWR	-33.83659818	19.11174645	Frequency: Quarterly 1) Groundwater level: ○ Manual groundwater level measurements, as well as average daily reading from automatically recorded level logger. 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
G1N0500	HYDSTRA	Biii2	EWR	-33.8466	19.0493	
G1N0501	HYDSTRA	Biii2	EWR	-33.81001	19.07955	
BHN Management Option 1						
W7D1	CoCT	GRU	BHN	-33.81629	19.06087	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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

4.24. Witzenberg

The Witzenberg 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 (refer to **Section 3.1** and **Figure 4-25**).

The following hydrogeologic features were considered in site selection: 1) there are no major surface water systems in this GRU except for a tributary of the Klein-Berg River; therefore, the extent of the TMG (predominantly Peninsula Formation) and its contact with the basement lithologies (Malmesbury Group) were used as the primary factor for site selection.

Additionally, the Witzenberg GRU is predominantly located within the Northwestern Cape Ranges and the Tulbagh-Ashton Valley SWSA-gw signifying a region characterized by high groundwater availability and acknowledged as a nationally important resource. Refer to DWS (2022d) for details.

Considering all these factors, a total of 1 monitoring sites for the EWR and 1 for the BHN were strategically selected within the Witzenberg GRU (**Figure 4-25** and **Table 4-24**).

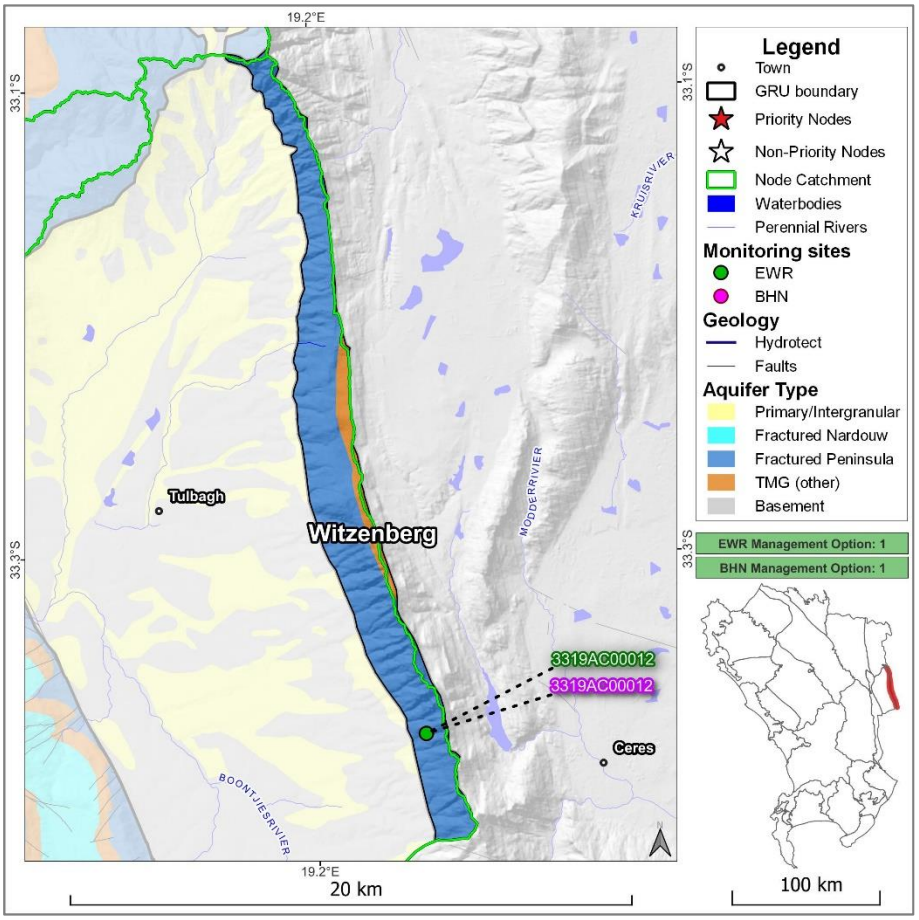


Figure 4-25 **Map depicting the Witzenberg GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-24 Summary of monitoring sites for the Witzenberg GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
3319AC00012	NGA	Biii4	EWR	-33.358	19.24152	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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 [5]: Biii4: Nutrients (Phosphate [PO4-P] and Total Inorganic Nitrogen [TIN]); Salts (Electrical Conductivity [EC]); Pathogens (Escherichia Coli); System Variables (Temperature, pH, Dissolved Oxygen); Toxins (Atrazine and Endusulfan).
BHN Management Option 1						
3319AC00012	NGA	Biii4	BHN	-33.358	19.24152	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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

4.25. Yzerfontein

The Yzerfontein 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 (refer to **Section 3.1** and **Figure 4-26**).

The following hydrogeologic features were considered in site selection: 1) the Dwars, Jakkals and Modder rivers; 2) the wetlands in the coastal dunes that are supported by groundwater discharge; and 3) the main contributing aquifer is the Primary / Intergranular Aquifers (see DWS, 2023a).

Additionally, the Yzerfontein GRU is predominantly situated within the West Coast Aquifer SWSA-gw, characterized by high groundwater availability and acknowledged as nationally important resource. Furthermore, this GRU is included in the Saldanha Bay and the Swartland (SGWCA). Refer to DWS (2022d) for details.

Considering all these factors, a total of 1 monitoring sites for the EWR and 2 for the BHN were strategically selected within the Yzerfontein GRU (**Figure 4-26** and **Table 4-25**).

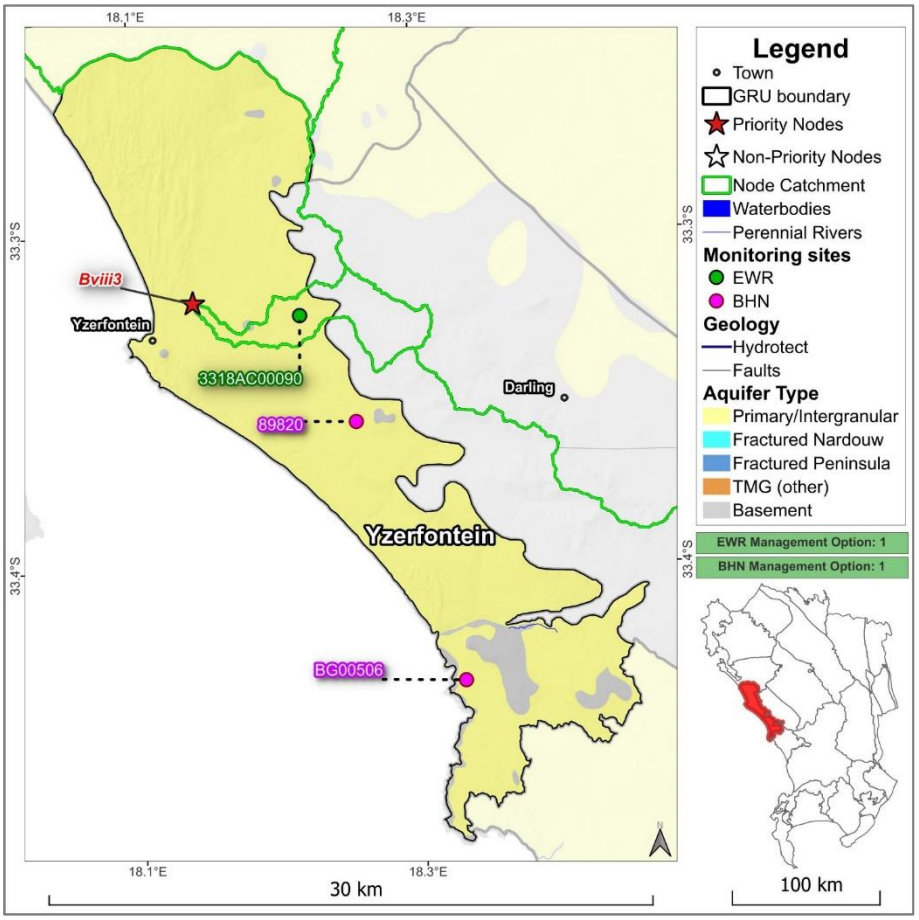


Figure 4-26 **Map depicting the Yzerfontein GRU and the associated EWR and BHN monitoring sites based on the respective Management Options.**

Table 4-25 Summary of monitoring sites for the Yzerfontein GRU including site names, monitoring area, data source, coordinates, and associated monitoring description based on the Management Options for the groundwater contribution to EWR and BHN.

Site Name	Data Source	Monitoring Area	Monitoring Objective	Latitude	Longitude	Monitoring Description
EWR Management Option 1						
3318AC00090	NGA	Bviii3	EWR	-33.33662	18.23898	Frequency: Quarterly or Biannual (Summer & Winter) 1) Groundwater level: ○ Manual groundwater level measurements 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						
BG00506	NGA	GRU	BHN	-33.50172	18.32304	Frequency: Quarterly or Biannual (Summer & Winter): 1) Groundwater level: ○ Manual groundwater level measurements 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
89820	WMS	GRU	BHN	-33.384722	18.267778	

5. CONCLUSION AND RECOMMENDATIONS

Following a comprehensive evaluation of various national datasets, including Hydstra, WMS, NGA, and known CoCT boreholes, suitable monitoring locations were identified for monitoring the groundwater contribution to the Reserve. However, in cases where neither database yielded appropriate boreholes, new locations are proposed and recommended to the DWS. These recommendations are specifically tailored to address areas where no boreholes were found in the national dataset or where existing locations were deemed unsuitable for monitoring the groundwater contribution to the BHN or EWR Reserves. The proposed new boreholes target the following regions, Cape Peninsula, Eendekuil Basin, Groot Winterhoek, Wellington, and the Wemmershoek GRUs, focusing on aquifer-specific units.

This Monitoring Programme is specific for the groundwater contribution to the Reserve for the entire Berg catchment and therefore does not supersede or negate additional monitoring programmes required for individual users or strategic water source areas. All monitoring programmes should collectively be used to effectively manage the regional water resource.

To enhance data management efficiency, it is crucial to establish connections between different monitoring programmes and national databases, potentially integrating them into a single national system. Recognizing potential inconsistencies in data storage, the creation of a structured link indicating where such data should be housed in the department's database becomes imperative for comprehensive and accessible information management. This holistic approach to recommendations aims to optimize monitoring efficiency and data utilization within the department's operational framework.

Furthermore, implementing a robust data quality control process is crucial for effective data management. This would involve regularly review and validation of the accuracy, completeness, and consistency of the data within the integrated databases. By implementing these quality control measures, the DWS can ensure that the data used for monitoring boreholes is reliable and trustworthy.

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7. APPENDIX

Appendix A: Management Programme Monitoring Sites

Table A-1 Summary table of all EWR monitoring site per GRU and their associated data source and coordinates.

GRU	Site Name	Data Source	Monitoring Area	Latitude	Longitude
Adamboerskraal	G1N0070	HYDSTRA	Berg (Groot)	-32.70555556	18.3208333
	G1N0364	HYDSTRA	Berg (Groot)	-32.80504	18.374
	G1N0239	HYDSTRA	Berg (Groot)	-32.87268	18.476
	G1N0240	HYDSTRA	Berg (Groot)	-32.901	18.33653
	3218CC00394	NGA	Berg (Groot)	-32.79027	18.20829
Atlantis	G2N0168	HYDSTRA	Bviii10	-33.58972222	18.5013889
	G2N0561	HYDSTRA	Biv6	-33.58638889	18.5366667
	AT-S17	CoCT	Silwerstroom	-33.57891838	18.3711581
	AT-MON01	CoCT	GRU	-33.63501833	18.4375844
	AT-EX01	CoCT	GRU	-33.55694787	18.3976652
	G2N0142	HYDSTRA	Silwerstroom	-33.57888889	18.3716667
	G2N0662	HYDSTRA	GRU	-33.5683	18.38632
	G2N0160	HYDSTRA	GRU	-33.63444444	18.4405556
	AT-MON05	CoCT	GRU	-33.61920291	18.4452584
Cape Flats	G2N0008	HYDSTRA	Zeekoevlei	-34.01008	18.50937
	G2N0104	HYDSTRA	Zeekoevlei	-34.050078	18.51937
	G2N0612	HYDSTRA	GRU	-34.01902	18.57068
	G2N0649	HYDSTRA	GRU	-34.03966	18.56788
	G2N0653	HYDSTRA	GRU	-34.04875	18.56313
	G2N0108	HYDSTRA	GRU	-34.02465	18.62082
	G2N0619	HYDSTRA	GRU	-33.9331	18.62162
	G2N0059	HYDSTRA	Zeekoevlei	-34.01008	18.49937
	3418AB00077	NGA	Bvii7	-34.06602	18.46429
Cape Peninsula	3418AB00024	NGA	Wildevöelvlei	-34.14185	18.34929
	G2N0048	HYDSTRA	Bviii6	-34.0008	18.379366
	Proposed BH		GRU	-34.10991286	18.4048776
	96073	WMS	GRU	-34.222778	18.410833
Cape Town Rim	G2N0103	HYDSTRA	Biv9	-34.010081	18.709376
	96058	WMS	Bviii6	-34.016389	18.382222
	96060	WMS	Bvii7	-34.028056	18.417222
	96139	WMS	Bviii8	-33.855556	18.627222
	G2N0637	HYDSTRA	Biv9	-33.85839	18.66518
	G2N0604	HYDSTRA	Bviii8	-33.90177	18.64386
	3318DC00027	NGA	Biv9	-33.89189	18.73259
	G2N0112	HYDSTRA	GRU	-33.980081	18.479369
Darling	G1N0555	HYDSTRA	Bii1	-33.393056	18.463889

GRU	Site Name	Data Source	Monitoring Area	Latitude	Longitude
Drakensteinberge	G1N0509	HYDSTRA	Bvii13	-33.95688	19.07258
	G1N0316	HYDSTRA	Bviii1	-33.90105	19.0503
	G1N0499	HYDSTRA	Bviii1	-33.9371	19.0198
Eendekuil Basin	G1N0193	HYDSTRA	Biii5	-32.960132	18.999392
	Proposed BH		Biv3	-33.21410414	18.9537051
	G1N0059	HYDSTRA	Biii5	-32.99013	18.849388
	3318BB00057	NGA	Biv4	-33.18023	18.95732
	3318BB00038	NGA	Bvii16	-33.1444	18.92009
	3319AA00063	NGA	Bvii16	-33.05716	19.01653
	3318BB00066	NGA	Bvii8	-33.10245	18.88343
	3319AA00013	NGA	Biv3	-33.1905	19.0243
	3319AC00042	NGA	Biv3	-33.28355	19.05208
Elandsfontein	G1N0516	HYDSTRA	Langebaan Lagoon (Bxi3)	-33.19332	18.1269
	G1N0035	HYDSTRA	Langebaan Lagoon (Bxi3)	-33.180118	18.189366
	G1N0513	HYDSTRA	Langebaan Lagoon (Bxi3)	-33.07631	18.2503
	G1N0269	HYDSTRA	Langebaan Lagoon (Bxi3)	-33.13302	18.13159
Groot Winterhoek	Proposed BH		Bi1	-33.13404333	19.0610177
	3219CC00015	NGA	Bi1	-32.98054	19.07122
Langebaan Road	G1N0050	HYDSTRA	Berg (Groot) (Bxi1)	-32.86598	18.09559
	G1N0337	HYDSTRA	Berg (Groot) (Bxi1)	-32.990127	18.229369
	G1N0507	HYDSTRA	Bii1	-33.02503	18.34761
	G1N0237	HYDSTRA	Berg (Groot) (Bxi1)	-32.91996	18.2942
	G1N0372	HYDSTRA	Langebaan Lagoon	-33.00888889	18.0725
	G1N0274	HYDSTRA	Berg (Groot)	-32.88552	18.24774
Malmesbury	G2N0126	HYDSTRA	Bviii5	-33.81805556	18.5166667
	G2N0671	HYDSTRA	Biv7	-33.80737	18.86339
	G2N0582	HYDSTRA	Biv7	-33.72022	18.71882
	G2N0506	HYDSTRA	Bviii5	-33.72222222	18.6005556
	G2N0583	HYDSTRA	Bv1	-33.47697	18.80027
	G2N0584	HYDSTRA	Bv1	-33.43762	18.75223
	G2N0586	HYDSTRA	Biv6	-33.49216	18.67617
	G2N0590	HYDSTRA	Biv7	-33.67055556	18.6275
	G2N0630	HYDSTRA	Biv7	-33.77349	18.70946
	G2N0636	HYDSTRA	Bviii5	-33.78196	18.55619
	G2N0623	HYDSTRA	Bviii4	-33.52931	18.60226
	3318DA00094	NGA	Bviii10	-33.6869	18.51176
	3318CB00377	NGA	Bviii10	-33.6495	18.49347
	G2N0622	HYDSTRA	Biv6	-33.65851	18.61567
Middle-Lower Berg	G1N0203	HYDSTRA	Biv2	-32.97013	18.569379
	BG00369	NGA	Bvii8	-33.09141	18.8334
	96095	WMS	GRU	-33.0925	18.710833
	96152	WMS	Bvii8	-33.138889	18.805556
	G3N0546	HYDSTRA	Biv2	-32.79555556	18.5127778
	G1N0548	HYDSTRA	Bvii17	-33.18139	18.87706
	G1N0531	HYDSTRA	Bvii17	-33.34023	18.80592

GRU	Site Name	Data Source	Monitoring Area	Latitude	Longitude
	3318BA00042	NGA	Bvii18	-33.14467	18.70759
	3218CB00140	NGA	GRU	-32.68957	18.45493
	G1N0195	HYDSTRA	Biv2	-32.96013	18.499377
	G1N0534	HYDSTRA	Bvii17	-33.25757	18.80806
Northern Swartland	G2N0587	HYDSTRA	Bii1	-33.35619	18.64199
	G1N0376	HYDSTRA	Bii1	-33.21675	18.39426
	G1N0439	HYDSTRA	Bvii2	-33.89888889	18.9902778
	G1N0440	HYDSTRA	Biv5	-33.92332	19.11257
	G1N0502	HYDSTRA	Biii3	-33.76862	19.01813
	G1N0320	HYDSTRA	Biv5	-33.88316	19.04709
	G1N0322	HYDSTRA	Bvii2	-33.87951	19.03125
Paarl-Franschhoek	3319CC00104	NGA	Biii2	-33.85883	19.0303
	G1N0428	HYDSTRA	Biv5	-33.92333333	19.0816667
	G1N0446	HYDSTRA	Biii3	-33.82835	18.94113
	BG00450	NGA	Bvii14	-33.91134	18.94703
	3318DD00243	NGA	Bvii2	-33.86135	18.99509
	3318DD00235	NGA	Bvii2	-33.84467	18.99092
	G3N0547	HYDSTRA	Biv2	-32.73111111	18.5219444
Piketberg	3218DC00011	NGA	Biv2	-32.80305	18.68729
	G1N0404	HYDSTRA	Biv2	-32.72257	18.5704
	H1A12	CoCT	Bvii22 & GRU	-34.15341755	18.9361921
	H2A1	CoCT	Bvii22 & GRU	-34.18480149	18.8468127
Steenbras-Nuweberg	H2A4	CoCT	Bvii22 & GRU	-34.18503396	18.8462845
	H3A2	CoCT	Bvii22 & GRU	-34.19704511	18.8691969
	H3A3	CoCT	Bvii22 & GRU	-34.19697736	18.8691454
	3418BB00038	NGA	Bviii9	-34.14602	18.87707
	3418BB00071	NGA	Bviii9	-34.11769	18.92707
	G2N0672	HYDSTRA	Biv8	-33.83622	18.84286
	G2N0674	HYDSTRA	Eerste (Bxi3)	-33.99185	18.80492
	G2N0684	HYDSTRA	Biii6	-33.93032	18.87903
Stellenbosch-Helderberg	G2N0690	HYDSTRA	Biii6	-33.96561	18.92327
	3418BB00016	NGA	Bvii21	-34.08269	18.86485
	3418BB00052	NGA	Bvii21	-34.06964	18.90762
	BG00479	NGA	Biv8	-33.93513	18.8528
	3319AA00001	NGA	Biii4	-33.23078	19.13263
	3319AC00001	NGA	Biii4	-33.38355	19.21597
Tulbagh	3319AC00043	NGA	Biii4	-33.32106	19.11874
	3319AA00005	NGA	Biii4	-33.24188	19.15487
	3319AA00009	NGA	Biii4	-33.23356	19.10763
Voëlvlei-Slanghoek	3319AC00039	NGA	Biii4	-33.31689	19.08263
Vredenburg	3217DD00034	NGA	GRU	-32.76058	17.95753
	G1N0024	HYDSTRA	GRU	-32.950127	17.91936
Wellington	3319CA00018	NGA	Bvii10	-33.69466	19.00487
	3319CA00056	NGA	Bvii3	-33.62661	19.02652
	Proposed BH		Bvii4	-33.49244285	19.0833996

GRU	Site Name	Data Source	Monitoring Area	Latitude	Longitude
	G1N0432	HYDSTRA	Bvii4	-33.5285	19.04005
	G1N0434	HYDSTRA	Bvii5	-33.44024	18.93324
	G1N0429	HYDSTRA	Bvii11	-33.37518	18.88481
	G1N0447	HYDSTRA	Bvii11	-33.39082	18.99627
	G1N0448	HYDSTRA	Bvii15	-33.52897	18.85041
	G1N0453	HYDSTRA	Bvii5	-33.59839	18.97863
	G1N0454	HYDSTRA	Bvii10	-33.6605	18.95209
	3318BD00196	NGA	Biv1	-33.28495	18.9912
	3318BD00182	NGA	Bvii4	-33.49301	18.9837
	3318BD00185	NGA	Bvii5	-33.46384	18.92232
	Proposed BH		Bviii11	-33.62228308	19.0869041
	3318DB00329	NGA	Bvii10	-33.63912	18.99648
	3318DB00328	NGA	Bvii10	-33.6369	18.96593
	G1N0551	HYDSTRA	Biv1	-33.29367	18.87805
Wemmershoek	Proposed BH		Biii2	-33.83659818	19.1117465
	G1N0500	HYDSTRA	Biii2	-33.8466	19.0493
	G1N0501	HYDSTRA	Biii2	-33.81001	19.07955
Witzenberg	3319AC00012	NGA	Biii4	-33.358	19.24152
Yzerfontein	3318AC00090	NGA	Bviii3	-33.33662	18.23898

Table A-2 Summary table of all BHN monitoring site per GRU and their associated data source and coordinates.

GRU	Site Name	Data Source	Monitoring Area	Latitude	Longitude
Adamboerskraal	93313	WMS	GRU & Berg (Groot)	-32.85	18.368889
Atlantis	91733	WMS	GRU	-33.628889	18.409722
	3318CB00186	NGA	GRU	-33.5619	18.49342
Cape Flats	3318DC00004	NGA	GRU	-33.97801	18.56871
	3318DC00114	NGA	GRU	-33.95301	18.5826
	3318DC00163	NGA	GRU	-33.98717	18.6276
	3418BA00026	NGA	GRU	-34.03686	18.59568
	3418BA00346	NGA	GRU	-34.06075	18.65068
	88847	WMS	GRU	-34.051389	18.601389
Cape Peninsula	96069	WMS	GRU	-34.132222	18.380833
Cape Town Rim	3318CD00036	NGA	GRU	-33.90301	18.41037
	3318DC00290	NGA	GRU	-33.88447	18.70283
	96211	WMS	GRU	-33.838611	18.607222
Darling	94570	WMS	GRU	-33.4259	18.4212
Drakensteinberge	G1N0499	HYDSTRA	Bviii1	-33.9371	19.0198
Eendekuil Basin	3218DD00046	NGA	GRU	-32.88721	18.75511
	3318BB00044	NGA	GRU	-33.00858	18.98259
	96167	WMS	GRU	-33.058333	18.884167
Elandsfontein	93871	WMS	GRU	-33.204722	18.291944
Groot Winterhoek	3219CC00015	NGA	Bi1	-32.98054	19.07122
Langebaan Road	G1N0158	HYDSTRA	GRU	-33.080122	18.049363
	3218CC00015	NGA	GRU	-32.92805	18.00483
	93873	WMS	GRU	-32.989722	18.093333
Malmesbury	96113	WMS	GRU	-33.858611	18.726667
	101603	WMS	GRU	-33.479167	18.716667
	3318DC00097	NGA	GRU	-33.81023	18.62704
	89665	WMS	GRU	-33.657778	18.608611
Middle-Lower Berg	3318BA00046	NGA	GRU	-33.13496	18.66871
Northern Swartland	96144	WMS	GRU	-33.245556	18.635556
Paarl-Franschhoek	96019	WMS	GRU	-33.915556	18.920833
	3318DD00221	NGA	GRU	-33.82247	18.96593
	3318DB00090	NGA	GRU	-33.7197	18.99509
Piketberg	3218DA00006	NGA	GRU	-32.6961	18.53395
Steenbras-Nuweberg	H1A3b	CoCT	Bvii22 & GRU	-34.1660434	18.9280848
	H8A1_Ope	CoCT	Bvii22& GRU	-34.1854748	18.8989277
Stellenbosch-Helderberg	96032	WMS	GRU	-34.052778	18.785556
	96036	WMS	GRU	-34.053333	18.840278
	BG00364	NGA	GRU	-33.92159	18.85123
	96033	WMS	GRU	-34.029444	18.806389
Tulbagh	3319AC00028	NGA	GRU	-33.28355	19.14096
	89812	WMS	GRU	-33.376667	19.168889
Voëlvlei-Slanghoek	3319AC00040	NGA	Biv3	-33.28911	19.06541
Vredenburg	46113	NGA	GRU	-32.98103	17.96632
Wellington	3318DB00358	NGA	GRU	-33.67853	18.95396

GRU	Site Name	Data Source	Monitoring Area	Latitude	Longitude
	3318DB00083	NGA	GRU	-33.68082	18.99092
	3318BD00169	NGA	GRU	-33.34884	18.87482
	96016	WMS	GRU	-33.691944	18.901667
Wemmershoek	W7D1	CoCT	GRU	-33.81629	19.06087
Witzenberg	3319AC00012	NGA	Biii4	-33.358	19.24152
Yzerfontein	BG00506	NGA	GRU	-33.50172	18.32304
	89820	WMS	GRU	-33.384722	18.267778