GARDEN ROUTE COMPLEX WORLD HERITAGE SITE & NATURE RESERVES

PART OF THE

CAPE FLORAL REGION PROTECTED AREAS WORLD HERITAGE SITE

Western Cape, South Africa

Protected Area Management Plan 2023 – 2033

DATE APPROVED: [Date]
MOST RECENT UPDATE: 20 April 2023

CapeNature

Western Cape Government

forestry, fisheries & the environment
Department: Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

United Nations Educational, Scientific and Cultural Organization

World Heritage Convention

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CITATION
CapeNature. 2023. Garden Route Complex World Heritage Site & Nature Reserves: Protected Area Management Plan 2023-2033. Internal Report, CapeNature. Cape Town.

AUTHORISATIONS

In terms of Section 41(4) the Minister hereby approves part of the Protected Area Management Plan for the Garden Route Complex World Heritage Site and Nature Reserves (GCWHS&NR) designated as World Heritage Sites, Special Nature Reserve and Marine Protected Areas (See Appendix 1, Table 1).

TITLE	NAME	SIGNATURE	DATE
NATIONAL MINISTER: Forestry, Fisheries and the Environment	Ms Barbara Creecy		

In terms of Section 41(4) the MEC hereby approves part of the Protected Area Management Plan for the Garden Route Complex World Heritage Site and Nature Reserves designated as State Forest Nature Reserves, Provincial Nature Reserves, Forestry Exit Areas and Island Nature Reserves (See Appendix 1, Table 2).

TITLE	NAME	SIGNATURE	DATE
PROVINCIAL MINISTER: Department of Environmental Affairs and Development Planning	Mr Anton Bredell	Anton Bredell Digitally signed by Anton Bredell	10/05/2023

Recommended:

TITLE	NAME	SIGNATURE	DATE
CHAIRPERSON OF THE BOARD: Western Cape Nature Conservation Board	Assoc Prof Denver Hendricks		04/05/2023
CHIEF EXECUTIVE OFFICER: CapeNature	Dr Razeena Omar		04/05/2023

Review Date: 10 years from the date of approval by the MEC or Minister.

ACKNOWLEDGEMENTS

All stakeholders are thanked for their participation and contribution to the development of this management plan.

This management plan was prepared by the reserve management committee comprised of Natalie Baker, AnneLise Schutte-Vlok, Patrick Meyer, Colin Fordham, Barend le Roux, Jan Makampies, Thulani Ndlovu and Henk Nieuwoudt with significant inputs from:

- Ms Natalie Baker (Information gathering, assemblage of draft document)
- Dr AnneLise Schutte-Vlok (Vegetation, fire regimes, veld restoration and rehabilitation, reviewing and editing)
- Dr Antoinette Veldtman (Invertebrates)
- Ms Jeanne Gouws (Freshwater ecosystems, freshwater invertebrates)
- Ms Alexis Olds (Marine ecosystems, marine mammals and marine fish)
- Mr Keith Spencer (Marine and coastal viability assessments, strategic framework)
- Mr Kevin Shaw (Avifauna)
- Dr Marienne de Villiers (Invertebrates and terrestrial mammals)
- Dr Martine Jordaan (Fish)
- Mr Llewellyn Jacobs (State of Biodiversity data provision)
- Mr Patrick Meyer (Maps and GIS support)
- Ms Megan Simons and Mr Colin Fordham (Municipal planning sections)
- Mr Carlo van Tonder and Ms Anita Wheeler (Expansion strategy)
- Mr Wilfred Williams (Concept development plan information)
- Ms Therese Forsyth (Sensitivity, zonation and zone of influence analyses)
- Outeniqua, Goukamma, Robberg and Keurbooms River Field Rangers (Collection and provision of ecological data)
- All contributors of photographs.

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- Mr Kyle Smith (South African National Parks: Marine and Coastal ecosystems viability assessments)
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Cover page images courtesy of AnneLise Vlok (*Syncarpha eximia* - strawberry everlasting) and Henk Nieuwoudt (Humpback whale - *Megaptera novaeangliae*).

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GLOSSARY

Derived from: Conservation Measures Partnership (CMP) 2020.

Term	Explanation
Adaptive management	The incorporation of a formal learning process into conservation action to reduce uncertainty in decision-making. Specifically, it is the integration of knowledge, management, and monitoring, to provide a framework to systematically and efficiently test assumptions, promote learning, and supply timely information for management to make decisions and adjust actions based on outcomes of monitoring. The *Conservation Standards* explicitly bring adaptive management principles into conservation practice.
Ecological / conservation target	An element of biodiversity (natural value) or heritage (cultural value) of the protected area, which can be a species, habitat, ecological system, or heritage feature, that management strives to protect, and threats towards which management should strive to minimise. All conservation targets at a site should collectively represent the biodiversity and heritage features of concern at the site.
Factor	A generic term for an element of a conceptual model including direct and indirect threats, opportunities, and associated stakeholders. It is often advantageous to use this generic term since many factors – for example tourism – could be both a threat and an opportunity. Also known as root causes or drivers.
Goal	A formal statement detailing a desired impact of a project, such as the desired future status of a target. A good goal meets the criteria of being *linked to targets*, *impact oriented*, *measurable*, *time limited*, and *specific*.
Heritage resources	Means any place or object of cultural significance as per the Heritage Resources Act, 1999 (Act No. 25 of 1999).
Human well-being value	In the context of a conservation project, human well-being values are those components of human well-being affected by the status of conservation targets. All human well-being values at a site should collectively represent the array of human well-being needs dependent on the conservation targets.

Indicator	A measurable entity related to a specific information need such as the status of a value / factor, change in a threat, or progress toward an objective, or association between one or more variables. A good indicator meets the criteria of being: *measurable*, *precise*, *consistent*, and *sensitive*.
Key (ecological) attribute	An aspect of a conservation target's biology or ecology that if present, define a healthy conservation target and if missing or altered, would lead to the outright loss or extreme degradation of that conservation target over time.
Living heritage	Means the intangible aspects of inherited culture, and may include— (a) cultural tradition; (b) oral history; (c) performance; (d) ritual; (e) popular memory; (f) skills and techniques; (g) indigenous knowledge systems; and (h) the holistic approach to nature, society and social relationships; in terms of the Heritage Resources Act, 1999 (Act No. 25 of 1999).
Objective	A formal statement detailing a desired outcome of a project such as reducing a critical threat. A good objective meets the criteria of being: *results oriented*, *measurable*, *time limited*, *specific*, and *practical*. If the project is well conceptualized and designed, realization of a project's objectives should lead to the fulfilment of the project's goals and ultimately its vision. Compare to vision and goal.
Results chain	A visual diagram of management's theory of change. A results chain includes core assumptions and the logical sequence linking interventions to one or more values. In scientific terms, it lays out hypothesized relationships or theories of change.
Situation analysis	The purpose of a situation analysis is to understand the relationships between the biological environment and the social, economic, political, and institutional systems, associated stakeholders and drivers that affect the conservation targets of the protected area.
Vision	A description of the desired long-term future or ultimate condition that stakeholders see and management strives to achieve for the protected area.

ACRONYMS AND ABBREVIATIONS

APO	Annual Plan of Operations
ASPT	Average Score Per Taxon
BBBSNR	Brenton Blue Butterfly Special Nature Reserve
BGCMA	Breede-Gouritz Catchment Management Agency
BIRP	Birds in Reserve Project
BLM	Bitou Local Municipality
BMP	Biodiversity Management Plan
BMP-s	Biodiversity Management Plan for Species
CBA	Critical Biodiversity Area
CCNet	Conservation Coaches Network
CDF	Conservation Development Framework
CEO	Chief Executive Officer
CFE	Cape Fold Ecoregion
CFR	Cape Floristic Region
CFRPA	Cape Flora Region Protected Areas
CITES	Convention on International Trade in Endangered Species in Wild Fauna and Flora
CMP	Conservation Measures Partnership
CR	Critically Endangered
CREW	Custodians of Rare and Endangered Wildflowers
CR PE	Critically Endangered, Possibly Extinct
DBI	Dragonfly Biotic Index
DD	Data Deficient
DEA	Department of Environmental Affairs (now DFFE)
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and the Environment
DFFE:O&C	Department of Forestry, Fisheries and the Environment: Oceans and Coast
DTPW	Department of Transport and Public Works
DWAF	Department of Water Affairs and Forestry (now Dept of Water and Sanitation)
EC	Electrical Conductivity

EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMI	Environmental Management Inspector
EN	Endangered
EPWP	Expanded Public Works Programme
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
FMU	Fire Management Unit
FPA	Fire Protection Association (In terms of the National Veld and Forest Fire Act, 1998 (Act No. 1 of 1998)
GIS	Geographical Information System
GLM	George Local Municipality
GCBR	Gouritz Cluster Biosphere Reserve
GRBR	Garden Route Biosphere Reserve
GRCWHS&NR	Garden Route Complex World Heritage Site and Nature Reserves
GRDM	Garden Route District Municipality
GREF	Garden Route Environmental Forum
GTUP	Game Translocation Utilisation Policy
IAP	Invasive Alien Plant
IAPO	Integrated Annual Plan of Operations
IAS	Invasive Alien Species
ICM	Integrated Catchment Management
IDP	Integrated Development Plan
IFSM	Invasive Fish Species Management
IUCN	International Union for Conservation of Nature and Natural Resources
IWP	Integrated Work Plan
KLM	Knysna Local Municipality
LC	Least Concern
m.a.s.l.	Metres above sea level
MBLM	Mossel Bay Local Municipality
MEC	Member of Executive Council
METT-SA	Management Effectiveness Tracking Tool - South Africa

MOA	Memorandum of Agreement
MPA	Marine Protected Area
MTEF	Medium Term Expenditure Framework
MTO	Mountain to Oceans Forestry Company
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:PAA	National Environmental Management: Protected Areas Act
NFEPA	National Freshwater Ecosystem Priority Area
NGO	Non-Governmental Organisation
NPAES	National Protected Area Expansion Strategy
NRM	Natural Resource Management
NT	Near Threatened
OECM	Other Effective Area-based Conservation Measures
OLM	Oudtshoorn Local Municipality
ONA	Other Natural Area
PAAC	Protected Area Advisory Committee
PSHB	Polyphagous Shot Hole Borer beetle
SABAP2	South African Bird Atlas Project version 2
SAFCOL	South African Forestry Company Limited
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SANRAL	South African National Roads Agency Limited
SASS 5	South African Scoring System version 5
SCFPA	Southern Cape Fire Protection Association
SDF	Spatial Development Framework
SMME	Small, medium and macro enterprises
SOB	State of Biodiversity
SPM	Single Point Mooring
SWSA	Strategic Water Source Area
TMG	Table Mountain Group

TPC	Threshold of Potential Concern
U-AMP	User Asset Management Plan
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VU	Vulnerable
WCBSP	Western Cape Biodiversity Spatial Plan
WCNCB	Western CapeNature Conservation Board
WCPAES	Western Cape Protected Area Expansion Strategy
WCPG	Western Cape Provincial Guideline
WfW	Working for Water
WHS	World Heritage Site
WMA	Water Management Area
WWF-SA	World Wide Fund for Nature – South Africa

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EXECUTIVE SUMMARY

In compliance with the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM:PAA) and Chapter 4 of the World Heritage Convention Act, 1999 (Act No. 49 of 1999), the management authority of a protected area is required to develop management plans for each of its protected areas. The national minister is authorised under section 25(1) of the World Heritage Convention Act, 1999 (Act No. 49 of 1999) to approve the management plan for a protected area so nominated, or declared under the World Heritage Convention Act, 1999 (Act No. 49 of 1999). Both the national minister and MEC in a particular province has concurrent jurisdiction to approve a management plan for a protected area submitted under section 39(2) of the NEMPAA. In developing the management plan for the Garden Route Complex World Heritage Site and Nature Reserves (GRCWHS&NR), CapeNature as the management authority strives to establish biodiversity conservation as a foundation for a sustainable economy, providing ecosystem services, access and opportunities for all.

An Overview of the Garden Route Complex World Heritage Site and Nature Reserves

The Garden Route Complex World Heritage Site was inscribed by the World Heritage Convention, United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2015 as a part of the Cape Floristic Region Protected Areas World Heritage Site extension. The latter comprises a serial property of ten protected areas covering a total area of 187 578.96 ha. Several additional properties have since been acquired for conservation purposes in order to expand and consolidate the protected area network, which increased the total size of the protected area network to 198 308.24 ha. A buffer zone of approximately 92 295.67 ha designed to facilitate functional connectivity and mitigate the effects of global climate change and other anthropogenic influences has also been identified. The GRCWHS&NR is supported and buffered by a network of adjacent or surrounding conserved areas ranging from Provincial Nature Reserves to Private Nature Reserves, Stewardship sites and the Garden Route National Park managed by SANParks.

The GRCWHS&NR represents outstanding examples of significant ongoing ecological and biological processes in the evolution of terrestrial ecosystems and plant communities such as a natural fire regime, and natural flow of water through the area supporting unique indigenous freshwater fish assemblages and agricultural sectors, and connectivity for species migration, gene flow, dispersal, etc. In addition, the GRCWHS&NR contains important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value.

Planning, Policy, Implementation and Review

The Open Standards for the Practice of Conservation is a Strategic Adaptive Management framework that is robust, yet flexible, multi-disciplinary in approach, and inclusive of internal and external stakeholders, as well as the public at large. It enables management teams to develop effective conservation plans, based on the best available traditional, expert and scientific information. Furthermore, it promotes

stakeholder and public engagement throughout the planning and implementation phase of the management plan. Key to this process is identifying the ecological and human well-being values representative of the protected area, determining what state they are in, and what threats they face. This forms the basis for establishing clear goals, strategies and objectives that are time bound.

This management plan provides the basis for the management, development and operation of the GRCWHS&NR over a timeframe of 10 years. The implementation of the management plan is subject to legislation, regulations, policies and guidelines to ensure and promote sound financial and biodiversity management, effective compliance, safety, good neighbour relations and to promote sustainable access to the reserve.

Fundamental to implementation is pursuing the achievement of conservation outcomes and regular review thereof. Strategic Adaptive Management integrates planning, management, and monitoring, and is used to systematically evaluate results, thus enabling management to "change direction" when required. Key to this process is the sharing of results, respectfully, honestly and transparently to facilitate learning through critical appraisal of conservation efforts. CapeNature uses an internationally recognised review system - The Management Effectiveness Tracking Tool for South Africa, adopted by the National Department of Forestry, Fisheries and the Environment, to assess the management effectiveness of all of its protected areas at a strategic level. Additionally, mechanisms for monitoring and evaluation are built into each aspect highlighted in the strategic plan.

Purpose, Vision and Desired State

CapeNature manages the GRCWHS&NR in accordance with its organisational vision, and in agreement with the vision, goals and strategies derived through the planning process. The vision of the GRCWHS&NR is:

"The Garden Route Complex World Heritage Site and Nature Reserves conserve living landscapes and seascapes that represent the region's biodiversity and ecosystems through integrated management and partnerships for the benefit of all".

Protected area values include healthy catchments, providing ecosystem services and human well-being benefits. Six conservation targets that incorporate a number of nested aspects have been selected for the GRCWHS&NR. These include:

1. Fynbos Mosaics including Indigenous Forests;
2. Brenton Blue Butterfly;
3. Freshwater Ecosystems;
4. Coastal Ecosystems including Estuaries;
5. Marine Ecosystems; and
6. Cultural Heritage, Scenic Land and Seascapes.

As the public entity responsible for biodiversity conservation in the Western Cape Province, CapeNature delivers a suite of core services to the public in support of the following outcomes: resilient ecosystems; the promotion of local economic development; job creation and skills development; growing diversified nature-based revenue streams; access to environmental education, advocacy and education; and access to natural and cultural heritage. Human well-being values that have been identified for the GRCWHS&NR include:

- Water security and environmental resilience;
- Security from natural disasters;
- Respect and care for the natural environment;
- Freedom of choice and capacity to act independently; and
- Tourism and nature-based economic opportunities.

Twenty-one goals have been formulated to maintain or enhance the conservation targets and human well-being values of the GRCWHS&NR. These are:

1. By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.

2. By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the Protea indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.

3. By 2033 surveys and monitoring of the Brenton Blue Butterfly within the Brenton Blue Butterfly Special Nature Reserve and other potential habitats have continued to confirm the conservation status of the species and healthy* populations of the food plant (*Indigofera erecta*) are maintained within proclaimed nature reserves. **More than 1000 individuals*.

4. By 2033 the ecosystem health condition of all wetlands in the GRCWHS&NR is near-natural with good wetland buffers and Groenvlei is at least a “C” condition (moderately modified). (Wetlands include seepage areas.)

5. By 2033 river flow of abstracted rivers is maintained above 80%.

6. By 2033 all rivers within the GRCWHS&NR are maintained in a healthy state* to support fish species of conservation concern. **Rivers that support macro-invertebrate species communities represent an ASPT of 6-8 with >50% of expected fish species present in at least two age classes and have a natural flow regime*.

7. By 2033 an established groundwater monitoring programme exists to improve the understanding of groundwater dependent ecosystems.

8. By 2033 all rivers within the GRCWHS&NR have been surveyed and the status of all fish Critical Biodiversity Areas (CBAs) determined.

9. By 2033 there is an improved understanding of the population dynamics of the carp population in Groenvlei Lake and a self-sustaining removal program in place, based on the ecological assessment results and recommendations.

10. By 2033 all domestic livestock, extra-limital and invasive faunal species* are removed or appropriately managed within the GRCWHS&NR. **Invasive faunal species in the MPAs will be managed appropriately and not necessarily removed.*

11. By 2033 biodiversity and ecosystems, and sustainable and regulated resource use are in accordance with applicable legislation, CapeNature policies and procedures.

12. By 2033 the estuarine health index category is maintained or improved for the Goukamma estuary to Category A/B or B and the Keurbooms estuary to Category A/B*. **A = Unmodified, approximates natural condition; B = Near-natural with few modifications.*

13. By 2033 the health* of the intertidal and inshore zones of the Goukamma and Robberg Marine Protected Areas is maintained at the current baseline state (good). **Stable populations of identified indicator species of the Agulhas sandy inshore habitats and stable adult-to-juvenile ratios of African black oystercatchers*.

14. By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. **Goukamma = 71 species; Robberg = 64 species.*

15. By 2033 the Cape fur seal populations at Robberg and Mossel Bay Seal Island are persistent and breeding.

16. By 2033 an integrated compliance and enforcement programme is being implemented.

17. By 2033 the natural and scenic land and seascapes are recognized and preserved as important landscape features providing ecosystem services that support human wellbeing.

18. By 2033 all forestry exit areas and other identified state land have been transferred and secured into the conservation estate and three priority properties will have signed stewardship agreements within priority corridors.

19. By 2033 anti-litter, energy and water saving campaigns within the GRCWHS&NR are contributing towards a healthy environment.

20. By 2033 all human disturbance to heritage features within the GRCWHS&NR is limited to maintain, or where feasible, improve condition.

21. By 2033 any land invasions/occupations or disturbance within the GRCWHS&NR are dealt with swiftly and effectively resolved*. **Within 12-24 hrs; occupants and structures removed within legal timeframes.*

<u>Threats</u>

Threats and contributing factors that degrade or destroy the GRCWHS&NR conservation targets were identified and unpacked in a conceptual model to illustrate the current conservation situation and to guide the formulation of mitigating strategies.

The main threats to the focal biodiversity values of the GRCWHS&NR were identified as:

- Invasive alien plants
- Inappropriate fire regime
- Biological alien organisms
- Bush encroachment
- Climate change and extreme weather conditions (droughts, storms and flooding)
- Over-abstraction of surface and ground water
- Habitat fragmentation / transformation
- Invasive alien fish (freshwater systems)
- Illegal and/or unsustainable harvesting of indigenous flora
- Fishing and harvesting of aquatic resources
- Hunting and/or collection of indigenous fauna
- Transportation and service corridors (shipping routes)
- Energy production (oil and gas exploration and drilling, wind and solar energy farms)
- Pollution: domestic, industrial, urban wastewater and oil spills
- Garbage and solid waste
- Vandalism and theft to Cultural Heritage Sites
- Mining and quarrying
- Instream and riparian structures (dams, bridges, weirs, jetties)
- Illegal recreational activities
- Telecommunication towers/high sites
- Tourism developments on-reserve
- Invasive alien fauna (terrestrial and marine)
- Human intrusion and disturbance
- Agro-industry plantations.

To assist the GRCWHS&NR to mitigate and manage threats and contributing factors effectively, both inside and outside the reserve boundaries, the reserve will incorporate spatial planning tools that include the **Sensitivity, Zonation and Zone of influence.**

<u>Strategic Plan</u>

A thorough analysis of the GRCWHS&NR conservation situation, inclusive of the biological, social, economic, cultural and institutional systems that affect the protected area’s conservation targets, formed the basis for developing conservation strategies and action plans. The aim was to identify opportunities and strategic points where intervention is feasible and likely to have the biggest positive impact towards achieving goals. CapeNature will lead the implementation of the management plan, although achieving the protected area’s vision requires coordinated effort between various key external stakeholders. Fourteen key strategies have been identified to assist the GRCWHS&NR. These are:

Strategy 1: Through partnerships, address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.

Strategy 2: In collaboration with partners, promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within GRCWHS&NR and zone of influence.

Strategy 3: In collaboration with relevant specialists and research institutions, monitor the Brenton Blue Butterfly population and habitat and implement appropriate management actions within the Brenton Blue Butterfly Special Nature Reserve.

Strategy 4: Through partnerships, address agricultural and urban (including industrial) water use best practice, pollution incidents and compliance within the zone of influence.

Strategy 5: Determine through partnerships and collection of empirical evidence the impact of groundwater abstraction on groundwater dependent ecosystems.

Strategy 6: Through partnerships, implement alien invasive fish control in Groenvlei Lake and relevant management actions in priority rivers.

Strategy 7: Through partnerships and extension work, address alien invasive, domestic and extra-limital fauna within the GRCWHS&NR and its zone of influence in line with relevant legislation and policies (Dept of Agriculture, Land Reform and Rural Development, Dept of Forestry, Fisheries and the Environment: Oceans and Coasts, Dept of Environmental Affairs and Development Planning and research institutions).

Strategy 8: Ensure the conservation of biodiversity and ecosystems and the sustainable and regulated use of resources within the GRCWHS&NR and zone of influence through the development and strengthening of partnerships.

Strategy 9: Address illegal and unsustainable resource utilisation practices within the GRCWHS&NR and its zone of influence through partnerships, extension work and enforcement actions (Dept Fishery, Forestry and Environment: Oceans and Coasts, South African National Parks, South African Police Service and Stewardship sites).

Strategy 10: Through partnerships and extension work, address illegal and inappropriate agricultural, tourism, urban, industrial, communication and energy production developments within the GRCWHS&NR and its zone of influence. (Dept of Agriculture: Western Cape (LandCare), Dept Water & Sanitation, Breede Gouritz Catchment Management Agency, Dept Environmental Affairs and Development Planning, Dept Environmental Affairs: Oceans & Coasts).

Strategy 11: Promote and implement the Protected Areas Expansion Strategy in collaboration with relevant partners to support ecological processes and maintain living land and seascapes (through the establishment of ecological buffer areas and corridors).

Strategy 12: Promote the values of a healthy environment for the benefit of present and future generations within the GRCWHS&NR and its zone of influence through partnerships.

Strategy 13: Through partnerships, share, evaluate and enhance the management and protection of cultural and natural heritage values both internally and externally.

Strategy 14: Through partnerships, monitor and manage land invasions/occupations and disturbance within the GRCWHS&NR and its zone of influence (South African Police Service, Protected Area Advisory Committee, Local Municipalities, South African National Parks, Transnet and South African National Road Agency).

Note that there is no specific strategy to deal with climate change as a threat. Climate change is an over-arching threat that affects all the conservation targets The Conservation Standards framework focuses on climate adaptation in identifying threats to conservation targets and developing strategies to abate these threats, and in so doing, providing resilience to the impacts of climate change.

1 INTRODUCTION

In working towards CapeNature's vision of conserving nature for a sustainable future, CapeNature's protected area management, in accordance with the purpose of the protected area, strives to:

- Conserve and represent natural habitats and indigenous biodiversity including threatened species for their scientific and conservation value in the Western Cape Province;
- Conserve representative samples of significant ongoing ecological processes in the evolution and development of ecosystems and communities of plants and animals;
- Provide ecosystem services for the benefit of all;
- Manage protected areas effectively and efficiently, including the interrelationships between biophysical, social and economic environments;
- Ensure that protected area planning and management is integrated and participatory; and
- Provide for sustainable use and equitable access.

The management plan is a strategic adaptive management framework for the protected area, guided by the Open Standards for the Practice of Conservation (hereafter referred to as the Conservation Standards) (Conservation Measures Partnership (CMP) 2020) adaptive management paradigm. The Conservation Standards is dependent upon and promotes stakeholder engagement and participatory planning in the development of the plan. The framework further stimulates the incorporation of mechanisms to facilitate stakeholder engagement and participation during operationalisation of the plan.

The Garden Route Complex World Heritage Site and Nature Reserves (GRCWHS&NR) protected area management plan serves as a reference to the management and development of the complex in its current and envisaged future state. It directs management at all levels. The management plan addresses:

- The mandate, human capacity and financial resources that are required to meet goals and objectives based on the condition of natural and cultural values, and core service areas requiring a focused effort;
- The delivery of socio-economic benefits to neighbouring communities;
- Flexibility of service delivery that encourages innovation and involvement by a wide range of government, community and non-government sectors; and
- Performance indicators and accountability measures that provides for regular review and adaptive management.

2 LEGAL STATUS AND BACKGROUND

This section provides a record of the legal status of the protected area, as well as its description, location and includes any areas designated by South Africa in terms of international agreements. Furthermore, it also provides an overview of the biophysical, biodiversity, heritage and socio-economic context.

2.1 Legal Status

2.1.1 Name and legal designations

The Cape Floral Region Protected Areas World Heritage Site (CFRPA WHS) as inscribed in 2004 was proclaimed in terms of the World Heritage Convention Act, 1999 (Act No. 49 of 1999) in Government Gazette no. 31832, proclamation 72 of 30 January 2009. This WHS included eight protected area components: Cedarberg Wilderness Area, Groot Winterhoek Wilderness Area, Table Mountain National Park, Boland Mountain Complex, Swartberg Complex, Boosmansbos Wilderness Area, De Hoop Nature Reserve and Baviaanskloof Wilderness Area.

In 2015 the CFRPA WHS was extended to include the Garden Route Complex which consists of the Garden Route National Park managed by South African National Parks (SANParks) and the following CapeNature-managed protected areas:

- **Ruitersbos State Forest Reserve:** Proclaimed a State Forest Reserve in Government Notices under various Forest Acts between 1947 and 1978 but later released in terms of Government Notice No. 596 of 2006 dated 5 May 2006.
- **Witfontein State Forest Reserve:** Proclaimed a State Forest Reserve in Government Notices under various Forest Acts between 1936 and 1977 but later released in terms of Government Notice No. 596 of 2006 dated 5 May 2006.
- **Doringrivier Wilderness Area:** Proclaimed a Wilderness Area in Government Notice No. 11307 dated 20 May 1988.
- **Goukamma Provincial Nature Reserve:** Established in terms of Section 6 (1) of the Nature Conservation Ordinance, 1974 (Ordinance No. 19 of 1974) on 12 April 1994 and proclaimed in the Provincial Gazette 4854 by Proclamation No. 37/1994). The boundary of the nature reserve was amended by the addition of the farm Walkers Point No. 215, Buffalo Bay, in Provincial Gazette 5533 dated 9 June 2000 by way of Proclamation 45/2000.
- **Keurbooms River Nature Reserve:** Established in terms of Section 6 (1) of the Nature Conservation Ordinance, 1974 (Ordinance No. 19 of 1974) on 18 December 1979 and proclaimed in the Provincial Gazette 1 by Proclamation No. 1/1980.
- **Robberg Nature Reserve:** Established in terms of Section 6 (1) of the Nature Conservation Ordinance, 1974 (Ordinance No. 19 of 1974) on 25 July 1980 and proclaimed in the Provincial Gazette 4116 by Proclamation No. 172/1980.

On 2 December 2022 the extension of the CFRPA WHS was proclaimed in terms of the above-mentioned Act. A full list of the land parcels included in the WHS is presented in Appendix 1, Table 1. Note that information for the Garden Route National Park is not included in this management plan. A separate management plan for the

Garden Route National Park was compiled by SANParks and approved by the minister in 2020 (SANParks 2020).

The GRCWHS&NR also comprises additional protected areas that have not been included as part of the land parcels inscribed as WHS but form part of the protected area network managed by CapeNature, namely:

- **Goukamma Marine Protected Area:** Established in terms of the Sea Fisheries Act, Act 12 of 1988 on 27 July 1990 and proclaimed in the Provincial Gazette 12667 by Proclamation No. R1810/1990 with amendment in Provincial Gazette 12805 by Proclamation No. R2497/1990. Subsequently the above Act has been replaced by the Marine Living Resources Act, 1998 (Ac No. 18 of 1998) and the Goukamma MPA, was re-proclaimed as a Marine Protected Area in terms of section 43 of this Act and published in Government Gazette No. 21948 dated 29 December 2000 by way of Government Notice R.1429 of 2000. Only shore angling is allowed between Portion 1 of the farm Walker's Point at Buffels Bay and the western boundary of the Goukamma Nature Reserve, extending one nautical mile seawards from the high-water mark. The use of personal watercraft is not allowed.
- **Brenton Blue Butterfly Special Nature Reserve (BBBSNR):** Established in terms of the Environmental Management Act, 1989 (Act No. 73 of 1989) on 4 July 2003 and proclaimed in the Provincial Gazette 25134 by Proclamation No. 939/2003.
- **Mossel Bay Seal Island Provincial Nature Reserve:** Established in terms of Section 6(1) of the Nature and Environmental Conservation Ordinance, 1974 (Ordinance 19 of 1974) on 9 March 1988 and proclaimed in Provincial Gazette 4524 by Proclamation No. 23/1988.
- **Robberg Marine Protected Area:** Established in terms of the Sea Fisheries Act, 1988 (Act 12 of 1988) on 27 July 1990 and proclaimed in the Provincial Gazette 12667 by Proclamation No. R1810/1990 with amendment in Provincial Gazette 12805 by Proclamation No. R2497/1990. Subsequently the above Act has been replaced by the Marine Living Resources Act, 1998 (Act No. 18 of 1998) and the Robberg MPA was re-proclaimed as a Marine Protected Area in terms of Section 43 of this Act and published in Government Gazette No. 21948 dated 29 December 2000 by way of Government Notice R.1429 of 2000. No fishing is allowed in a rectangular area surrounding the Robberg Peninsula between the latitudes 34°04.916'S and 34°07.633'S and the longitudes 023°22.300'E and 023°25.967'E, although shore angling is allowed. Personal watercraft is not allowed.
- **Annex Vlugt:** Proclaimed a State Forest Reserve in Government Notices under various Forest Acts between 1912 and 1978, but later released in terms of Government Notice No. 596 dated 5 May 2006.

In 2020 the Zebraskop property, located north of Ruitersbos, was acquired for conservation purposes to expand and consolidate Gamkaberg WHS with the Outeniqua WHS (Appendix 2 Map 1). This property is currently in the process of being proclaimed as a Provincial Nature Reserve.

In addition, since the early 2000s there has been an extended process of transferring several ex-forestry areas under the management of Dept of Forestry, Fisheries and the Environment (DFFE) to the Western Cape Province to be managed by the Western Cape Nature Conservation Board. These properties are known as the 'forestry exit areas' and will be proclaimed as Provincial Nature Reserves once the transfer process has been completed. Appendix 1, Table 2 provides a list of these land parcels.

The spatial boundaries for the individual land parcels within the CapeNature reserve layers were extracted from the cadastral boundaries spatial layer provided by the Surveyor-General (SG) (Office of the Chief Surveyor-General 2011). According to the Land Survey Act, 1997 (Act No. 8 of 1997), and the South African Spatial Data Infrastructure established as per the Spatial Data Infrastructure Act, 2003 (Act No. 54 of 2003), the Surveyor-General is the custodian of all cadastral surveying and land information.

Each land parcel boundary was verified against available proclamations and SG diagrams. Any differences between the SG cadastral boundaries and the proclaimed areas of the SG diagrams were corrected accordingly. The areas for each land parcel were calculated using geographical information system (GIS) with the projection set to Universal Transverse Mercator, zone 34 South.

A full list of the declarations and status of land appears in Appendix 1, Tables 1 & 2.

2.1.2 Contractual agreements

Protected areas managed by way of contractual agreements are one of the options available for private landowners who wish to manage their land for conservation and improve the ecological representation of the complex. Appendix 1, Table 2 provides a summary of land contractually included into the complex. In this regard, the following land was incorporated:

Buffalo Valley Contract Nature Reserve: Proclamation as a Nature Reserve in terms of Section 23 (1) of the NEM:PAA is currently underway. A Protected Area Management Agreement established in terms of Section 2 of the Western Cape Nature Conservation Board Act, 1998 (Act No. 15 of 1998) t/a CapeNature has been drawn up between CapeNature and the Buffalo Valley Trust on 9 March 2012. CapeNature has been appointed as the Managing Authority for this property for a period of 30 years.

The Zebraskop property mentioned above that was purchased for conservation purposes by the WWF-SA is being managed by CapeNature, based on a 99-year lease contract. This property is in the process of being proclaimed as a Nature Reserve in terms of Section 23 (1) of the NEM:PAA.

2.1.3 Location, extent and highest point

The GRCWHS&NR is located on the Outeniqua Mountains and the adjacent coastal plain area of the Garden Route between the Gouritz River in the west and the Keurbooms River in the east. This protected area network is 88 042 ha in size.

For reference and management purposes the GRCWHS&NR has been split into three clusters, with the larger clusters consisting of different sectors and will be referred to as such throughout the management plan (Appendix 2, Map 1):

- **Outeniqua Cluster** consists of the Witfontein, Doringrivier, Ruitersbos and Zebraskop sectors and the adjacent Forestry Exit land, totalling 57 469 ha. This cluster extends for approximately 80 km from roughly the Gouritz River in the west to Bergplaas above the town of Wilderness in the east.

  Witfontein sector is situated between the towns of George, Wilderness and Hoekwil in the south and with the rural farming communities of Herold in the north and Waboomskraal to the west. It comprises 20 195.8 ha and is intersected by the north-south Outeniqua and Montagu Passes. Three well known mountain peaks on Witfontein are Cradock Peak (1 579 metres above sea level (m.a.s.l.), George Peak (1 337 m.a.s.l) and Melville Peak (1 301 m.a.s.l.)).

  Doringrivier sector lies between the Robinson Pass and west of the Outeniqua Pass and adjoins the northern boundary of the Ruitersbos sector. The highest points are Engelseberg (1 521 m.a.s.l.), Jonkersberg (1 465 m.a.s.l) and Saagtandberg (1 374 m.a.s.l.). The total extent of this sector is 11 495.8 ha.

  Ruitersbos sector adjoins the Doringrivier sector on the eastern side and is 20759.4 ha in size. Towns in close proximity to the southern boundary of the sector are Friemersheim, Ruitersbos, Bonniedale and Brandwag. The Robinson and Attaquaskloof Passes intersect the Ruitersbos sector with the highest peaks being Ruitersberg (1 363 m.a.s.l.) Fouriesberg (1 197 m.a.s.l.), Attaquasberg (1 175 m.a.s.l.) and Sebraskop (1 170 m.a.s.l.).

  Zebraskop sector abuts the northern boundary of the Ruitersbos sector. It stretches northwards into the Klein Karoo towards the Gamkaberg WHS and is 5 017.9 ha in extent. The highest point is 989.1 m.a.s.l.

- **Goukamma Cluster** consists of Goukamma, Buffalo Valley, Goukamma Marine Protected Area and Brenton Blue Butterfly sectors, situated along the coast, approximately 40 km east of George, 20 km west of Knysna and south of the N2 highway. Mossel Bay Seal Island also forms part of this cluster.

  Goukamma sector covering an area of 2 711.8 ha is located east of Sedgefield and stretches up to Buffalo Bay. The highest point is at Trig. Beacon 221 and is 202.3 m.a.s.l.

  Buffalo Valley sector is 396.9 ha in size and abuts the northern boundary of the Goukamma sector. It is being managed as a unit by CapeNature.

  Goukamma MPA sector includes 16.5 km of coastline (from Buffalo Bay to Platbank) and reaches 1 nautical mile (1.85 km) out into the Indian Ocean. It is 4 111.1 ha in extent.

  Brenton Blue Butterfly sector is 1.7 ha in size and located at Brenton on Sea, ca. 5 km east of Goukamma and is managed from the Goukamma office.

  Mossel Bay Seal Island sector is a small nature reserve comprising of 3.3 ha and situated 6 km offshore from Mossel Bay. This island is managed as part of the Goukamma Cluster.

- **Keurbooms River Cluster** consists of Keurbooms River, Robberg, Robberg Marine Protected Area and Annex Vlugt sectors.

Keurbooms River sector is 1 081.8 ha in extent and situated approximately 6 km north-east of Plettenberg Bay on the N2 national road towards Port Elizabeth and includes the section of the Keurbooms River and adjacent land from the N2 bridge northwards up the gorge for about 7 km and the reserve office which is situated on Erf 542 in Plettenberg Bay. The highest point on Keurbooms is the plateau area of 240 m.a.s.l.

Robberg sector (230.9 ha) situated approximately 7 km south of Plettenberg Bay is a peninsula, and thus almost entirely surrounded by the sea, except for the western section, where it abuts the mainland. The coastline is approximately 9.5 km long, of which 8.5 km is rocky shoreline, and the remaining beach sand. The highest point on the Robberg peninsula is 148.5 m.a.s.l.

Robberg Marine Protected Area sector is 3 169.2 ha in extent and almost surrounds Robberg, except where the latter is connected to the mainland.

Annex Vlugt sector is a solitary triangular-shaped property of 475.3 ha and is situated approximately 32 km southeast of the Kammanassie WHS and 27 km northeast of the Keurbooms River sector. The highest point is located at the far southeastern corner at 649 m.a.s.l. where it adjoins the Tsitsikamma Section of the Garden Route National Park. The historical Prince Alfred's Pass intersects the property. This property is managed from the Plettenberg Bay office as part of the Keurbooms River Cluster.

The location and extent of the GRCWHS&NR is illustrated in Appendix 2, Map 1.

2.1.4 Municipal jurisdiction

The GRCWHS&NR is situated entirely within the Garden Route District Municipality and the following local municipalities:

- Mossel Bay Local Municipality;
- Oudtshoorn Local Municipality;
- George Local Municipality;
- Knysna Local Municipality; and
- Bitou Local Municipality.

Municipalities within which the GRCWHS&NR occurs are shown in Appendix 2, Map 1.

2.1.5 International, national and provincial listings

UNESCO World Heritage Site

The Garden Route Complex WHS is inscribed as part of the extension to the CFRPA WHS. The CFRPA WHS comprises a serial property of eight initial protected areas that were inscribed in 2004 and extended in 2015. The Garden Route Complex covers a total area of approximately 557 584 ha. It includes a buffer zone of 798 514 ha designed to facilitate functional connectivity and mitigate the effects of global climate change and other anthropogenic influences (Dept of Environmental Affairs (DEA) 2015).

The Garden Route Complex WHS represents outstanding examples of significant ongoing ecological and biological processes in the evolution of terrestrial ecosystems and plant communities (Dept of Environmental Affairs & Tourism (DEAT) 2003) such as a natural fire regime and natural flow of water through the area, supporting unique indigenous freshwater fish assemblages and agricultural sectors, and connectivity for species migration, gene flow, dispersal, etc.

The Garden Route Complex WHS contains important and significant natural habitats for *in-situ* conservation of biological diversity, including those containing threatened species of outstanding universal value (DEAT 2003). The complex is a centre of endemism for plants, amphibians, small mammals and importantly, endemic and threatened freshwater fish.

UNESCO Biosphere reserves

The Garden Route Biosphere Reserve (GRBR) was designated in June 2017 by UNESCO as South Africa's 9th biosphere reserve and falls within the CFR along the southern coast and includes the Goukamma and Robberg Marine Protected Areas, the Nelson Bay Cave situated in Robberg sector, the Wilderness Lake RAMSAR site, the Garden Route National Park and the Langkloof Valley. The GRBR's surface area totals 698 363 ha and contains high species diversity.

The Gouritz Cluster Biosphere Reserve (GCBR), a landscape-scale initiative aimed to create a biodiversity corridor along the Gouritz River, where naturally occurring indigenous plants and animals could disperse freely from conservation areas of the inland mountains to the coastal mountains resulted in the designation of South Africa's 7th biosphere reserve in June 2015, totalling 3 187 893 ha. The GCBR is characterised by high levels of plant endemism and is the only area in the world where three global biodiversity hotspots, the Fynbos, Succulent Karoo and Maputoland-Tongoland-Albany Subtropical Thicket biomes, converge. Doringrivier, Ruitersbos and Zebraskop sectors form part of the Core Areas of the GCBR.

Provincial Heritage Sites (previously National Monuments)

Attaquaskloof Pass, Mossel Bay area was declared as a Provincial Heritage Site on 22 September 1995. Initially this pass was made and utilized by elephants before the arrival of European settlers later becoming the main road to the north (the old ox-wagon route) that linked Mossel Bay to Oudtshoorn. Attaquaskloof pass is 10 km long and reaches a height of 820 m.a.s.l.

Montagu Pass and the Old Tollhouse, George area were both declared as Provincial Heritage Sites on 4 August 1972. Built between 1844 to 1847 by 250 convicts, the passage over the Outeniqua Mountains became much easier (3 hours) compared to 3 full days for the early settlers. The Old Tollhouse is situated along the Montagu Pass where it cost one penny per wheel and one penny per ox to travel over the pass.

The Keur River Bridge in Montagu Pass was declared a Provincial Heritage Site on 18 December 1970.

Cradock Pass in the George area was declared a Provincial Heritage Site on 5 February 1999.

Robberg in the Plettenberg Bay area, including the 19 archaeological sites was declared a Provincial Heritage Site on 5 February 1999.

2.2 Biophysical Description

2.2.1 Climate

The climate of the Southern Cape is largely influenced by major air masses that extend over hundreds of kilometres. In the local context there are also many variations in temperature, rainfall and windiness that occur over shorter distances. Prevailing atmospheric conditions are also influenced by altitude, mountain orientation and distance from the Indian Ocean (Lubke & De Moor 1998).

2.2.1.1 Rainfall

The Southern Cape coastal region shows variations in rainfall patterns within a relatively small area. Although the GRCWHS&NR receives mainly winter rainfall it is not uncommon to receive rainfall all-year round. Rainfall patterns change as one moves further eastward, becoming characteristic of a bimodal rainfall pattern (rainfall peaking twice a year) with a strong orographic influence (rise and cooling of moisture-laden air) against the Outeniqua Mountains. Cold fronts bring winter rainfall that are associated with low-pressure systems and westerly winds. Snowfall occurs periodically on the high mountain peaks of the Outeniqua Mountains. Plettenberg Bay area and surrounds experience rainfall all-year round with spring being the wettest period. The George area also receives higher rainfall during the months of spring due to the late winter frontal systems as well as the effects of orographic rain due to the proximity of the Outeniqua Mountains (Lubke & De Moor 1998).

Thunderstorms occur during the summer months with lightning striking the high mountain peaks. In terms of global warming, climate modelling studies indicate that summer thunderstorms are likely to become more intense in the future, particularly those areas transitioning towards summer rainfall, thus potentially having a detrimental effect on the natural fire regimes of the protected areas.

An analysis of the rainfall data for each of the protected area clusters within the GRCWHS&NR is documented below. Note the period of rainfall data collected is indicated in brackets behind each station name.

Outeniqua Cluster rainfall. The Outeniqua Mountain Range spans an east-west gradient of 73 km in distance. Due to this extensive range, rainfall data have been collected from several manual and automatic stations to determine the seasonal distribution of rainfall for the Ruitersbos, Doringrivier and Witfontein sectors. The locations of these stations are shown in Appendix 2, Map 16.

Figure 2.1 shows the total annual rainfall measured from 1992 to present, as well as the average annual rainfall and the trendline for this 30-year period. Rainfall has been measured from the early 1990s to present at ten weather stations in the Outeniqua Cluster.

The Ruitersberg station has data collected over the longest period from 1992 to present date. Data from the D12 station show that the northern slopes of the Outeniqua Mountain Range are much drier than the southern slopes and that the stations situated at higher altitudes namely Ruitersberg, Ruitersbos office and Neriifolia receive noticeably more rainfall compared to the stations situated at lower altitudes. The highest annual rainfall for the Ruitersbos sector has been recorded from the Neriifolia station totalling 1 839.6 mm in 2011.

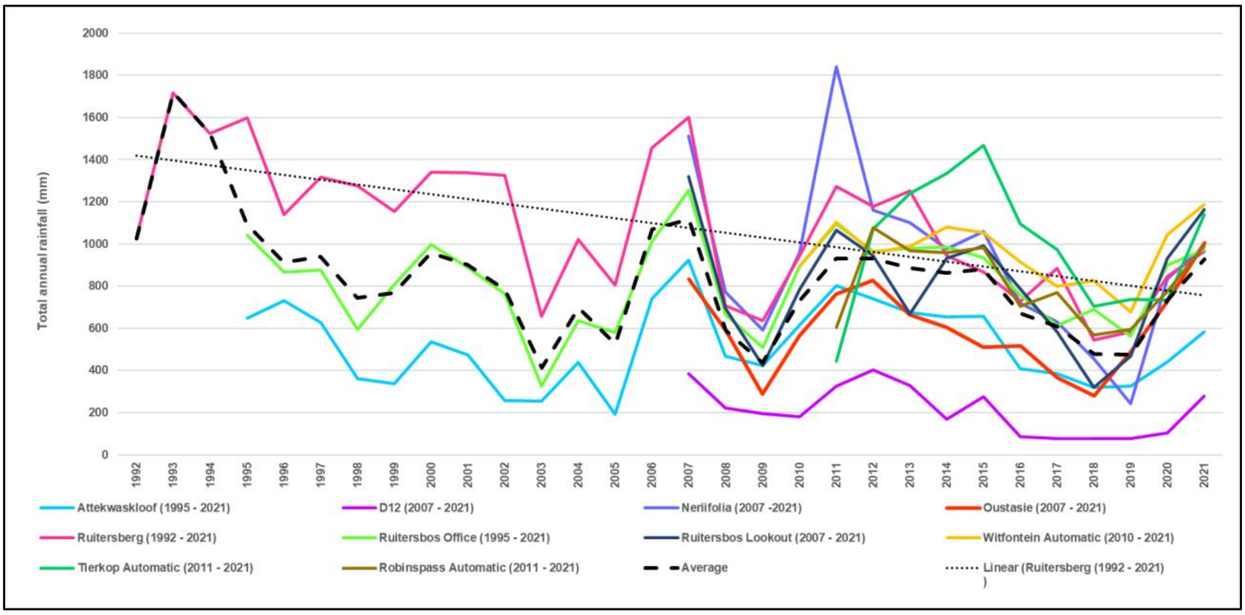

Figure 2.1: The annual total rainfall measured at various weather stations (manual and automatic) within the Outeniqua Cluster from 1992 to 2022. Average rainfall and the trendline are also indicated. Note the period of rainfall recorded for each station is indicated in brackets.

In 2010 and 2011 four automatic weather stations were installed by the South African Weather Service (SAWS) at Witfontein office (263 m.a.s.l.), Tierkop (988 m.a.s.l.) George Lookout Tower (521 m.a.s.l.) and the Robinson Pass (772 m.a.s.l.). The Witfontein station is the only fully automated station and records temperature, wind, humidity and rainfall. The remaining three automatic stations record rainfall only. The highest annual rainfall of 1 469 mm was recorded for the Witfontein sector from the Tierkop station in 2015. Witfontein station next to the office complex recorded its highest annual rainfall of 1 103 mm in 2011 and Robinson Pass received 1 077 mm in 2012. Unfortunately, the George Lookout Tower station was stolen in July 2018 and hence not shown here.

Total annual rainfall measured at all the weather stations shows a decline in rainfall over the period and this is indicated by the trendline. The sharp decline in annual rainfall from 2016-2019 is noteworthy. Incidentally this is also the time when the massive October 2018 George fire occurred (see 2.2.4.5 below).

The average rainfall recorded per month for each of the weather stations is shown in Figure 2.2. There are clear peaks in January and November, with a minor peak in March. At the D12 station, which is located on the Klein Karoo side of the mountain the monthly average rainfall over the period reaches a peak during June with slightly lower peaks in August and October, and the lowest rainfall months during December, January and February.

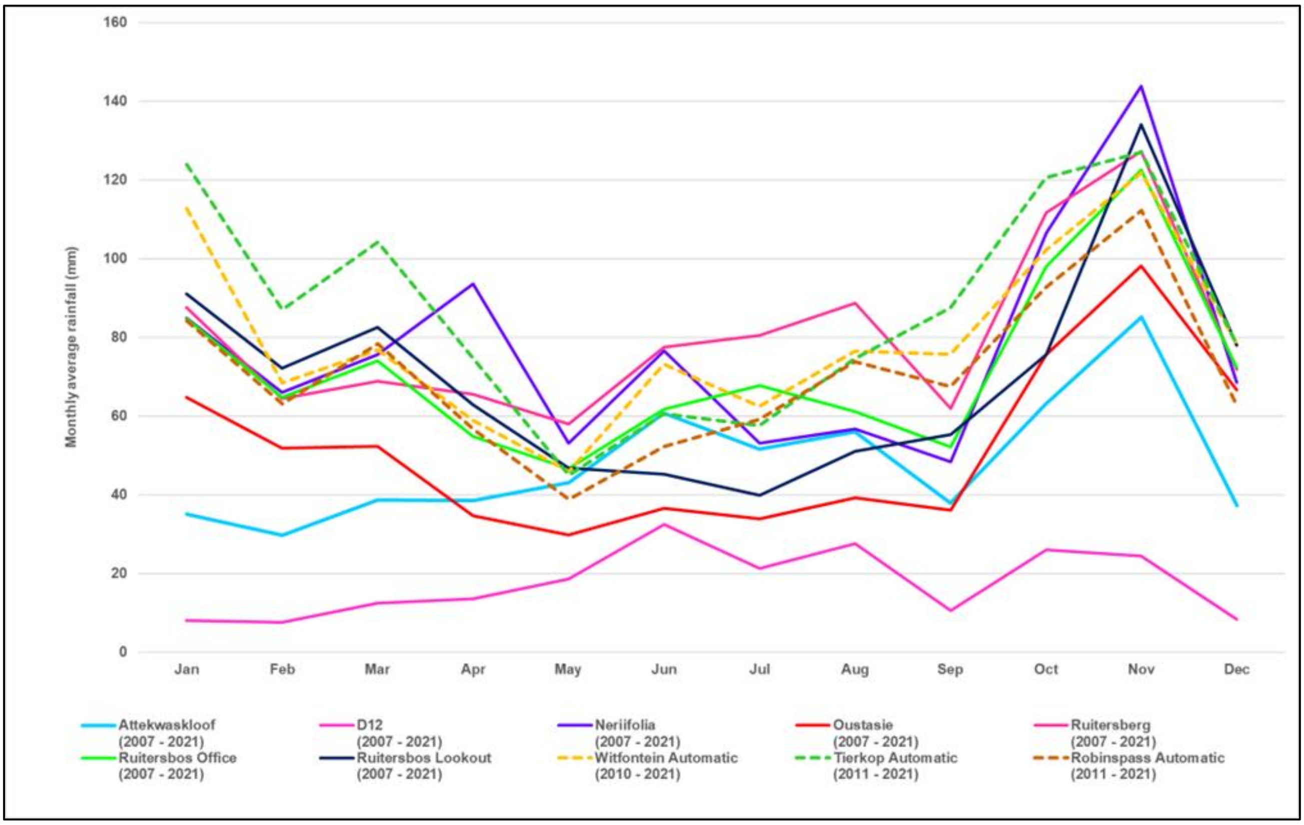

Figure 2.2: Average monthly rainfall recorded at the various weather stations within the Outeniqua Cluster. Note the period of rainfall recorded for each station in brackets.

Goukamma Cluster rainfall. In the Southern Cape, the cyclonic coastal lows are confined to areas below the escarpment of the Outeniqua Mountains. They show sharp changes in the wind direction, temperatures and humidity as they move eastward along the coast, typically bringing high intermittent rains. The wind change is generally to the south west. Due to the northward shift of the “Roaring Forties” belt there is an increase in coastal lows and associated cold fronts in winter. During summer, the Southern Indian Ocean Anti-cyclone ridging in south of the sub-continent, causes a predominance of easterly winds along the coast. These south easterly (SE) winds cause upwelling and bring cold water into the coastal areas (8°C). This sudden drop in water temperature often stuns fish which are subsequently washed onto the beaches. Precipitation is caused by advection of cool moist air by this anti-cyclone and by the influence of the mountains. The prevailing winds are south-easterly during summer and south-westerly during winter, while very strong winds are uncommon. (Schultz 1965).

Rainfall readings have been recorded monthly from one manual station located at Groenvlei Lake from 1989 to present. Total annual rainfall for this period is illustrated in Figure 2.3.

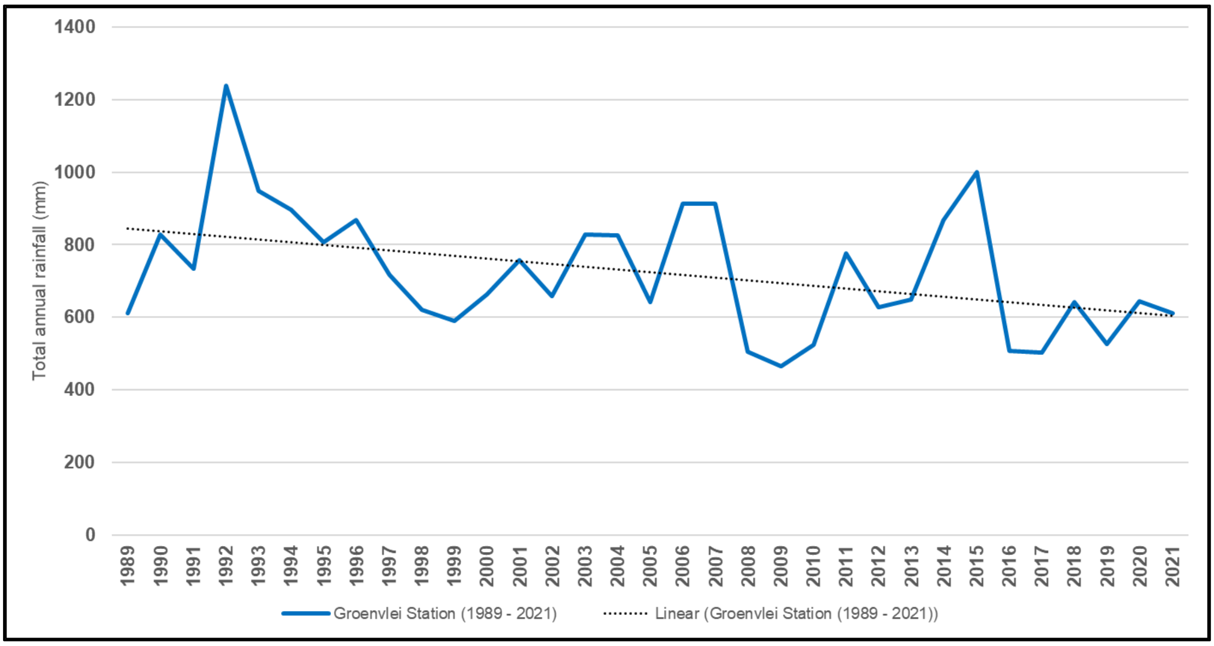

Figure 2.3: Total annual rainfall recorded at the Groenvlei weather station from 1989 to 2021. The trendline is also indicated.

The outstanding rainfall years of 1992 (1 239 mm) and 2015 (1 000 mm) are striking. However, the continual decline in rainfall over the 32-year period is evident and the very low rainfall years in 2008-2010 and 2016-2017 are alarming. Of significance is that the devastating Knysna fire occurred in 2017, which burnt almost the entire Goukamma sector (see 2.2.4.5 below).

The 32-year average monthly rainfall graph indicates three peaks during the year; a low peak during March, higher during August, with the highest in November (Figure 2.4). In August 2006 (274 mm) and November 2007 (273 mm) the highest rainfall was recorded over the period. Rain occurs mostly at night and in the early morning. Thunderstorms occur rarely and contribute little to the annual rainfall. The average humidity is high at 88%, caused by the close proximity of the warm ocean current (Agulhas Current). Frost and hail do occur, and dew is a common occurrence during autumn, winter and spring (Schultz 1965).

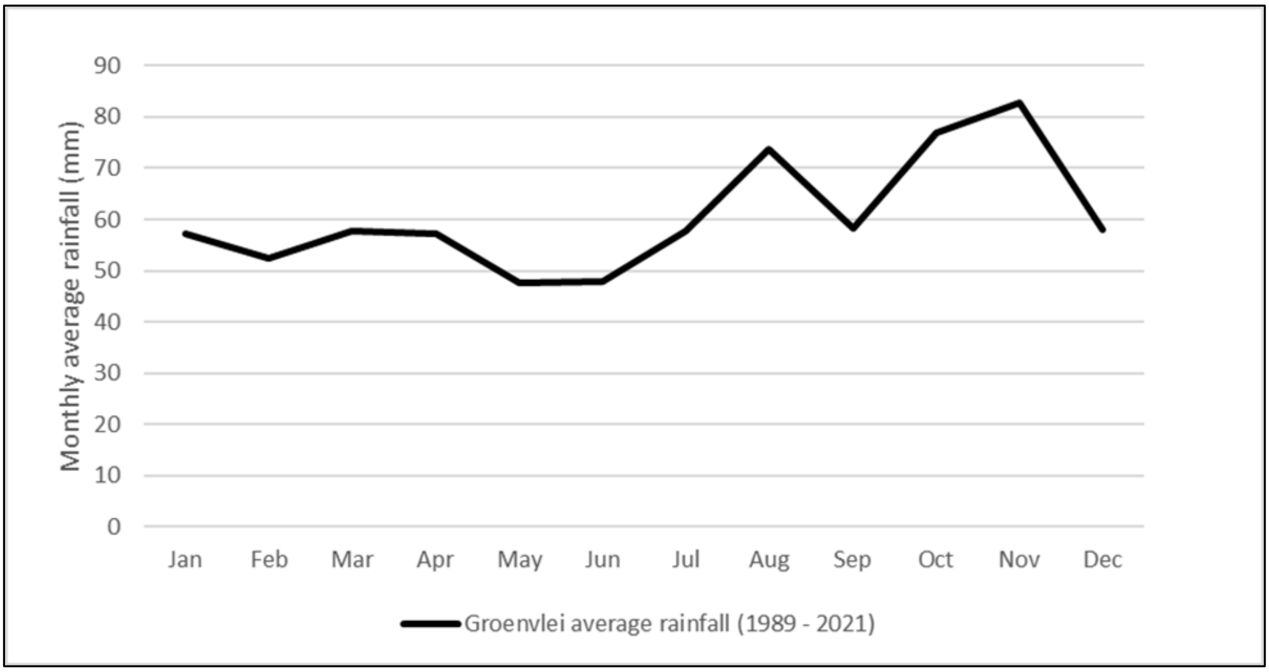

Figure 2.4: Monthly rainfall averages for the Groenvlei station from 1989 to 2021.

Keurbooms River Cluster rainfall. There are three weather stations in this cluster: at the Robberg entrance gate (148 m.a.s.l.) where rainfall has been recorded from 1998 to present; and at the Keurbooms River Bridge gate (113 m.a.s.l.) and Uplands (203 m.a.s.l.) where rainfall has been recorded from 1995 to present (Figure 2.5).

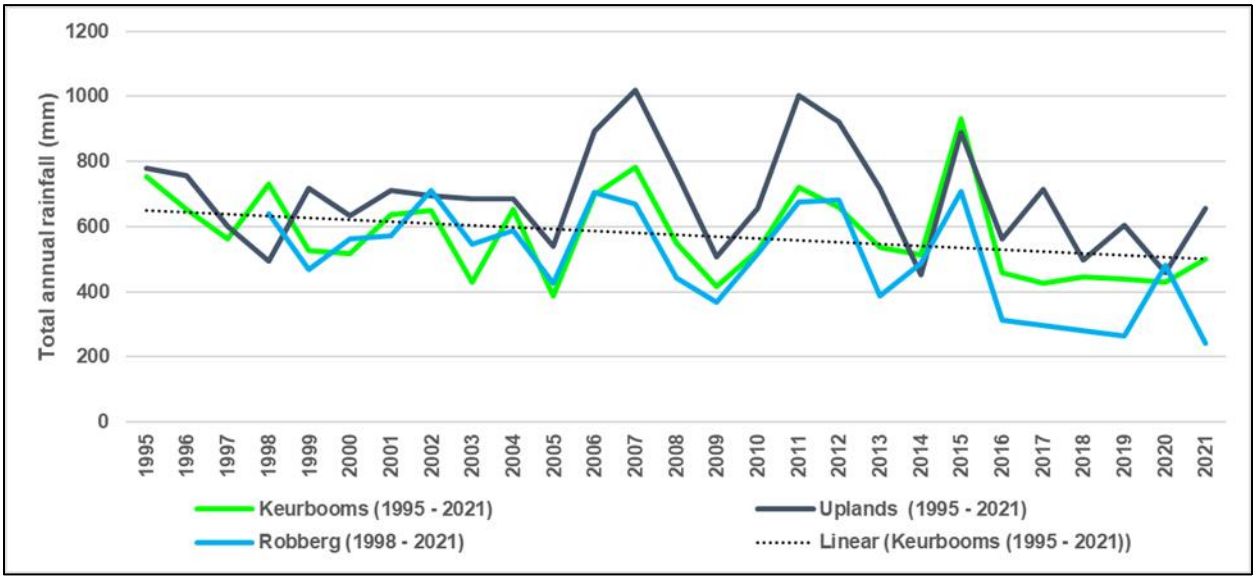

Figure 2.5: Total annual rainfall recorded at the Robberg, Keurbooms River office and Uplands weather stations from 1995 to 2021. The trendline is also indicated.

Rainfall at Uplands has fluctuated between 450 and 1 000 mm per annum, with peaks in 2006, 2007 2011, 2012 and 2015. At Keurbooms River Bridge gate the rainfall is lower, fluctuating between 388 and 800 mm per annum, but with an exceptional peak in 2015 of 933 mm. Robberg shows less fluctuation with smaller peaks in 2002, 2006, 2007, 2011, 2012 and 2015. The decline in annual rainfall over the 32-year period is evident.

Rainfall is spread throughout the year peaking from July to November in the Uplands area (Figure 2.6). At the Keurbooms River Bridge gate rainfall peaks in March, August and notably in November. The inland valleys generally receive less rain because of the rain shadow effect from the mountain ranges, which lie parallel to the coast. Rainfall in this region is spread throughout the year with a peak in August, October and November. For Robberg, rainfall peaks in July and August, with February being the driest month.

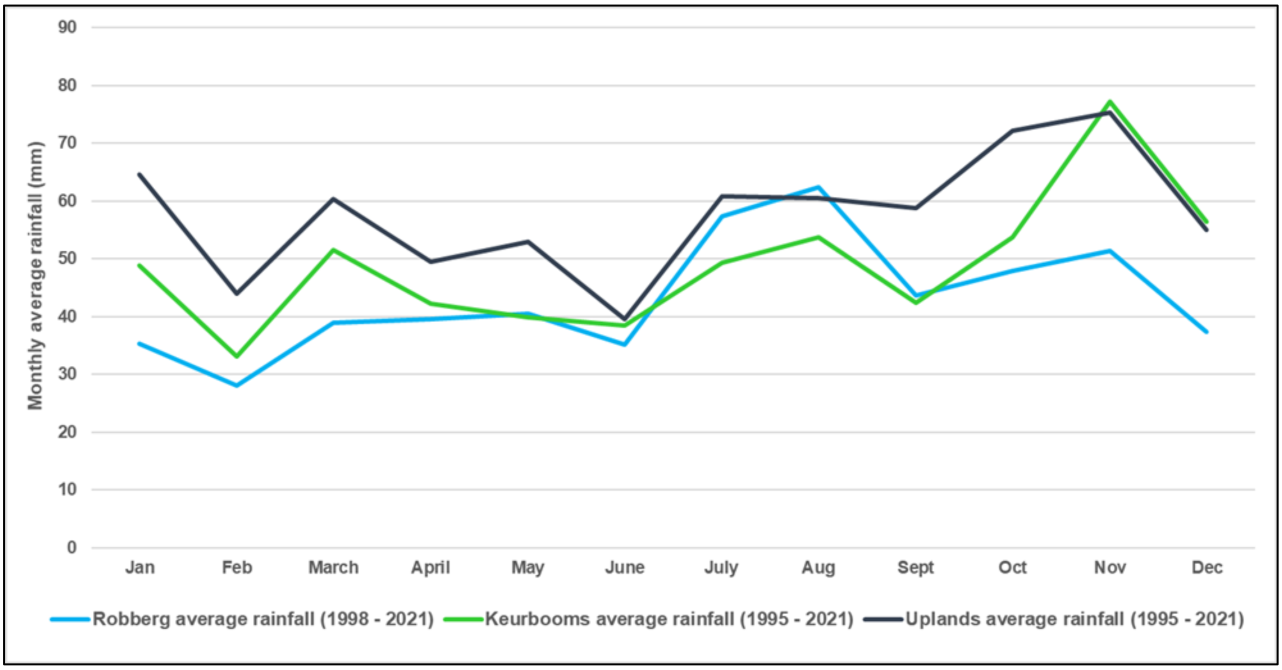

Figure 2.6: Monthly rainfall averages for the Robberg, Keurbooms River Bridge gate and Uplands weather stations recorded from 1995 to 2021.

2.2.1.2 Temperature

Temperature records are only available from the automatic weather station at Witfontein and from the manual stations at the Robberg and Keurbooms River sectors. The average minimum and maximum monthly temperatures recorded for these stations are illustrated in Figure 2.7.

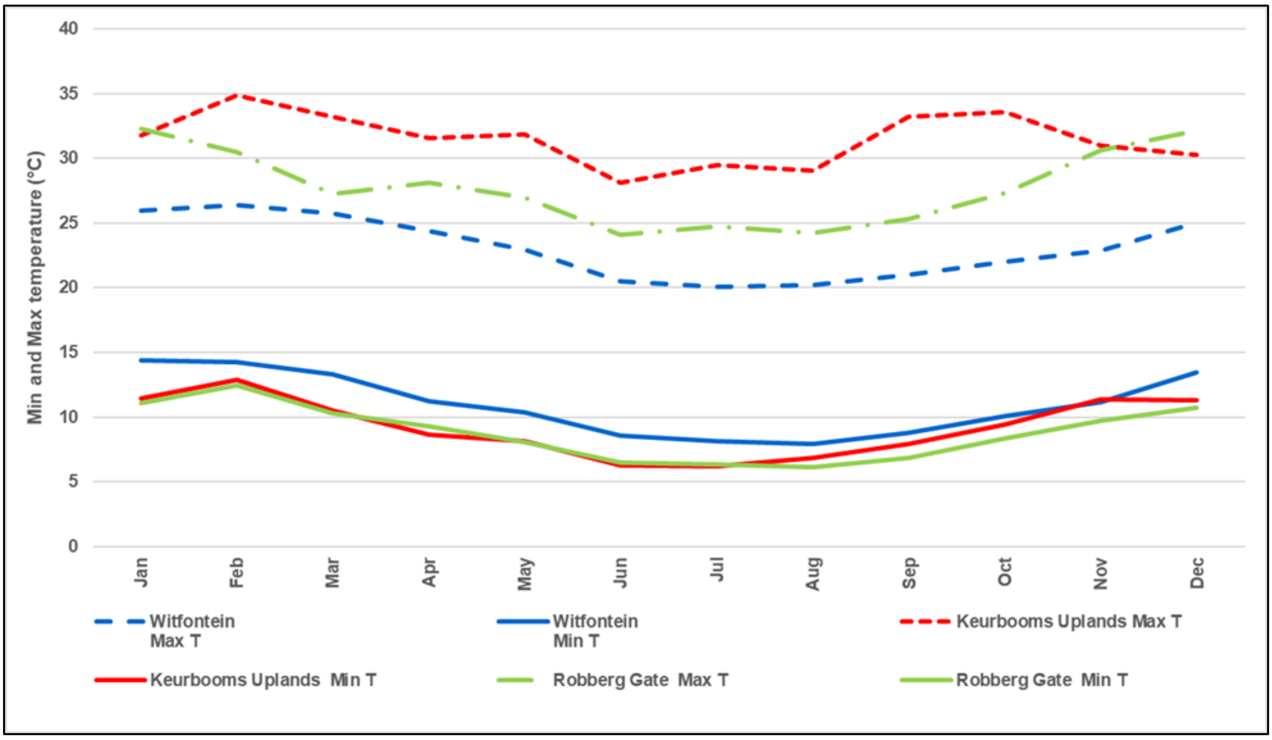

Figure 2.7: Average minimum and maximum monthly temperatures recorded for the Outeniqua and Keurbooms River Clusters.

Outeniqua Cluster. The Outeniqua Mountain Range affects the weather patterns in the complex. The northern slopes of the range have higher temperatures compared to the southern slopes and much lower temperatures during winter. In summer, the mean maximum temperature recorded from the station at Witfontein is 26 °C. During winter the mean minimum temperatures ranged between 8 and 9 °C from June to September. Frost does occur on the southern slopes in some of the lower lying areas, but minimum temperatures seldom drop below 7 °C. Temperatures differ along the coastal regions of the complex, being slightly higher as they are further away from the mountain and therefore influenced less by orographic changes. Dry bergwinds from the north cause a severe lowering in humidity and an increased fire hazard, especially during winter (Schultz 1965).

Goukamma Cluster. The Goukamma area receives more sunlight in the afternoon than the morning, due to coastal fog and mist. Average yearly sunlight period varies between 50% and 60% and seldom drops below 40%. The average number of days that receive 10% or less sunshine is between 40-50 days, while the number of days where 90% or more sunshine is received is between 50-100 days (Schultz 1965).

Keurbooms River Cluster. Warmest temperatures occur during February, September and October at Uplands, and November to February at Robberg. The hottest month is February. Coldest months are normally between the months of April and September, with the coldest temperatures recorded during July. The dominant winds throughout the year are south-westerly, as a result of an anticyclonic low-pressure system, which originates from the circumpolar westerlies. These interact with two subtropical high-pressure anticyclones, which fluctuate over the South Atlantic and South Indian Oceans (Hellström 1990).

In summer the winds are predominantly south-westerly alternating with lesser south-easterlies. During autumn and winter, the alternation is most frequent between south-westerlies and north-westerlies. This is a result of the anticyclonic low-pressure system with its associated coastal low being displaced by inland cyclonic high-pressure systems. This allows for a moderate to strong katabatic land breeze component from the north-west and influenced by the Outeniqua Mountain Range. These are the typical bergwind conditions experienced in May and August, which result in hot dry conditions with high evapotranspiration conditions (Hellström 1990).

2.2.2 Topography

The topography of the different clusters of the GRCWHS&NR is illustrated in Appendix 2, Maps 2a-f.

Outeniqua Cluster. The Cape Fold Belt Mountain range consists of Table Mountain quartzite and includes the southern Outeniqua-Tsitsikamma-Kareedouw range. The entire Outeniqua Cluster forms part of this range (Appendix 2, Map 2a). Geological folding is clearly visible in the Outeniqua Pass where it cuts through the mountain and kloofs. The mountains that we see today were formed approximately 226-220 million years ago. Mountain peaks formed on top of the erosion-resistant Table Mountain and Witteberg quartzites, the former having folded into huge anticlinal structures and thrust faulted from the south, piling formations on top of one another to raise the mountain belt. Rivers have eroded the less-resistant Bokkeveld shale and considerable volumes of quartzite along planes of weakness such as joints, bedding and fault planes. These erosive processes are still taking place today (Lubke & De Moor 1998).

Goukamma Cluster. During the complex sea-level history there have been numerous phases of dune-building followed by coastal erosion that formed sea cliffs. These fossil sea cliffs form large, steep seaward-facing slopes parallel to the present coastline and form a major element in the morphology of the cordons. Trailing arms of parabolic dunes form another major topographic element, oriented at 15-30° to the shoreline.

Within the Goukamma Cluster, there are quaternary sand dunes running in an east-west direction increasing in height as one moves inland from the coast (Appendix 2, Map 2b). Some connect with one another forming a lattice or dune mosaic. These dune cordons consist of steep-sided ridges, and the highest point in the reserve is one of these cordons measuring 202.3 m in height. They probably formed during the sea-level rises of the Pleistocene inter-glacial period. Three major dune cordons exist in the area. The dunes form ridges which are cemented together by calcium carbonate to form dune rock or aeolionite. There is an additional coalesced mass of older fossil dunes inland of these cordons that form hills up to 340 m high. In places, the dune sand can reach thicknesses in excess of 300 m (Tinley 1985).

Keurbooms River Cluster. The Keurbooms River sector forms part of the Outeniqua-Tsitsikamma Mountain Range and is dissected by the Keurbooms River which flows through a steep gorge. This sector ranges from sea level to a plateau with the highest point at 240 m.a.s.l. (Appendix 2, Map 2d).

Robberg sector is in the form of an elevated peninsula, with a plateau area and in parts, cliff faces, with the highest point of 148.5 m.a.s.l. (Appendix 2, Map 2e). This sector further contains an excellent example of a tombolo (a sandy hour-glass shaped spit connecting the island to the main peninsula). This is cut off from the mainland during spring highs.

The Annex Vlugt sector also forms part of the Outeniqua-Tsitsikamma Mountain Range with the highest point being the northern corner at 903 m.a.s.l. It is dissected by a deep gorge, known as Die Poort, where the Prince Alfred's Pass cuts through at about 380 m.a.s.l. (Appendix 2, Map 2f).

2.2.3 Geology and soils

Outeniqua Cluster. The south-eastern Cape coastal zone is dominated by three geological terranes: the Cape Supergroup, the Karoo Supergroup and the Uitenhage Group. The Cape Supergroup, the backbone of the Cape Fold Mountains, comprises the Table Mountain Group, the Bokkeveld Group and the Witteberg Group. The Outeniqua Mountain Range forms part of the Cape Supergroup and large parts of the Outeniqua Cluster is underlain by the Table Mountain Group where white to ash grey quartz sandstone has been metamorphosed to quartzite (Appendix 2, Map 3a). Where quartzite has been crushed, then breccia has formed. Breccia is a rock that has been crushed through natural forces and later re-cemented. Table Mountain quartzitic sandstone can be seen in the Outeniqua and Robinson Passes. Some of the oldest rocks occur within the George area comprising of metamorphosed sediments, limestone, quartzite and phyllite which belong to the Kaaimans Group. The age of these rocks is approximately ~650-510 million years (Lubke & De Moor 1998; Rosendaal et al. 1999).

The dominant lithological classes that underly the Ruitersbos, Doringrivier and Witfontein sectors from about midway to the northern parts of the protected area consist of white, coarse-grained to fine-grained, thick-bedded pebbly quartz arenite, thin bedded feldspathic and ferruginous sandstone, very subordinate shale and siltstone of the Nardouw Subgroup. Dominant lithological classes of the Peninsula, Pakhuis and Cedarberg Formations that underly the southern parts consist of pebbly quartz arenite, diamictite, minor conglomerate, mudrock, siltstone and shale.

According to South African National Parks (2014) soils of the Outeniquas are mostly acidic, leached, low in nutrients, and have a poor buffering capacity. In the upper river catchments, sandstone soils predominate and are characteristically light in texture, acidic, podzolised fine sandy loams. Rocky well drained soils commonly occur on north-facing slopes, whereas poorly drained or even peaty soils frequently occur on southern aspects. Dark acidic topsoils with high organic matter content frequently occur in wetter areas, particularly at high altitudes. In drier areas topsoils are frequently ash grey in colour and low in nutrients as a consequence of podsolization processes where iron, aluminium and organic matter are stripped from the topsoil and deposited lower down in the profile.

Goukamma Cluster. The area covered by the Goukamma, Buffalo Valley and Brenton Blue Butterfly sectors is entirely underlain by Late Pliocene (~3.6 - 2.6 Ma) rocks of the Wankoe Formation. This formation forms the bulk of the Neogene-aged (~66 - 2.5 Ma) Bredasdorp Group (Malan 1989; Appendix 2, Map 3b). It generally unconformably overlays the Skurweberg Formation of the Table Mountain Group which outcrops just outside the reserve at the headlands Rowwehoek and Walker Point (Malan 1989).

The Wankoe Formation (indicated as the Bresdasdorp Group on Appendix 2, Map 3b) generally outcrops as prominent ridges of calcified dune sand and consists of grey-weathered, massive or large-scale cross-bedded calcarenite and calcareous sandstone (Council for Geological Science 2004). At Goukamma, the Wankoe Formation represents amongst the most easterly outcrops of the formation and group which extends from Hermanus in the west to Plettenberg Bay in the east (Malan 1989).

The Garden Route Lakes complex extends from the Kaaimans River mouth at Wilderness in the west, to Rowwehoek and Brenton in the east and 8 km inland to Homtini. This coastal sand forms the foothills of the Outeniqua Mountains that proceeds inland over the escarpment of Table Mountain Sandstone. Alluvial sedimentation occurs in the river valleys whilst the coastal areas consist of recent sand beaches (Malan 1989; Harris et al. 2010).

The intertidal zone is composed of wave cut limestone platforms, exposed reefs and sandy beaches to the west of the Goukamma Estuary. To the east, from Rowwehoek to Walker point, sand-stone headlands and intertidal areas of rounded boulders and deep rock pools predominate. The offshore zone includes sub-tidal rocky reefs of aeolianite or sandstone origin (Flemming et al. 1983), and sub-tidal sandy and muddy substrates.

According to the 1:250 000 geological map (3322 Oudtshoorn), the geological formation of the Brenton-on-Sea area consists of fixed dunes and dune rock from Neogene to Quaternary times which extends westwards along the coast, up to Wilderness. East of Knysna, this formation is enclosed by whitish-weathering quartz sandstone of the Table Mountain Group.

The ancient dunes of the Brenton-on-Sea area consist of Pleistocene aeolianite substrates, which form alkaline soils of high calcium content and a low clay fraction. On steep slopes, the clay fraction increases (Lubke & De Moor 1998). Soils formed from these substrates are generally richer in nutrients than most fynbos soils. This promotes the occurrence of other vegetation types, such as coastal thicket vegetation (Cowling & Holmes 1992).

Keurbooms River Cluster. The Robberg and Keurbooms River sectors have a classic sequence of late Jurassic age that includes deposits from a variety of terrestrial, beach and near-shore environments that were deposited in the intertidal and subtidal environment. These beds are tilted between 10° to 20°. Exposed palaeosurfaces occur along the outcrops facing the Indian Ocean (Reddering & Rust 1997).

The dominant geological types of the Keurbooms River and Annex Vlugt sectors are quartzitic sandstones with minor shale from the Nardouw Subgroup, and the Ceres Subgroup (consisting of sandstone and shale units). In addition, the Keurbooms River sector has conglomerates, sandstones and claystones of the Enon formation which is the main geological type on Robberg (Appendix 2, Maps 3d&e). Another lithological series that is identified is that of whitish-weathering quartz sandstone, which is medium to coarsely grained, quartzitic and massive (Reddering 1993).

2.3 Biodiversity Context: Ecosystems

2.3.1 Vegetation

The GRCWHS&NR falls within the Core Cape Subregion (previously termed the Cape Floristic Kingdom) of the Greater CFR (Manning & Goldblatt 2012).

The Core Cape Subregion is one of the world's smallest but richest floral kingdoms, encompassing a land area of approximately 90 760 km² (less than 4% of the southern African subcontinent). An estimated 9 383 species of vascular plants (ferns and other spore-bearing vascular plants, gymnosperms, and flowering plants) are known to occur here, of which just over 68% are endemic. The majority of these species are flowering plants.

The vegetation of the area has been mapped nationally at a 1:1 000 000 scale (Mucina & Rutherford 2006; South African National Biodiversity Institute (SANBI) 2006-2018), and regionally at a fine-scale at 1:50 000 (Vlok et al. 2005; Vlok & De Villiers 2007; Vlok et al. 2008).

2.3.1.1 National Vegetation Map

The original 2006 national vegetation map (Mucina & Rutherford 2006) was updated in 2018 with substantive changes to vegetation types in the Namaqualand area and the Subtropical Thicket vegetation types in the Western Cape and Eastern Cape Provinces (SANBI 2006-2018). According to this map a total of 14 different vegetation types and two non-terrestrial aquatic types occur within the GRCWHS&NR. These are listed in Table 2.1 and illustrated in Appendix 2, Map 4(a-e).

South Africa recognises that different ecosystems have differing species compositions and to effectively conserve biodiversity, the country has set targets for each ecosystem. The biodiversity target is the minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state over the long term to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystems. The biodiversity target is calculated based on species richness, using species–area relationships, and varies between 16% and 36% of the original extent of each ecosystem type (Desmet & Cowling 2004).

Threat status is provided for each ecosystem according to the assessment of criterion A1 (habitat loss), which is considered the best available status for the Western Cape Province (Pence 2017).

It is, however, of great concern that the habitat loss transformation layer does not adequately take the impacts of infestations by invasive alien plants and over-grazing by domestic stock and/or game into account. In the case of invasive alien plants, active and continual follow-up clearing need to be systematically implemented to really have a significant effect, and on a landscape level this would require decades of focussed attention and substantial amounts of resources. Severely over-grazed areas would need active restoration plans to be implemented together with a reduction in, or sometimes even total removal of domestic stock or game to allow for the slow recovery of the natural habitat, especially in drier areas.

Table 2.1: Vegetation types conserved by the Garden Route Complex World Heritage Site and Nature Reserves. (CR = Critically Endangered; EN = Endangered; VU = Vulnerable; LT = Least Threatened. * Data from vegmap2009_CN_2014stats_gw.xlsx; ** new updates based on Grobler et al. 2018.)

Vegetation type	WC Provincial Protection Target in Ha *	% of WC target conserved in GRCWHS&NR	Ha conserved in GRCWHS&NR	Ecosystem Status
Outeniqua Cluster				
Central Coastal Shale Band Vegetation	1 853.1 (27%)	6.6%	122.2	LT
Swellendam Silcrete Fynbos	26 035.6 (30%)	0.2%	59.1	EN
Garden Route Shale Fynbos	12 132.7 (23%)	0.7%	80.0	VU
North Outeniqua Sandstone Fynbos	20 204.5 (23%)	79.0%	15 961.0	LT
South Outeniqua Sandstone Fynbos	36 192.1 (23%)	111.3%	40 272.0	LT
Southern Afrotemperate Forest	21 774.7 (22%)	2.6%	556.0	LT
Uniondale Shale Renosterveld	20 593.8 (29%)	0.2%	31.6	LT
Montagu Shale Renosterveld	43 381.9 (27%)	0.4%	152.2	LT
Goukamma Cluster				
Goukamma Dune Thicket (**)	2 109.4 (19%)	118.2%	2 493.0	LT
Cape Seashore Vegetation	982.9 (20%)	2.5%	24.5	LT
Knysna Sand Fynbos	3 533.2 (23%)	0.1%	4.0	CR
Southern Cape Dune Fynbos	3 164.8 (36%)	0.03%	12.5	LT
Non-terrestrial (Aquatic)	-	0	432.2	-
Non-terrestrial (Estuarine Functional Zone)	-	0	133.3	-
Keurbooms River Cluster				
Cape Seashore Vegetation	982.9 (20%)	1.0%	9.3	LT
Garden Route Shale Fynbos	12 132.7 (23%)	0.1%	16.2	VU
Goukamma Dune Thicket (**)	2 109.4 (19%)	8.0%	168.3	LT
Hartenbos Dune Thicket (**)	15 007.7 (19%)	0.1%	11.1	LT
Southern Afrotemperate Forest	21 774.7 (22%)	2.4%	531.9	LT
South Outeniqua Sandstone Fynbos	36 192.1 (23%)	0.1%	456.4	LT
Tsitsikamma Sandstone Fynbos	17 654.7 (23%)	2.7%	475.3	LT
Non-terrestrial (Estuarine Functional Zone)	-	0	80.5	-

2.3.1.2 Regional Fine-scale Vegetation Map

According to the fine-scale vegetation maps compiled for the Klein Karoo (Vlok et al. 2005), Riversdale Domain (Vlok & De Villiers 2007) and Garden Route Initiative (Vlok et al. 2008) vegetation units representing four biomes (Fynbos, Subtropical Thicket, Forest and Marine) occur within the protected areas. A brief description of each vegetation unit (based on Vlok et al. 2005, 2008, Vlok & De Villiers 2007) is given below as well as the conservation status according to Pence (2008), Skowno et al. (2010) and Vromans et al. (2010).

2.3.1.2.1 Outeniqua Cluster (consisting of Witfontein, Doringrivier, Ruitersbos and Zebraskop sectors)

Terrestrial vegetation (Appendix 2, Map 5a)

Fynbos biome:

- **Outeniqua Subalpine Fynbos** (LT) – This habitat type (185.6 ha) is restricted to the crests of the highest peaks (>1350 m altitude) and is found on the Witfontein and Ruitersbos sectors. The vegetation on these windswept peaks is usually very short (< 1 m tall) and consists mostly of ericoid shrubs and graminoids. Fires have a return interval of about 10 to 20 years in this habitat. This habitat tends to be quite rocky and there are often fire safe sites where a different assemblage of fire prone species can establish. Lightning fires often start at the top of the mountain in this unit and it is not unusual to find several small (< 1 ha) burnt patches that were started by lightning and then quickly extinguished by the rain from the thunderstorm that usually follows. Thus, it is possible to find a mosaic of different veld ages within a relatively small area. Snow occurs sporadically in winter, but it is not as cold as similar examples in the more inland mountains. Despite its limited size, it contains several endemic species and is very vulnerable to trampling and nutrient enrichment. Some uncommon widespread species such as *Protea grandiceps* occur here, as well as the localized endemic species, *Erica outeniquae* and *Pentameris uniflora*. Succulents belonging to the Crassulaceae and Aizoaceae (typically *Oscularia deltoides*) are also found here. **Condition**: Dense infestations of *Pinus* spp. and *Hakea sericea* in Ruitersbos and 2-5% in Witfontein sectors. This habitat is often also targeted for installation of radio telecommunication masts, which has already resulted in the degradation of this habitat on Cradock Peak.

- **Ruitersberg Ericaceous Fynbos** (LT) - 1 923.5 ha occur on Ruitersbos, Doringrivier and the western part of Witfontein. Ericaceous Fynbos fulfils an important water catchment function and is the source of most of the perennial streams. Soils are sandy and mostly nutrient deficient, they are often deep and peaty, but can also be shallow as many rocky outcrops are present. It differs from the Proteoid Fynbos habitat types in having only a sparse cover of proteoid shrubs, with species such as *Protea cynaroides* and local endemic species such as *Mimetes pauciflorus* present. It is the most species rich Fynbos in the Garden Route and is dominated by ericoid shrubs (representing several different families) and restioids (mostly Restionaceae and Cyperaceae, but some grasses such as *Ehrharta dura* can be abundant after a fire). Geophytes are also prolific in the first few years after a fire, of which several (such as the well-known *Cyrtanthus elatus*) are endemic to this habitat. It is without doubt of very high conservation value, both in terms of its water catchment function and plant diversity. Most of the endemic species (e.g., *Mimetes pauciflorus*) occur over almost the entire domain. This unit is structurally similar to the Tsitsikamma Ericaceous Fynbos but is perhaps somewhat drier. *Agathosma planifolia* and *Erica viridiflora* are endemic to both, but they do differ somewhat in their species composition with typical species such as *Mimetes pauciflorus* less common, while others such as *Erica viridescens* and *Penaea acutifolia* are more abundant. Ruitersberg Ericaceous Fynbos extends westwards, where several endemic species occur (such as *Acmadenia rupicola*, *Erica juniperina* and *Erica velatiflora*) that are not captured in this domain. Several widespread species, such as *Disa ferruginea* and *Syncarpha vestita*, reach their easternmost distribution in the Ruitersberg Ericaceous Fynbos and do not occur in the Tsitsikamma Ericaceous Fynbos. **Condition**: Densities of *Hakea sericea* and *Pinus* spp. vary between 0-10% on Witfontein, Doringrivier and Ruitersbos, but 91-100% in Moordkuils area.

Tsitsikamma Ericaceous Fynbos (LT) – 2 531.9 ha of this unit occur on Witfontein and is by far the most extensive unit spanning from about Jonkersberg to the eastern end of the Tsitsikamma Mountains. Ericaceae are very abundant to often dominant in this very wet unit. Typical common species include *Erica curviflora*, *Erica copiosa, Erica hispidula, Erica fuscescens* and *Erica nabea*, but there are several uncommon endemic species such as *Erica georgica, Erica inconstans, Erica lehmannii, Erica priorii* and *Erica stylaris*. Other typical and often locally dominant ericoid shrubs include *Berzelia intermedia* and *Grubbia rosmarinifolia*. Many Restionaceae are present, of which species such as *Platycaulis anceps* are very typical, but no endemic species are known. Geophytes are common after fire, of which species such as *Disa vasselotii* are endemic. **Condition**: Infestations with *Hakea sericea* and *Pinus* spp. are between 2-10% in most of Witfontein, but up to 30% and including *Acacia mearnsii* and *Paraserianthes lophantha* in the Montagu and Cradock Pass areas.

- **Witberg Arid Proteoid Fynbos** (LT) – A total of 2 619.1 ha of this unit occur on the Doringrivier, Ruitersbos and Zebraskop sectors. Common species include *Aspalathus hystrix, Aspalathus rubens, Cannomois scirpoides, Erica cerinthoides, Erica melanthera, Hermannia flammula, Hypodiscus striatus, Leucospermum cuneiforme, Leucospermum wittebergense, Metalasia massonii, Metalasia pulcherrima, Pelargonium fruticosum, Phylica axillaris, Protea repens, Protea lorifolia, Rhodocoma fruticosa* and *Tenaxia stricta.* It is similar to Rooiberg Arid Proteoid Fynbos in containing rare species such as *Agathosma lanata, Disa arida* and *Leucospermum pluridens*, but it differs in having species such as *Aspalathus sceptrum-aureum* abundant and having uncommon species such as *Disa salteri* and *Romulea jugicola* present. Some of these species become more prominent in the Arid Proteoid Fynbos units that are located towards the east. **Condition**: *Hakea sericea*, *Pinus* spp., *Acacia mearnsii* infestations vary between 6-20% in Ruitersbos and 2-5% in Doringrivier. Densities of alien species on Zebraskop have not yet been assessed.
- **Doringrivier Arid Proteoid Fynbos** (LT) – 1 480.1 ha of this unit occur in the Doringrivier and Witfontein sectors. Proteas, ericas and restios are abundant, as well as sedges and grasses. *Aspalathus rubens, Aspalathus sceptrum-aureum, Erica discolor* subsp*. speciosa, Erica glomiflora, Erica versicolor, Ficinia deusta, Hypodiscus aristatus, Hypodiscus striatus, Leucadendron salignum,*

Leucospermum cuneiforme, Pentameris eriostoma, Pentameris macrocalycina, Pentameris malouinensis, Pentameris pallida, Protea eximia, Protea lorifolia, Protea repens, Restio capensis, Rhodocoma fruticosa, Schoenus cuspidatus, Tetraria ustulata and *Thamnochortus rigidus* are particularly abundant. Rare and local endemic species known from this unit are *Aloe lineata* var*. muirii, Aspalathus glabrescens, Erica vlokii, Erica zebrensis* and *Haworthia outeniquensis.* **Condition:** *Hakea sericea*, *Pinus* spp. and *Acacia mearnsii* infestations vary between 2-40% in Doringrivier and Witfontein.

- **Attaquas Mesic Proteoid Fynbos** (LT) - This unit (2 370.2 ha) is found in the Ruitersbos and Zebraskop sectors. It has *Leucadendron eucalyptifolium, Mimetes cucullatus, Protea aurea, Protea eximia, Protea neriifolia* and *Serruria fasciflora* prominent in the proteoid component, and also *Aulax cancellata* and *Protea coronata* present. It has its own unique component of rare and localised endemic species, including *Acmadenia macropetala, Acmadenia tetragona, Amphithalea flava, Aspalathus digitifolia, Erica gillii, Erica velatiflora, Leucospermum formosum, Paranomus longicaulis, Protea aspera, Protea grandiceps, Satyrium muticum* and *Spatalla barbigera.* **Condition:** Infestations vary between 3-10% *Hakea sericea* and *Pinus* spp. and 5-75% *Acacia mearnsii*, 1% *Populus canescens* and <1% *Paraserianthes lophantha* along drainage lines or in wet places. Densities on Zebraskop have not been determined yet.

- **Doringrivier Mesic Proteoid Fynbos** (LT) - 9 333.8 ha of this unit occur on the Ruitersbos, Doringrivier and Witfontein sectors. It is a more arid unit than its counterparts as it occurs more inland. It has a distinctive flora with *Leucadendron eucalyptifolium, Mimetes cucullatus, Protea aurea, Protea eximia, Protea neriifolia* and *Serruria fasciflora* prominent in the communities. Several rare and localized endemic species are present, including: *Acmadenia gracilis, Acrolophia barbata, Acrolophia ustulata, Agathosma blaerioides, Cyclopia bowieana, Cyrthanthus debilis, Erica brachycentra, Erica elsiana, Erica inflaticalyx, Erica outeniquae, Leucadendron ericifolium, Leucadendron olens, Leucospermum hamatum, Prismatocarpus cliffortioides, Prismatocarpus rogersii, Protea grandiceps, Rafnia vlokii* and *Spatalla barbigera*. **Condition:** Poor in parts of the protected area due to *Hakea sericea* and *Pinus* spp. densities varying between 0.02-40.0% and *Acacia mearnsii* between 0.01 and 25.0% on Doringrivier and Witfontein.

- **Ruitersbos Mesic Proteoid Fynbos** (LT) – A total of 10 296 ha of this unit is found on Ruitersbos and Witfontein. It is structurally similar to Mellville Mesic Proteoid Fynbos, with proteoid shrubs like *Leucadendron eucalyptifolium, Leucadendron spissifolium, Leucospermum cuneiforme, Mimetes cucullatus, Protea aurea, Protea eximia* and *Protea neriifolia* often forming dense stands, but it differs in having rare proteoid species such as *Leucospermum formosum* present. Ericoid shrubs that are abundant include *Erica glomiflora, Erica nutans, Erica sparsa* and *Erica versicolor*. *Penaea acutifolia* is a rare species present in this unit. **Condition:** Poor in the Moordkuils area of Ruitersbos due to very high infestations (up to 100%) of *Pinus* spp., *Hakea sericea* and sometimes also *Acacia mearnsii* with lower densities west of Robinson Pass. Medium infestations (up to 27%) of *Paraserianthus lophantha*, *Acacia mearnsii* and *Pinus* spp. occur in the Witfontein sector.

- **Mellville Mesic Proteoid Fynbos** (VU) – 5 416 ha are restricted to Witfontein. An overstorey of proteoid shrubs such as *Leucadendron eucalyptifolium,* *Leucadendron uliginosum, Leucospermum cuneiforme*, and *Protea neriifolia* is usually present. Distinctive species such as *Mimetes cucullatus* and *Protea aurea* are absent, but are replaced by another distinctive local endemic, *Leucospermum glabrum*. This unit is very similar to the Tsitsikamma Mesic Proteoid Fynbos unit but is slightly less mesic with moisture-loving species such as *Protea mundii* uncommon here. **Condition:** *Pinus* and *Acacia* spp. occur in densities of up to 5%, *Eucalyptus* spp. up to 10% and *Hakea sericea* up to 15%.

- **Paardeberg Mesic Proteoid Fynbos** (LT) – A total of 253.8 ha occurs on Witfontein. This unit has *Leucadendron eucalyptifolium*, *Protea eximia, Protea punctata* and *Protea neriifolia* present in its proteoid component. Although not yet recorded on the Outeniqua Mountains, this unit is special in having the rare *Mimetes chrysanthus* present on Paardeberg, north of the Outeniqua Mountains. It also contains other rare species such as *Erica zebrensis*, *Geissorhiza roseoalba* and an *Osteospermum glabrum* that may be restricted to this unit. **Condition:** Low infestations of *Pinus* spp. and *Hakea sericea* of up to 2% density have been recorded here.
- **Wolwedans Grassy Fynbos** (EN) – 21.1 ha of this unit occur on Witfontein. The grass component is usually well developed on north-facing slopes with few Cyperaceae and Restionaceae present. Ericoid shrubs are usually abundant in the matrix Fynbos, especially *Erica sparsa* and *Phylica axillaris* on southern slopes and *Metalasia acuta* and *Passerina falcifolia* on north-facing slopes. Proteoid shrubs such as *Leucadendron eucalyptifolium* and *Protea neriifolia* were probably present on south-facing slopes, but most of this unit has been transformed to pastures. It is thus very difficult to reconstruct the vegetation of this unit. The remnants of this unit are not very rich in species, but some uncommon geophytes such as *Brunsvigia josephinae* and *Gladiolus emiliae* are still present. **Condition:** Historically completely transformed as the office complex and associated infrastructure are located in this area.
- **Fouriesberg Waboomveld** (LT) – 3 753.3 ha occur on Ruitersbos and Zebraskop. *Protea nitida* is prominent and abundant in this unit, often along with other proteoid shrubs such as *Leucadendron salignum, Leucadendron teretifolium, Leucospermum cuneiforme, Protea repens* and occasionally *Protea decurrens*. The grass component is often well developed with sweet grass species (e.g., *Themeda triandra*) and sedges (e.g., *Schoenoxiphium ecklonii*) common. It is the home of several rare and uncommon species, including *Erepsia pentagona, Erica brachycentra, Cyrtanthus carneus, Satyrium pumilum* and *Xiphotheca phylicoides*. **Condition:** The Ruitersbos sector is infested with 10% *Hakea sericea* and 1% *Pinus* spp. Densities of alien species on Zebraskop have not yet been assessed.
- **Outeniqua Waboomveld** (LT)- 128.6 ha of this unit occur on Witfontein and is most similar to the Fouriesberg Waboomveld. It differs in often having *Protea neriifolia* prominent, lacking species such as *Leucadendron teretifolium* and having a different component of small shrubs, such as *Erica solandri*. Uncommon and rare species present in this unit include *Aspalathus glabrescens*, *Erica ingeana*, *Erica* sp.nov. (cf. *alfredii*) and *Lotononis elongata*. **Condition:** Infested with 2% *Pinus pinaster* and 1% *Hakea sericea*.

- **Witberg Waboomveld** (LT) –This unit (3 285.3 ha) occurs on Zebraskop, Ruitersbos and Doringrivier. It is most similar to and share many of its common species with the Doringrivier Waboomveld, but it differs in the rare and localised endemic species present, which include species such as *Disa arida, Erica inflaticalyx, Leucospermum pluridens, Lotononis filiformis* and *Rafnia vlokii*. It also shares many of its common species with the Gamkaberg Waboomveld, but *Aspalathus pedunculata* is less abundant here. **Condition:** Occasional (up to 1%) density infestation with *Hakea sericea* and in some places on Doringrivier also 1% *Acacia cyclops*. Densities of alien species on Zebraskop have not yet been assessed.

- **Doringrivier Waboomveld** (LT) – 624.6 ha of this unit occur on the Doringrivier and Witfontein sectors. It is similar to the Outeniqua- and Fouriesberg Waboomveld units but differs in being more arid with *Protea lorifolia* often prominent. Succulents (e.g., *Aloe lineata* var. *muirii)* are often prominent on rocky north-facing slopes. This unit is also often densely invaded by *Hakea sericea,* which threatens the uncommon species present in this unit, such as *Gladiolus mutabilis* and the localised endemic *Leucadendron olens.* **Condition:** Infested with *Pinus* spp. (up to 2%), *Hakea sericea* (up to 10%) and *Acacia mearnsii* (up to 5%).

- **Woeska Waboomveld** (LT) - This unit (271.8 ha) occurs on the Ruitersbos sector. It shares many common species with Fouriesberg Waboomveld, but has a unique combination of rare and localised endemic species present, such as *Acmadenia macropetala*, *Amphithalea flava*, *Aspalathus florifera*, *Erepsia pentagona*, *Leucadendron teretifolium*, *Lotononis filiformis*, *Paranomus longicaulis*, *Protea aspera*, *Protea decurrens*, *Protea subulifolia* and the very rare orchid *Satyrium muticum*. **Condition:** Infested with up to 10-17% *Hakea sericea*, 5-10% *Acacia mearnsii* and 2% *Paraserianthus lophantha.*

- **Paardebont Fynbos-Sandolienveld** (VU) - 548.3 ha occur on Zebraskop. It is unusual in having Fynbos well-developed on the south-facing slopes of hills, with an odd combination of species such as *Aspalathus sceptrum-aureum*, *Calopsis andreaeana*, *Cannomois parviflora*, *Cannomois scirpoides, Erica cerinthoides, Erica speciosa, Gladiolus patersoniae, Hypodiscus striatus*, *Leucadendron salignum*, *Leucadendron teretifolium*, *Oedera imbricata*, *Protea lorifolia* and *Protea repens*. *Dodonaea angustifolia* is prominent and dominant on the northern slopes, along with succulents such as *Aloe lineata*, *Cullumia decurrens*, *Passerina obtusifolia* and *Phylica axillaris*. The only rare species known in this unit is a *Heliophila* sp.nov. (cf. *glauca*), but there may be several more. **Condition**: Densities of alien species on Zebraskop have not yet been assessed.

- **Fouriesberg Renoster-Sandolienveld** (LT) – This unit (1 808.5 ha) is found on Zebraskop and Doringrivier. It is largely restricted to outcrops of silcrete, but here Renosterveld is prominent on the deeper loamy soils between the hills. *Dicerothamnus adpressus* and *Stoebe microphylla* are often abundant in this Renosterveld type. It has well developed stands of Fynbos on the south-facing slopes with species such as *Aspalathus sceptrum-aureum, Calopsis andreana, Cannomois scirpoides, Erica anguliger, Erica cerinthoides, Erica rosacea, Restio capensis, Leucadendron salignum* and *Leucospermum cuneiforme* present. Succulents (e.g., *Aloe ferox)* are not uncommon on rocky north-facing slopes. Several rare and localised endemic plants are known from this unit, including

Athanasia quenquedentata subsp*. quenquedentata, Disa salteri, Erica zebrensis, Haworthia emelyae, Haworthia kingiana, Leucadendron ericifolium, Leucospermum pluridens, Lotononis filiformis, Otholobium racemosum, Oxalis attaquana, Protea decurrens* and *Romulea jugicola.* **Condition:** *Hakea sericea* and *Acacia cyclops* occur in densities of up to 2%. Densities of alien species on Zebraskop have not yet been assessed.

- **Herold Renoster-Sandolienveld** (EN) – A very small section (43.4 ha) of this unit occurs on Witfontein. It has *Dicerothamnus adpressus* and *Stoebe microphylla* abundant in the Renosterveld component. It also has Fynbos species such as *Aspalathus sceptrum-aureum, Calopsis andreaeana, Cannomois scirpoides, Erica anguliger, Erica cerinthoides, Erica rosacea, Leucadendron salignum, Prismatocarpus candolleanus* and *Restio capensis* present on south-facing slopes with succulents *(*e.g., *Aloe ferox, Aloe lineata, etc.)* present on rocky north-facing slopes. Rare and local endemic species such as *Aspalathus glabrescens, Disa spathulata* subsp*. tripartita, Haworthia outeniquensis, Lotononis elongata* and *Oxalis ioeides* are present, that are absent from the other units. **Condition:** This section of Witfontein was previously under *Pinus* plantation as part of a seed orchard but is in the process of being transferred to CapeNature. This area is currently also infested with 5% *Acacia mearnsii* and 1% *Hakea sericea*.

Subtropical Thicket biome:

- **Blossoms Asbos-Gwarrieveld** (EN) – 234 ha occur on Zebraskop. Succulent Karoo communities on the south-facing slopes are dominated by *Pteronia incana*, with *Dicerothamnus rhinocerotis* occasionally also present, but never the dominant species. Woody trees and shrubs (*Carissa haematocarpa, Euclea undulata, Gloveria integrifolia, Gymnosporia szyszylowiczii*, *Nymannia capensis*, etc.) are most abundant on the north-facing slopes, where a few *Portulacaria afra* may also be present. This unit is rich in succulents and geophytes, of which some are rare or localised endemic species (e.g., *Drosanthemum* sp.nov., *Glottiphyllum linguiforme*, *Haworthia emelyae*, *Pelargonium ochroleucum*, *Tylecodon leucothrix*, etc.). Grasses, especially *Ehrharta calycina*, can also be abundant on south-facing slopes. Small patches of quartz outcrops occur sporadically in this unit, and they are particularly rich in succulent species. **Condition**: Densities of alien species on Zebraskop have not yet been assessed.

- **Gouritz Asbos-Gwarrieveld** (LT) – 167.3 ha occur on Zebraskop. Woody trees and shrubs (e.g., *Carissa haematocarpa*, *Euclea undulata, Nymannia capensis, Searsia glauca, Searsia undulata*, etc.) are quite abundant, along with a few *Portulacaria afra* on the northern slopes. Succulents (*Aloe ferox, Drosanthemum giffenii, Euphorbia mauritanica*, etc.) are also abundant and some of those present, such as *Delosperma asperulum, Delosperma pageanum, Drosanthemum albiflorum* and *Drosanthemum bicolor* are uncommon species. *Pteronia incana* and *Dicerothamnus rhinocerotis* are the dominant shrubs on the south-facing slopes, with *Calobota cytisoides* and *Polygala pinifolia* sometimes also prominent. Patches of woody trees (e.g., *Buddleja saligna*, *Olea europaea* subsp. *cuspidata*, etc.) occur sometimes in the water drainage areas on southern slopes. Grasses (e.g., *Ehrharta calycina*, *Ehrharta erecta*, *Pentameris airoides*, etc.) and geophytes (e.g., *Lapeirousia pyramidalis*, *Tritonia securigera*, etc.) are sporadically also abundant on the south-facing slopes. *Apodolirion lanceolatum* is the only rare species known from this unit. **Condition**: Densities of alien species on Zebraskop have not yet been assessed.

Forest biome:

- **Outeniqua Montane Forest** (LT) **-** The higher altitude forests are a distinct habitat and 176.8 ha of it occur on Witfontein. These forests differ from the lower altitude forests not only in occurring in a generally higher rainfall area, with lower ambient temperatures, but also in the dominant species present. Unlike plateau forests it occurs as isolated patches on screes and around the drainage lines and ravines on the steep south-facing slopes. It has *Cunonia capensis, Ilex mitis* and *Halleria lucida* dominant. These are inaccessible and poorly surveyed forests. Many have not been captured because they were invisible in the shadow cast by the mountains on the aerial images that were used. Useful indicator species are: *Blechnum tabulare, Cassine schinoides, Cunonia capensis, Cyathea capensis, Diospyros whyteana, Gleichenia polypodioides, Ilex mitis, Laurophyllus capensis, Platylophus trifoliatus, Podocarpus latifolius, Rapanea melanophloeos* and *Virgilia oroboides* subsp*. ferruginea*. The edges of the Outeniqua Mountain Forest tend to have a well-developed stand of *Virgilia* and often with rare species such as *Gladiolus sempervirens* and *Mimetes splendidus* not far beyond it. The uncommon *Myosorex longicaudatus* also seems to be associated with these forest edges. **Condition:** Some *Hakea sericea* and *Acacia mearnsii* occur around the margins, with *Solanum mauritianum* present in disturbed parts. Many of these forest patches burnt during the 2018 George fire when the wind drove the fire upslope into the patches. This impacted a great number of the characteristic species (e.g., *Cunonia capensis*, *Rapanea melanophloeos*, *Ilex mitis*, *Ocotea bullata*, *Cassine peragua*, *Apodytes dimidiata*, *Podocarpus latifolius*), some of which have resprouted, but many which have also subsequently died (Ivan Donian, pers. comm.).
- **Outeniqua Plateau Forest** (CR) **-** Within this habitat (89.8 ha) there are two major units, the moist forest types and the dry forest types that are often restricted to north-facing slopes, especially where they occur on shale. The structure and the species dominant differ in these moist and dry forests. Especially in a dissected landscape these two forest types can occur in close proximity and rapidly change from one to the other. The two forest types have however not been mapped as separate entities, because of mapping scale issues. There are a large number of smaller rivers that intersect or originate in these forests. The forest flora of these rivulets is quite different and mostly consists of water demanding species (such as *Cunonia capensis* and *Platylophus trifoliatus*). They can, however, occur in close proximity to species typical of dry forests (such as *Aloe arborescens*, *Gymnosporia buxifolia, Lachnostylis hirta, Scutia myrtina*, etc.) where there are rocky outcrops on a north-facing slope next to such rivers. Useful indicator tree species include: *Afrocarpus falcatus, Apodytes dimidiata, Canthium inerme, Cassine peragua, Curtisia dentata, Podocarpus latifolius, Olea capensis* subsp*. macrocarpa, Olinia ventosa* and *Trichocladus crinitus* as an understory species. Outeniqua Plateau Forest in general have more dry forest sections present and some uncommon tree species such as *Faurea macnaughtonii* and the epiphytic orchid *Angraecum conchiferum* present, which seems to be absent from the Tsitsikamma Plateau Forest unit. **Condition:** Infestations of *Pinus* spp. (up to 2%) and *Hakea sericea*

(<1%) have been recorded. *Cyathea cooperi* is increasingly invading margins and openings in some forest patches. Some of these patches were also impacted by the 2018 George fire as mentioned above.

Aquatic vegetation

Four Perennial Stream and three River and Floodplain habitat units occur within the Outeniqua Cluster (Appendix 2, Map5a).

The perennial streams habitat starts at the higher altitudes within the Ericaceous Fynbos where subsurface water starts to seep above ground. Vegetation is usually short (<1.5 - 2.0 m tall) and dominated by members of the Ericaceae and Restionaceae. After fire there is usually a rich assembly of geophytes (especially Iridaceae and Orchidaceae) present. Lower down the mountain slopes, where several seepage areas unite, surface water is usually more prominent and some taller woody shrubs (e.g., *Berzelia intermedia* and *Grubbia rosmarinifolia*) and tall restios (e.g., *Cannomois virgata* and *Rhodocoma gigantea*) become prevalent. Further down the mountain, usually where the perennial stream enters the Mesic Proteoid Fynbos habitat, tall woody shrubs such as *Brachylaena neriifolia, Cliffortia strobilifera, Laurophyllus capensis, Leucadendron conicum* and *Psoralea affinis* start to dominate the vegetation. Where these perennial streams enter sites that are protected from fire, the vegetation changes to Afromontane forests, typically with species such as *Brachylaena neriifolia, Cunonia capensis, Halleria lucida, Ilex mitis, Ocotea bullata, Platylophus trifoliatus, Rapanea melanophloeos, Sparmannia africana* and *Virgilia oroboides* subsp. *ferruginea* present. Perennial Stream units are separated from the lower lying River and Floodplain units where the water body becomes exposed with a different flora present in the drainage zone (e.g., *Prionium serratum* present) and along the embankments (e.g., dense tangled mats of *Cliffortia odorata*).

- **E-Langeberg Perennial Stream** (LT) – This unit (471.7 ha) is found on Ruitersbos only. Species that are reliable indicators of permanently wet sites are abundant (e.g., *Berzelia intermedia, Cannomois virgata, Erica curviflora, Leucadendron salicifolium, Platycaulos compressus, Psoralea aphylla* and *Pteronia camphorata*). It differs in also having *Protea coronata* present and its own distinctive species such as *Cyclopia buxifolia, Erica rhodantha* and *Otholobium bowieanum*. The very rare orchid *Pachitis appressa* occurs in the upper seepage areas. **Condition:** The Kamma River has dense patches of *Acacia mearnsii*, *Paraserianthes lophantha* and *Populus canescens* infestations in places.

- **Moordkuils Perennial Stream** (EN) – This unit (3 964.7 ha) that occurs on Ruitersbos and Witfontein intersects few forest patches and is thus largely dominated by Fynbos affiliated species. *Leucadendron conicum* is typically abundant along the upper streams and a good indicator of this unit. Along its outer perimeter it often has a distinct band of plants largely dominated by *Cliffortia odorata*. *Nebelia paleacea* reaches its easternmost distribution in the upper region here. It shares many typical species that occur further east such as *Cyrtanthus elatus*. Not many local endemic species are known from this unit, but there are a few in upper seepage areas such as *Erica aneimena, E. gillii* and *E. juniperina*. **Condition:** This unit is in a poor state as it has very high infestations (up to closed canopy) of *Pinus radiata*, *Hakea sericea*, *Acacia mearnsii* and *Acacia melanoxylon*.

- **Outeniqua Perennial Stream** (LT) **-** This unit (1 961.6 ha), which occurs on all four sectors, can be easily identified in lacking *Protea mundii* as a prominent element and has *Virgilia oroboides* subsp*. ferruginea* only occasionally abundant along the main drainage channel. *Berzelia intermedia, Cannomois virgata, Leucadendron conicum, Leucadendron eucalyptifolium* and *Protea aurea* are here the most prominent species along the stream banks. *Aponogeton distachyos* occur in some pools in this unit. The upper seepage areas also have grasses such as *Ehrharta dura* abundant after fire, along with many orchid species. Rare and localized species known in this unit include *Erica gillii, Gladiolus fourcadei* and *Psoralea vlokii*. **Condition:** Kandelaars River and Kleindoring River have 2% *Hakea sericea*, 1% *Acacia mearnsii*, 1% *Populus canescens* and *Pinus* spp. infestations. Grootdoring River has up to 5% infestations of *Pinus* spp. and *Hakea sericea* (Ivan Donian, pers. comm.), while Doring River has up to 5% infestation of *Acacia mearnsii*, 2% *Paraserianthes lophantha* and 1% *Hakea sericea* and *Pinus* spp.

- **Tsitsikamma Perennial Stream** (CR) – 1 783 ha of this unit occur on Witfontein. As is typical of this habitat, the water is dark, fresh and acidic. It is in all respects very similar to the Moordkuils Perennial Stream unit but differs in having much of the upper water catchment in inland valleys. Here *Protea mundii* replaces the typical *Protea aurea* of the western example, perhaps the easiest way to differentiate the two units. *Laurophyllus capensis* also tends to be more abundant, replacing to some extent *Leucadendron conicum*. The only rare plant known is *Gladiolus sempervirens*, but it is not restricted to this unit. **Condition:** The Kaaimans River, Silwer River and Touws River have infestations of 15% *Hakea sericea*, 5% *Pinus* spp., 2% *Acacia longifolia*, 2% *Acacia mearnsii* and 0.5% *Acacia melanoxylon*.

- **Groot Brak River and Floodplain** (VU) – A total of 144.4 ha occur on Witfontein only. *Prionium serratum* is a distinctive species of this habitat type, but within the Garden Route domain it does not form extensive stands, as it does in the more western Breede - and Goukou River systems. The vegetation present varies from Fynbos-Forest ecotone dominated communities in the upper areas where large shrubs such as *Brachylaena neriifolia, Laurophyllus capensis, Psoralea affinis* and *Virgilia oroboides* subsp*. ferruginea* are abundant, to true forest communities **-** with species such as *Afrocarpus falcatus, Calodendrum capense, Cunonia capensis, Nuxia floribunda, Platylophus trifoliatus* and *Searsia chirindensis* abundant within the floodplain zone. Also rather typical of this habitat is *Cliffortia odorata* that often develops extensive mats along the embankments of the river systems, but this may be an artifact of altered flow regimes. The Groot Brak River and Floodplain unit seems to have a more punctuated flooding regime resulting in a wider floodplain zone, usually with fewer forest patches in the upper region. **Condition:** *Pinus* spp. (2%), *Acacia mearnsii* (0.5%) and *Acacia melanoxylon* (0.5%) infestations have been recorded in this habitat on Witfontein.

- **Olifants River and Floodplain** (VU) – 210.2 ha of this unit occur in Doringrivier. It is a brack water system and differs from most of the other riverine units in that its upper inland streambeds are still eroding into the landscape with a great many fingers. *Vachellia karroo* is the most prominent species here, often along with herbs such as *Ballota africana*. An interesting feature in this unit is the occasional abundance of *Senegalia caffra*. Many perennial freshwater streams used to feed into the main drainage channel from the Kammanassie and Tsitsikamma

Mountains, with periodic floods coming from the eastern Great Karoo during summer. The floodplain of this unit is somewhat different from all the other riverine units, but the shrub *Salsola aphylla* remains abundant and distinctive. Odd species noted in the floodplain include *Chrysocoma oblongifolia* and *Cyperus congestus*. **Condition:** *Acacia cyclops* (1%) and *Hakea sericea* (1%) infestations have been recorded within this sector.

- **Gouritz River and Floodplain** (VU) – 134.7 ha of this unit occur on Zebraskop. This unit is the recipient of all the waters from the other riverine units and it is thus no surprise that it shares characteristics and species with all the other riverine units. In pre-European days it had a perennial flow of fresh water, only periodically punctuated with floods from the Nama Karoo. In places the vegetation on the riverbanks still contains typical fresh-water dependant plants such as *Cliffortia strobilifera* and *Salix mucronata*, but they are now uncommon. The floodplain vegetation is often dominated by *Vachellia karroo*, *Salsola aphylla* and *Suaeda fruticosa*, but many of the embankments are sandy with a fairly well-developed grass cover (*Cynodon dactylon*, *Ehrharta ramosa*, *Stipagrostis namaquensis*, etc.). These sandy embankments are often rich in annual species after rain. The steep cliff embankments just above the 1:100-year floodline have a rich assemblage of succulent species, some being local endemics such as *Cotyledon tomentosa* subsp. *ladismithiensis* it probably also harbours a number of interesting *Haworthia* species. **Condition**: Densities of alien species on Zebraskop have not yet been assessed.

Based on the records in the CapeNature State of Biodiversity database a total of 1316 species (including subspecific taxa) of plants have been recorded for the Outeniqua Cluster. This number is by no means complete and is continuously being updated through baseline data collection.

At least 111 species are considered of conservation concern or priority species (Table 2.2; Raimondo et al. 2009, http://redlist.sanbi.org) within the Outeniqua Cluster. These include species listed as CR, EN, VU, NT, LC, Data Deficient - Insufficient Information (DDD) or Data Deficient - Taxonomically Problematic (DDT), Rare or Critically Rare. Some of these are illustrated in Figure 2.8. The species are being monitored with the assistance of the Custodians of Rare and Endangered Wildflowers (CREW) groups.

Table 2.2: Plant species of conservation concern recorded from the Outeniqua Cluster and on adjacent areas.

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Erepsia pentagona	Aizoaceae	NT (B1ab(iii,v))	Langeberg and Outeniqua Mtns
Boophone disticha	Amaryllidaceae	LC (Decreasing)	Robertson and Bredasdorp to tropical E Africa
Cyrtanthus debilis	Amaryllidaceae	Rare	Outeniqua Mtns: Attaquaskloof

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Alepidea delicatula	Apiaceae	Rare	Swartberg and Outeniqua Mtns
Centella eriantha var. *rotundifolia*	Apiaceae	DDT	George and De Hoop
Ilex mitis	Aquifoliaceae	LC (Decreasing)	Cape Peninsula to Kwa-Zulu Natal
Haworthia emelyae	Asphodelaceae	DDT	Klein Karoo
Haworthia outeniquensis	Asphodelaceae	VU (B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v))	Outeniqua Mtns
Tulista kingiana	Asphodelaceae	EN (A2cd+4cd; B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v))	Great Brak River to Herbertsdale
Curio ficoides	Asteraceae	DDT	Swartberg to E Cape: Suurberge
Mairia hirsuta	Asteraceae	Rare	Langeberg and Outeniqua Mtns
Osteospermum aciphyllum	Asteraceae	NT (D2)	Piketberg to Outeniqua Mtns
Osteospermum pterigoideum	Asteraceae	EN (B1ab(ii,iii,v)+2ab(ii,iii,v))	George to Humansdorp
Osteospermum pyrifolium	Asteraceae	VU (D2)	Robinson Pass to Garcia Pass
Zyrphelis outeniquae	Asteraceae	VU (D2)	Outeniqua Mtns
Prismatocarpus cliffortioides	Campanulaceae	EN (B1ab(ii,iii)+2ab(ii,iii))	Cloetes Pass to Robinson Pass
Prismatocarpus rogersii	Campanulaceae	NT (B1ab(iii))	Outeniqua Mtns: Robinson Pass
Elaeodendron croceum	Celastraceae	LC (Decreasing)	Outeniqua Mtns to Mpumalanga
Pterocelastrus rostratus	Celastraceae	LC (Decreasing)	Betty’s Bay to Mpumalanga
Curtisia dentata	Curtisiaceae	NT (A2d)	Coastal Mtns to Mpumalanga
Alsophila capensis	Cyatheaceae	LC (Decreasing)	Outeniqua Mtns to Mpumalanga
Erica aneimena	Ericaceae	VU (D2)	Outeniqua Mtns: George

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Erica bicolor	Ericaceae	Rare	Outeniqua Mtns
Erica croceovirens	Ericaceae	Critically Rare	Outeniqua Mtns
Erica elsieana	Ericaceae	EN (D)	Outeniqua Mtns
Erica gillii	Ericaceae	VU (D2)	Outeniqua Mtns: Mossel Bay
Erica heleophila	Ericaceae	DDT	Langeberg to Robinson Pass
Erica inconstans	Ericaceae	VU (B1ab(ii,iii,v))	Outeniqua Mtns: Knysna
Erica inflaticalyx	Ericaceae	Rare	Outeniqua Mtns: N side
Erica ingeana	Ericaceae	Rare	Swartberg and Outeniqua to Kouga Mtns
Erica intermedia subsp. *albiflora*	Ericaceae	Rare	Outeniqua Mtns: George
Erica juniperina	Ericaceae	EN (D)	Outeniqua Mtns
Erica outeniquae	Ericaceae	VU (D2)	Outeniqua Mtns
Erica setulosa	Ericaceae	Rare	Keeromsberg to Kammanassie Mtns
Erica stylaris	Ericaceae	VU (B1ab(iii)+2ab(iii))	Outeniqua to Tsitsikamma Mtns
Erica unicolor subsp. *mutica*	Ericaceae	EN (B1ab(ii,iii,v))	Outeniqua Mtns: Robinson Pass
Erica unicolor subsp. *georgensis*	Ericaceae	Rare	Outeniqua Mtns near George
Erica velatiflora	Ericaceae	VU (D1+2)	Outeniqua Mtns, Attaquaskloof
Erica vlokii	Ericaceae	VU (B1ab(iii,v)+2ab(iii,v))	Swartberg, Kammanassie and Outeniqua Mtns
Erica zebrensis	Ericaceae	EN (B1ab(iii,v)+2ab(iii,v))	Outeniqua Mtns: Robinson Pass to George
Erica zwartbergensis	Ericaceae	Rare	Swartberg to Outeniqua Mtns
Amphithalea axillaris	Fabaceae	Rare	Langeberg and Outeniqua Mtns
Amphithalea flava	Fabaceae	VU (D2)	Rooiberg and Outeniqua Mtns

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Aspalathus bowieana	Fabaceae	EN (B1ab(i,ii,iii, iv, v))	Outeniqua Mtns
Aspalathus digitifolia	Fabaceae	VU (A2c; D2)	Outeniqua Mtns near Mossel Bay
Aspalathus glabrescens	Fabaceae	EN (A2c)	Outeniqua Mtns
Aspalathus pedunculata	Fabaceae	Rare	Outeniqua Mtns
Cyclopia subternata	Fabaceae	LC (Decreasing)	Langeberg to Tsitsikamma Mtns
Lotononis elongata	Fabaceae	EN (B1ab(iii))	Outeniqua Mtns
Lotononis filiformis	Fabaceae	EN (B1ab(iii))	Outeniqua Mtns; northern slopes
Otholobium heterosepalum	Fabaceae	Rare	Outeniqua to Tsitsikamma Mtns
Otholobium racemosum	Fabaceae	Rare	Outeniqua and Kammanassie Mtns
Psoralea diturnerae	Fabaceae	EN (B1ab(iii,v)+2ab(iii,v))	Outeniqua Mtns; northern slopes
Psoralea trullata	Fabaceae	Rare	Langeberg to Tsitsikamma Mtns
Psoralea vlokii	Fabaceae	EN (B1ab(iii,v))	Outeniqua Mtns
Rafnia vlokii	Fabaceae	VU (B1ab(iii)+2ab(iii); C2a(i))	Outeniqua Mtns
Xiphotheca phylicoides	Fabaceae	CR (B1ab(ii,iii))	Outeniqua Mtns
Pelargonium denticulatum	Geraniaceae	Rare	Langeberg to Outeniqua Mtns
Gunnera perpensa	Gunneraceae	LC (Decreasing)	Swartruggens to Cape Peninsula and Klein Karoo, to N Africa
Aristea simplex	Iridaceae	NT (B1ab(ii,iii,iv,v))	Stellenbosch to George
Geissorhiza outeniquensis	Iridaceae	NT (D2)	Outeniqua Mtns
Gladiolus fourcadei	Iridaceae	EN (B1ab(i,ii,iii,iv,v))	Outeniqua Mtns

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Gladiolus roseovenosus	Iridaceae	CR (C2a(i))	Outeniqua Mtns
Gladiolus sempervirens	Iridaceae	Rare	Outeniqua Mtns
Romulea jugicola	Iridaceae	VU (B1ab(ii,iii,v))	Kammanassie and Outeniqua Mtns
Tritonia pallida subsp. *taylorae*	Iridaceae	VU (B1ab(ii,iii,iv,v))	Outeniqua Mtns
Watsonia aletroides	Iridaceae	NT (A2cb)	Botrivier to Knysna
Ocotea bullata	Lauraceae	EN (A2bd)	Cape Peninsula to Mpumalanga
Cyphia georgica	Lobeliaceae	DDT	George
Lobelia ardisiandroides	Lobeliaceae	VU (D2)	Outeniqua Mtns
Rapanea melanophloeos	Myrsinaceae	LC (Decreasing)	Cape Peninsula to Malawi
Acrolophia lunata	Orchidaceae	EN (B1ab(ii,iii,v); D)	Langeberg to Kouga Mtns
Acrolophia ustulata	Orchidaceae	VU (D1+2)	Cape Peninsula to Robinson Pass
Disa arida	Orchidaceae	EN (B1ab(ii,iii,v))	Outeniqua, Rooiberg and Gamkaberg Mtns
Disa bodkinii	Orchidaceae	Rare	Cape Peninsula to Robinson Pass
Disa lineata	Orchidaceae	Rare	Cederberg to Robinson Pass
Disa schlechteriana	Orchidaceae	VU (D2)	Langeberg and Outeniqua Mtns
Disa spathulata subsp. *tripartita*	Orchidaceae	EN (A2c)	Worcester to Joubertina
Holothrix pilosa	Orchidaceae	NT (B1ab(ii,iii))	Bredasdorp to Gqeberha
Pachites bodkinii	Orchidaceae	Rare	Cape Peninsula to Outeniqua Mtns
Oxalis attaquana	Oxalidaceae	Rare	Outeniqua Mtns
Oxalis ioeides	Oxalidaceae	DDD	Kammanassie and Robinson Pass

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Oxalis pendulifolia	Oxalidaceae	NT (B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v))	Langeberg and Outeniqua Mtns
Penaea acutifolia	Penaeaceae	Rare	Robinson Pass to Montagu Pass
Prionium serratum	Poaceae	LC (Decreasing)	Cederberg to Makhanda and KwaZulu-Natal
Leucadendron conicum	Proteaceae	NT (A4c)	Langeberg and Outeniqua Mtns
Leucadendron olens	Proteaceae	NT (D2)	Outeniqua Mtns
Leucadendron pubibracteolatum	Proteaceae	NT (B1ac(iv)+2ac(iv))	Swartberg and Outeniqua to Baviaanskloof Mtns
Leucadendron teretifolium	Proteaceae	NT (B2ab(ii,iii))	Witteberg and Kleinrivier Mtns to Riversdale
Leucadendron tinctum	Proteaceae	NT (A4c)	Hottentots Holland to Langeberg Mtns
Leucadendron uliginosum subsp. *uliginosum*	Proteaceae	NT (B1ab(iii)+2ab(iii))	Cloete's Pass to Plettenberg Bay
Leucospermum formosum	Proteaceae	EN (A3c+4c; B1ab(ii,iii,v)c(iv)+2ab(ii,iii,v)c(iv))	Riviersonderend to Outeniqua Mtns
Leucospermum glabrum	Proteaceae	EN (B1ab(iii,v)c(iv)+2ab(iii,v)c(iv); C2a(i))	Outeniqua Mtns
Leucospermum hamatum	Proteaceae	EN (B1ac(iv)+2ac(iv))	Outeniqua Mtns
Leucospermum pluridens	Proteaceae	NT (B1b(iii,v)+2ab(iii,v))	Gamkaberg to Outeniqua Mtns
Mimetes pauciflorus	Proteaceae	VU (A2c+3c+4c)	Outeniqua Mtns
Mimetes splendidus	Proteaceae	EN (B1ab(i,ii)c(iv)+2ab(i,ii)c(iv); C2a(i)b)	Outeniqua Mtns
Paranomus esterhuyseniae	Proteaceae	NT (A3c+4c)	Outeniqua and Kouga Mtns
Paranomus longicaulis	Proteaceae	VU (B1ab(v)+2ab(v))	Garcia Pass to Attaquaskloof
Protea coronata	Proteaceae	NT (A2c+3c+4c)	Cape Peninsula to Humansdorp

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Protea grandiceps	Proteaceae	NT (B1ac(iv)+2ac(iv))	Cape Peninsula to Great Winterhoek Mtns
Serruria fasciflora	Proteaceae	NT (A2c+4c)	Hopefield to George
Spatalla barbigera	Proteaceae	NT (B1ab(i)+2ab(i))	Langeberg and Outeniqua Mtns
Phylica velutina	Rhamnaceae	NT (A2c; B1ab(ii,iii,iv,v))	Langeberg Mtns to Robinson Pass
Acmadenia gracilis	Rutaceae	VU (D2)	Outeniqua Mtns
Acmadenia rupicola	Rutaceae	VU (D2)	Outeniqua Mtns: Robinson Pass
Acmadenia tetragona	Rutaceae	NT (B1ab(iii)+2ab(iii))	Outeniqua Mtns
Thesium susannae	Santalaceae	Rare	Langeberg and Outeniqua Mtns
Nemesia elata	Scrophulariaceae	VU (B1ab(iii,v)+2ab(iii,v))	Outeniqua Mtns
Selago burchellii	Scrophulariaceae	VU (B1ab(ii,iii,iv,v))	Outeniqua Mtns to Plettenberg Bay
Gnidia chrysophylla	Thymellaeaceae	NT (B1ab(i,ii,iii,iv,v))	Bredasdorp to Outeniqua Mtns

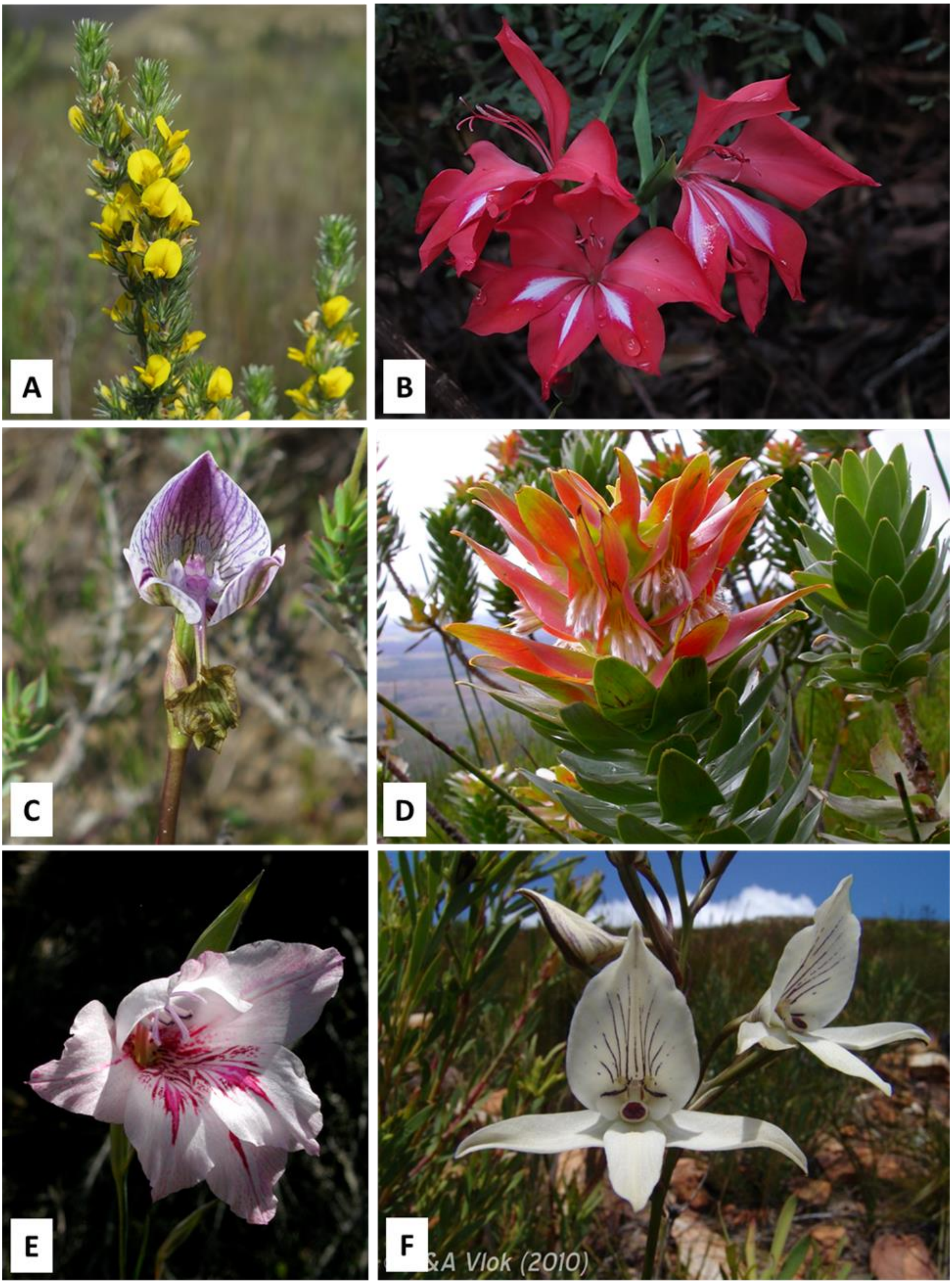

Figure 2.8: Plant species of conservation concern recorded from the Outeniqua Cluster. A: *Aspalathus glabrescens*; B: *Gladiolus sempervirens*; C: *Disa spathulata* subsp. *tripartita*; D: *Mimetes splendidus*; E: *Gladiolus roseovenosus*; F: *Disa schlechteriana*. (Photos: J&A Vlok).

2.3.1.2.2 Goukamma Cluster (including Goukamma, Buffalo Valley and Brenton Blue Butterfly sectors)

Terrestrial vegetation (Appendix 2, Map 5b)

Fynbos biome:

- **Sedgefield Thicket-Fynbos** (LT) – This is the largest vegetation unit (1 222.2 ha) occurring on Goukamma and Buffalo Valley and the only one found on the BBBSNR. It is a mosaic of Dune Sandplain Fynbos and Subtropical Thicket. The bush-clumps currently present in this unit are probably much more abundant and larger than they used to be as most of this habitat has been protected against fires for many years. In the past browsers probably also contained the extent of these bush-clumps, which consist mostly of dune thicket species such as *Azima tetracantha, Carissa bispinosa, Cussonia thyrsiflora, Euclea racemosa, Olea exasperata, Pterocelastrus tricuspidatus, Searsia glauca, Sideroxylon inerme* and *Tarchonanthus littoralis*, which all can grow rapidly in the absence of fire. These bush-clumps easily overgrow the adjacent matrix Fynbos vegetation in the absence of fire. This results in the loss of the rich biodiversity of the matrix Sandplain Fynbos. Geophyte species endemic to the Sandplain Fynbos, such as *Gladiolus vaginatus* and *Satyrium princeps* will first become locally extinct without the correct fire regimes, but they will soon be followed by endemic shrubs such as *Erica glandulosa* subsp. *fourcadei*. On the Brenton Blue Butterfly sector this is particularly concerning as fires and natural large animal disturbance have been kept out of the area for several decades. As a result, the entire reserve has become overgrown with thicket species through thicket building which have displaced the fynbos species in many respects. *Indigofera erecta*, the foodplant of the Brenton Blue Butterfly is a fire dependent species and its numbers have decreased because of the lack of fires and the gradual expansion of the thicket clumps. Recent research following the 2017 fires in the Knysna area have indicated that almost all the thicket tree species are able to resprout and are resilient to high intensity fires (Strydom et al. 2020). They conclude that prescribed high-intensity fires are unlikely to reduce thicket expansion and promote an increase in fynbos but suggest that thicket may be vulnerable to frequent fires and that more research is needed in this regard. A study by O'Connor et al. (2020) on woody-encroached grasslands in the USA found that the combined use of browsing and fire is a valuable management tool to decrease the abundance of clonal-resprouting woody plants in mesic grasslands and shows the potential importance of browsers as a key driver in that ecosystem. It is strongly advised that this aspect should be investigated as soon as possible. **Condition:** Virtually the entire unit within the Goukamma Cluster (including the BBBSNR) burnt during the June 2017 fire. This fire stimulated the seedbanks of the invasive alien plant species (especially *Acacia cyclops, A. saligna, Paraserianthus lophantha*) and this has resulted in massive regeneration in certain parts of these protected areas. Fortunately control of invasive alien plants within the BBBSNR was undertaken on a regular basis before the fire. Hence, there is virtually no alien plants within the reserve at present. Adjacent on the municipal land, however, the infestation density for *Acacia cyclops* is 15%, *A. mearnsii* (1%), *A. saligna* (0.5%), *A. melanoxylon* (0.5%) and *Pinus radiata* (0.5%).

- **Sedgefield Sandplain Fynbos** (CR) **–** This unit totalling 179.1 ha, occurs in narrow strips and small pockets on Goukamma and Buffalo Valley. It is an arid unit restricted to north-facing slopes of the secondary dune systems and is a vulnerable habitat that is very sensitive to physical disturbance. It is poor in species, with the bulk of its dry sands held together by *Agathosma apiculata, Restio eleocharis, Olea exasperata, Searsia crenata* and a few graminoids such as *Stipagrostis zeyheri*. No rare species are known from this unit, but the local variant of the uncommon *Centella calcarea* may prove to be a distinct endemic taxon. **Condition**: The entire unit burnt in the June 2017 fire. Infestations of invasive alien plant species (mainly *Acacia cyclops* and *A. saligna*) vary between 0.6-35.0% densities.

- **Rondevlei Sandplain Fynbos** (CR) – This unit (126.1 ha) occurs in wetter sites on south-facing slopes where some Proteaceae, such as *Leucadendron salignum, Leucospermum cuneiforme* and *Protea cynaroides* are usually present. Both the latter species are unusual ecotypes with rather narrow leaves and smaller flowers than their montane counterparts, which deserves specific conservation measures. Only *Leucadendron salignum* has, however, been recorded on Buffalo Valley. Ericaceae are uncommon, but *Erica discolor* is sometimes abundant in wet sites. *Restio triticeus* is usually abundant, along with many other graminoid taxa such as *Stenotaphrum secundatum*. Geophytes such as *Brunsvigia orientalis* are usually abundant. Local rarities include *Pentameris barbata* subsp. *orientalis* and *Satyrium princeps*. Other useful indicator species include *Aspalathus hispida, Disparago tortilis, Felicia echinata, Heliophila subulata, Lampranthus tegens, Passerina vulgaris, Salvia africana-lutea* and *Zygophyllum flexuosum.* **Condition**: The entire unit burnt in the June 2017 fire, resulting in an explosion of invasive alien plant species and an increase in infestation densities (mainly *Acacia cyclops* and *A. saligna*) of between 10-30%.

Subtropical Thicket Biome:

- **Wilderness Forest-Thicket** (VU) – This habitat (571.4 ha) is restricted to the secondary dune systems, just inland of the mobile dune systems. The matrix vegetation consists of Dune Thicket with typical species such *Azima tetracantha, Carissa bispinosa, Cassine peragua, Euclea racemosa, Lycium cinereum, Muraltia spinosa, Mystroxylon aethiopicum, Putterlickia pyracantha, Searsia crenata, Searsia pterota,* often forming impenetrable stands as these shrubs are usually woven together with creepers such as *Asparagus aethiopicus, Cynanchum ellipticum, Rhoicissus digitata, Sarcostemma viminale* and *Solanum quadrangulare*. A forest like community of trees such as *Olinia ventosa*, *Pterocelastrus tricuspidatus, Sideroxylon inerme* and *Tarchonanthus littoralis* occur in the protected dune slack areas. Where these dune slack areas are deep, these trees form a dense closed canopy that is well lifted above ground level, thus qualifying to be called a "Milkwood forest". These forests are never very wide, although they can be quite long. **Condition**: About 75% of this unit within Goukamma and Buffalo Valley burnt during the June 2017 fire and is currently in a process of recovery. Infestation densities vary between 1-25% *Acacia cyclops*, 0.5-15.0% *Acacia saligna*, and <1% *Pinus pinaster*, *Opuntia ficus-indica* and *Solanum mauritianum*.

Forest Biome:

- **Groenvlei Coastal Forest** (EN) - This habitat is restricted to deep sandy soils in the lowlands with 244.3 ha occurring in Goukamma. It is best developed next to extensive water bodies, where fires originate and burn upslope. The tall, closed canopy consists of tall *Afrocarpus falcatus* often emerging above the canopy. It also has deciduous trees such as *Celtis africana* often locally abundant, and a substantial Milkwood forest of large *Sideroxylon inerme* trees towards the western extent of the unit. It is most easily recognized as it has trees with a subtropical affiliation such as *Calodendrum capense, Ekebergia capensis, Strychnos decussata* and even sometimes *Olea europaea* subsp. *cuspidata* present. The population of *Celtis africana* on the nature reserve may be of particular interest, as it may be the southern-most population of a species which occurs as far north as the equator. Such peripheral populations often contain unusual genetic material within the species. No rare plant species are known from this unit, but it is the habitat of the rare Knysna Woodpecker (*Campethera notata*). These forests were probably more extensive in the past as they were initially not afforded much protection. **Condition**: This unit is in a near pristine condition on the southern side of Groenvlei, but the section east of the vlei has been transformed in the past and is currently in a very slow state of recovery. This disturbed section also burnt during the June 2017 fire. *Acacia cyclops* and *A. saligna* have been recorded at densities of 1 to <1% respectively in this unit.

Marine Biome:

- **Hartenbos Primary Dune** (LT) – About 135.6 ha of this unit occur in Goukamma. It has few species present, mostly *Arctotheca populifolia, Gazania rigens, Hebenstretia cordata, Ipomoea pes-caprae, Senecio elegans, Scaevola plumieri, Tetragonia decumbens* and *Thinopyrum distichum*. The plants tend to be sparse, but just inland (secondary dunes) the vegetation becomes rapidly more dense and taller, with shrubs such as *Metalasia muricata, Morella cordifolia, Passerina rigida, Searsia crenata* and often somewhat stunted *Sideroxylon inerme* present. The latter constitutes the transition to Dune Thicket vegetation and the cut-off point between these two units is often difficult to determine. The absence of species such as *Scaevola plumieri, Tetragonia decumbens* and *Thinopyrum distichum* is useful to indicate the transition from Primary Dune to Dune Thicket units. The Primary Dune units act as a precursor to the Dune Thicket units. Wherever they are absent, often due to stabilization of the supporting Drift Sands habitat, wave action starts eating into the secondary dunes, undermining the sands of the Dune Thicket. *Gladiolus gueinzii* is the only uncommon plant species present in this unit. **Condition**: Infestation with *Acacia cyclops* varies between 1.5-15.0% and *A. saligna* between 5-15%.
- **Kleinkrantz Driftsands** (LT) – This unit belongs to the marine component. It is 173.3 ha in extent within Goukamma. Being a natural area where windswept sand from the sea is deposited and periodically released back to the sea, this is not a habitat in which many plant species flourish. After good rain some annuals such as *Senecio elegans* may be locally abundant in spring, but not for long. In its natural state this habitat is largely devoid of vegetation. Its natural sand movement did not allow for development of many coastal areas and this habitat was therefore stabilized, mostly by alien species *Acacia cyclops* and *A. saligna* in the previous century. **Condition**: Almost the entire section of this vegetation unit occurring within Goukamma burnt during the June 2017 fire. As a result, the seedbanks of *Acacia*

cyclops and *A. saligna* were stimulated and infestation densities vary between 15-25% for the former and 5-30% for the latter.

Note that no vegetation has been recorded on Mossel Bay Seal Island yet.

Aquatic vegetation (Appendix 2, Map 5b)

- **Wilderness Wetlands** (LT) – Groenvlei Lake falls entirely in this unit, as well as a small wetland on the Buffalo Valley property, and covers an area of 471.4 ha. Species such as *Phragmites australis* and *Typha capensis* are abundant and sound indicators of this unit. It is not particularly rich in species and no endemic plant species are known from it. It is, however, an important habitat for a range of aquatic wildlife. Not much is known about the ecological role of fire in this habitat, but it may well be required periodically to control the growth of tall species (such as *Phragmites*) in the absence of large herbivores, which probably curbed their growth in the past. **Condition**: From a vegetation point of view, this unit is in a good condition.
- **Wilderness Estuary** (LT) – This unit is 45 ha in size on Goukamma and Buffalo Valley. According to Vlok et al. (2008), every estuary in the Garden Route domain should probably be recognized as a distinctive unit as they vary much in ecological processes and the fauna present. However, all the estuaries in the Western Cape have been lumped into the Wilderness Estuary unit, as the plant species present in this habitat do not vary much. Differentiating the Estuary habitat from the upland River and Floodplain habitat is not easy. The boundary between these two units changes as freshwater input from the inland competes with saltwater penetration from the sea. Useful indicators to determine this boundary is the presences of submerged aquatic species (e.g., *Potamogeton pectinatus, Ruppia maritima, Zostera capensis*) and plant species such as *Cotula coronopifolia*, *Juncus kraussii, Limonium scabrum, Scirpus maritimus, Suaeda caespitosa* and *Tinopyrum distichum* along the outer edge. The Goukamma Estuary falls within this unit. **Condition**: *Acacia cyclops* and *A. saligna* occur in high densities (15-25% and 5-30% respectively) above the highwater mark of the estuary.
- **Groot Brak River and Floodplain** (VU) **–** Only 12.5 ha of this unit occur in Goukamma and Buffalo Valley. *Prionium serratum* is a distinctive species of this habitat type, but within the Garden Route domain it does not form extensive stands, as it does in the more western Breede - and Goukou River systems. This species does not occur within the boundaries of Goukamma, as the part of the river flowing through the reserve is salty because of the penetration from the sea. The vegetation present varies much, from Fynbos-Forest ecotone dominated communities in the upper areas where large shrubs such as *Brachylaena neriifolia*, *Laurophyllus capensis*, *Psoralea affinis* and *Virgilia divaricata* are abundant, to true forest communities - with species such as *Afrocarpus falcatus*, *Calodendrum capense*, *Cunonia capensis, Nuxia floribunda, Platylophus trifoliatus* and *Searsia chirindensis* abundant within the floodplain zone. Also, rather typical of this habitat is *Cliffortia odorata* that often develops extensive mats along the embankments of the river systems, but this may be an artefact of altered flow regimes.

There are seven plant species of conservation concern known to occur within the Goukamma Cluster (Table 2.3.; Raimondo et al. 2009; www.sanbi.org.za). These include species listed as CR, VU, LC and Decreasing. The species are being monitored with the assistance of the CREW groups. Some of the species are illustrated in Figure 2.9.

Table 2.3: Plant species of conservation concern known to occur within the Goukamma Cluster.

Scientific Name	**Family**	**Status according to Raimondo et al. (2009); http://redlist.sanbi.org**	**Distribution**
Erica chloroloma	Ericaceae	VU (B1ab(ii,iii,iv,v)+2ab(ii,iii,iv,v))	Wilderness to the Fish River Mouth
Erica glandulosa subsp. *fourcadei*	Ericaceae	VU (B1ab (ii,iii,iv,v))	Mossel Bay to Cape St Francis
Erica glumiflora	Ericaceae	VU (B1ab(i,ii,iii,iv,v))	Wilderness to East London and Makhanda
Gladiolus vaginatus	Iridaceae	VU (B1ab(iii))	Cape Peninsula to Knysna
Eulophia speciosa	Orchidaceae	LC (Decreasing)	Western Cape to tropical East Africa and Sudan
Satyrium princeps	Orchidaceae	VU (C2a(i))	Wilderness to Port Alfred
Pentameris barbata subsp. *orientalis*	Poaceae	CR (B1ab(i,ii,iii,iv,v)+2ab (i,ii,iii,iv,v); D)	Buffalo Bay to Knysna

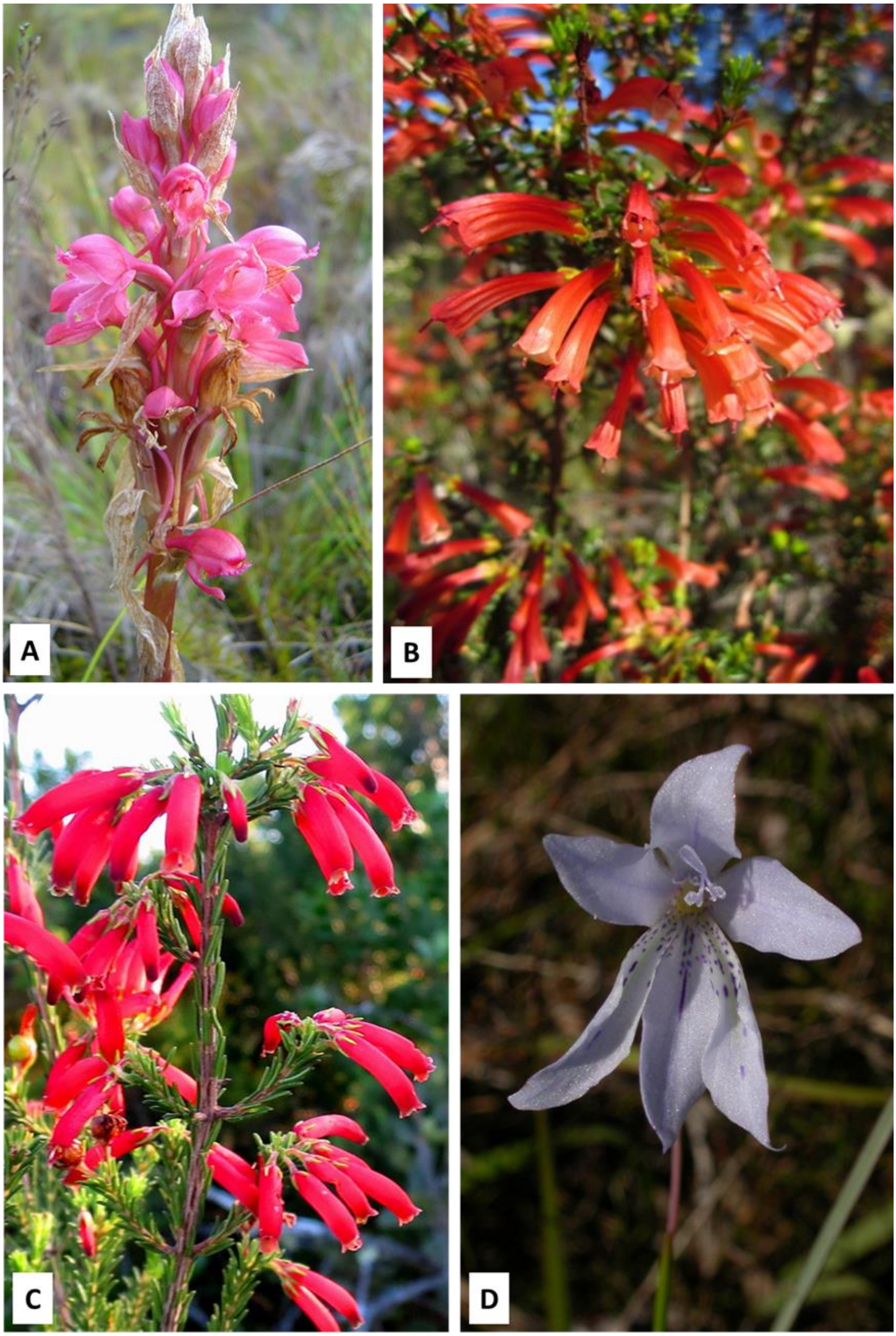

Figure 2.9: Plant species of conservation concern recorded from the Goukamma Cluster. A: *Satyrium princeps*; B: *Erica glandulosa* subsp. *fourcadei*; C: *Erica chloroloma*; D: *Gladiolus vaginatus*. (Photos: A, D: A Vlok; B, C: D Turner).

2.3.1.2.3 Keurbooms River Cluster (including Robberg, Keurbooms River and Annex Vlugt)

Terrestrial vegetation (Appendix 2, Maps 5c-e)

Fynbos biome:

- **Tsitsikamma Forest Fynbos** (LT) – A total of 17.8 ha of this habitat occurs on Keurbooms River. It has a natural mix of forest and fynbos vegetation. The broken topography in which it occurs may result in fires burning here less frequently and this allows many different forest species to establish and persist in the tall fynbos vegetation. Useful indicator species are *Erica diaphana, Erica sparsa, Passerina falcifolia, Protea mundii, Rhodocoma gigantea* and *Widdringtonia nodiflora*. **Condition**: Good, infestations are low and in maintenance phase.

- **Uplands Grassy Fynbos** (EN) – This unit is the largest vegetation unit on Keurbooms River (285.6 ha). It generally lacks specific features. Some *Protea neriifolia* is sometimes present on moist south-facing slopes, but they are never abundant. It contains few restios and several grasses are abundant, as well as several small wetlands (indicated by an abundance of *Cliffortia linearifolia*). In this unit the small wetlands look suspiciously much like old elephant wallows, which probably harboured the now threatened fern *Marsilea schelpeana*. When not burned, this unit is often overgrown by *Euryops virgineus*. Some interesting eastern species such as *Thunbergia alata* are present in dry rocky areas, including the very rare *Brachystelma comptum*. **Condition**: Good, with very low infestations of invasive alien plants; currently in maintenance phase.

- **Knysna Enon Fynbos** (LT) – Of this unit 67.2 ha occur on Keurbooms River. The base geology of this habitat, Enon Conglomerate, often erodes in such a way that the hills have steep slopes with many small ravines, which afford protection against fires. Patches of Dune Thicket usually occur in these ravines, often along with a few odd individuals of coastal forest tree species such as *Calodendrum capense* and *Celtis africana*. Fynbos occurs on moist south-facing slopes, often with an overstorey of proteoid shrubs such as *Leucadendron eucalyptifolium* and *Protea neriifolia* and an abundance of ericoid shrubs (such as *Agathosma ovata, Erica versicolor, Phylica axillaris*, etc.). The north-facing slopes support mostly Grassy Fynbos, in which grasses such as *Brachiaria serrata, Cynodon dactylon, Digitaria eriantha, Eragrostis capensis, Eragrostis curvula, Eragrostis obtusa, Eustachys paspaloides, Harpochloa falx, Heteropogon contortus, Pentameris pallida, Themeda triandra* and *Tribolium uniolae* are usually abundant, with only a few overstorey proteoid shrubs such as *Leucadendron salignum* present. Many succulents, such as *Aloe arborescens, Bulbine alooides* and several *Crassula* species, are present on bare rocky outcrops. The broken topography thus results in three different vegetation units, Thicket, Proteoid Fynbos and Grassy Fynbos to occur in close proximity. Threatened species present include *Acmadenia alternifolia, Satyrium muticum* and *Satyrium princeps*. It is suspected that two long-lost and probably highly threatened orchid species, *Disa newdigateae* and *Disa forcipata*, occur (or occurred) in this unit. **Condition**: Good, infestations are kept in maintenance phase (total density <0.5%).

- **Noetzie Proteoid Fynbos** (LT) – Only 8.8 ha of this unit occur on Robberg and is limited to the area between Knysna and Plettenberg Bay. Subtropical thicket patches are absent as most of the habitat is exposed to periodic fire, but when physically disturbed the vegetation can be quite grassy. Another differentiating feature is the periodic occurrence of seasonally wet sites in which robust sedges such as *Tetraria bromoides* are locally dominant. Although overstorey proteoid shrubs such as *Leucadendron eucalyptifolium*, *Leucadendron salignum* and *Protea neriifolia* are often locally abundant in this unit, these species have not been recorded on Robberg, but only on properties adjacent to the reserve. Ericoid shrubs such as *Erica formosa*, *Erica sparsa* and *Erica versicolor* are also typical of this habitat, but it is not very rich in geophytic species. **Condition:** Good, infestations of invasive alien plants kept at very low densities.

- **Noetzie Thicket-Fynbos** (VU) – This habitat, of which 103.1 ha occur on Robberg, has small patches of thicket and forest vegetation present in fire-protected sites. These woody communities are not very rich in species and are dominated by trees such as *Colpoon compressum, Pterocelastrus tricuspidatus, Searsia lucida, Sideroxylon inerme, Tarchonanthus littoralis and Virgilia divaricata*. This unit occurs in a narrow strip along the coast in the higher rainfall zone from Brenton-on-Sea to Plettenberg Bay. The matrix shrubby vegetation is dominated by species, such as *Agathosma apiculata, Aspalathus alopecuroides, Aspalathus opaca, Athanasia juncea, Cliffortia falcata, Cliffortia serpyllifolia, Cullumia carlinoides, Delosperma inconspicuum, Diospyros dichrophylla, Eragrostis capensis, Erica versicolor, Eriocephalus africanus, Ficinia oligantha, Lampranthus pauciflorus, Metalasia acuta, Metalasia pungens, Oedera imbricata, Ornithogalum dubium, Passerina corymbosa, Pelargonium fruticosum, Phylica axillaris, Relhania calycina, Relhania pungens, Restio triticeus, Stoebe microphylla, Syncarpha paniculata, Themeda triandra, Thesidium fragile and Wahlenbergia desmantha*. *Disa hallackii, Psoralea vanberkelae, Lampranthus pauciflorus, Selago burchellii, Freesia leichtlinii* subsp. *alba, Erica glumiflora* and a localised, undescribed species of *Wahlenbergia* are some of the threatened species recorded in the unit. **Condition**: Very good, with infestation levels in maintenance phase (<1%). A part of this unit near the entrance gate burnt in the June 2017 fire.

- **De Vlugt Forest-Waboomveld** (LT) – 240.8 ha occur on Annex Vlugt. This is a very distinctive unit as small patches of forest (with species such as *Buddleja salviifolia, Diospyros dichrophylla, Pittosporum viridiflorum, Pterocelastrus tricuspidatus, Searsia chirendensis, Virgilia divaricata, etc.)* are often present on steep south-facing slopes. Waboom *(Protea nitida)* remain prominent in the matrix fynbos, along with *Leucadendron salignum, Protea neriifolia* and occasionally *Leucadendron eucalyptifolium.* Other shrubs are also abundant, with *Erica copiosa, Erica sparsa* and *Printzia polifolia* abundant. Succulents *(*e.g., *Aloe arborescens, Bulbine latifolia, Crassula rupestris, Haworthia cymbiformis,* etc.*)* are abundant on rocky outcrops, despite the fact that this unit occurs in a fairly high rainfall area. **Condition:** Poor, as it is heavily infested with *Pinus* spp. and *Hakea sericea*.

- **Tsitsikamma Mesic Proteoid Fynbos** (LT) – This unit occurring on Annex Vlugt (102.9 ha) is mostly dominated by *Leucadendron eucalyptifolium* and *Protea mundii,* with *Protea neriifolia* and *Leucadendron uliginosum* subsp*. glabratum* more common on north-facing slopes. It is most easily recognised by the presence of *Protea mundii* in wet sites and *Leucadendron uliginosum* subsp*. glabratum* in more arid sites. Another feature is the often super-abundance of *Cannomois virgata* on south-facing slopes. Small forest patches often occur in fire protected ravines, usually with *Laurophyllus capensis* and *Virgilia divaricata* abundant on the ecotone. A number of fynbos species, such as *Gladiolus carneus,* reach their easternmost distribution in this unit. Rare and localised endemics present include *Acrolophia barbata, Erica trachysantha, Gladiolus sempervirens* and *Protea vogtsiae.* **Condition:** Poor, as it is heavily infested with *Acacia*, *Pinus* spp. and *Hakea sericea*.

- **Kouga Grassy Fynbos** (LT) - The unit (61.4 ha) on Annex Vlugt is characterised by having *Capeochloa arundinacea* dominant on north-facing slopes with few proteas and ericas present. *Protea nitida* and shrubs such as *Erica cerinthoides, Erica simulans, Leucadendron salignum* and *Leucospermum cuneiforme* are occasionally prominent in small patches on south-facing slopes. It shares most of its common species with the Grassy Fynbos of the more western areas (e.g., *Heliophila glauca, Osteospermum imbricatum,* etc.), but some of the species present in the unit (e.g., *Agathosma puberula and Muraltia juniperifolia, etc*.) are absent from all the other Grassy Fynbos units of the Klein Karoo domain. It also differs from most of the other Grassy Fynbos units in often having sweet grasses (C4 species such as *Themeda triandra)* quite abundant after fire. **Condition:** Poor, as it is heavily infested with *Acacia*, *Pinus* spp. and *Hakea sericea*.

Forest biome:

- **Tsitsikamma Plateau Forest** (LT) – 59.2 ha of this habitat occurs on Keurbooms River. It contains moisture loving ferns, such as *Cyathea capensis,* which tend to be more abundant in the understorey of this unit, but that may be an artifact of the large number of rivulets that originate and intersect the Tsitsikamma Plateau Forest unit. **Condition**: Good, infestations are kept in maintenance phase (total density <0.5%).

- **Piesang River Fynbos-Forest** (LT) – 88.4 ha of this unit is found on Keurbooms River. It is easily recognized in having *Strelitzia alba* present in the forest component. These forests also tend to have *Lachnostylis hirta* often super abundant, which may be an artifact of regular fires that enter these forests. The associated Grassy Fynbos has one uncommon species present, *Muraltia knysnaensis*. **Condition**: Good, with infestations kept in maintenance phase (total density <0.5%).

- **Keurbooms Thicket-Forest** (VU) – This unit (231.2 ha) is found on Keurbooms River. It occurs on steep slopes adjacent to the Keurbooms River, with the vegetation on the southern and northern slopes quite different. In being centrally located it assimilated an enormous range of non-fire adapted species. Even succulents such as *Aloe arborescens* and *A. pluridens* are present in arid sites. **Condition**: Good, infestations are kept at a low density (<0.5%).

- **Tsitsikamma Riverine Forest** (LT) - This forest unit (133.7 ha) occurs on the eastern embankment of the Keurbooms River. It varies much in height depending on the local conditions and includes some of the tallest forest in the Southern Cape. *Afrocarpus falcatus* can grow into giant trees that tower over the forest canopy. The canopy is often tangled with a variety of creeping and climbing plants, often dominated by *Rhoicissus tomentosa*. In disturbed examples *Pittosporum viridiflorum* and *Tarchonanthus littoralis* are usually very abundant and seem to act as pioneer species, seemingly more so than *Virgilia divaricata*. This habitat may be confused with the Coastal Dune Milkwood and *Ekebergia* Forests, but *Sideroxylon inerme* is less prevalent and it is easily recognized by the presence of the localized endemic *Strelitzia alba*. Some uncommon understorey species, such as *Liparis remota* reach their southernmost distribution here. **Condition**: Good, with very low infestation levels (<0.5% total density).

Subtropical Thicket biome:

- **Wilderness Forest-Thicket** (VU) – Only 0.5 ha of this unit occurs in the north-western end of Robberg. This habitat is restricted to the secondary dune systems, just inland of the mobile dune systems. The matrix vegetation consists of Dune Thicket with typical species such *Azima tetracantha, Carissa bispinosa, Cassine peragua, Euclea racemosa, Lycium cinereum, Muraltia spinosa*, *Mystroxylon aethiopicum*, *Putterlickia pyracantha, Searsia crenata* and *Searsia pterota* often forming impenetrable stands as these shrubs are usually woven together with creepers such as *Asparagus aethiopicus*, *Cynanchum ellipticum*, *Rhoicissus digitata*, *Sarcostemma viminale* and *Solanum africanum*. A forest-like community of trees such as *Olinia ventosa*, *Pterocelastrus tricuspidatus*, *Sideroxylon inerme* and *Tarchonanthus littoralis* occur in the protected dune slack areas. Where these dune slack areas are deep these trees form a dense closed canopy that is well lifted above ground level, thus qualifying to be called a “Milkwood forest”. These forests are never very wide, although they can be quite long. **Condition**: Good, with infestation level kept below 1%.
- **Herolds Bay Littoral-Thicket** (CR) – This unit, of which 81 ha occur on Robberg, has a higher succulent component present. It is restricted to steep slopes, just above the high-water mark. In rocky, arid sites the vegetation consists mostly of patches of short shrubs and herbs such as *Carpobrotus deliciosus, Chenolea diffusa, Chironia baccifera, Delosperma litorale, Gazania rigens, Helichrysum tenuifolium, Limonium scabrum, Silene primuliflora* and *Tetragonia fruticosa* present. In slightly deeper soils taller shrubs such as *Cliffortia serpyllifolia, Erica versicolor, Eriocephalus africanus* and *Passerina vulgaris* are dominant, often with some thicket elements such as *Azima tetracantha, Carissa bispinosa, Cassine peragua, Euclea racemosa, Lycium cinereum, Muraltia spinosa, Mystroxylon aethiopicum, Putterlickia pyracantha* and *Searsia crenata* also abundant. In more protected sites taller shrubs and trees such as *Pterocelastrus tricuspidatus, Searsia pterota, Sideroxylon inerme* and *Tarchonanthus littoralis* are abundant, along with numerous lianas such as *Asparagus aethiopicus, Cynanchum ellipticum, Rhoicissus digitata, Sarcostemma viminale* and *Solanum quadrangulare*. Succulents are often present on the rocky outcrops, including species such as *Crassula nudicaulis*, *Delosperma littorale* and *Lampranthus* species. The constant sea breeze from below does not allow fires to penetrate this habitat. **Condition**: Density of *Acacia cyclops* on the steep northern slopes is 5% and *Opuntia ficus-indica* 1%.

Marine biome:

- **Hartenbos Primary Dune** (EN) – A total of 25.2 ha of this unit occur on Robberg, mainly where the gap is and in the north-western corner. It has few species present. *Arctotheca populifolia, Gazania rigens, Hebenstretia cordata, Ipomoea pes-caprae*, *Scaevola plumieri*, *Senecio elegans*, *Tetragonia decumbens* and *Thinopyrum distichum* are most prevalent. The plants tend to be sparse, but just inland (secondary dunes) the vegetation becomes rapidly denser and taller, with shrubs such as *Metalasia muricata*, *Morella cordifolia*, *Passerina rigida*, *Searsia crenata* and often somewhat stunted *Sideroxylon inerme* present. The latter constitutes the transition to Dune Thicket vegetation and the cut-off point between these two units is often difficult to determine. The absence of species such as *Scaevola plumieri*, *Tetragonia decumbens* and *Thinopyrum distichum* indicates the transition from Primary Dune to Dune Thicket units. The Primary Dune units act as a precursor to the Dune Thicket units. Wherever they are absent, often due to stabilization of the supporting Drift Sands habitat, wave action starts eating into the secondary dunes, undermining the sands of the Dune Thicket. **Condition**: Good, with very low infestation of invasive alien plants (<1%).

Aquatic vegetation (Appendix 2, Maps 5c-e)

With regards to the aquatic vegetation, three units occur within Keurbooms River Cluster according to the fine-scale vegetation map compiled by Vlok et al. (2008) (Appendix 2, Map 5c-e).

- **Garden Route River and Floodplain** (EN) – Only 1.7 ha of this unit occur on Keurbooms River. There are two river and floodplain units in the Garden Route area. They span a bridge from subtropical affiliated plants (e.g., *Calodendrum capense*) in the lowlands to temperate affiliated plants (e.g., *Laurophyllus capense*) of the uplands. They intersect both fire and non-fire systems so functioned as a conduit to enable species of vastly different systems to intermingle, which confused ecologists much in the past. They are and will remain to be vital corridors to convey vastly different genetic material over the Garden Route domain. Sadly, the functioning of this corridor is now impeded over most of the domain by severe invasion of especially alien *Acacia* tree species. This more eastern unit occurs in a generally higher rainfall zone with high rainfall events more frequently and thus the drainage channels are more clearly defined. No rare or endangered plant species are known from these units, but uncommon species such as *Watsonia galpinii* occurs within the flood zone. **Condition**: Good, infestation densities are at maintenance level (<0.5%)
- **Groot Brak River and Floodplain** (EN) – 106.1 ha of this more western unit occur on Keurbooms River. This habitat type is found along rivers from Groot Brak River to Plettenberg Bay with *Prionium serratum* present in the mainstream. Along the upper tributaries *Cliffortia odorata* tends to form very dense mats, allowing only a few other shrubs and trees (e.g., *Psoralea affinis* and *Salix mucronata*) to persist. Perhaps most distinctive about this unit is the presence of riverine forest within much of the floodplain zone, often with tall *Afrocarpus falcatus* trees present. In the more exposed areas the vegetation of these tributaries has a well-developed grass and sedge component and *Vachellia karroo* present. **Condition**: Poor, stands of *Arundo donax, Rubus fruticosus* and *Acacia mearnsii* occur in the unit at total densities of between 5-50%.
- **Keurbooms River and Perennial Streams** (LT) - This unit that occurs on Annex Vlugt (70.2 ha) is easily identified in having Keurbooms *(Virgilia divaricata)* abundant along the main drainage channel as well as small patches of Afromontane

forest, often with *Afrocarpus falcatus* and *Searsia chirendensis* present. *Berzelia intermedia, Cannomois virgata, Leucadendron conicum, Leucadendron eucalyptifolium* and *Protea mundii* are abundant and prominent along the upper streams. The upper seepage areas often have grasses such as *Ehrharta dura* abundant after fire. The rare orchid *Acrolophia barbata* and the uncommon localized endemic shrubs *Erica inconstans* and *Psoralea keetii* also occur in these upper seepage areas. This unit is most similar to the Outeniqua Perennial Stream unit but can be easily recognized by the presence of *Protea mundii* and the absence of *Protea aurea.* **Condition:** Poor, as it is heavily infested with *Acacia* spp.

- **Tsitsikamma Perennial Stream** (CR) – This unit, of which 35.3 ha occur on Keurbooms River, is associated with the freshwater streams originating from the Tsitiskamma Mountains. It has dark, fresh and acidic water. *Protea mundii* and *Laurophyllus capensis* tend to be abundant. The only rare plant known is *Gladiolus sempervirens*, but it is not restricted to this unit. **Condition**: Good, infestation densities are at maintenance level (total density <0.5%).

- **Wilderness Estuary** (LT) – This unit is 58.9 ha in size on Keurbooms River. Submerged aquatic species include *Potamogeton pectinatus, Ruppia maritima* and *Zostera capensis*, and plant species such as *Cotula coronopifolia*, *Juncus kraussii, Limonium scabrum, Scirpus maritimus, Suaeda caespitosa* and *Tinopyrum distichum* along the outer edge. **Condition**: *Acacia mearnsii* (<0.5%) and *Arundo donax* (5%) occur above the highwater mark of the estuary. The south-eastern part of the estuary has been transformed historically through the construction of the picnic area and relevant management infrastructure.

Six plant species of conservation concern are known to occur within Keurbooms River and at least seven on Robberg (Table 2.4; Raimondo et al. 2009; www.sanbi.org.za). These include species listed as Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC) and Decreasing. The other two species (*Acmadenia alternifolia* and *Erica glandulosa* subsp. *fourcadei*) listed for Keurbooms River are potentially also present but have not yet been recorded officially. Some of these species are illustrated in Figure 2.10.

Table 2.4: Plant species of conservation concern recorded from or potentially present in the Keurbooms River Cluster.

Scientific Name	**Family**	**Status according to Raimondo et al. (2009); http://redlist.sanbi.org**	**Distribution**
KEURBOOMS RIVER			
Boophone disticha	Amaryllidaceae	LC (Decreasing)	Robertson to Tropical East Africa
Ilex mitis	Aquifoliaceae	LC (Decreasing)	Cape Peninsula to Ethiopia and Madagascar
Elaeodendron croceum	Celastraceae	LC (Decreasing)	Outeniqua Mtns to Mpumalanga
Curtisia dentata	Curtisiaceae	NT (A2d)	Coastal Mtns to Mpumalanga

Scientific Name	Family	Status according to Raimondo et al. (2009); http://redlist.sanbi.org	Distribution
Rapanea melanophloeos	Myrsinaceae	LC (Decreasing)	Cape Peninsula to Malawi
Leucospermum glabrum	Proteaceae	EN (B1ab(iii,v)c(iv)+2ab(iii,v)c(iv); C2a(i))	Outeniqua Mtns
Erica glandulosa subsp. *fourcadei*	Ericaceae	VU (B1ab (ii,iii,iv,v))	Mossel Bay to Cape St Francis
Acmadenia alternifolia	Rutaceae	VU (B1ab(ii,iii,iv)+2ab(ii,iii,iv))	Knysna to Plettenberg Bay
ROBBERG			
Lampranthus pauciflorus	Aizoaceae	EN (B1ab(ii,iii,iv,v))	Cape Infanta to Plettenberg Bay
Wahlenbergia sp.nov.	Campanulaceae	Possibly VU (D2)	Plettenberg Bay
Erica glumiflora	Ericaceae	VU (B1ab(i,ii,iii,iv,v))	Wilderness to East London and Makhanda
Psoralea vanberkelae	Fabaceae	VU (D2)	Plettenberg Bay
Freesia leichtlinii subsp. *alba*	Iridaceae	NT (B1ab(ii,iii,iv,v))	Stilbaai to Plettenberg Bay
Disa hallackii	Orchidaceae	EN (C2a(i))	Cape Flats to Gqeberha
Selago burchellii	Scrophulariaceae	VU (B1ab(ii,iii,iv,v))	George to Plettenberg Bay

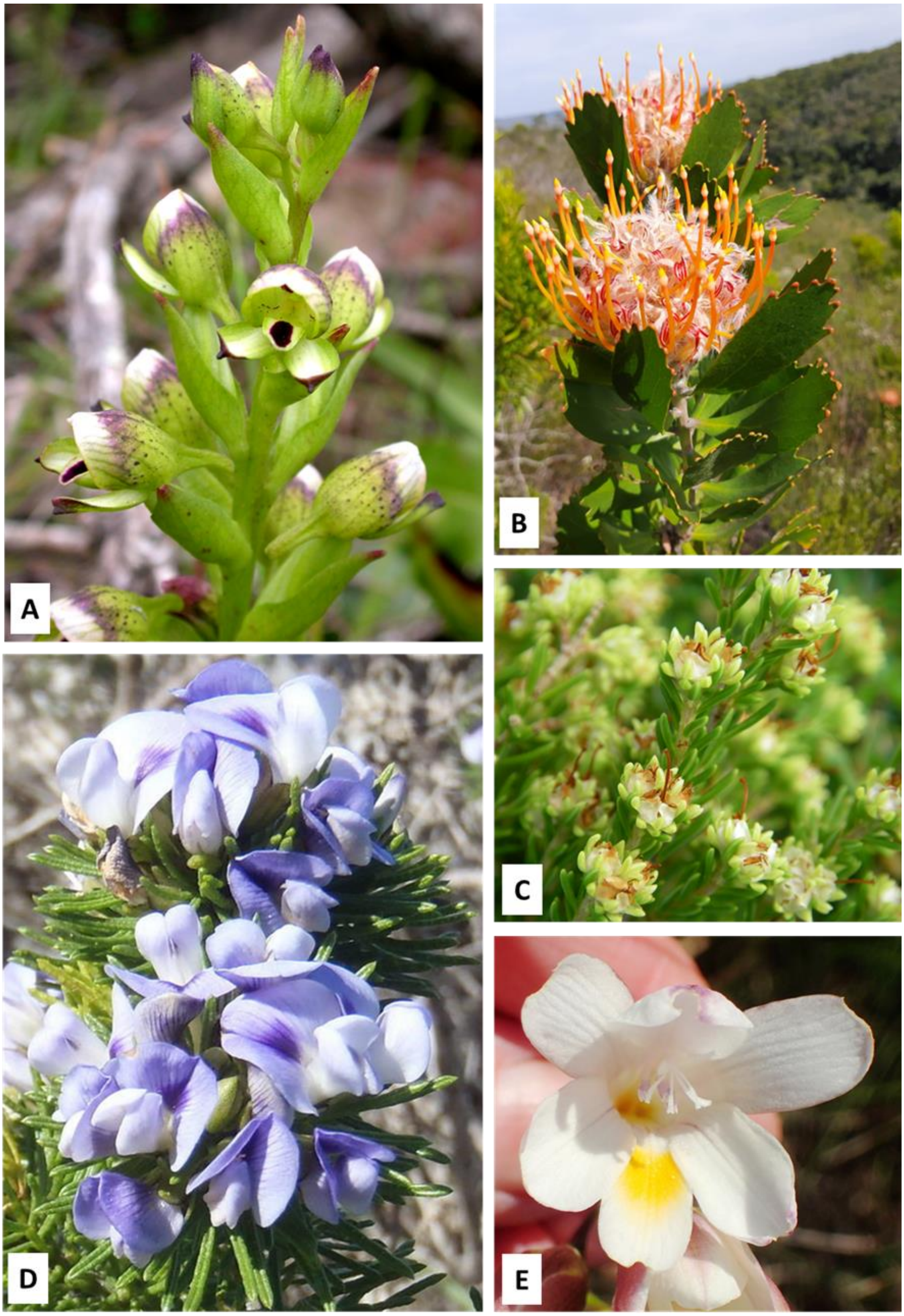

Figure 2.10: Plant species of conservation concern recorded from the Keurbooms River Cluster. A: *Disa hallackii*; B: *Leucospermum glabrum*; C: *Erica glumiflora*; D: *Psoralea vanberkelae*; E: *Freesia leichtlinii* subsp. *alba*. (Photos: A: A Vlok; B, C: H Nieuwoudt; D, E: N van Berkel).

2.3.1.3 Invasive Alien Vegetation

By 1997 invasive tree species had invaded an estimated 10 million ha in South Africa with the Fynbos biome being the worst affected (Le Maitre et al. 2000; Van Wilgen et al. 2001). Furthermore, invasive alien trees have a major negative impact on our limited water resources and it is estimated that 6.7% of the water runoff of the entire country is used by these plants (Le Maitre et al. 2000; Van Wilgen et al. 2008b; Van Wilgen & De Lange 2011). Moreover, it has been argued that the future impacts of invasive alien species may be much higher than anticipated, especially on surface water runoff, groundwater recharge and biodiversity (Van Wilgen et al. 2008b), and will likely continue to spread faster than they can be cleared (Van Wilgen et al. 2016). The current level of invasions already reduces the yield by 38 mill. m^3 per year and, in 45 years' time with no clearing, the reductions would increase to 130 mill. m^3 (Le Maitre et al. 2019). It has been estimated that the water yield from mountain catchments invaded by invasive alien species may reduce by more than 30% over 20 years of invasion (Van Wilgen et al. 2001).

Invasive alien plant species within riparian zones and wetland buffers are a known threat to freshwater ecosystems (Hill et al. 2020; Le Maitre et al. 2020). Therefore, their removal needs to be prioritised for maintenance of these systems, especially for rivers in high-water yield catchments. Not only will this improve the health of the freshwater ecosystems, but it will also allow for the release of more good quality water.

The Outeniqua Mountains have been identified as one of the Strategic Water Source Areas for South Africa (Le Maitre et al. 2018) delivering water to the farming communities, businesses, industries and residents of the Garden Route from Mossel Bay to Plettenberg Bay, as well as to those in the south-eastern Klein Karoo and Langkloof.

Invasive alien plants have been identified as a very high threat to all the ecosystems of the Garden Route area. A considerable number of the alien species in the GRCWHS&NR have been declared as invaders according to the latest published Alien and Invasive Species Lists, 2020 in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity Act (NEM:BA), 2004 (Act No. 10 of 2004). These species, their status, category and distribution on the various protected areas are presented in Table 2.5. This table also lists other exotic species that have been recorded on the protected areas as these too need to be monitored and managed in case they do become a bigger threat.

Invasive alien species plans have been completed for each of the clusters addressing not only invasive alien plant species, but also invasive alien animals (CapeNature 2022a, b, c). The current extent and density classes of invasive alien vegetation in each of the clusters are presented in Appendix 2, Maps 6a-e.

Table 2.5: Invasive alien plant species recorded within the various clusters of the Garden Route Complex World Heritage Site and Nature Reserves. Other exotic species that have been recorded and require monitoring and management are also listed. Species in bold are the most prominent species present on the protected areas.

Scientific name	Vernacular name	Family	Status	Category (NEM:BA Invasive Alien Species Regulations 2014, 2020)	Distribution
Schinus terebinthifolius	Brazilian Pepper tree/ Braziliaanse Peperboom	Anacardiaceae	Declared invader	Category 3	Goukamma
Vinca major	Greater periwinkle	Apocynaceae	Declared invader	Category 1b	Goukamma
Opuntia ficus-indica	Prickly pear / Turksvy	Cactaceae	Declared weed	Category 1b	Goukamma, Keurbooms River, Robberg
Bryophyllum delagoense	Mother of millions / Kandelaarplant	Crassulaceae	Declared weed	Category 1b	Goukamma
Ricinus communis	Caster oil plant / Kasterolieboom	Euphorbiaceae	Declared invader	Category 2	Goukamma, Keurbooms River
Acacia cyclops	Red eye / Rooikrans	Fabaceae	Declared invader	Category 1b	Goukamma, Keurbooms River, Outeniqua, Robberg
Acacia longifolia	Long-leaved wattle	Fabaceae	Declared invader	Category 1b	Goukamma, Outeniqua
Acacia mearnsii	Black wattle / Swartwattel	Fabaceae	Declared invader	Category 2	Goukamma, Keurbooms River, Outeniqua
Acacia melanoxylon	Australian blackwood / Australiese swarthout	Fabaceae	Declared invader	Category 2	Goukamma, Outeniqua
Acacia podalyriifolia	Pearl Acacia	Fabaceae	Declared invader	Category 1b	Goukamma, Outeniqua
Acacia saligna	Port Jackson / Goudwilger	Fabaceae	Declared invader	Category 1b	Goukamma

Scientific name	Vernacular name	Family	Status	Category (NEM:BA Invasive Alien Species Regulations 2014, 2020)	Distribution
Paraserianthes lophantha	Stinkbean / Stinkboon	Fabaceae	Declared weed	Category 1b	Goukamma, Outeniqua
Sesbania punicea	Red sesbania	Fabaceae	Declared invader	Category 1b	Goukamma
Myoporum insulare	Manatoka, Boobyalla	Myoporaceae	Declared invader	Category 3	Robberg
Myoporum montanum (= *Myoporum tenuifolium*)	Manatoka	Myoporaceae	Declared invader	Category 3	Robberg
Callistemon viminalis	Weeping bottlebrush	Myrtaceae	Declared invader	Category 1b	Outeniqua
Eucalyptus camaldulensis	Red river gum	Myrtaceae	Declared invader	Category 1b	Goukamma
Eucalyptus diversicolor	Karri / Karie	Myrtaceae	Declared invader	Category 1b	Goukamma
Eucalyptus saligna	Blue gum / Bloekom	Myrtaceae	Declared invader	Category 1b	Outeniqua
Leptospermum laevigatum	Australian myrtle / Mirt	Myrtaceae	Declared invader	Category 1b	Goukamma
Psidium cattleianum	Strawberry guava	Myrtaceae	Declared invader	Category 1b	Goukamma
Phytolacca octandra	Forest inkberry	Phytolaccaceae	Proposed Declared invader	Category 1b	Keurbooms River
Pinus pinaster	Cluster pine	Pinaceae	Declared invader	Category 2 and 1b	Goukamma, Keurbooms River, Outeniqua
Pinus radiata	Radiata pine, Monterey pine	Pinaceae	Declared invader	Category 2 and 1b	Goukamma, Outeniqua
Arundo donax	Giant reed / Spaansriet	Poaceae	Declared weed	Category 1b	Goukamma, Keurbooms River

Scientific name	Vernacular name	Family	Status	Category (NEM:BA Invasive Alien Species Regulations 2014, 2020)	Distribution
Cortaderia jubata	Purple pampas grass	Poaceae	Declared weed	Category 1b	Outeniqua
Cortaderia selloana	Pampas grass / Pampasgras	Poaceae	Declared weed	Category 1b	Goukamma, Outeniqua
Pennisetum clandestinum	Kikuyu grass/ Kikoejoegras	Poaceae	Proposed Declared invader	Category 1b	Goukamma, Keurbooms River, Outeniqua
Hakea gibbosa	Rock Hakea / Harige Hakea	Proteaceae	Declared weed	Category 1b	Outeniqua
Hakea salicifolia	Willow-leaved Hakea / Wilger Hakea	Proteaceae	Declared weed	Category 1b	Outeniqua
Hakea sericea	Silky Hakea/ Syerige Hakea	Proteaceae	Declared weed	Category 1b	Keurbooms River, Outeniqua
Rubus cuneifolius	American bramble / Amerikaanse sandbraam	Rosaceae	Declared weed	Category 1b	Goukamma, BBBSNR, Outeniqua
Rubus fruticosus	European blackberry / Braam	Rosaceae	Declared invader	Category 2	Keurbooms River
Populus canescens	Grey poplar / Vaalpopulier	Salicaceae	Declared invader	Category 2	Outeniqua
Salvinia molesta	Kariba weed / Watervaring	Salviniaceae	Declared weed	Category 1b	Goukamma
Datura ferox	Large thorn apple	Solanaceae	Declared weed	Category 1b	Goukamma
Datura stramonium	Common thorn apple	Solanaceae	Declared weed	Category 1b	Goukamma, Keurbooms River
Cestrum laevigatum	Inkberry / Inkbessie	Solanaceae	Declared weed	Category 1b	Goukamma

Scientific name	Vernacular name	Family	Status	Category (NEM:BA Invasive Alien Species Regulations 2014, 2020)	Distribution
Solanum elaeagnifolium	Silver-leaf bitter apple; Satansbos	Solanaceae	Declared weed	Category 1b	Goukamma
Solanum mauritianum	Bugweed / Luisboom	Solanaceae	Declared weed	Category 1b	Goukamma, Keurbooms River
Solanum pseudocapsicum	Jerusalem cherry	Solanaceae	Proposed weed	Category 1b	Keurbooms River
Solanum sisymbriifolium	Wild tomato, Dense-thorned bitter apple	Solanaceae	Declared weed	Category 1b	Goukamma
Lantana camara	Lantana, Tickberry	Verbenaceae	Declared invader	Category 1b	Goukamma, Outeniqua, Robberg
Verbena bonariensis	Wild verbena, Tall verbena	Verbenaceae	Declared invader	Category 1b	Keurbooms River, Outeniqua
Other alien species (not declared invaders or weeds)					
Asystasia gangetica	Creeping foxglove	Acanthaceae	Exotic species	Not declared invader	Robberg
Yucca sp.	Yucca	Agavaceae	Exotic species	Not declared invader	Goukamma
Amaranthus hybridus cruentus	Blood amaranth	Amaranthaceae	Exotic species	Not declared invader	Keurbooms River
Hypochaeris radicata	Catsear, flatweed	Asteraceae	Exotic species	Not declared invader	Goukamma
Myosotis arvensis	Field forget-me-not	Boraginaceae	Exotic species	Not declared invader	Goukamma
Raphanus raphanistrum	Wild radish, white charlock	Brassicaceae	Exotic species	Not declared invader	Goukamma
Humulus lupulus	Common hop, hops	Cannabaceae	Exotic species	Not declared invader	Outeniqua
Lonicera sempervirens	Coral honeysuckle	Caprifoliaceae	Exotic species	Not declared invader	Outeniqua

Scientific name	Vernacular name	Family	Status	Category (NEM:BA Invasive Alien Species Regulations 2014, 2020)	Distribution
Drymaria cordata subsp. *diandra*	Tropical chickweed	Caryophyllaceae	Exotic species	Not declared invader	Outeniqua
Medicago sativa	Lucerne	Fabaceae	Exotic species	Not declared invader	Keurbooms River
Vicia sativa	Common vetch, garden vetch	Fabaceae	Exotic species	Not declared invader	Goukamma, Keurbooms River
Quercus robur	Common oak	Fagaceae	Exotic species	Not declared invader	Goukamma, Outeniqua
Fumaria muralis subsp. *muralis*	Common ramping fumitory	Fumariaceae	Exotic species	Not declared invader	Goukamma, Keurbooms River
Fumaria officinalis	Common fumitory	Fumariaceae	Exotic species	Not declared invader	Goukamma
Eucalyptus globulus	Tasmanian blue gum	Myrtaceae	Exotic species	Not declared invader	Goukamma, Outeniqua
Psidium guajava	Guava	Myrtaceae	Not listed in Western Cape, but elsewhere in RSA.	Not declared invader	Goukamma
Metrosideros excelsa	New Zealand Christmas tree	Myrtaceae	Only listed in Overstrand area.	Emerging invader (Malan 2021 (pers. comm.)	Outeniqua
Avena fatua	Common wild oats	Poaceae	Exotic species	Not declared invader	Goukamma
Briza maxima	Greater quaking-grass	Poaceae	Exotic species	Not declared invader	Goukamma, Keurbooms River, Outeniqua
Bromus catharticus	Rescue grass, grazing brome	Poaceae	Exotic species	Not declared invader	Goukamma
Bromus diandrus	Great brome, ripgut brome	Poaceae	Exotic species	Not declared invader	Goukamma

Scientific name	Vernacular name	Family	Status	Category (NEM:BA Invasive Alien Species Regulations 2014, 2020)	Distribution
Chloris gayana	Rhodes grass	Poaceae	Exotic species	Not declared invader	Goukamma
Eleusine coracana	Finger millet	Poaceae	Exotic species	Not declared invader	Goukamma
Lagurus ovatus	Hare's tail	Poaceae	Exotic species	Not declared invader	Goukamma
Lolium rigidum	Annual ryegrass	Poaceae	Exotic species	Not declared invader	Goukamma
Poa annua	Annual bluegrass	Poaceae	Exotic species	Not declared invader	Goukamma
Poa pratensis	Kentucky bluegrass	Poaceae	Exotic species	Not declared invader	Keurbooms River
Polypogon monspeliensis	Annual beard-grass, annual rabbitsfoot	Poaceae	Exotic species	Not declared invader	Goukamma
Rumex acetosella angiocarpus	Common sheep sorrel	Polygonaceae	Exotic species	Not declared invader	Keurbooms River
Anagallis arvensis	Scarlet pimpernel	Primulaceae	Exotic species	Not declared invader	Goukamma, Keurbooms River
Cydonia oblonga	Common quince	Rosaceae	Exotic species	Not declared invader	Keurbooms River
Pyracantha coccinea	Scarlet firethorn	Rosaceae	Exotic species	Not declared invader	Keurbooms River
Rubus ulmifolius	Wild blackberry, braam	Rosaceae	Exotic species	Not declared invader	Outeniqua
Citrus limon	Lemon tree	Rutaceae	Exotic species	Not declared invader	Goukamma
Tribulus terrestris	Puncture vine, Gokshura, caltrop, goat's head / Duwweltjies	Zygophyllaceae	Exotic species	Not declared invader	Outeniqua

Clearing and controlling invasive alien plant species are costly and given the limited funding available, prioritisation of areas to be cleared need to be undertaken to maximise benefit. Invasive alien vegetation is eradicated by reserve management according to priorities set during the annual Integrated Work Planning (IWP) sessions and which are included in the Integrated Annual Plan of Operations (IAPO). For the Outeniqua and Goukamma Clusters, funding for implementation is obtained through DFFE Natural Resource Management (NRM) and for the Keurbooms River Cluster through the CapeNature Integrated Catchment Management (ICM) programme.

Current status of invasive alien plants

In the GRCWHS&NR the most prominent and widespread invasive alien plant species on the Outeniqua Cluster are European pines (*Pinus pinaster, P. radiata*), and Australian Acacias (*Acacia mearnsii, A. melanoxylon, A. longifolia, A. cyclops*), *Hakea sericea* and pockets of stinkbean (*Paraserianthus lophantha*) infestations. On Goukamma and Buffalo Valley, *Acacia* species (*A. cyclops, A. saligna, A. mearnsii*), *Paraserianthus lophantha*, pines (*Pinus pinaster*, *P. radiata*) and *Leptospermum laevigatum* are the most abundant, while the BBBSNR is generally kept clear of invasive alien plant species. Within the Keurbooms River Cluster, Robberg has dense infestations of *Acacia cyclops* on the steep north-facing slopes and some *Opuntia ficus-indica*. Keurbooms River has low infestations of *Hakea sericea*, *Pinus pinaster*, *Acacia cyclops* with denser clumps of *Acacia mearnsii* and pockets of *Arundo donax* along the riverbanks. Annex Vlugt has dense infestations of pines (*Pinus pinaster, P.radiata*), *Hakea sericea* and *Acacia mearnsii*. The distribution of these species within the various clusters is highlighted in the vegetation unit descriptions above (see 2.2.4.3).

The spread of most invasive alien plant species is affected by fire. Virtually all the invasive alien plant species occurring in the GRCWHS&NR are fire-adapted and have a competitive advantage over indigenous plant species (CapeNature 2022a, b, c). Invasion of ecosystems by these fire-adapted alien trees and shrubs occur due to an abundance of seeds that accumulate in the soil or are released from cones or fruits when the trees are burnt or die. With every fire, the fire-adapted invasive alien plants within the burnt area are stimulated to spread and recruit. If alien clearing has not kept up with the spread after previous fires, the invasion will increase in size and densities. This significantly influences clearing activities and the prioritisation thereof.

The current levels of infestation within the Outeniqua and Goukamma Clusters are a very serious cause for concern. An analysis of the densities and spread of invasive alien plants in the Outeniqua Cluster indicates an increase from before the massive 2018 fires to 2020, 2021 and 2022 (Figure 2.11). While most of the Outeniqua fell in the maintenance and up to 1% density classes before the fires in 2018, this has moved to the higher category density classes (very scattered (1-5%) and scattered (5-25%)) with larger proportions becoming progressively more densely infested, i.e., moving into the higher density classes. The change from 2020 to 2021 and 2022 is noticeable and it is evident that the clearing projects are not keeping pace with the rate of reinfestation. Of great concern is the fact that infestations on intermediate and high-altitude slopes are increasing dramatically due to lack of funding to work in these areas. The battle against the invasive alien plants is being lost and as a result biodiversity and ecosystem services (particularly water security) are being compromised.

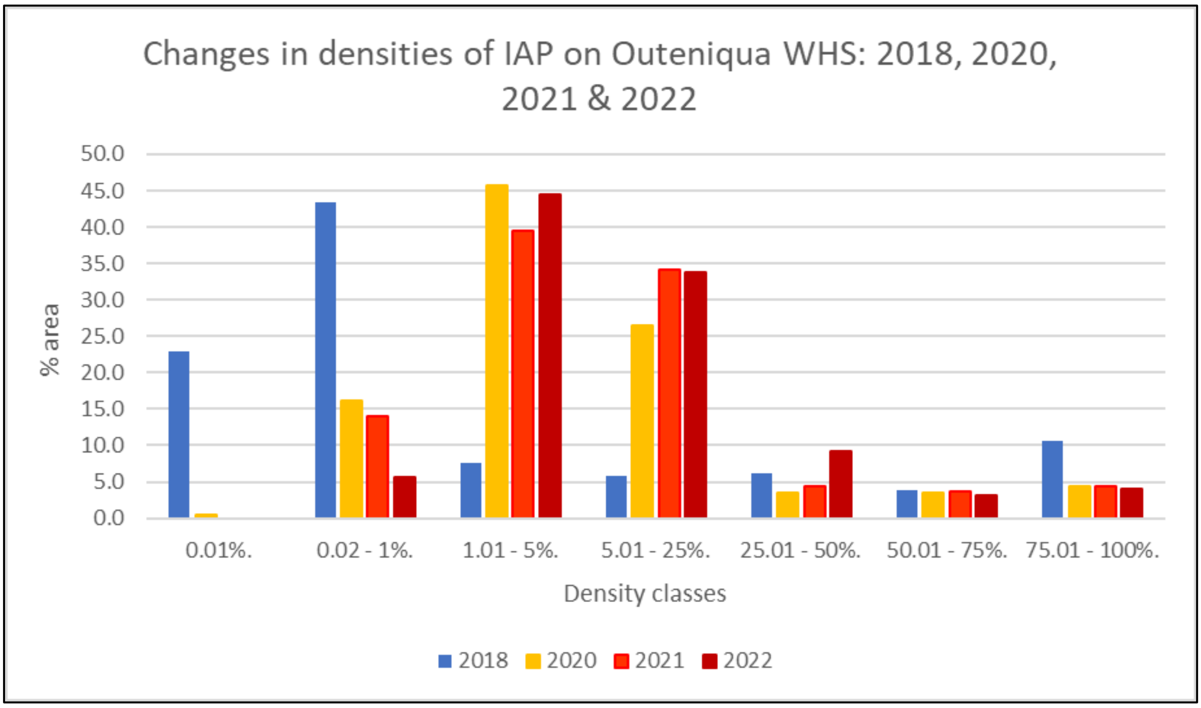

Figure 2.11: Proportion area of the Outeniqua Cluster falling within the different density classes for invasive alien plants in 2018, 2020, 2021 and 2022. Note that the data for 2018 are from before the big 'George' fire.

Data for Goukamma are displayed in Figure 2.12. In 2016 (i.e., before the 2017 'Knysna' fire) the majority of the protected area fell in the very scattered category (1.01-5%). Note that the data for 2016 were mainly restricted to the boundaries of Goukamma (i.e., not including Buffalo Valley and the properties to the west) and hence comprise a much smaller area. Data for Buffalo Valley and adjacent properties to the north and west were incorporated in 2018, 2020, 2021 and 2022 and are therefore comparable. Before the fire, 88% of Goukamma had very scattered densities (1-5%) and about 10% had scattered (5-25%) infestations. The fire in 2017 clearly stimulated the recruitment and regeneration of the invasive alien plants resulting in the densities moving into the higher density categories. From 2020 to 2022 the increase in infestations is significant, with almost 2/3^{rds} of the area falling in the very scattered (1-5%) to scattered (5-25%) classes in 2020, but by 2022 this has changed to 2/3^{rds} in the medium (25-50%) to dense (50-75%) classes. This indicates that follow-up clearing efforts could not keep up with the reinfestations, leading to substantial build-ups in the scattered to dense categories over the past three years.

Alien vegetation densities in the Keurbooms River Cluster are classified as rare to occasional (densities of 1% or less) for the Keurbooms River and Robberg sectors, but dense (60% or more) for the Annex Vlugt sector. It was recently noted that densities of *Arundo donax* (Giant reed) along the Keurbooms River are increasing at an alarming rate and need to be addressed as a priority.

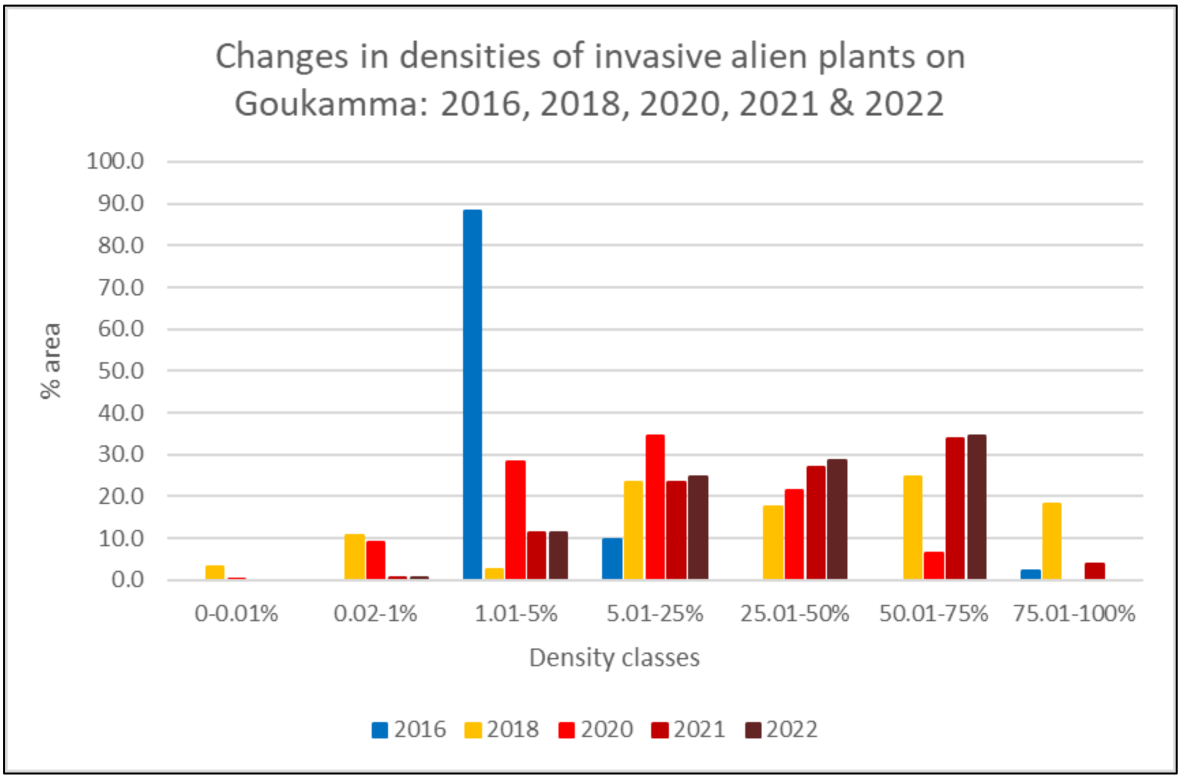

Figure 2.12: Proportion area of Goukamma falling within the different density classes for invasive alien plants in 2016, 2018, 2020, 2021 and 2022. Note that the data for 2016 is from before the big 'Knysna' fire and excludes Buffalo Valley and the adjacent properties to the north and west. Data for 2018, 2020, 2021 and 2022 include Buffalo Valley and the adjacent properties to the north and west.

Challenges

Management has highlighted several challenges that have led to the deterioration of Outeniqua and Goukamma in terms of invasive alien plant infestations. Some of these include:

- Funding approval and release being erratic and late, resulting in limited time to complete work before financial year-end;
- Rules stipulated by funder that only work on state land is to be funded;
- Contractor shortcomings and problems with non-compliance;
- Red-tape required for start-up contractors;
- Loss of contractors due to delayed funding;
- Funding being only available for work on general slopes; none for intermediate and high-altitude work, or for fly-in and extended in-field camping by clearing teams;
- The massive fires that have occurred in the area and not being able to do follow-up clearing within the critical periods;
- Reinfestation of cleared areas through spill-over from adjacent unmanaged public (no-man's land) and private land;
- Flooding events that have resulted in roads being washed away;
- Lockdown due to Covid-19 halted all contractor work on protected areas for extended periods; etc.

The current scale of invasive alien plant infestations within certain parts of the GRCWHS&NR is discouraging as substantial resources have been spent in the past to clear these areas and achieving success. For example, during the early 1980s the then Dept of Forestry implemented invasive alien plant clearing projects in the Doringrivier and Witfontein sectors of the Outeniqua. At that time *Hakea* trees and seedlings covered vast areas of up to 100% densities (Ivan Donian, pers. comm.). Fully trained teams of 50 permanent labourers camped in Doringrivier and Camferskloof for extended periods to clear alien plants. Controlled burns were executed in very dense areas and followed up with regular scheduled manual clearing work (Tony Marshall, Jan Vlok, pers. comms.). Additional teams of women were brought in to pull out *Hakea* seedlings at Doringrivier following fires. By the early 1990s these areas were cleared to densities of less than 5%. In addition, *Protea neriifolia* and *Protea repens* seedheads were collected and spread in areas where these *Protea* species had been outcompeted by the dense cover of *Hakea* (of up to 100%) before clearing took place (Ivan Donian, pers. comm.). Funding was secured and allocated towards these projects, especially to do follow-up work. These efforts were further supported in the 1990s through the Working for Water programme but were less effective because of the contractor models that were implemented. This involved replacing permanent labourers by appointing contractor teams to do the clearing work. Although this was a noble idea at the time, it has not worked successfully in practice and is one of the major reasons why substantial areas within the Garden Route have deteriorated in terms of the presence and densities of invasive alien plants. Vast sums of money have been spent in the area on alien plant clearing with little to no improvement in densities and spread (Ivan Donian, pers. comm.). In addition to the relevant challenges listed above, one of the key factors in the poor performance of contractors is the fact that there is no accountability or consequence management for contractors not complying with contractual agreements (Ivan Donian, pers. comm.). These challenges will have to be urgently addressed if the goals set for alien plant clearing in this management plan are to be met. This is even more critical because of decreasing year-on-year funding and the added challenge of the forestry exit areas being added to the Outeniqua Cluster.

There is a number of examples in the Western Cape where alien plant clearing has been implemented successfully. These are all projects that are focussed on a collective action approach that includes multiple private and public partners, such as the Upper Breede Collaborative Extension Group project in the Breede and Berg Rivers (Rudolph Röscher, pers. comm); the Greater Cape Town Water Fund project in the Theewaterskloof area (Louise Stafford, pers. comm.); and the Grootvadersbosch Conservancy invasive alien plant clearing project in the Swellendam-Heidelberg Area (Aileen Anderson, pers. comm.).

All these projects have an independent implementation body that oversees and manages the clearing projects to which private landowners, government institutions, non-government organisations, industry, research institutions, etc. contribute funding and expertise where relevant. The over-all objectives include building capacity and support where initiatives and responsibilities overlap; improving communication; planning collaboratively; sharing knowledge and expertise; improving coordination; enhancing service delivery; and owning and embracing the initiative (Rudolph Röscher, pers. comm.).

Recommendations

From the above, it is clear that urgent interventions are required to address the problems associated with alien vegetation management, especially in the Outeniqua and Goukamma Clusters. Motivations for focussed alien plant clearing programmes by fully trained teams, supported by secured, dedicated funding for at least a 5 to preferably 10-year period need to be compiled and actively promoted and negotiated with various funding institutions. Partnerships (existing and new) are key to ensure the long-term implementation of an effective and sustained alien clearing programme.

Emphasis would need to be placed on catchment prioritisation (Van Wilgen et al. 2008a), the use of prescribed burning as part of invasive alien vegetation management, the release of biological control agents in strategic areas, especially where clearing projects will only be executed in later years (Van Wilgen et al. 2022). In particular, the forestry exit areas that are to be integrated into the protected area network would need to be planned for and incorporated in the long-term clearing and rehabilitation plans.

2.3.1.4 Fire Regimes

Fire is the driver of ecological processes in fynbos ecosystems. All species that have evolved within the Fynbos biome are adapted to periodic fires as part of their life cycles – in fact, without fire they would not be able to persist. Fires are essential to stimulate recruitment (regeneration) and maintain species richness (Van Wilgen & Forsyth 2008; Forsyth et al. 2010).

In CapeNature's Integrated Veldfire Management Policy (CapeNature 2022d) one of the objectives is to protect the ecological integrity of CapeNature-managed land. Other objectives are to comply with the National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) and other relevant legislation; to minimize risk posed by wildfires to CapeNature, in respect of property, liability and reputation; to provide for the management of corporate and cooperative governance structures to practice integrated fire management; and to provide a standardised approach to integrated fire management, aligned to national, provincial, and local requirements. CapeNature promotes ecological principles in the management of fires for the conservation of biodiversity and ecosystem resilience across the landscape of the Western Cape Province.

One of the most critical functions of conservation managers of catchment areas is to implement ecologically sound fire management. This involves managing fire regimes, which include varying the frequency, season, intensity, and size of fires, and reconciling ecological and practical requirements. According to the CapeNature fire management guideline (CapeNature 2016), fire management practices (such as prescribed burning, adaptive intervention management and natural burning zones) can be collapsed into a single model that simply varies with regards to the degree to which intervention (in the form of fire suppression, containment, or prescribed burning) is practiced. Fire management should be adapted more to the circumstances a protected area finds itself in than the eco-zone (according to Van Wilgen & Forsyth (2008)) in which it is situated.

Within the GRCWHS&NR all the Fynbos habitat types, as well as the Subtropical Thicket units that form a mosaic with Fynbos (listed and described in section 2.3.1.2 above), are dependent on periodic fires to persist. The local fire regime (i.e., the intervals between successive fires, season of fires, intensity, and fire size) plays a significant role in the species composition of fire dependent habitat units (Vlok & Yeaton 1999, 2000; Esler et al. 2014).

History of fire management

The establishment of forestry plantations along large tracts of land for timber production in the Garden Route area has had a profound impact on fire management over the past century. In Appendix 2, Map 7 the extent of these plantations on the Outeniqua Mountains between Cloete's Pass and Prince Alfred's Pass and in the adjacent coastal plain area is shown. Except for Robberg, all the CapeNature-managed protected areas, as well as the SANParks land are abutted or fragmented by state-owned or private plantations. Because of the severe threat posed to plantations, fires had to be intensely managed and controlled.

Various approaches to the management of fires in fynbos have been implemented in the catchment areas of the Garden Route since the 1920s. A chronological account of these practices is summarized by Kraaij et al. (2011). Although this publication is mainly focused on the Garden Route National Park, the changes in management approaches are also relevant to the Outeniqua Cluster, as the adjacent state-owned plantations were also managed by the then Dept of Forestry. In the case of Goukamma, the plantations were and still are privately-owned. Some of the managers, scientists and field staff who previously worked in these areas were contacted to verify details about the management of the state forests, plantations, and conservation areas over the past few decades (Tony Marshall, Jan Vlok, Tom Barry, Jan Makampies; pers. comms.).

Initially, from the 1920s to the 1940s, a fire exclusion policy was implemented, except adjacent to afforested areas where broad firebreaks ('mountain belts') of 100-500 m (sometimes up to 2 km) wide were maintained through prescribed burning to protect plantations (Kraaij et al. 2011). Conservation of fynbos was not a priority during this period. From the mid-1940s to late 1950s prescribed burning of firebreaks were implemented on a (3-) 5–6-year rotation and fynbos areas on a 10-year cycle during spring and early summer. During the 1960s to late 1980s prescribed burning was systematically implemented – mainly to protect plantations, but also to promote water, soil and biodiversity conservation (Kraaij et al. 2011). Substantial areas were burnt in successive prescribed burns, but fires caused by lightning were to be suppressed. Fynbos conservation became the primary objective only in specific nature reserves.

During the mid-1980s a split occurred in the Dept of Forestry between plantation management, conservation management and research, and at a national level, catchment areas were transferred to provincial conservation agencies. Budget cuts resulted in plantation management not being able to maintain prescribed burning of the mountain belts and these areas subsequently became the so-called 'no-man's land' due to neglect. All lightning-induced fires were to be suppressed.

Implementation of the prescribed burning system in catchments ceased during the 1990s because of a decline in funding. The South African Forestry Company Limited (SAFCOL) was established and catchment and plantation management separated completely. The broad firebreak system was reduced to a 50 m wide tracer belt and brush-cut strip along the northern boundary of plantations, and the 'no-man's land' areas degraded further due to lack of management. In the early 2000s SAFCOL plantations were sold to a private forestry company, Mountain to Ocean Forestry (MTO), but the Dept of Forestry remained the landowner. Firebreaks along the northern boundaries of plantations were reduced to 10-30 m wide with the larger mountain belts reverting back to fynbos. Alien clearing within these areas became challenging and the no-man's land areas degraded even further. During this time the Western Cape Nature Conservation Board was established as the provincial nature conservation authority and SANParks took ownership of large sections of the fynbos areas on the Outeniqua and Tsitsikamma Mountains with the establishment of the Garden Route National Park (Kraaij et al. 2011). This led to a conflict of interest between forestry and the conservation agencies regarding the burning of fynbos adjacent to plantations versus the ecologically sound management of fynbos in protected areas.

Outeniqua Cluster. A total of 268 fires are recorded in the CapeNature fire database for the period from 1936 to 2020. Figure 2.13 shows the number and total size of fires per year within the cluster from 1940 to 2022. Roughly five periods are evident – from the 1940s to the early 1960s very small areas burnt at a time (except for 1952); during the mid-1960s fewer fires occurred but larger areas burnt per fire; the 1970s to 1980s saw very many, but small fires (this is the time when the prescribed burning system was implemented). From the mid-1990s to about 2005 the extent of areas burnt increased a great deal, followed by a period where there were many, but small fires from 2006-2014. However, from 2015 the number and sizes of fires increased, with 2018 being an extraordinary year when 22 800 ha of the Outeniqua Cluster burnt in only two fires. One of these fires formed part of the devastating 'George fire' that raged for a full month burning a total of 84 402 ha on the Outeniqua Mountains. Co-incidentally this increase in number and sizes of fires appears to be correlated with the decrease in rainfall that has been experienced in the Garden Route and Klein Karoo areas (see 2.2.1.1).

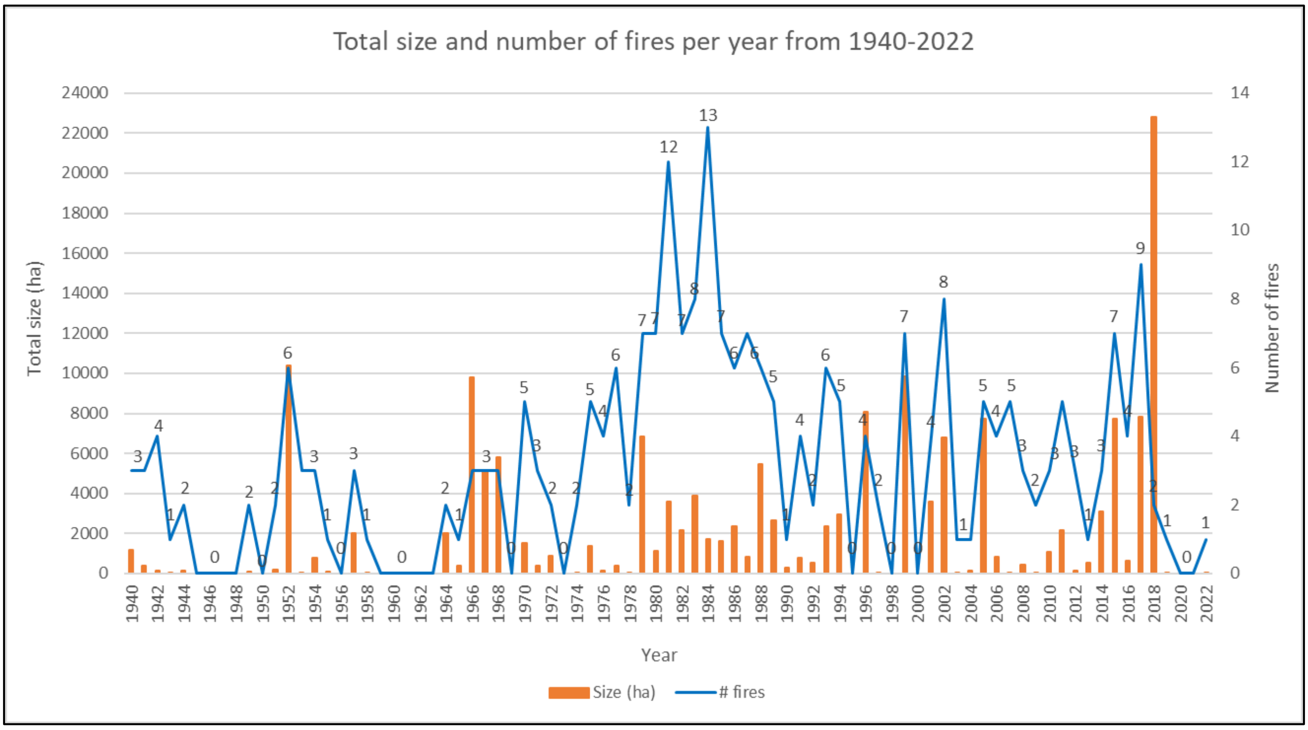

Figure 2.13: Total size and number of fires per year within the Outeniqua Cluster from 1940-2022.

Goukamma Cluster. As is evident from the map (Appendix 2, Map 7) Goukamma is abutted by plantations along its northern boundary. This has cut-off natural fires from spreading into the protected area from the coastal mountains. According to Van der Merwe (1976) a prescribed burning programme was implemented from 1962 to 1968. This was however stopped due to financial constraints, but internal and boundary firebreaks were maintained. In 1969 a fire and slashing programme was started to ascertain the management requirements for veld management. These test plots were placed on the southern slope of the main Groenvlei dune (Van der Merwe 1976). Unfortunately, these earlier fires have not been captured in the CapeNature Fire Database, but a total of 20 fires from 1991 to 2020 have been recorded. Only two of these fires were induced by lightning but were rapidly contained and extinguished. Prescribed burning was re-initiated in 2002 when a block along the northern boundary was burnt, and subsequently controlled burns have taken place in 2004 and 2005. Reasons for the fires were to reduce fuel loads along boundaries, to prepare for ecological burns and for alien vegetation management. No controlled burns have been conducted since 2006, but a fire started in the reeds near the jetty north of Groenvlei in 2015 and burnt eastwards covering an area of 41 ha. In June 2017 virtually the entire Goukamma Cluster (including Buffalo Valley and Brenton Blue Butterfly sectors) burnt in the massive 'Knysna fire' that extended over an area of 19 347 ha. This highly destructive fire was driven by an increased buildup of fuel loads due to the pine plantations that have been established in fynbos areas, the associated spreading of pine trees from plantations into fire-prone vegetation and the suppression of fires from burning fire-dependent shrublands (Kraaij et al. 2018). In addition, the area was in the grip of an extended drought and fire danger weather conditions were exceptional during that period.

Keurbooms River Cluster. Three fires have been recorded for Robberg from 2001-2017 and four for Keurbooms River from 1997 to 2013 in the CapeNature Fire Database. These have mostly been through prescribed burning, except for the spot-fire on Robberg that originated from the 2017 Knysna-fire. Of the three fires recorded on Annex Vlugt from 1974 to 2017, two were caused by lightning and one by a farmer.

Fire size and Fire return interval

The 2021-2022 veld age maps for the GRCWHS&NR are shown in Appendix 2, Maps 8a-e and the proportions of veld in different veld age classes in Figure 2.14 and Table 2.6.

Table 2.6: Summary of total sizes (ha) and proportions (%) of veld in specific veld age classes within each of the clusters of the Garden Route Complex World Heritage Site and Nature Reserves as in December 2022.

Veld age class	Outeniqua	Goukamma	Keurbooms River	Robberg
1-6	(30 568.3ha) - 65.4%	(1 711.1 ha) - 94.4%	0	(6.3 ha) - 53.3%
7-10	(10 987.9ha) - 23.5%	(40.6 ha) - 2.2%	(192.3 ha) - 74.9%	0
11-15	(628.6 ha) - 1.3%	(0.0 ha) - 0.0%	(28.3 ha) - 11.0%	0
16-20	(1 048.8ha) - 2.2%	(12.4 ha) - 0.7%	0	(2.1 ha) - 17.9%
21-25	(1 232.8ha) - 2.6%	(1.1 ha) - 0.1%	0	(3.4 ha) - 28.8%
>26	(2 296.5 ha) - 4.9%	(48.4 ha) - 2.7%	(36.0 ha) - 14.0%	

For the Outeniqua Cluster 65.4% of the veld is up to 6 years old and 89% 10 years or less. This very large proportion of young veld is worrying as it is known that Cape sugarbirds, the primary pollinator of most *Protea* species needs old veld to forage and breed (Alan Lee, pers. comm.). Only 3.5% is between 11 and 20 years old and considered good veld for Cape sugarbirds.

Within the Goukamma Cluster 94.4% is 6 years or less, mainly due to almost the entire area burning in the 2017 Knysna-fire. Only 5.7% of the area is older. This goes against the aim of having a more or less equal spread of young, medium and old veld ages. Most of the veld (75%) on Keurbooms River is 7 to 10 years old, 11% up to 15 years and 14% older than 26 years. For Robberg 53% is up to 6 years old and the remainder of the burnable veld 16 years or more, and on Annex Vlugt 38% is 6 years old and the rest 44 years or older.

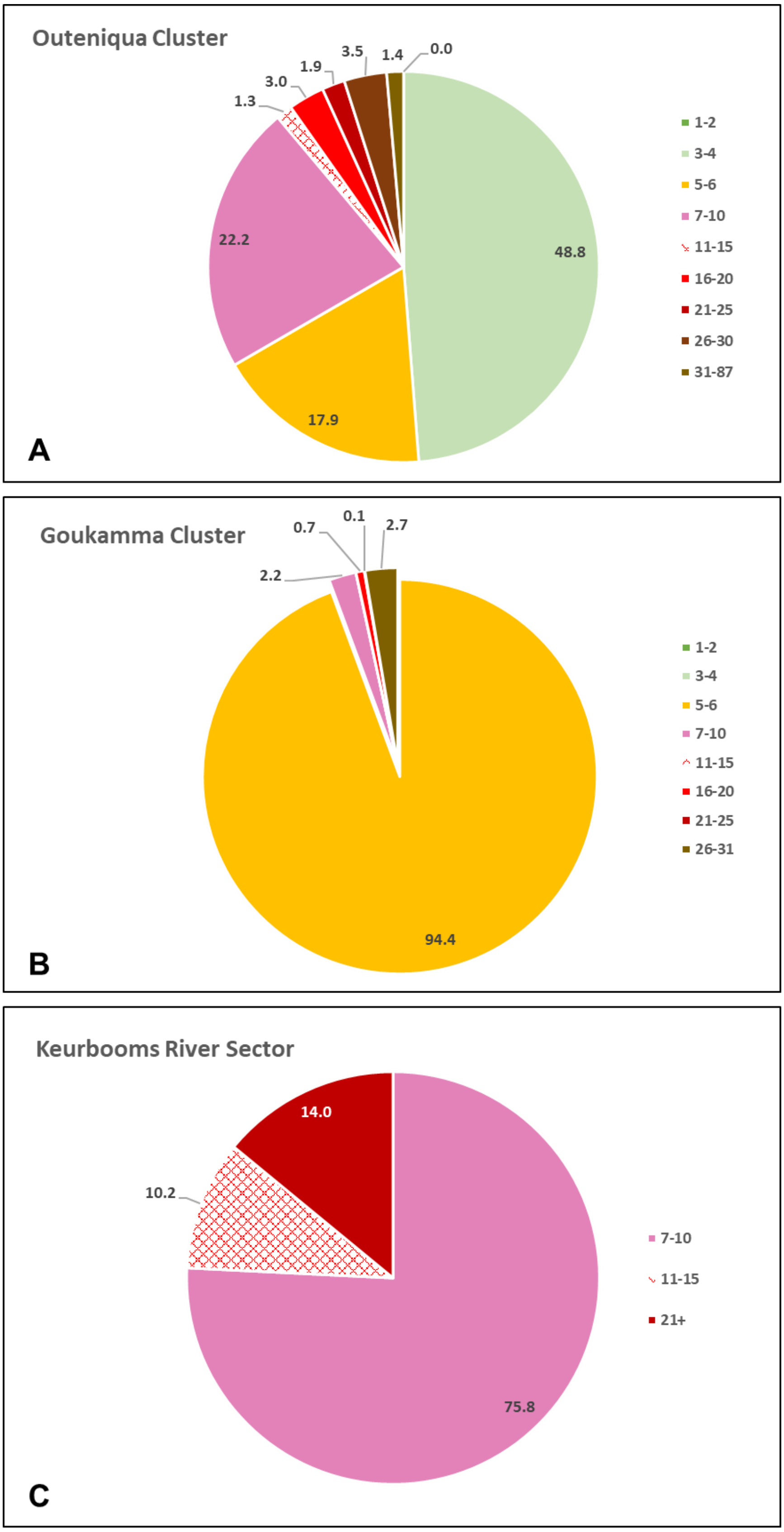

Figure 2.14: Proportion area in each of the veld age classes for A: Outeniqua; B: Goukamma Clusters, and C: Keurbooms River sector as in December 2022.

From a fire management perspective, it is of great concern that such extensive areas of Outeniqua and Goukamma (89-96%) consist of young veld. These large areas of even-aged veld are maturing and becoming burnable and ignitable at the same time, which could result in more uncontrollable fires originating. Especially since these protected areas are abutted by plantations or land that is unmanaged and infested with invasive alien plants. As such, fires could spread into or from the protected areas. The management of these areas needs to be properly planned for in partnership with other relevant agencies and integrated into the long-term veldfire management and response plan for the landscape.

An analysis done on the sizes of fires that occurred within the Outeniqua Cluster over the past six decades (1961-2020) showed that the sizes of individual fires have increased markedly over the period (Figure 2.15). In the 1960s there were two very large fires burning just over 50% of the area, one of which was a prescribed burn and the other a human-induced fire. The largest proportion of area on the Outeniqua Mountains burnt in medium-sized fires in the 1970s and 1980s through the prescribed burning programme that was being implemented by Dept of Forestry during that time. In the 1990s two very large fires resulted in 51% of the area being burnt, one caused by lightning and the other human-induced; only four prescribed burns were executed during this period. Three large fires burnt 57% of the area during the 2000s, one caused by people, the other by lightning and one of unknown origin. Most lightning fires were small to medium in size during this period. However, in the 2010s there were four very large fires resulting in 75% of the area being burnt; two fires were started by humans, one by lightning and the other was recorded as of unknown origin. Similar increases in fire sizes during the past decade have been recorded on the Swartberg Complex WHS and Nature Reserves (CapeNature 2020b).

An analysis of fire return intervals within the Outeniqua Cluster from 2005 to 2020 found that 24.4% (11 733.1 ha) of the area burnt at least twice in 13 years, 17.8% (8 557.5 ha) twice in 12 years, 15% (7 216.9 ha) twice in 10 years and 2.4% (1 159.6 ha) twice in 6 years. The spatial extent of these impacted areas is displayed in Appendix 2, Map 9. From the map it is evident that all the sectors have been subjected to fires with short to very short return-intervals. This is in addition to the mentioned increase in very large sized fires experienced over the past decade (Figure 2.15). Recent research has confirmed that globally and within the CFR, many areas are experiencing more frequent and larger-sized fires (Kraaij et al. 2012a; Kraaij & Van Wilgen 2014).

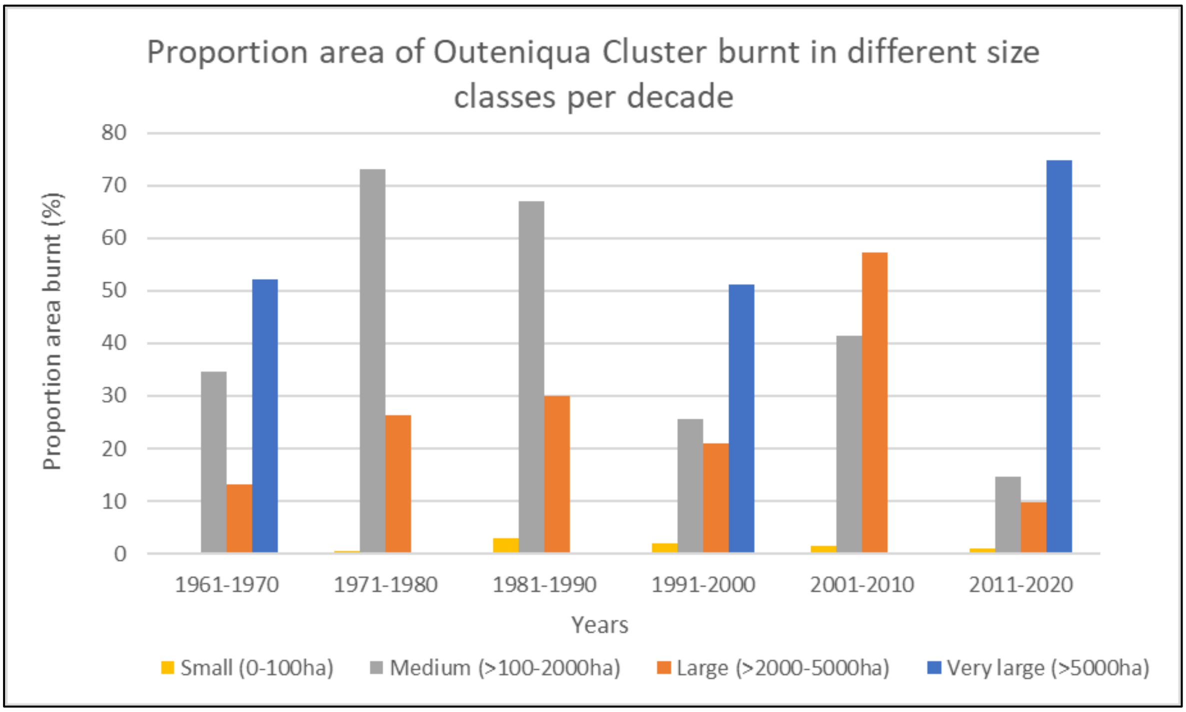

Figure 2.15: Proportion of Outeniqua Cluster burnt per decade in small, medium, large and very large fires from 1961-2020.

The above findings are of great concern, as it is known that fires that are occurring at repeated short return intervals and that are large, are detrimental to Fynbos biodiversity and ecosystem health. Fynbos endemic Cape Sugarbirds require flowering proteas (such as *Protea lorifolia*, *Protea neriifolia*, *Protea eximia*, *Protea repens*) as their primary food source, and proteas are also their preferred nesting locations (Alan Lee, pers. comm.). Because these non-sprouting overstorey *Protea* species are the slowest to mature and set seed after fires, they are used as indicator species in monitoring to set thresholds of potential concern (TPC) for fire return interval and fire season where they occur (Kraaij et al. 2012b; Esler et al. 2014; Kraaij & Van Wilgen 2014; Jacobs et al. 2017).

Research has indicated that non-sprouting overstorey *Protea* species are not only important for Cape Sugarbirds, but they also play a critical role in maintaining species richness in the landscape (Vlok & Yeaton 1999, 2000). In return, the proteas are also dependent on Cape Sugarbirds for effective pollination of their flowers in order to set proper seed.

As a rule, it is said that fire return intervals between successive fires must not be shorter than the time it takes for 50% individuals of the slowest maturing non-sprouting *Protea* species to have flowered three times (Kruger & Lamb 1978). Monitoring results have indicated that the youth phase periods (from seedling to flowering and setting seed) of the different indicator *Protea* species vary considerably. Based on the Kruger and Lamb (1978) rule of thumb method results show that *Protea lorifolia* is the slowest maturing indicator species for the northern slopes of the Outeniqua, and in particular for Camferskloof, Doringrivier and Zebraskop. Based on data collected for this species in Doringrivier over two fire cycles (1989-2002 and 2011-2018) the threshold for the species had not yet been reached by year 13, as only 45% of the individuals had flowered three times by 2002. There were three consecutive fires in the area with inter-fire periods of 13, 8 and 7 years. With the last 7-year inter-fire period only 1% of the individuals had flowered twice and none yet three times.

Data collected from 2005 to 2018 for two other species (*Protea neriifolia* and *P. repens*) in Camferskloof and Doringrivier indicate that the former reaches the threshold by year 9 and the latter by year 10. Results of an earlier fire cycle from 1982-1999 show that these species took much longer to start flowering and reaching the threshold, with *P. neriifolia* at 13 years and *P. repens* at 16 years. Incidentally, the in-between fire cycle of 6 years from 1999-2005 resulted in these two populations being severely impacted in the Camferskloof area as a result of the very short fire return interval, with only 10 individuals of *P. neriifolia* and 7 of *P. repens* that had flowered for the first time at year 6. Similarly, data collected for *P. repens* over two fire cycles (1989-2006 and 2006-2018) in Attaquaskloof (i.e., the southern slopes of Outeniqua) show that the species took 14 years to reach the threshold during the first inter-fire period and 9 years during the second one. With fires burning at shorter return intervals, it appears that the indicator species reach the threshold age earlier, both on the northern and southern slopes. This may be a selection process for faster growing genetic material. However, it is known that flowering of *Protea* species is linked to rainfall and with conditions said to become drier with climate change these fast-growing populations are likely to be impacted. It is therefore suggested that the threshold be set at 15 years for both the northern and southern slopes to accommodate the slowest maturing species and the fact that most fires tend to burn over mountain crests from south to north or north to south. All the areas highlighted in the map (Appendix 2, Map 9) have thus burnt at intervals below the suggested threshold and monitoring results indicate poor to very poor recruitment following fires with short return intervals. These areas need to be protected from burning again at short frequency to allow for the indicator species to flower and produce sufficient seed.

For Keurbooms River, *Protea neriifolia* has been monitored from 2005-2012 on a dry west-facing slope following a fire in 1997 to determine the threshold for fire return interval. The results show that at the age of 15 years only 33% of the individuals had flowered three times and 54% had flowered twice. It is suggested that the threshold will be reached at about 16 to 17 years which is markedly longer than the suggested threshold of 9 to11 years for the Tsitsikamma area (Kraaij et al. 2012b). The monitoring site in the Tsitsikamma area was however located on a moist south-facing slope.

Post-fire monitoring results support these thresholds as the best seedling recruitment takes place when the pre-fire veld age is in the order of 15 years. Of interest is that Protea *neriifolia* generally shows better recruitment than *P. repens*, similar to the difference in the growth rate and flower production between these two species. It is anticipated that other slow-maturing, restricted and threatened high-altitude species, such as *Protea grandiceps* would be accommodated within this threshold, as the plants occur mostly in rocky habitats, where they are partially protected from fires burning an entire population out. This, however, needs to be carefully monitored. The suggested thresholds are being further refined as more monitoring data are being collected.

Fire season, intensity and cause

For the Outeniqua Cluster the total number and sizes of fires per month from 1940-2022 are illustrated in Figure 2.16. This figure differentiates between fires that have originated through various causes: natural (lightning, rock falls), fire operations (prescribed burns, firebreaks), accidental (mechanical, train), human induced (arson, smokers, braaivleis, farmers) and of unknown origin. There are two main peaks in the graph, with most fires occurring during February-March and October-November. These peaks are influenced by the high number of prescribed burns that were executed during late summer, early autumn and spring in the 1970s and 1980s. The effect of human induced fires is evident almost throughout the year, especially January, April, May, June, August, October and November. The large area that burnt in October fires is mainly as a result of the massive 2020 George-fire that was caused by people and resulted in 17 531 ha (62.5% of the area) burning in one fire. It is believed that almost all the fires indicated as of 'unknown' origin are likely to have also been started by people. Most (if not all) fires that occurred during May, June and likely also July and August were caused by humans, with these fires burning large areas, often exacerbated by bergwind conditions. May to August are considered bergwind months by catchment managers in the Garden Route and Klein Karoo as this is the time when hot, dry downslope winds occur blowing down from the escarpment to the coast. It is known that fire potential is increased by bergwind conditions (Kraaij et al. 2012a). Except for November and December, fires started through natural causes (lightning, falling rocks) appear to have played a less significant role in terms of very large areas burning down.

In terms of season of fire, post-fire monitoring results have shown that the best recruitment takes place following fires during summer to early autumn (January-April). This is in line with recommendations stipulated in the literature (Bond et al. 1984; Esler et al. 2014). Fire intensity is closely linked to fire season. When fires occur during summer or early autumn (i.e., the hot, dry months of the year) the fire intensity is high resulting in a clean burn, which is best for proper seedling recruitment. Seedlings then also have the cooler late autumn, winter and spring months to establish and manifest themselves. As such, all prescribed burns that have been executed by management at Robberg, Keurbooms River and Goukamma over the past two decades were done during late summer to early autumn.

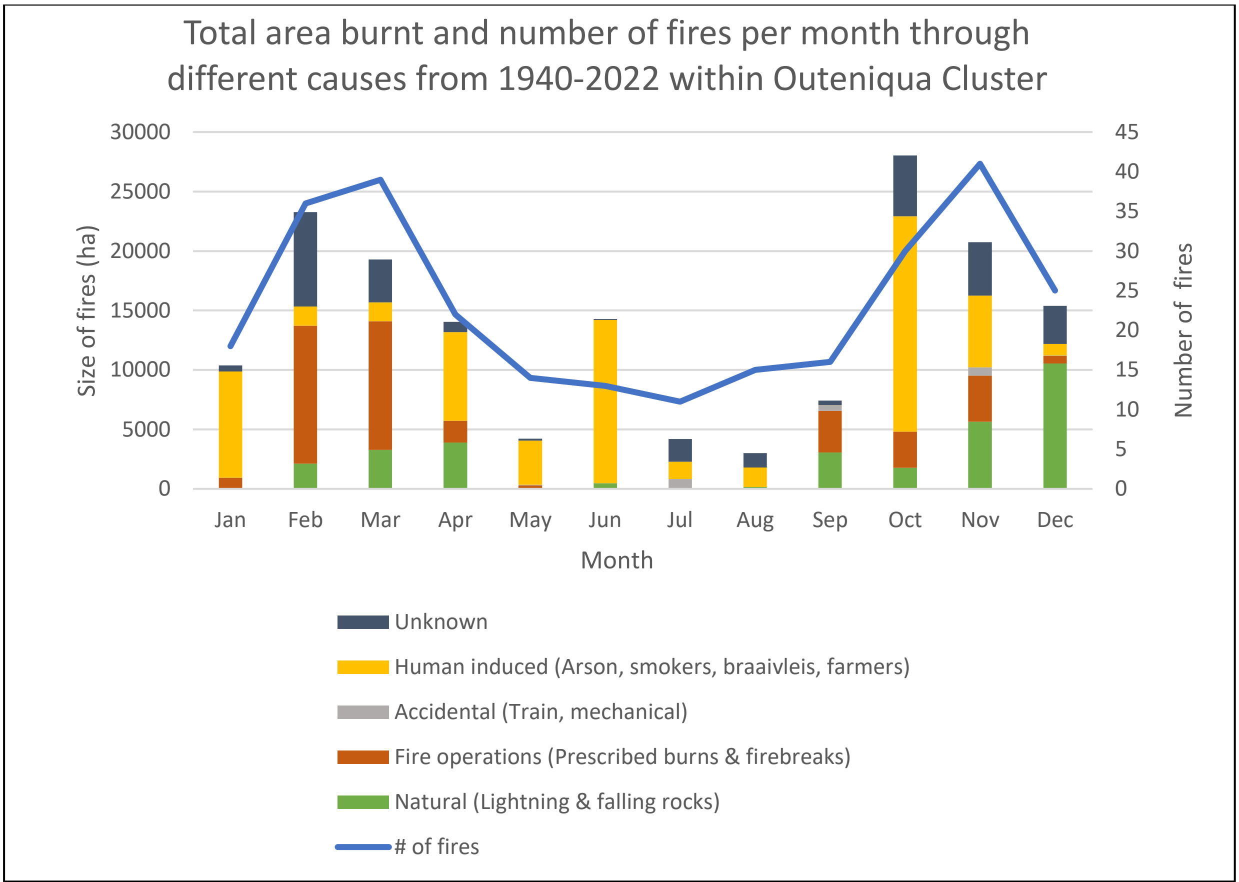

Figure 2.16: Total sizes and number of fires that have originated through various causes per month within the Outeniqua Cluster 1940-2022.

Fires and Ecosystem services

Managing and maintaining the Fynbos mosaics in an ecologically sound condition is critical to ensure that maximum ecosystem services are delivered from catchment areas. Especially since one of the most valuable functions of Fynbos is the delivery of high, sustained yields of clean water, i.e., contributing significantly towards human wellbeing values. If Fynbos burns at too short fire return intervals the *Protea* indicator species will be eliminated and the density of sprouting species will be enhanced. The latter will replace the non-sprouting species as they are able to grow rapidly after a fire, because of their well-developed underground rootstocks. Sprouters mature rapidly and use much more water than the developing and slow-maturing *Protea* seedlings that may take up to 10 (or mostly more) years to mature. So, if sprouters take over there will be less water run-off from the catchments (Esler et al. 2014). Retaining the non-sprouting *Protea* species in the landscape is critical to keep high densities of sprouters at bay (Vlok & Yeaton 1999, 2000) and maintain a sustained water run-off from the catchments. Other ecosystem services gained from intact and ecologically healthy Fynbos mosaics include pollination services, habitat for biological ecosystems and species, carbon storage, soil formation and retention, flood control, natural products, scenic natural landscapes supporting tourism-based livelihoods, and spiritual and physical health.

Management implications and recommendations

Fire management within the Outeniqua Cluster has been executed according to the Adaptive Interference model for at least the past three decades. This entails that fires that are caused through natural ignitions (e.g., lightning strikes, rock falls) are left to burn until they burn out or are extinguished as a result of rainfall. However, if the fire threatens young veld, infrastructure or threatens to burn across the protected area boundary onto neighbouring properties, every reasonable effort is made to contain it. Provision is made for prescribed burns in certain areas that have become too old and are situated adjacent to plantations where it may become a fire hazard, or where it can be implemented as part of an invasive alien clearing programme. This adaptive interference management strategy needs to be spatially refined, highlighting ecologically sensitive areas that need to be protected at all cost from burning again at short return interval and focused on improving the ecological health of the ecosystem. Every attempt must be made to try and prohibit fires from burning young veld within the protected area.

On the Goukamma and Buffalo Valley sectors an adaptive interference management system is also recommended. Here the focus needs to be on the clearing of invasive alien plants, especially in the areas that have become densely infested following the 2017 fire. Prescribed burns may be required to get access to some of these overgrown sites. This should only be considered if there is secure and adequate funding available to do follow-up clearing in these areas after the burn. There are no *Protea* indicator species on Goukamma or Buffalo Valley; therefore, it is best to follow the recommendations for fire return interval suggested by Esler et al. (2014) for dune fynbos, indicated as a 20-year minimal return interval.

For the Brenton Blue Butterfly sector it is pivotal that a study be undertaken to investigate the importance of animal disturbance in relation to fire to contain thicket building (Vlok & Euston-Brown 2002) from entirely overwhelming the fynbos matrix communities within the fynbos-thicket mosaics. Following the devastating 2017 fire, a study was conducted in the Knysna area (Strydom et al. 2020) investigating the effect of severe fires on the resprouting of thicket species. It is important to note that thicket and forest communities are fire-avoiding while fynbos communities are fire-dependent.

For the Robberg sector it is suggested that a prescribed burn be implemented in the fynbos community east of the gap as this veld has no recorded fires in the CapeNature Fire Database. This is supported by the fact that several rare and threatened fynbos species have been recorded in the two areas that were burnt between the gate and the gap.

For the Keurbooms River sector monitoring should continue to determine when the threshold for fire return interval is reached. Kraaij et al. (2012b) used data collected on Keurbooms River and recommended a return interval of 12 years for the Outeniqua Mountains west of the Keurbooms River.

Compliance with legislation

In terms of fire management and in order to comply with the National Veld and Forest Fire Act, 1998 (Act No.101 of 1998), the GRCWHS&NR maintains firebreaks in accordance with the firebreak register. In cases where the vegetation is burnable on the state and adjacent properties, it is recommended that agreements be concluded with neighbouring landowners to move the firebreaks to a position in the landscape where it is practical to fight a fire from (e.g., existing roads). This would significantly reduce the costs of maintaining the firebreaks for both parties.

CapeNature is obliged to be a member of the local Fire Protection Association in terms of the National Veld and Forest Fire Act. GRCWHS&NR falls entirely within the Southern Cape Fire Protection Association (SCFPA). There are several Fire Management Units (FMU) in place in the area:

Outeniqua Cluster: Kammanassie, Waboomskraal and Herold FMUs on the Klein Karoo side; Attaquas, Kleinbrak, Friemersheim, Grootbrak, George West, George East and Wilderness Heights FMUs along the southern side.

Goukamma Cluster: Groenvlei, Ruigtevlei and Western Heads FMUs for Goukamma, Buffalo Valley and the Brenton Blue Butterfly sectors.

Keurbooms River Cluster: Wittedrift, Crags and Keurbooms FMUs for Keurbooms River; Plett South FMU for Robberg; Jonkheurs Rust and Middel-Keurbooms FMUs for Annex Vlugt sectors.

These FMUs are voluntarily managed by the landowners themselves and effectivity varies from one FMU to another. FMUs present an opportunity to CapeNature as an available tool for larger fire management of an area, effectively allowing improved fire management on private land which is currently not well managed in terms of fire. Where landowners are willing, particularly those with extensive natural veld, efforts within the FMU could improve fire management towards the principles outlined above.

2.3.1.5 Veld restoration and rehabilitation

Three seed orchards for *Pinus radiata* were historically (1960-1970s) established in Camferskloof and at North Station in the Witfontein sector to serve operations on plantations in the Garden Route area. Since all these sites burnt in the October 2018 fire, MTO harvested the logs that could be used. Following the termination of the MTO forestry exit areas lease at the end of 2020, the company concluded its seed orchard operations at these sites, removed the remaining plant material and cleared the invasive alien species that had recruited in the area. MTO sent a formal request to CapeNature to take over the management of these sites as part of the Outeniqua Cluster. Going forward, follow-up clearing of pine seedlings in and around these previously planted areas will be undertaken by management as part of the Outeniqua Cluster invasive alien species clearing plan. No further active restoration has been planned for these areas but could be considered should the natural recovery and restoration process take too long. This may require the local harvesting of seedheads of e.g., *Protea repens* to sow in these areas directly after the next fire in the area.

Other sites that may require active restoration and rehabilitation are the forestry exit areas that are in the process of being transferred to CapeNature to be managed as part of the protected area estate. Proper restoration plans would need to be compiled for these properties to address the restoration process in a systematic way.

2.3.2 Freshwater ecosystems

The land parcels of the GRCWHS&NR fall entirely within the Gouritz Water Management Area (WMA). The WMA consists of three sub-WMAs, namely the Coastal Gouritz (or Garden Route) to the south, the mainstem Gouritz to the north and the Olifants to the north-east. The entire area is managed together with the Breede WMA by the Breede-Gouritz Catchment Management Agency (BGCMA; see BGCMA, 2017). The freshwater ecosystems of the Complex fall into the Southern Folded Mountains (north), the Southern Coastal Belt (south and west) and South-eastern Coastal Belt (south and east) level 1 ecoregions (Kleynhans et al. 2005).

The rivers draining the northern slopes of the Outeniqua Mountains flow into the Olifants River, which in turn, joins the Gamka River to the west and eventually forms the mainstem Gouritz River.

The greater part of the area is drained by numerous perennial rivers that flow south to the ocean in the Garden Route area. These rivers drain from the Outeniqua Mountain Range (Appendix 2, Map 10), which falls between the Langeberg Mountains to the west and the Tsitsikamma Mountains to the east. This mountain catchment consists mainly of the underlying high water yielding arenite (sandstones) geology, with sedimentary deposits at the coast and some shale deposits near the Keurbooms River mouth. The Outeniqua Mountain catchment is classified as a national Strategic Water Source Area (SWA) for surface and groundwater (Le Maitre et al. 2018). This SWA abuts the sub-national Tsitsikamma (Upper Keurbooms) SWA to the east, which includes the upper parts of the Keurbooms River.

The southern slope tributaries provide surface water to towns along the coast, including the large urban areas of Mossel Bay, George and the smaller towns to the east. Tributaries from the northern slope (Olifants River catchment) feed into the water supply for the agricultural areas south of the town of Oudtshoorn. The Outeniqua Mountain catchment is mainly surrounded by agricultural areas and most water is used for a variation of farming practices, including fruit orchards and livestock farming.

Other freshwater ecosystems found within the GRCWHS&NR boundaries and the greater mountain catchment area, include wetlands and groundwater dependent ecosystems. Several wetland systems have been mapped within the western part of the mountain catchment, but very few have been mapped for the eastern side [e.g., Nel et al. 2011a, b; Van Deventer et al. 2019]. The wetlands that have been mapped so far (national level), include a variety of wetland types, such as hillslope seeps, bench flats and channelled valley-bottom wetlands. Some of these would be dependent on groundwater and/or aquifer water sources and may also contribute to the sustained base flow for many of the perennial rivers. Moreover, the mountain catchment also serves as an important recharge zone for the aquifers present in the upper and lower lying areas.

Generally, the rivers, wetlands, and their buffer zones, located within the protected area boundaries are expected to be in at least a near-natural or natural condition. However, there is a degree of intrusion by invasive alien plant (IAP) species, stemming from especially historic forestry areas, and the presence of dams. Additional pressures on the hydrological functioning of the aquatic systems in these catchments include the ever-increasing water demands from urban areas and surrounding agricultural practices. These pressures are only exacerbated by the effects associated with climate change, including the expected increased frequency of droughts and storm (flooding) events.

Mitigation for the effects of climate change is difficult and here adaptive management that is informed by thorough long-term monitoring, including the collection of hydrological data for flow regime determination, is of the utmost importance. Flow regime data, together with rainfall data can inform the establishment of a link between surface water (hydrological), groundwater and aquifers (geo-hydrological) and rainfall conditions. This in turn will provide insight into, for example, the possible impacts imposed by water abstraction (surface or ground) on surface or groundwater flows (see also Rose & Conrad 2006).

Furthermore, other important factors regarding catchment management include the clearing of invasive alien plant species within the WHS site boundaries, specifically within riparian zones and wetlands. Clearing of invasive alien plants, such as Australian wattles (*Acacia mearnsii, A.cyclops, A.saligna*), pines (*Pinus pinaster, P.radiata*), river gums (*Eucalyptus camaldulensis*) and poplars (*Populus* spp.) is also important in larger mountain catchment and lowland areas adjacent to protected areas and SANParks land (i.e., zone of influence). The recharge potential of these catchments to surface water ecosystems and aquifers underlying and extending from the mountains is becoming increasingly important and must be conserved. Beyond the boundaries of the GRCWHS&NR, there are several additional factors that also have an impact on freshwater ecosystems. It seems to be standard practise that rivers are blocked to varying degrees by the presence of diversion weirs just outside of the protected area boundaries. These weirs tend to block off most or all the natural flow to downstream areas during the dry months and divert the water to farm dams. Additionally, the lowland sites are under increased threat from unsustainable land-use activities related especially to agricultural practices within the rivers and wetlands and their buffer zones.

2.3.2.1 Groundwater

The groundwater systems associated with the GRCWHS&NR are dominated by four main geological units, including from oldest to youngest substrates, formations of the basement rocks of the Table Mountain Group (TMG), Uitenhage Group and Bredasdorp Group (Roberts et al. 2008; Meyer 1999b; Toerien 1979; see also Dept of Environmental Affairs & Development Planning (DEA&DP) 2011). The basement rocks include the Namibian and Kaaimans Groups (shales/phillites, gritty sandstone, quartzites and limestones) and the George and Woodville Plutons of the Cape Granite Suite. These basement rocks outcrop from the base of the Outeniqua Mountains to the coast from between George and Wilderness and are under the younger TMG and Breadasdorp Group formations between Wilderness to Sedgefield (South African Geological Survey 1979). The Kaaimans Group and George/Woodville Plutons generally form weathered and fractured, low yielding (<1-2 l/s) basement aquifers (Dept of Water Affairs and Forestry (DWAF) 1999). The groundwater quality from these layers can be relatively saline [Electrical Conductivity (EC) of >200 mS/m] with high levels of alkalinity, chloride, fluoride, manganese and sodium (DWAF 2012).

The TMG outcrops as the Outeniqua Mountains, as well as along the coastline from the Knysna Heads to the Robberg Peninsula, where it also underlies the Bredasdorp Group coastal sediments (South African Geological Survey 1979). It is comprised of the Peninsula Formation (dominant in the Outeniqua Mountains), Cedarberg Formation (absent between George and Wilderness), Goudini Formation, Skurweberg Formation and the Baviaanskloof Formations. These layers contain two secondary, fractured aquifers (groundwater in faults and fractures), i.e., the deeper Peninsula Aquifer (only in Peninsula Formation) and the Nardouw Aquifer (within the Skurweberg and Baviaanskloof Formations). Both aquifers are moderate (~2-5 l/s, if unconfined) to very high (>10 l/s if confined and in regional fault zone) yielding systems, with very good groundwater quality (EC of <50 mS/m, with a slightly acidic pH and naturally high levels of iron and manganese). These aquifers provide a sustained baseflow to the Outeniqua Mountain rivers in addition to feeding the groundwater dependent ecosystems associated with springs and seeps.

The conglomorates and sandstones of the Enon Formation and sandstones and mudstones of the Kirkwood Formation form the Uitenhage Group within the Knysna and Plettenberg Bay basins (South African Geological Survey 1979). This Group generally forms low yielding (<1-2 l/s) primary (groundwater in primary pore spaces between sedimentary grains) or secondary weather and fractured (if consolidated sedimentary rocks are present) aquifers. These systems tend to have poor groundwater quality (EC >200 mS/m) with very high iron concentrations (DWAF 2012).

The Bredasdorp Group consists of the Waenhuiskrans and Strandveld Formations (calcareous dune sands and calcrete/dune rocks) between Wilderness and Knysna. These layers are sometimes underlain by the thin, shallow marine to fluvial gravels of the Klein Brak Formation (South African Geological Survey 1979). The calcareous dune sands and calcretes of the older Wankoe Formation outcrop between Knysna and Plettenberg Bay, and are sometimes underlain by the thin, shallow marine to fluvial gravels of the De Hoopvlei Formations. The Bredasdorp Group formation forms an intergranular or primary aquifer, and in some instances where dissolution of cemented gravels of the Klein Brak and De Hoopvlei Formations has occurred, a karst aquifer. These systems have a relatively low (<1-2 l/s) to moderate (~2-5 l/s) yields, with relatively good water quality (some hardness and slightly higher salinity levels in parts, EC ~100-150 mS/m. The Bredasdorp Group primary aquifer plays an important part in sustaining the Wilderness Lake system, Swartvlei and Groenvlei.

Clearly there is some variance in the aquifer types within the WHS, with the TMG aquifers being prevalent in the mountain catchments. The higher rainfall (linked to water yield) in the catchments of most of the GRCWHS&NR leads to a moderate to high groundwater recharge in these areas (see Nel et al. 2011a). This, together with the pressures imposed by drought events, has led to an increasing use of groundwater to augment the water supply for urban and agricultural areas, posing a significant threat to this ecosystem in the future. Expectations are that increased abstraction of groundwater will introduce ecological impacts for the freshwater (rivers and wetlands) and terrestrial ecosystems in the catchment. Although some work has been done to determine the extent and effect of potential impacts (e.g., Boland Mountains; see Colvin et al. 2009), information is mostly lacking for the Outeniqua Mountain catchment. In one study related to the Kammanassie WHS (Cleaver et al. 2003) observed impacts included those associated with plant water stress, reduction in surface water flow (Vermaaks River) and the drying up of natural springs (Cleaver et al. 2003). These potential impacts, coupled with the effects of climate change does not bode well for the ecosystems that are dependent on groundwater and/or aquifers. Further development of the Blossoms Wellfield (Outeniqua Mountains, Oudtshoorn side) is of special concern. This wellfield has a potential to impact on the catchments of (from east to west) the Klip, Doring, Brak, Ganskraal and Kammanassie Rivers.

Aspects to be monitored on the WHS would include primary water level of boreholes, should borehole development take place in the future within the GRCWHS&NR properties. Monitoring could also include monitoring of the physico-chemical variables (including water temperature, pH and EC). This should be done according to the CapeNature Groundwater Monitoring Protocol. Currently there are six boreholes being abstracted from, both for internal CapeNature and zone of influence water use purposes. These boreholes are located on the Goukamma and Witfontein sectors and the water is used to augment the water supply for on-reserve staff housing, office water provision, tourism facilities or municipal water use (George).

2.3.2.2 Rivers

Several unnamed tributaries (mostly non-perennial) drain in a westerly or northerly direction into the mainstem Gourits River from the north facing slopes in the Ruitersbos sector. The named rivers include the mostly non-perennial Riet/Brand River and the perennial Slang River. The Slang River catchment is considered an Upstream Area according to the National Freshwater Ecosystem Priority Area (NFEPA) status (Table 2.7). The Saffraan River exits the land parcel in a slightly north-easterly direction and joins the Moeras River further downstream, a few kilometers east of Fontein Nature Reserve (Gamkaberg WHS&NR). The uppermost parts of the Moeras River also originate here, and this catchment is considered to be a Fish Support Area (Table 2.7).

The unnamed, mostly non-perennial headwater tributaries of the Kamma River originate in the south facing slopes of the western part of the Ruitersbos sector. The Kamma River joins the Gourits River some kilometres upstream of the confluence with the Groot River and the catchment is an important catchment for indigenous fish species (i.e., Fish Freshwater Ecosystem Priority Area (FEPA); Table 2.7). The headwaters of the Meul and Kouma Rivers also originate here and drain into the Haelkraal River, which becomes the Palmiet River from where the Kouma River joins it. The Kouma River catchment is a Fish Support Area (Table 2.7). The Ruitersbos River originates in the mountains within the sector to the east of the Kouma River and joins the Palmiet River, where it becomes the Brandwag River. This system eventually joins the Moordkuil River to form the Klein-Brak River estuary system. Headwaters of the Moordkuil River originate in the easternmost section of the Ruitersbos sector, adjacent to the Doringrivier sector.

The Doringrivier sector boundary runs along the watershed between the north and the south. Therefore, all the rivers in this land parcel drain from the north-facing slopes into the mainstem Olifants River system. The headwaters of at least three perennial rivers, including the Kandelaars, Klein-Doring and Doring Rivers, are present here. The Klein-Doring River joins the Doring River upstream of the confluence with the Kandelaars River. The upper catchments of the Groot-Brak and Maalgate Rivers drain the south-facing slopes just outside the Doringrivier sector’s southern-most border. The Groot-Brak River catchment is a Fish Support Area (Table 2.7). The unprotected corridor between the Doringrivier and Witfontein sectors includes the headwaters of the Klip River, another tributary of the Olifants River. This catchment has been mapped as an Upstream Area (Nel et al. 2011a, b).

Table 2.7: NFEPA status and estimated health condition of the rivers of the GRCWHS&NR and the mountain catchment, from west to east. Health scores are defined as follows: natural (A), good-natural (AB), good (B), fair (C), degraded (D). Condition values were estimated through a combination of real data, desktop study and specialist input.

Nature Reserve	River	Condition*	FEPA catchment status	River reach/type
Ruitersbos	Upper Kamma River	AB**	FEPA fish sanctuary	Mountain stream
	Upper Slang/ Perdebont	AB	Upstream Area	Mountain stream
	Upper Saffraan	AB**	Fish Support Area	Mountain stream
	Saffraan tributary	AB**	Fish Support Area	Mountain stream
	Upper Meul (tributary of Healkraal	AB	No FEPA status	Mountain stream
	Upper Kouma Western tributary	AB	Fish Support Area	Mountain stream
	Upper Kouma	AB**	Fish Support Area	Mountain stream
	Upper Bosmans (tributary of Moordkuils	AB**	No FEPA status	Mountain stream
	Upper Huis (tributary of Palmiet)	AB**	No FEPA status	Mountain stream
	Upper Perdeberg	AB**	No FEPA status	Mountain stream
	Upper Moordkuil	AB**	No FEPA status	Mountain stream – upper foothills
	Small tributaries of Moeras	AB	Fish Support Area	Mountain stream
Forestry exit areas	Tributaries of Kouma	BC**	Fish Support Area	Mountain stream – upper foothills
	Upper tributaries Bosmans	B**	No FEPA status	Moutain stream
	Upper tributaries of Perdeberg	B**	No FEPA status	Mountain stream
Doringrivier Wilderness Area	Upper Western tributary of Kandelaars	AB**	Fish Support Area	Mountain stream
	Upper Klein-Doring	AB**	Fish Support Area	Mountain stream
	Upper Groot-Doring	AB**	Fish Support Area	Mountain stream
	Parts of upper tributaries of Groot-Brak	AB*	Fish Support Area	Mountain stream
	Parts of upper tributaries of Maalgate/ Witels	AB**	No FEPA status	Mountain stream
Witfontein	Upper Doring (tributary of Kammanassie)	BC**	Upstream Area	Mountain stream - foothills
	Afguns (tributary of Doring)	B**	Upstream Area	Mountain stream - foothills
	Keur (Malgas)	AB**	Fish Support Area	Mountain stream

Nature Reserve	River	Condition*	FEPA catchment status	River reach/type
	2 Keur tributaries	AB**	Fish Support Area	Mountain stream
	Upper Camfersdrift/ Rooi (tributary of Gwaiing)	AB**	Fish Support Area	Mountain stream
	Upper Swart	AB**	No FEPA status	Mountain stream
	Upper Kaaimans	AB**	Fish Support Area	Mountain stream
Goukamma	Small non perennial streams (Groenvlei)	C	FEPA catchment	Lowland
	Lower Homtini	B	FEPA fish sanctuary	Lowland - estuarine
Keurbooms	Lower Keurbooms	B	FEPA catchment	Lowland - estuarine
	Lower Duiwelsgat	B**	FEPA catchment	Lower foothills
	Lower Hartbees	B**	FEPA catchment	Lower foothills

**Condition estimated through a combination of real data, desktop study and specialist input. **Condition unknown, but expected value given.*

Rivers draining from the northern slopes of the Witfontein sector include several non-perennial streams that feed into the perennial upper Doring and Eseljags Rivers. The catchments for both rivers are classified as Upstream Areas (Table 2.7). The Eseljags River flows into the Brak River, which joins the Kammanassie River in the Kammanassie Dam. The Doring River flows into a large farm dam, located at the border of the sector. Thereafter, it eventually joins the Kammanassie River some distance downstream of the larger Kammanassie Dam. This system ultimately flows into the Olifants River system, a few kilometres southeast of Oudtshoorn.

The headwaters of the Malgas River (Fish Support Area; Table 2.7) and the Rooi River drains south from the Witfontein sector. These rivers join just west of George and become the Gwaiing River. The source zone and upper catchment of the Swart River is in the eastern section of the Witfontein sector and runs into the Garden Route Dam. Downstream of the dam, the Swart River eventually joins the Kaaimans River estuarine system. The Kaaimans River (a Fish Support Area; Table 2.7) also originates in the Witfontein sector, before flowing through the forestry exit areas bordering on the sector and the Saasveld forested area. The Touws River (FEPA Important Fish Area; Table 2.7) forms the boundary line for the most eastern land parcel of the Witfontein sector.

Although Goukamma is a coastal protected area, there seems to be some groundwater driven (springs) water courses that drain towards the beach. There are also some non-perennial streams that flow into Groenvlei Lake. The Homtini River originates upstream, in the Garden Route National Park. It becomes the Goukamma River, downstream of the junction with the Middelrug River, a few kilometers upstream of the border of the Goukamma sector. The river already becomes estuarine upstream of the N2 highway crossing. This river catchment has been classified as a FEPA Important Fish Area (previously fish sanctuary).

Last river system relevant to the GRCWHS&NR, is the Keurbooms River, which drains into the ocean via the estuary just downstream of the boundary of the Keurbooms River sector. Two smaller tributaries, the Hartbees and Duiwelsgat Rivers, join the Keurbooms River within the boundaries of the sector from the west and east respectively. The upper catchments of the Keurbooms River system are FEPA Important Fish Areas, while the part of the catchment within the sector boundaries have been classified as a FEPA catchment (Table 2.7). This classification includes a section of the Keurbooms Estuary, which also receives freshwater inflow from the Bietou River, another Important Fish Area.

Threats that have been identified for the rivers located on the GRCWHS&NR include the presence of invasive alien plant species within the riparian zones and in wetlands and their buffer areas. The presence of structures within the river channels (e.g., weirs) also pose a threat to the ecological functioning of rivers. Therefore, removal of invasive alien trees (IAPs) from river riparian zones should be prioritised. Not only will this improve the health of the riparian zones and the instream environments, but it will also allow for the increased release of good quality water. Moreover, the establishment of indigenous vegetation after alien clearing should be encouraged to enable the re-establishment of for example aquatic macro-invertebrates, like the Odonata (dragonflies and damselflies; Samways et al. 2010b).

Reduction in river flow, as a result of over-abstraction of surface water and groundwater, is also a threat, more so within the zone of influence surrounding the GRCWHS&NR, especially in the north facing sections of the complex. Over-abstraction of water is often linked to over allocation of water from the relevant authorities, or in the case of the increasing threat of groundwater over-abstraction, unregulated water use.

When considering the management of rivers, it is important to take into account activities in the entire catchment of the river. This is especially important for rivers that are considered priorities, i.e., FEPA rivers and catchments and important fish areas (Nel et al. 2011a, b). For these rivers, flow volume, timing and frequency are of particular importance. Therefore, monitoring the flow regime of strategically selected rivers within the GRCWHS&NR, would add a lot to tracking flow patterns linked to for example IAP clearing in the catchment or water use from the land parcels. This in turn will highlight the importance of adaptive and sustainable management of our freshwater ecosystems, especially in relation to the ecosystem services that the GRCWHS&NR provides with regards to water provision. It is particularly important considering the current and future effects of climate change. Additionally, monitoring of the flow regime, together with water quality assessments (using bio-indicators such as macro-invertebrates) could significantly add to the informed adaptive management of river reaches falling within the GRCWHS&NR boundaries.

2.3.2.3 Wetlands

Although several wetlands have been mapped to occur within the GRCWHS&NR [e.g., Nel et al. 2011a, b; Pool-Stanvliet et al. 2017; Van Deventer et al. 2019], it is likely to be an under-representation. Of those that have been mapped, several higher and lower altitude hillslope seeps, bench flats and even some channelled valley-bottom wetlands seem to occur within the GRCWHS&NR boundaries. Most of these have been mapped to occur along the wetter south-facing slopes of the Outeniqua Mountains.

The wetlands within most of the GRCWHS&NR fall into the Eastern Fynbos Renosterveld Bioregion (Van Deventer et al. 2019). Within this bioregion, the hillslope seeps and bench flats have a threat status of VU while being moderately protected. In contrast, the channelled valley bottom wetlands, for example are CR and poorly protected. No wetlands have been mapped in the Witfontein sector. However, there are bound to be at least hillslope seeps in this part of the mountain catchment and their presence needs to be verified. The health condition of these higher lying wetlands is expected to be good to natural.

The wetlands within the coastal sectors either fall into the Eastern Fynbos-Renosterveld (possibly on Keurbooms River) or Albany Thicket (e.g., Goukamma wetlands) bioregions. Groenvlei Lake has been mapped as a depression, with this wetland type being CR and poorly protected within the Albany Thicket Bioregion. The health condition for Groenvlei is likely to at least fall into the moderately modified level, with impacts including the inflow of storm water from the N2-road, possible groundwater abstraction impacts, presence of invasive alien fish species (i.e., common Carp, *Cyprinus carpio*) and resulting Cyanobacteria (also known as Blue-Green algal) blooms.

The estuarine ecosystems associated with the Goukamma and Keurbooms Rivers both fall into the Warm Temperate coastal region. These systems are considered to be VU and moderately well (Goukamma) or poorly protected (Keurbooms).

Wetlands in general are one of the most highly threatened freshwater ecosystems globally, especially those located in the lowland areas (Gouws et al. 2012; Gouws & Gordon 2017). Despite these levels of threat, they continue to be the least studied and monitored freshwater ecosystem in the country. It is with this in mind that a greater understanding of the health of wetlands and other freshwater ecosystems located within the boundaries of the GRCWHS&NR is needed. This is important, especially when managing a protected area within a Strategic Water Source area (Le Maitre et al. 2018) with the entire catchment (i.e., the “catchment to coast” concept) in mind.

To conduct initial baseline assessments and biomonitoring of strategically selected wetland ecosystems, the simplified version of the WetHealth (McFarlane et al. 2008) assessment method should be used (see Wetland Monitoring Protocol). Baseline wetland ground-truthing surveys, or at least an in-depth desktop survey is needed to update the wetlands inventory for the GRCWHS&NR and to identify monitoring sites. Long-term monitoring sites should represent a variety of different wetland types and be chosen based on their threat status (e.g., VU, EN or CR), whether they are groundwater or aquifer dependent ecosystems or where they might be impacted on by any development within the protected area. If a wetland might be impacted on by threats from outside the boundaries of the protected area, for example by groundwater abstraction, these sites should also be considered for long-term monitoring. Furthermore, with the additional threats associated with the presence of invasive alien vegetation and other physical impacts, the vegetation structure of the buffer areas of the wetland systems should also be maintained as close to natural as possible, at least within the first 32 m of any wetlands.

2.3.3 Marine and coastal systems

The South Africa marine realm has been categorized to reflect four main shelf ecoregions: the Southern Benguela Shelf, Agulhas Shelf, Natal Shelf and Delagoa Shelf, and two Deep Ocean ecoregions: the Southeast Atlantic Deep Ocean, and Southwest Indian Deep Ocean (Sink et al. 2019). The marine protected areas of the GRCWHS&NR fall entirely within the Agulhas Shelf ecoregion. The warm temperate

Agulhas ecoregion incorporates the shelf area from Cape Point to the Mbashe River in the Eastern Cape and includes the central and eastern Agulhas Bank. The continental shelf is at its widest in the Agulhas Shelf ecoregion, extending up to 260 km offshore at its widest point south of Cape Infanta on the Agulhas Bank (Sink et al. 2019). The Agulhas Shelf ecoregion hosts the greatest number of South African endemics including sparid reef fishes, octocorals and algae and is a spawning and nursery ground for many species. This region supports numerous important commercial fisheries including the pelagic fishery and trawl fisheries for hake and sole.

In the Goukamma MPA, Agulhas Inner Shelf Mosaic is the largest ecosystem type followed by the Agulhas Sandy Mid Shelf (Table 2.8). Both these ecosystem types are offshore and support a wide range of species including reef dependent sparid species. Agulhas Sandy Mid Shelf is a NT ecosystem and is moderately protected. The subtidal habitat features several reefs formed by submerged aeolianite dune cordons running parallel to the shore, separated by flat sandy areas. The maximum depth in the Goukamma MPA is 36 m, but most of the area is <30 m deep (Kerwath et al. 2007).

The Robberg MPA shows a distinct change in ecosystem types between the southern and northern aspects of the Robberg peninsula. North of the peninsula, the dominant ecosystem is the Western Agulhas Bay whereas on the southern aspect, the dominant ecosystem type is Agulhas Inner Shelf Mosaic (Table 2.8). The Agulhas Inner Shelf Mosaic is classified as VU and is moderately protected. The Western Agulhas Bay is an EN ecosystem type and is partially protected. Inclusion of this ecosystem type in the Robberg MPA is greatly beneficial to the protection of this ecosystem type and the species it hosts.

Both Robberg and Goukamma MPAs have Exposed and Very Exposed Rocky Shores which are interspersed with Agulhas Dissipative-Intermediate Sandy Shore and Agulhas Mixed Shore. Dissipative beaches are exposed to strong wave action that flattens the profile leading up to the beach. The surf zone is therefore wide and wave energy is largely ‘spent’ before reaching the beach, which consists of fine sediments that retain water, so they are damp most of the time. The beaches themselves are flat, wide and often backed by large dunes. Robberg MPA has a section of Sheltered Rocky Shore along the northern banks of the Robberg Peninsula. South African rocky shores are among the most diverse in the world. Within ecoregions, biotic communities on rocky shores are shaped by tides, wave exposure, shoreline configuration and rock type (Harris et al. 2019). As tides rise and fall, the intertidal zone alternates between being exposed to air and being submerged in the ocean. There are four basic zones that can be recognized on most shores but with species assemblages changing from the west coast to the south and east coast. In the south coast Agulhas ecoregion, there are five zones (Littorina, Upper and Lower Balanoid, Cochlear and Infratidal) that are the same as the west coast but with different species (Branch & Branch 2018). The Littorina Zone is dominated by the southern periwinkle (*Affrolittorina knysnaensis*) and the purple laver (*Porphyra capensis*). The Upper Balanoid has a host of dense stands of indigenous barnacles, particularly the toothed barnacle (*Chthamalus dentatus*) at the top zone, the volcano barnacle (*Tetraclita serrata*) lower down on more sheltered areas, and the eight-shell barnacle (*Octomeris angulosa*) on exposed rocky shores which face very high wave action (Branch & Branch 2018). The granular limpet (*Scutellastra granularis*) is abundant on all types of shores and the goat’s-eye limpet (*Cymbula oculus*) is also common. Topshells (*Oxystele variegata* and *O. impervia*) are common on more sheltered shores. In sheltered areas, the Lower

Balanoid Zone supports thick beds of algae, particularly the tongue-weeds (*Gigartina polycarpa* and *Sarcothalia stiriata*), and the jelly-weed (*Gelidium pristiodes*). Interspersed are smaller numbers of animals, including the long-spined limpet (*Scutellastra longicosta*) and the topshells (*Oxystele sinensis* and *O. tigrina*). On exposed shores in the Lower Balanoid, the brown mussel (*Perna perna*) takes over most of the lower half of the shore (Branch & Branch 2018). Higher up, the invasive Mediterranean mussel (*Mytilus galloprovincialis*) dominates. Within the Cochlear Zone, the pear limpet (*Scutellastra cochlear*) is dominant and Argenville's limpet (*Scutellastra argenvillei*) is present but not abundant. The infratidal Zone supports redbait (*Pyura stolonifera*) and algae such as corallines, the wracks, green tips, species of *Zonaria* and the spiny kelp (*Ecklonia radiata*). In sheltered areas, the Cape urchin (*Parechinus angulosus*) is associated with encrusting corallines (Branch & Branch 2018).

Table 2.8: Marine ecosystem types found within the Garden Route Complex World Heritage Site and Nature Reserves along with their descriptions and threat statuses according to the National Biodiversity Assessment (SANBI 2018).

Habitat type	Description	Threat Status (NBA, 2018)	Goukamma MPA	Robberg MPA
Agulhas Inner Shelf Mosaic	Mosaic seafloor and associated water column on the inner shelf. Extends from the back of the surf zone to fair weather wave base at -40 m.	VU	X	X
Agulhas Dissipative-Intermediate Sandy Shore	Fine grained, sloping sandy shore with moderately wide beach and surf zone	LC	X	X
Agulhas Mixed Shore	A shore with both rocky and sandy habitat	NT	X	X
Agulhas Sandy Mid Shelf	Sandy seafloor and associated water column on the mid shelf in the Agulhas ecoregion (-40 to -100 m).	NT	X	X
Agulhas Exposed Rocky Shore	Rocky shore type in the Agulhas ecoregion exposed to moderate wave intensity.	VU	X	X
Agulhas Very Exposed Rocky Shore	Rocky shore type in the Agulhas ecoregion that is exposed to high wave intensity.	VU	X	X
Agulhas Sheltered Rocky Shore	Rocky shore type in the Agulhas ecoregion that is sheltered from high wave intensity.	EN		X
Agulhas Intermediate Sandy Shore	Beach with medium grain size and moderate slope in the Agulhas ecoregion. Often with cusps on the shore and sandbars and rips in the surf.	LC	X	
Western Agulhas Bay	Western bays (St Sebastian, Vleesbaai, Mosselbay and Plettenberg Bay) of the Agulhas ecoregion from back of surf zone to outer edge of embayment which ranges between -40 and -70 m.	EN		X

Estuarine ecosystem

Estuaries are difficult to classify because they vary temporally in shape and size and encompass a gradient in conditions from riverine to marine areas. The classification of estuarine systems underwent a revision with the National Biodiversity Assessment (SANBI 2018; Van Niekerk et al. 2019). Estuaries were classified according to four biogeographical regions (Cool Temperate, Warm Temperate, Subtropical and Tropical). These were classified further into the nine newly described estuary categories (Estuarine Lake, Estuarine Bay, Estuarine Lagoon, Predominantly Open, Large Temporarily Closed, Small Temporarily Closed, Large Fluvially Dominated, Small Fluvially Dominated and Arid Predominantly Closed). Lastly, the estuaries were assigned estuarine ecosystem types (of which there are 22).

There are two estuarine systems in the GRCWHS&NR. Goukamma Estuary falls within the Goukamma Cluster and the Keurbooms/Bitou Estuary falls within the Keurbooms River Cluster. The Goukamma and Keurbooms Estuaries both fall within the Warm Temperate biogeographical region which extends from the Mendwana Estuary in the Eastern Cape to the Ratel Estuary near Cape Agulhas.

The Goukamma Estuary is classified as a Large Temporarily Closed Estuary. This category replaced the Temporary open/closed estuary as described by Whitfield (1992). Large Temporarily Closed estuaries are blocked off from the sea for varying lengths of time by a sand bar which forms at the mouth. This occurs during low river flows combined with longshore sand movements in the nearshore marine environment. Most of these estuaries have small river catchments and long periods when the river flow is minimal or stops altogether. These systems are a minimum of 15 ha in area (associated with at least 10 ha of open water area) (Van Niekerk et al. 2019).

The estuary is fed primarily by the Goukamma River (Appendix 2, Map 10b). It is approximately 9 km long, with a high tide area of 355 000 m^2 and a volume of 0.6 x 106 m^3. The upper parts of the estuary are narrow with an average width of 30 and 40 m in the upper and middle reaches, respectively. The system widens in the lower reaches (ca. 2 km from the mouth) to a maximum width of ca. 200 m about 0.9 km from the mouth. Depth varies between 1 and 2 m, with some localised deeper areas (> 2 m) in the upper and middle reaches. The N2-national road crosses the estuary about 9 km from the mouth, at the approximate limit of tidal variation.

The mouth area of the Goukamma Estuary is dominated by marine sediment. Monthly mouth observations made by CapeNature indicate that the estuary is closed for 20 to 30% of the time. In the past, artificial breaching took place at the request of farmers, whose activities on the floodplain were affected by raised water levels. At present artificial breaching is only done in extreme circumstances, such as when required to facilitate maintenance of the Buffalo Bay road. A maintenance management plan dated 1 October 2022 for the artificial breaching of the Goukamma Estuary Mouth has been compiled and adopted by DFFE.

According to the Estuary Condition and Biodiversity Priorities stipulated in the NBA (SANBI 2019), Goukamma Estuary has an A/B ecological state and is rated as an important system to biodiversity. The estuary is a priority estuary for the Western Cape. There are no major pressures on the Goukamma Estuary with pollution and fishing effort being of medium pressure and the largest pressure on the system being the invasion of alien fish (Van Niekerk et al. 2019).

The Keurbooms/Bitou estuarine system is comprised of two estuaries that meet at a confluence prior to the estuary mouth. Confluence of the Bitou and Keurbooms estuaries is approximately 3.5 km from the mouth. The Bitou River is 23 km long, with its source at Buffelsnek, and is tidal for 7.2 km from the confluence to the causeway at Wittedrift. Keurbooms River is approximately 85 km long, with its source at Spitskop in the Outeniqua Mountains and is tidal for approximately 8.5 km from the confluence to about 1.5 km upstream of Whiskey Creek (Appendix 2, Map 10c). This system is a predominantly open estuarine one and flows into what is known as the Keurbooms lagoon or basin, a 500 m wide stretch of water (also known as a back-barrier lagoon) separated from the sea by a prominent berm, prior to it flowing out to sea. The combined catchment has been estimated at anywhere between 1 085 and 1 188 km^2. Due to the close association between the two estuaries and the fact that they meet at the confluence prior to the permanently open mouth, the two systems and the lagoon are often collectively referred to as the Keurbooms.

According to the Estuary Condition and Biodiversity Priorities (Van Niekerk et al. 2019), Keurbooms Estuary has an A/B ecological state and is rated as a highly important system to biodiversity. The estuary is a priority estuary for the Western Cape. There are serious concerns about the increase in the volume of water abstraction from the Keurbooms River allocated to the Bitou Municipality by the Dept of Water and Sanitation, as no restriction is in place should the water flow drop below the threshold of 300 l/s. Other pressures on the system include habitat loss and invasion by alien fish species (Van Niekerk et al. 2019).

2.4 Biodiversity Context: Taxa

2.4.1 Invertebrates

Invertebrates comprise more than 80% of animal diversity, yet they are vastly under-represented in studies of African diversity. Site biodiversity estimates that do not consider this group thus omit the greatest component of what they are attempting to measure. They also ignore significant contributors to ecosystem processes (McGeoch 2002; Samways et al. 2010a, 2012) such as primary production, nutrient recycling, predation, herbivory and competition. The core of the CFR represents a distinct zoogeographic zone, the Cape Faunal Centre (Stuckenberg 1962), which is characterised by the phylogenetic antiquity of much of its invertebrate fauna. The component species of this centre represent what is probably the richest known assemblage of post-Gondwanan relict species. The CFR is a pronounced hotspot for faunal endemism within southern Africa, where high levels of endemism are characterised for virtually all taxa examined.

There is no comprehensive invertebrate species list for the GRCWHS&NR but 322 invertebrate taxa belonging to eight orders have been recorded on the protected areas or within a 2 km buffer around them. These records were obtained through baseline data collection by CapeNature personnel and taxon specialists, and by members of the public via the online citizen science Virtual Museums (http://vmus.adu.org.za/).

Some protection might be provided to certain invertebrate groups in protected areas given the fact that there are correlations between insect species richness and biomes in the Western Cape (e.g., Procheş & Cowling 2006, 2007; Procheş et al. 2009). The attention and protection that the area receives in terms of its floral diversity might thus provide some protection for its invertebrate diversity (Samways et al. 2012).

2.4.1.1 Terrestrial invertebrates

Honeybees

The Cape flora is dependent on specialised pollination guilds. The biggest threat to insect pollinators is habitat destruction or transformation resulting in a decrease in available forage. Other threats include agricultural pesticides such as neonicotinoids, other volatile pollutants, pests, diseases, and climate change. An important pollinator in the GRCWHS&NR is the Cape honeybee, *Apis mellifera capensis.* Bees are affected by all the above threats. The primary objective of CapeNature's 2020 bee policy (CapeNature 2020a) is to protect wild honeybees on provincial reserves from genetic, ecological, pathogenic, and parasitic threats. Protected areas thus serve as refugia for locally adapted bee populations and contribute towards a network of healthy source bee populations that can disperse naturally throughout the rest of the province, thereby providing support to apiculture. Because of the risks posed by commercial beekeeping to wild bee populations (e.g., the introduction of pests or diseases), commercial beekeeping, including the use of catch boxes, is not permitted in the GRCWHS&NR.

Butterflies

South African butterflies are the most intensely studied and conserved group of invertebrates (Edge & Mecenero 2015) and were assessed according to IUCN criteria as part of the South African Butterfly Conservation Assessment project (Mecenero et al. 2013). These assessments were revised for the 165 butterfly species of conservation concern, after improving the accuracy of the dataset and revaluating the threats (Mecenero et al. 2020). Eight of the 102 butterfly species recorded in or near the GRCWHS&NR are species of conservation concern and are all Western Cape endemics. The Lepidopterists' Society of Africa is monitoring these species of conservation concern, as well as all those elsewhere in the country through its COREL (Custodians of Rare and Endangered Lepidoptera) programme (Edge 2011).

The Brenton blue butterfly (*Orachrysops niobe*) (Figure 2.17) is a high priority species for the GRCWHS&NR, being both CR and a highly localized endemic (Edge 2020c). It has a complex interaction with its host plant species (*Indigofera erecta*) and host ant species (*Camponotus baynei*). Although the butterfly does not rely on *I. erecta* for nectar, it lays its eggs on this plant. The younger forms of the larvae feed on the leaves, while older forms usually subsist below-ground on the rootstock of the plant. Larval protection and access to and from the rootstock is provided by the ants, which benefit by feeding on a sugary solution produced by the larvae (Edge 2005 and references therein).

Of the two localities at which it is known to have occurred, *Orachrysops niobe* is now extinct at one (Nature's Valley) and has not been recorded at the main site in Brenton on Sea since 2018. Following the June 2017 Knysna fire that burnt the entire site, four individuals were recorded during November 2017 and not again thereafter.

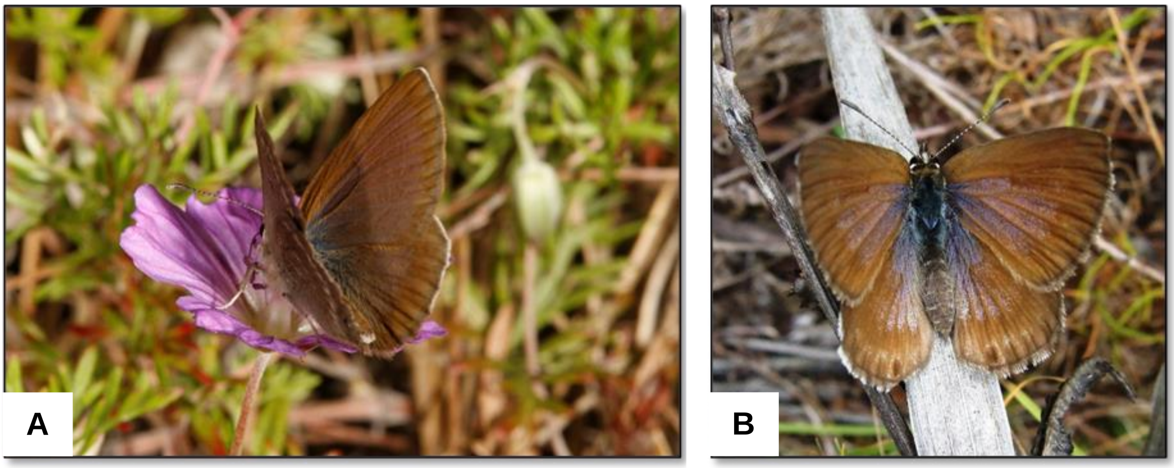

Figure 2.17: The Brenton Blue butterfly, *Orachrysops niobe*. A: Male (Photo: A. Coetzer); B: Female (Photo: J. Bode).

The BBBSNR was proclaimed in July 2003 after a major campaign by the Lepidopterists' Society of Africa and several other Non-Governmental Organisations (NGOs) (Steenkamp & Stein 1999). CapeNature is the management authority for the protected area and management is overseen by the Brenton Blue Butterfly Management Committee, with representation by the Brenton Blue Trust. A management plan for the site has been established and management is continuously refined according to research and monitoring findings. Management aims are to ensure the long-term survival of a genetically viable population of the butterfly, to ensure the ecological processes which are necessary for this, to locate suitable sites and establish new populations of the butterfly, and to support the objective of the Brenton Blue Trust (Edge 2008). Management strategies include the eradication of alien species, creation and maintenance of paths through the reserve, modification of habitat to promote the growth of the host plant, ongoing data collection, monitoring and research, fire prevention and reserve expansion through stewardship (Edge 2008).

The most significant threats to the species are stochastic events such as runaway fires, prolonged drought, loss of genetic diversity and climate change (Edge 2016a). The species is especially vulnerable to these threats because it is confined to the small 1.5 ha reserve, although the declaration of two adjacent new stewardship Contract Nature Reserves will increase the available habitat to nearly 15 ha. The number of butterflies on the protected area declined alarmingly over the past few years. This was initially because of the impact of drought on the host plant population. On top of this, the 2017 Knysna fire may have resulted in the extinction of the species, although it is hoped that the larvae may still persist underground. Prior to the fire, attempts were made to reintroduce *Orachrysops niobe* at the Nature's Valley Fynbos Reserve. However, due to the poor condition of the host plant population in the area and the absence of the larvae's host ant, this was not successful (Edge et al. 2008).

CapeNature currently considers the Brenton Blue Butterfly to be Critically Endangered, Possibly Extinct (CR PE). According to the Red List Categories, CR PE is a special tag associated with the category CR, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct have not yet been completed. A small chance remains that the species may still be rediscovered and as such, continued surveys are being carried out annually during the known flight periods of the butterfly (November and February).

Also assessed as CR PE and recorded in the zone of influence of the GRCWHS&NR is the Brenton opal (*Chrysoritis thysbe mithras*) (Edge 2020b). Historically, this butterfly was known to occur at Brenton on Sea near Knysna (95% of the population), in the Still Bay area and at Goesabos near Tsitsikamma. However, despite intensive search efforts, it has not been seen at any of these locations for more than 20 years. The three locations are separated by 80-120 km, much greater than the average dispersal distance of 1-2 km for the taxon (Edge 2020b). At Brenton on Sea, there is severe habitat degradation and fragmentation due to invasive alien vegetation and housing developments. A reduction in fire frequency, with a concomitant increase in fuel load, made this tiny location extremely vulnerable to the 2017 Knysna fire and may well have resulted in the extinction of the taxon (Edge 2020b). The Endangered Brenton copper (*Aloeides thyra orientis*) is known from six locations and was recorded on the Goukamma sector in 2008. It is subject to the same threats as the Brenton opal, particularly on the Brenton peninsula (Edge 2020a).

South African butterfly red list assessments apply rarity criteria on top of IUCN red list criteria, with the rationale that it is important to not only be aware of taxa that are threatened, but also those that are not currently threatened but that may be at risk in future because they are intrinsically rare or localised (Mecenero et al. 2020). The Dickson's sylph (*Tsitana dicksoni*) is classified as Rare (Low Density) (Dobson & Dobson 2020). This species has three subpopulations of which one is in the Outeniqua Mountain Range. Although a rare, low-density species, the Dickson's sylph can be found in suitable habitat throughout its range and is not threatened.

Two alien butterfly species, the cabbage white (*Pierus brassicae*) and the Oleander hawkmoth (*Daphnis nerii*, used for biocontrol of the invasive oleander plant, *Nerium oleander*) have been recorded in the GRCWHS&NR.

<u>Ants</u>

In the Fynbos biome myrmecochory, or seed dispersal by ants, is another important ecological function performed by some invertebrates (Le Maitre & Midgley 1992). Approximately 20% of strictly Fynbos plant species are dependent on this process (Johnson 1992), with 78 genera containing species that are ant-dispersed (Bond & Slingsby 1983). The only records of ants for the GRCWHS&NR are from the Brenton Blue Butterfly sector, where 44 taxa have been recorded (Edge et al. 2008). These include a number of major myrmecochores such as the small pugnacious ant (*Anoplolepis steingroeveri*), hairy sugar ant (*Camponotus niveosetosus*) and *Tetramorium quadrispinosum*. Bayne's sugar ant (*Camponotus baynei*) is also of great importance, as the host species for the Brenton blue butterfly. Threats to ants include invasive alien species (ant species richness in Southern Cape Fynbos is inversely related to *Hakea sericea* infestation levels) and inappropriate fire regimes (Koen & Breytenbach 1988). The invasive Argentine ant (*Linepithema humile*) has not been recorded on the GRCWHS&NR but is a potential future threat. The occurrence of *Lepisiota* species on the Brenton Blue Butterfly sector may provide some protection against this alien species (Edge et al. 2008).

Other

Other ecologically important invertebrate orders are Araneae (spiders), Neuroptera (net-winged insects) and Coleoptera (beetles). A total of 966 spider species have been recorded in the Western Cape (Dippenaar-Schoeman et al. 2015) and more than one-third of these are endemic to the province. Twenty-eight spider taxa are known from the GRCWHS&NR. There is a high level of endemism amongst Western Cape Neuroptera and eight of the 156 species recorded thus far in the province (Veldtman et al. 2017) have been found on or near the protected area. Beetles are the largest insect order, with over 350 000 species worldwide. There are records of 28 beetle taxa on and around the GRCWHS&NR. One alien species, the polyphagous shothole borer beetle (*Euwallacea fornicates*) has invaded the Garden Route but has not yet been discovered on any of the sectors. This beetle is symbiotic with a fungus (*Fusarium euwallaceae*), which attacks, and in some cases kills a wide range of alien and indigenous trees. It is important that reserve staff know what the signs of infection are and report these immediately if they are detected.

2.4.1.2 Freshwater Macro-invertebrates

Benthic macro-invertebrates

Benthic macro-invertebrates can be used to monitor water quality and habitat diversity over the long term, using the South African Scoring System version 5 (SASS 5) methodology following standardized protocols (Dickens & Graham 2002). SASS 5 is a rapid bio-assessment method and is used to assess the water quality, habitat availability and health of a river system. The method uses the presence/absence of macroinvertebrate families to evaluate water quality, with a sensitivity/tolerance score out of 15 linked to each taxon. The higher the score, the more sensitive the specific taxon is to disturbance. The method also takes invertebrate abundance into account as well as habitat (or biotope) availability, as different taxa prefer different parts of a river system. The SASS 5 score is linked to an ecological category developed by Dallas (2007) (Table 2.9).

Table 2.9: Ecological categories for interpreting SASS 5 data. Adapted from Dallas (2007).

Ecological Category	Category Name	Description
A	Natural	Unmodified, natural
B	Good	Largely natural with few modifications
C	Fair	Moderately modified
D	Poor	Largely modified
E	Seriously modified	Seriously modified
F	Critically modified	Critically or extremely modified

Consequently, SASS 5 data provide only a snapshot of water quality and biotope/habitat availability at a site. Internal baseline freshwater surveys have been conducted for all Clusters within the GRWHS&NR over the past 10 years. The surveys included both fish surveys and SASS 5 assessments, starting with the Keurbooms sector (2012; unpublished data), followed by the Goukamma sector (2015; unpublished data). In 2022 only SASS 5 surveys were conducted in the Outeniqua Cluster (Gouws 2022). Due to access constraints, many of the sites for these protected areas were located just outside the property boundaries. Surveys were conducted during spring (October) or early summer (December), with the Outeniqua survey taking place in mid-summer (January) due to a flood event in the system in November 2021. These surveys were only once-off to set the baseline for the present ecological state of the rivers sampled. Seasonal, more in-depth invertebrate surveys are also needed to get a complete picture of the species present, community structure and to determine the effects of certain impacts, including those associated with climate change. The baseline surveys only allowed for preliminary analysis of the data, and patterns of seasonal, temporal and impact effect variance will only be detected with long-term monitoring of selected sites.

No SASS sampling could be conducted at the two Keurbooms River sites, due to very high flow conditions at the time of sampling in October 2013. However, physico-chemical variables were collected, including pH, conductivity, dissolved oxygen and temperature. These variables varied considerably between the upstream and downstream sites, where they tended to be higher at the upstream site (at the causeway near the De Vlugt trout farm in Prins Alfred’s Pass) than at the downstream site at the Whiskey Creek cottage within the upper area of the Keurbooms estuary. For example, the pH at the upper site was 6.75 compared to a pH of 4.02 at the lower site.

Only two sites were sampled for the Goukamma Cluster, one in the upstream on the Homtini River and a lower site where the river becomes the Goukamma River, near the estuary. This survey was conducted in early December 2015 and flow was moderate to high at this time. The SASS 5 results for the two sites were found to be in a good to fair condition, depending on the river reach. More high scoring taxa were present at the upper site, leading to both a higher SASS score and Average Score per Taxon (ASPT) than the lower site, while the presence of an isopod species at the lower site is an indication of some estuarine intrusion. This was also reflected in the water quality variables, where the upper site had a slightly more acidic pH reading than the lower site (5.14 versus 6.16) and the conductivity, increased with 0,053 mS/m from the upper to the lower site. The dissolved oxygen levels showed slight variation, with higher values, and therefore more available oxygen, being recorded at the upstream site.

A total of 24 river sites were sampled within the Outeniqua Cluster (Gouws 2022). The survey was conducted in January 2022 and water flow levels varied between low flow in some of the north-western rivers (Ruitersbos sector), to moderate flow in the south draining rivers of the Outeniqua Cluster. This survey was conducted 2.5 months after a significant flood event in most of the river catchments and the results obtained reflected this impact. Despite the presence of a variety of sensitive macro-invertebrate families, the present ecological scores of many of the river sites was much lower than would be expected, many of which were falling into moderately to largely modified conditions. Recovery of macroinvertebrate assemblages after extreme flood events can last for up to a few years (Pažourková et al. 2021), however, at least some invertebrate communities would have had enough time to re-colonise and increase in numbers since the 22 November 2021 flood event.

The apparently low ecological health scores for the sites in especially the north draining rivers (Gouws 2022) were noteworthy. These sites were all located within the Outeniqua Cluster boundaries and in natural areas and therefore the expectation would be for high ecological condition scores. The river geomorphology (shape of the channel and banks) and instream and riverbank structure at these sites were likely the main drivers for these results. Many of the more sensitive invertebrate families (e.g., the stoneflies, some mayflies, and caddisflies) utilise the cobble/stones habitat, that was largely absent at most of these sites. The season of sampling would also influence the observed results (Dallas 2004). Therefore, seasonal, long-term monitoring would be needed to determine the true trends in invertebrate communities in these rivers.

The southern slope rivers generally had higher ecological health condition results. These sites were mostly located outside of the protected area boundaries in the mountain catchment area, with some within forestry areas. The variation in instream habitat and good water quality allowed for a higher level of invertebrate diversity in at least the higher lying sites. Only a few rivers had upstream and downstream sites (Kaaimans, Rooihoogskloof-Kouma, Swart and Klein Swart Rivers). Not surprisingly, the less impacted upstream sites of both the Kouma (Rooihoogskloof) and Swart River systems had higher river health results than the lower sites. The major impacts leading to this reduction includes agricultural land use (Kouma River), low flow bridges (e.g., Groot Brak River) and a large instream dam (Klein Swart River) (Gouws 2022). Other impacts include the presence of alien invasive tree species (e.g., tributary of Swart River), pine forests (e.g., Meulen River), water abstraction (e.g., Kouma River) and litter (e.g., Touws River).

<u>Odonata</u>

Another taxon useful for measuring freshwater quality is the Order Odonata, comprising dragonflies and damselflies. Western Cape dragonflies and damselflies represent ancient lineages, e.g., species in the genus *Syncordulia* (Corduliidae or Emeralds) diverged about 60 million years ago. They currently survive in small populations but are more resilient than expected, recovering quickly when invasive alien trees are removed. In the Western Cape, invasive alien trees are the biggest threat to dragonflies, shading out essential sunny habitat. There is a wide range of sensitivity of South African dragonflies to habitat disturbance (Samways & Simaika 2016). The Dragonfly Biotic Index (DBI) is an index of freshwater conditions. Each dragonfly species is rated according to distribution, threat category and sensitivity to change. The total of DBI scores for a site divided by the number of species can be used to compare sites and to track change per site over time (Samways & Simaika 2016).

Of the 76 Odonata taxa in the Western Cape (Underhill et al. 2018), 25 have been recorded in or adjacent to the GRCWHS&NR. Three of these are of conservation concern. The Mahogany presba (*Syncordulia venator*, VU) is a Western Cape endemic that is found up to the Eastern Cape border and occurs only at 300-1300m elevation in clear montane streams with an abundance of boulders and pools in bushy areas (Samways & Simaika 2016). The Cape thorntail (*Ceratogomphus triceraticus*, NT) is a highly localized and rare Western Cape endemic that occurs up to an elevation of about 800 m, along wide, shallow, bush-lined and rocky streams and rivers (Samways & Simaika 2016). The Queen malachite (*Chlorolestes nylephtha*, NT) is only known from the forests of the Southern Cape where the preferred habitat is small, clear streams with pools with high organic content in full forest (Samways & Simaika 2016). Each of these three species scores seven on the DBI and they can thus be useful indicators of habitat change (Samways & Simaika 2016). Threats to these dragonfly species include habitat degradation due to alien invasive trees, habitat loss caused by viticulture and to a lesser extent, cattle farming and plantation forestry. Increasing threats are over-abstraction of water from streams and possibly pollution.

Several Odonata species were observed during the Outeniqua Cluster freshwater survey. Some species observed are listed in Table 2.10 (these where casual observations).

Table 2.10: Odonata species observed during freshwater surveys in the Outeniqua Cluster.

Order	Species	Common name	Threat status	River(s)
Anisoptera (dragonflies)	*Orthetrum capicola*	Cape skimmer	Least Concern	Paardebont/Slang, Kamma, Saffraan, Kandelaars
	Crocothemis sanguinolenta	Little scarlet	Least Concern	Paardebont/Slang
	Trithemis stictica	Jaunty dropwing	Least Concern	Meul, Kamma, Saffraan
	Anax speratus	(Eastern) orange emperor	Least Concern	Saffraan, Klein-Doring
	Paragomphus cognatus	Rock hooktail	Least Concern	Meul
Zygoptera (damselflies)	*Elattoneura frenulata*	Sooty threadtail	Least Concern	Paardebont/Slang
	Pseudagrion kersteni	Powder-faced sprite	Least Concern	Meul, Kandelaars
	Allocnemis leucosticta	Goldtail	Least Concern	Meul, Saffraan
	Chlorolestes umbratus	White malachite	Least Concern	Saffraan, Kaaimans
	Africallagma glaucum	Swamp bluet	Least Concern	Kandelaars
	Ecchlorolestes nylephtha	Queen malachite	Near Threatened	Kandelaars
	Platycypha fitszimonsi	Klipjuweeltjie	Least concern	Moordkuil

2.4.1.3 Marine invertebrates

Refer to Section 2.3.3.

2.4.2 Amphibians

Twenty-two amphibian species have been recorded for the GRCWHS&NR, and this is likely to be a near-comprehensive list. The Knysna leaf-folding frog (*Afrixalus knysnae*) is listed as EN according to the Global IUCN Red List (IUCN 2020) and is currently the only priority frog species as it is known from few localities and most of these localities have very small populations. Furthermore, very few populations are within protected areas and therefore specific effort needs to be put into maintaining these sites.

Conservation of amphibians in the GRCWHS&NR depends on the persistence of wetland breeding habitat and sufficient surrounding foraging and sheltering habitat for frogs. The priority frog conservation action will be managing the water bodies known to support Knysna leaf-folding frogs, especially in the Goukamma sector where the species has been recorded in Groenvlei Lake. Creation of artificial water bodies may become a viable management tool for this species, but this conservation action will need to be tested and developed as part of a species conservation plan. A formal monitoring programme for the Knysna leaf-folding frog is recommended.

Also required is the effective control of invasive alien woody plant species and an appropriate fire-return interval. These management actions should be sufficiently measured and monitored under the vegetation and fire indicators to ensure persistence of the amphibian diversity in the protected area.

2.4.3 Fish

2.4.3.1 Freshwater fish

The GRCWHS&NR is located within the Cape Fold Ecoregion (CFE), one of the six aquatic ecoregions of Southern Africa (Abell et al. 2008). This protected area spans five discrete river systems. It also includes one unique freshwater lake, Groenvlei.

<u>River systems</u>

Of the five river systems included in the GRCWHS&NR, the Gouritz system is the largest. It is located primarily inland and makes up significant sections of the northern and western side of the protected area. This system is home to seven described indigenous freshwater fish species. The cyprinids are the most species-rich group, which includes the smallscale redfin (*Pseudobarbus asper*), slender redfin (*Pseudobarbus tenuis*), chubbyhead barb (*Enteromius anoplus*) and moggel (*Labeo umbratus*). The smallscale redfin is endemic to the Gouritz and Gamtoos River systems and is currently listed as VU (Jordaan & Chakona 2018a). The slender redfin is relatively widespread in the headwater streams of the Gouritz system and is NT (Jordaan & Chakona 2018b). A unique lineage, *Pseudobarbus* sp. "*tenuis* keurbooms", occurs exclusively in the Keurbooms River system and is EN (Jordaan & Chakona 2018c).

The moggel and chubbyhead barb are widespread, with distribution ranges that extend beyond the CFE (Skelton 2001). The chubbyhead barb is listed as LC primarily due to its large distribution range and ability to thrive in a wide variety of habitats (Woodford 2017). However, a number of historically isolated lineages exist within this species

(Skelton & Swartz 2011) and its conservation status should be revised (Skelton & Swartz 2011; Woodford 2017). Ramoejane (2021) presented evidence that the moggel belongs to a species complex consisting of several distinct lineages. The population in the Gouritz system represents a unique management unit in terms of conservation purposes. The Gouritz system is home to the Cape galaxias (*Galaxias zebratus*) and the Cape kurper (*Sandelia capensis*). These taxa are both endemic to the CFE and listed as DDT. This status relates to taxonomic uncertainty as each taxon comprises a species complex consisting of genetically distinct lineages (Chakona et al. 2013; Bronaugh et al. 2020). The presence of the longfin eel (*Anguilla mossambica*) in the Gouritz system has also been confirmed.

As the GRCWHS&NR is located primarily in mountainous areas, only the headwater sections of rivers are included within the protected area boundary. This has important implications for freshwater fish as it benefits headwater specialists but excludes lowland species, leaving the latter unprotected and vulnerable to threats downstream of the reserve boundary. Examples of headwater species that are relatively well represented in the GRCWHS&NR are the slender redfin and Cape galaxias. In contrast, there are no records for the protected area of smallscale redfin or chubbyhead barb. This can be ascribed to these species' preference for lower foothill and mainstream river habitat. Consequently, the majority of smallscale redfin and chubbyhead barb populations within the greater Gouritz system are vulnerable to threats including unsustainable water abstraction, alien fish invasions and impacts associated with climate change (Jordaan & Chakona 2018a). While the status of many smallscale populations have been investigated in the past five years (e.g., Jordaan et al. 2016, Jordaan & Gouws 2017), it is possible that many other populations may have been lost already and a survey to establish the status of these is urgently required (Jordaan & Chakona 2018a). A similar situation applies to the chubbyhead barb, especially given the imminent taxonomic revisions for this species.

On the southern side of the Outeniqua Mountains, the GRCWHS&NR spans four smaller coastal catchments namely the Klein-Brak, Gwaing, Kaaimans and Touws. These catchments share both *Galaxia zebratus* and *Sandelia capensis* with the Gouritz system (and the greater CFE) but, given that these species both comprise species complexes, the populations from the coastal systems may constitute novel taxa. The only other native freshwater fish species associated with the catchments on the southern side of the GRCWHS&NR is the Eastern Cape redfin (*Pseudobarbus afer*). The currently described *P. afer* is native to the smaller coastal catchments systems from Mossel Bay to Algoa Bay and has long been considered a single species with variable morphological traits between populations. However, following molecular studies, four distinct lineages were identified (Swartz et al. 2007; 2008). Subsequently Chakona & Skelton (2017) described three new species namely *Pseudobarbus afer*, *P. senticeps* and *P. swartzi*, all of which are restricted to river systems in the Eastern Cape Province. The remaining lineage is *P. afer* 'sp. Forest', which occurs in the coastal systems from Klein Brak River to Tsitisikamma. The taxonomy of this lineage is still unresolved. A phylogenetic analysis based on both morphological and molecular data indicates that it is more closely related to *P. phlegethon* from the Olifants River on the west coast of the Western Cape Province (Swartz et al. 2008). This is evidence that phylogenetically it does not belong to the *P. afer sensu lato* complex (Chakona & Skelton 2017). The current status of this lineage is NT (Chakona 2017). Eels of the genus *Anguilla* also occur in the coastal catchments associated with the protected area. These eels are widespread along the east coast of South Africa and further north. The two eel species expected to occur in the area, *Anguilla mossambica* and *A. marmorata* are listed as NT and LC respectively (Pike et al. 2020a, b).

A number of non-native fish species are present in the greater Gouritz system as well as the four coastal catchments on the southern side of the GRCWHS&NR. These include species from outside the country as well as species native to the country but alien to the CFE. The former includes two salmonids (rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*)), four centrarchids (black bass species, namely largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*) and spotted bass (*M. punctulatus*), as well as bluegill sunfish (*Lepomis macrochirus*)) and a single cyprinid (common carp (*Cyprinus carpio*)). Mozambique tilapia (*Oreochromis mossambicus*), sharptooth catfish (*Clarias gariepinus*), banded tilapia (*Tilapia sparrmanii*) and Orange-Vaal smallmouth yellowfish (*Labeobarbus aeneus*) are all native to South Africa but alien and invasive in the rivers of the Western Cape (Skelton 2001). Non-native fish species are generally widespread throughout the Gouritz system with rainbow and brown trout favouring cooler mountain streams and black bass, tilapia and carp being more common in the warmer lower altitude sections of rivers. Sharptooth catfish is also a typical lowland species but has been shown to be able to invade headwater streams in its extralimital range in the Eastern Cape (Ellender et al. 2015) and recent records have been reported from the Groot River in Meiringspoort (Jordaan & Chakona 2018a).

The fine-scale distribution of non-native fish in the four coastal catchments, especially in headwater sections that are included in the protected area, are relatively poorly reported in the literature. For the forest redfin, Chakona (2017) reported a paucity of recent distribution data and stated that the redfin is threatened by invasive alien fish species, water abstraction and impacts from forestry activities that result in sedimentation of headwater streams. Further threats include urban development, which can cause loss or degradation of habitat. These threats likely threaten the rest of the native species compliment in these catchments and surveys are required to confirm the extent and severity of these impacts.

<u>Groenvlei Lake</u>

Groenvlei Lake, within the Goukamma sector, is an inland coastal lake that is isolated from the sea and is fed with rainwater from the surrounding catchment (Parsons 2009). There are two indigenous fish species in the lake: estuarine round herring (*Gilchristella aestuaria*) and Cape silverside (*Atherina breviceps*). Although these species are widespread and not threatened, the Groenvlei subpopulations are morphologically and genetically different from elsewhere (Phair et al. 2015) and this increases their conservation value. Public access to the vlei is not controlled. Historically, it has been a popular site for recreational angling of largemouth bass (Parsons 2009) and common carp, which were illegally introduced in the 1990s (Olds et al. 2011). Other alien fish species in Groenvlei are bluegill sunfish, mosquitofish (*Gambusia affinis*) and Mozambique tilapia (Dredge 2016). The indigenous fish still persist in the lake more than 20 years after the introduction of carp, but the current status of their populations is unknown (Josephine Pegg, pers. comm.).

Carp are large, fecund, robust fish that are adaptable and tolerant of a range of environmental conditions and they are keystone modifiers of habitats. They are bottom-feeders which uproot water plants and can increase water turbidity and nitrification. This can result in algal blooms and have other negative impacts on aquatic environments (Global Invasive Species Database 2019). Since their introduction into Groenvlei, the carp have flourished (Dredge 2016). A preliminary estimate is that the vlei currently supports in the order of 60 000 carp or 180 tons (Josephine Pegg, pers. comm.). Water chemistry data from the 1980s to the present does not suggest that there has been a decline in water quality but this could be due to paucity of data rather than indicative of the absence of impacts (Josephine Pegg, pers. comm.).

At intervals over the years, carp numbers in Groenvlei have been reduced through gillnetting, with the recent addition of bow-hunting by volunteers (Invasive Fish Species Management (IFSM) team). A recent positive spin-off of carp removal from the lake has been the provision of fish as a food source for local communities through Knysna Municipality and the Gift of the Givers NPO. Between March 2018 and April 2022, 2 408 man-hours of bow-hunting resulted in the removal of 4 240 carp with a combined mass of 16 146 kg (unpublished data, Johnny Snyman). This equates to 6.7 kg/man-hour. Catch per unit effort was highest from October to December 2018 and June to August 2019 (Figure 2.18) and bow-hunting success was highest in the eastern section of the lake (Figure 2.19). In contrast, 656 hours of gillnetting (a netting event usually involves 2 people) between February 2020 and March 2022 resulted in a total catch of 1 442 fish with a combined mass of 3 779.7 kg, or 2.88 kg/man-hour (unpublished data, CapeNature).

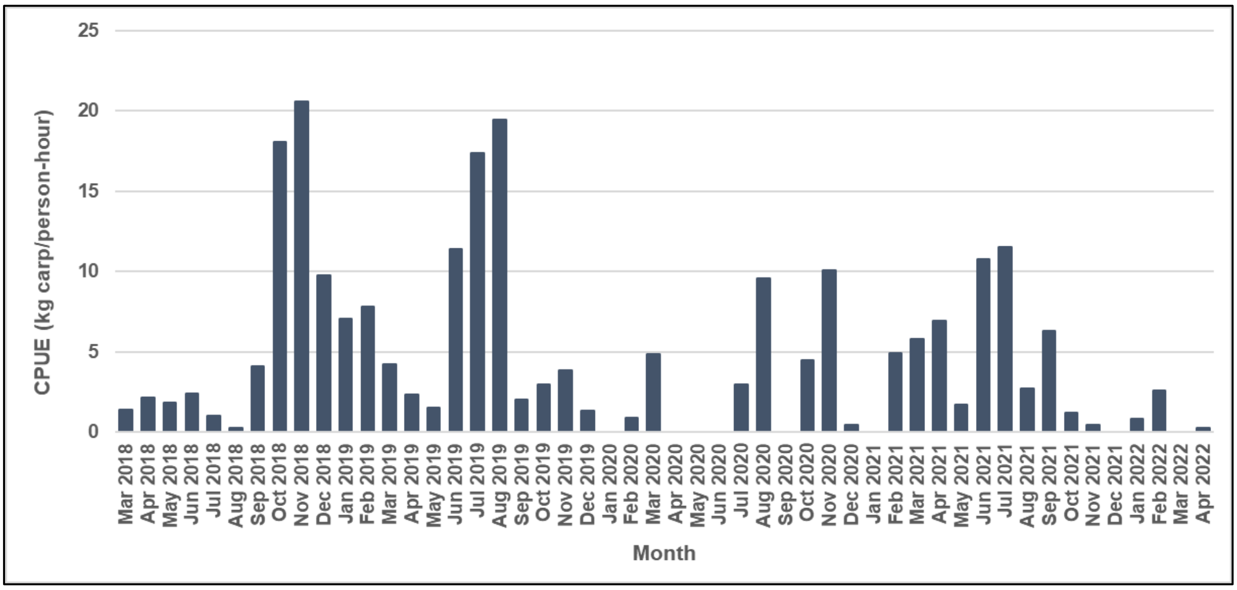

Figure 2.18: Bow-hunting catch per unit effort on Groenvlei Lake recorded from March 2018 to April 2022 (unpublished data, Johnny Snyman).

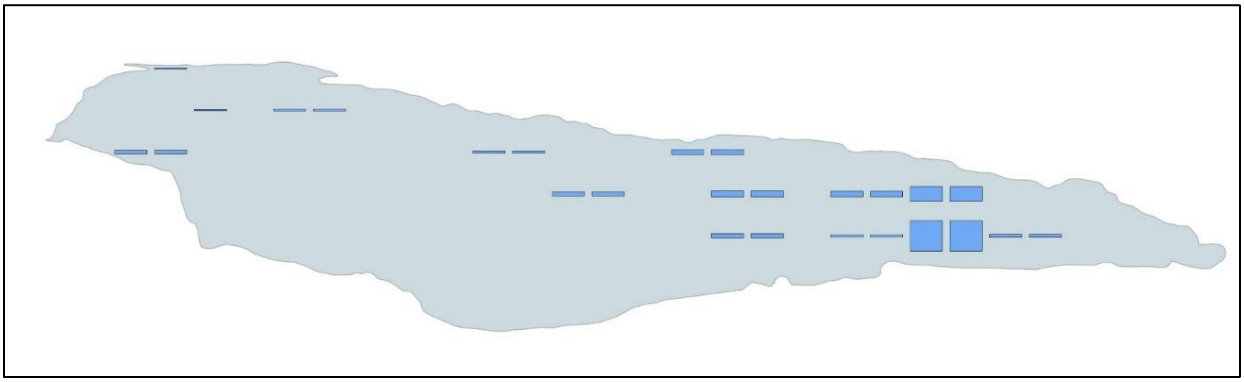

Figure 2.19: Spatial representation of bow-hunting catch per unit effort on Groenvlei, March 2018 to November 2020 (unpublished data, Johnny Snyman).

The current level of take-off through combined netting and bow-hunting is estimated to be equivalent to a maximum of 10% of the carp population (Josephine Pegg, pers. comm.). There is no information on carp population growth rate in Groenvlei so the effectiveness of this off-take cannot be determined. However, given that carp show plasticity in terms of fecundity, size at sexual maturation and growth rate and that conditions for carp in Groenvlei are ideal, it is estimated that about 50% of the current population will have to be removed to have a noticeable effect (Josephine Pegg, pers. comm.). This will require a much more intensive effort than has been achieved to date and it is intended to appoint contractor teams for this purpose. There are a number of other carp control methods which could be employed (Impson 2019), but a feasibility assessment concluded that in terms of risk and effectivity, the preferred control option is that which is now in use, i.e., gillnetting in combination with bow-hunting (De Villiers & Jordaan 2020). The feasibility assessment also recommended that the progress of carp control programmes elsewhere should be followed, particularly the planned Australian programme and the development of genetic biocontrol techniques. Regardless of the method employed at Groenvlei, management must be informed by reliable, long-term monitoring of carp numbers and water quality.

2.4.3.2 Marine Fish

There have been numerous research and monitoring projects relating to the rich fish diversity in Goukamma MPA (CapeNature unpublished data, Pradevand & Hiseman 2006; Götz 2005; Van Zyl 2011). Goukamma supports a rich mixture of warm temperate species, including many that are endemic to the south coast of South Africa. Goukamma MPA has been recognized as an invaluable area for resident, long-lived reef species such as the roman (*Chrysoblephus laticeps*) (Figure 2.20), galjoen (*Dichistius capensis*) and black musselcracker (*Cymatoceps nasutus*) with roman and galjoen being more abundant inside the MPA than outside (Götz 2005; Götz et al. 2009, CapeNature unpublished data). A total of 91 marine fish species have been recorded in the Goukamma MPA. Table 2.11 represents the marine fish species that have threat statuses according to the IUCN. Twenty-five species from the Sparidae have been recorded in the Goukamma MPA. Dageraad (*Chrysoblephus cristiceps*) (Figure 2.20) and seventy-four (*Polysteganus undulosus*) are both classified as CR. They are endemic, reef associated species from the Sparidae family.

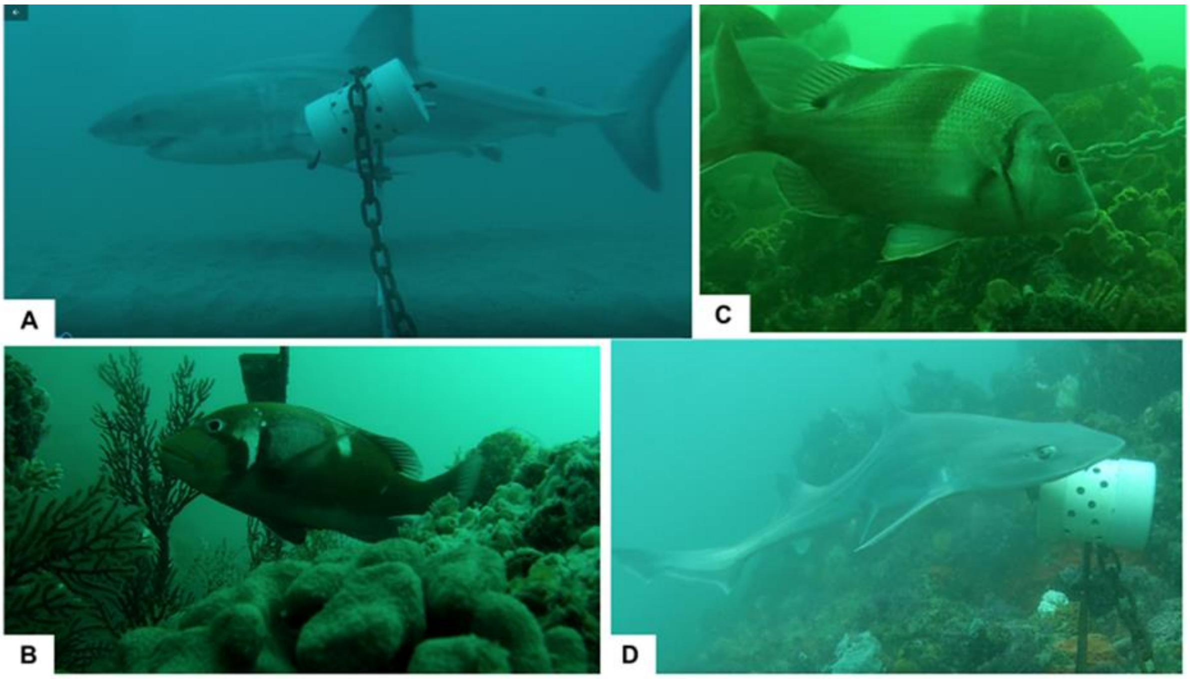

Figure 2.20: Fish species of conservation concern recorded in the Goukamma Marine Protected Area. A: Great white shark (*Carcharodon carcharias*); B: Roman (*Chrysoblephus laticeps*); C: Dageraad (*Chrysoblephus cristiceps*); D: Smooth hound shark (*Mustelus mustelus*). (Photos: CapeNature).

Figure 2.21: Red steenbras (*Petrus rupestris*) and pyjama shark (*Poroderma africanum*) at a bait cannister during Baited Remote Underwater Videoing (BRUV) monitoring in the Goukamma Marine Protected Area. (Photo: CapeNature).

Table 2.11: Marine fish species recorded in the Goukamma and Robberg Marine Protected Areas that have IUCN threat statuses. Some are illustrated in Figures 2.20 and 2.21. Species that are listed as Least Concern, Data Deficient or have not been assessed are not included.

Common Name	Scientific Name	Goukamma MPA	Robberg MPA	IUCN Threat Status
Dageraad	*Chrysoblephus cristiceps*	X		CR
Seventy-four	*Polysteganus undulosus*	X		CR
Soupfin shark	*Galeorhinus galeus*	X	X	CR
Scalloped hammerhead	*Sphyrna lewini*		X	CR
Dusky kob	*Argyrosomus japonicus*	X		EN
Dusky shark	*Carcharhinus obscurus*	X	X	EN
Puffader shyshark	*Haploblepharus edwardsii*	X	X	EN
Red steenbras	*Petrus rupestris*	X		EN
Red stumpnose	*Chrysoblephus gibbiceps*	X		EN
Spearnose skate	*Rostroraja alba*	X		EN
White Steenbras	*Lithognathus lithognathus*	X	X	EN
Black musselcracker	*Cymatoceps nasutus*	X	X	VU
Brown shyshark	*Haploblepharus fuscus*	X	X	VU
Elf	*Pomatomus saltatrix*	X	X	VU
Great white shark	*Carcharodon carcharias*	X	X	VU
Lesser guitar shark	*Acroteriobatus annulatus*	X	X	VU
Spiny dogfish	*Squalus acanthias*	X		VU
Smooth hammerhead shark	*Sphyrna zygaena*	X	X	VU
Spotted ragged-tooth	*Carcharias taurus*	X	X	VU
Tiger catshark	*Halaelurus natalensis*	X		VU
Yellowbelly rockcod	*Epinephelus marginatus*	X	X	VU
Horse mackerel	*Trachurus trachurus*		X	VU
Smooth hound shark	*Mustelus mustelus*	X	X	VU
Belly-striped blaasop	*Arothron inconditus*		X	VU
White stumpnose	*Rhabdosargus globiceps*		X	VU
Blue stingray	*Dasyatis chrysonota*	X	X	NT
Bronze bream	*Pachymetopon grande*	X	X	NT
Bronze whaler	*Carcharhinus brachyurus*	X		NT
Carpenter	*Argyrozona argyrozona*	X	X	NT
Geelbek	*Atractoscion aequidens*	X		NT
Roman	*Chrysoblephus laticeps*	X	X	NT
Spotted eagle ray	*Aetobatus narinari*	X		NT

Common Name	Scientific Name	Goukamma MPA	Robberg MPA	IUCN Threat Status
White musselcracker	*Sparodon durbanensis*	X		NT
Yellow-spotted catshark	*Scyliorhinus capensis*	X		NT

Historical catch rates led to these, and other, sparid species being overexploited and the populations crashing. The population levels are still recovering owing to these species being slow growing and long-lived. Six other Sparidae species with threat statuses have been recorded in the MPA, including red steenbras (*Petrus rupestris*) (Figure 2.21), red stumpnose (*Chrysoblephus gibbiceps*), white steenbras (*Lithognathus lithognathus*), black musselcracker (*Cymatoceps nasutus*), bronze bream (*Pachymetopon grande*), carpenter (*Argyrozona argyrozona*), roman (*Chrysoblephus laticeps*) and white musselcracker (*Sparodon durbanensis*).

Thirty shark, skate and ray species are known to occur in the MPA. These include ten shark, one skate and two ray species with threat statuses (Table 2.11).

Many shark species are transient and travel the oceans and only use the MPA as a food source and a place of refuge. The CR soupfin shark (*Galeorhinus galeus*), EN dusky shark *(Carcharodon carcharias*), smooth hammerhead (*Sphyrna zygaena*) and spotted ragged-tooth sharks (*Carcharias taurus*), and NT bronze whaler (*Carcharhinus brachyurus*) are all examples of transient species. There are, however, shark species found in Goukamma MPA that are endemic to Southern Africa and do not travel great distances. At least 16 catshark species are endemic to Southern Africa. Seven of these species have been recorded and some are abundant in the Goukamma MPA. Four of these have IUCN threat statuses. The puffadder shyshark (*Haploblepharus edwardsii*) is listed as EN, the brown shyshark (*Haploblepharus fuscus*) and tiger catshark (*Halaelurus natalensis*) are both VU and yellowspotted catshark (*Scyliorhinus capensis*) is NT.

A total of 64 species have thus far been recorded in the Robberg MPA. This MPA has not been extensively monitored for fish fauna so the species numbers are not representative of the full suite of species found in the MPA. Twenty-one species recorded have an IUCN threat status of NT or worse. Two CR shark species occur in the MPA, the soupfin shark (*Galeorhinus galeus*) and the scalloped hammerhead shark (*Sphyrna lewini*). Both these species are transient in nature and only use the MPA for refuge and to hunt prey. The dusky shark (*Carcharhinus obscurus*), puffadder shyshark (*Haploblepharus edwardsii*) and white steenbras (*Lithognathus lithognathus*) are all classified as EN and occur in the MPA.

There is a strong component of inshore reef species that are typical along the southern coast of South Africa. A large proportion of these are from the Sparidae family including black musselcracker (*Cymatoceps nasutus*), hottentot (*Pachymetopon blochii*), carpenter (*Argyrozona argyrozona*), roman (*Chrysoblephus laticeps*), bronze bream (*Pachymetopon grande*), fransmadam (*Boopsoidea inornate*), blacktail (*Diplodus capensis*), zebra (*Diplodus cervinus*), janbruin (*Gymnocrotaphus curvidens*) and strepie (*Sarpa salpa*). Species from the Sparidae family are under significant fishing pressure with a few species' populations having crashed. The protection of these species within MPAs is crucial for their long-term survival.

The connection between estuaries and MPAs is very important. There are species that rely on estuaries for some part of their life cycle and the uninterrupted protection between these systems offers an important refuge for these species. The dusky kob (*Argyrosomus japonicus*) and white steenbras are two very important linefish species, both EN, that use estuaries in their juvenile life stages. These species spawn at sea and the juveniles migrate into estuaries which are considered safer and more productive than the adjacent ocean. Once the fish become sub-adults, they migrate back to the ocean to spawn. Even as adults, the fish migrate between the ocean and the estuary when conditions are favorable. These and other important linefish species are found in both the Goukamma and Keurbooms estuaries and the adjacent marine protected areas (Goukamma and Robberg respectively). Data collected during the catch per unit effort monitoring project in Goukamma has shown that the vast majority of white steenbras and dusky kob caught in the Goukamma MPA have been sub-adult. This indicates that sub-adults stay in the MPA once they leave the estuary (CapeNature, unpublished data).

2.4.3.3 Estuarine Fish

The fish abundance and distribution along the length of the Goukamma Estuary is typical of black water systems (Kaselowski 2012). In a study by James and Harrison (2008), a total of five seine net hauls and five gillnet sets sampled a total of 1 313 fish from 16 species and nine families. The highest proportion of these were from the Mugilidae family (4 species) followed by Gobiidae (3 species), Sparidae and Soleidae (2 species respectively). The estuarine round-herring (*Gilchristella aestuaria*), an estuarine resident, dominated the catch numerically at 44.7% followed by Cape stumpnose (*Rhabdosargus holubi*) (18.1%), white steenbras (17.5%), southern mullet (*Chelon richardsonii*) (8.7%), flathead mullet (*Mugil cephalus*) (3.9%), Knysna sand goby (*Psammogobius knysnaensis*) (3.7%) and prison goby (*Caffrogobius gilchristi*) (1.7%). Southern mullet dominated the catch gravimetrically with 52.9% followed by dusky kob (17.0%), spotted grunter (*Pomadasys commersonnii*) (12.8%), white steenbras (*Lithognathus lithognathus*) (12.5%) and freshwater mullet (*Myxus capensis*) (2.6%). This study found that the majority of Cape stumpnose and white steenbras sampled were 0+ recruits. The estuarine-dependent marine species dominated the fish composition with 11 species comprising 49.9% of the catch numerically and 99.0% by mass. Five estuarine dependent species comprised 50.3% of the catch numerically but only 1.0% by mass. From this, the Goukamma Estuary serves as a viable function for both marine migrant and estuarine resident fishes (James & Harrison 2008).

The fish fauna of the Keurbooms and Bitou estuary were sampled by multi-mesh gillnets and seine nets in November 1994 (James & Harrison 2008). A total of 23 species representing 13 families were caught, with the Mugilidae (5 species), Sparidae (4 species) and Gobiidae (4 species) dominating the catch. The Cape stumpnose was numerically dominant (46.4% of total catch and mostly newly recruited juveniles) followed by juvenile mullet (27.5%). Dusky kob dominated the catch in terms of biomass (31.1%) followed by the southern mullet (29.2%).

The Knysna seahorse (*Hippocampus capensis*) was not recorded during these surveys in 1994, however in 2021 several were sampled from the Keurbooms River estuary by DFFE during a fish and invertebrate survey (Figure 2.22). This species, which is listed as EN by the IUCN, is the only fully estuarine species and its distribution amongst aquatic vegetation has been confirmed historically in only four SA estuaries, namely Knysna, Swartvlei, Keurbooms/Bitou and Klein Brak (Bell et al. 2003). However, evidence suggests it no longer occurs in the Klein Brak (Teske et al. 2003; Lockyear et al. 2006). The species does not appear to show a preference for a specific type of vegetation and is found in association with *Zostera capensis*, *Caulerpa filiformis*, *Codium extricatum*, *Halophila ovalis* and *Ruppia cirrhosa* (Teske et al. 2007). It does, however, appear to prefer areas where vegetation cover exceeds 75% and any conservation efforts should concentrate in sections of the estuary where vegetation cover is high. Both James and Harrison (2008) and Whitfield (1994) recorded the longsnout pipefish (*Syngnathus acus*) in the estuary. Both studies report that the fish fauna is dominated by marine migrant species (utilize estuaries but spawn at sea), with a large juvenile component mostly occurring below the N2 bridges, reflecting the importance of these systems as a nursery area (typical of permanently open estuaries). In addition to dusky kob, both systems are home to other important and over-exploited linefish species such as white steenbras, spotted grunter and leervis (*Lichia amia*). The baardman (*Umbrina canariensis*), a marine species, is also found in the system and is caught quite regularly.

Figure 2.22: A Knysna seahorse (*Hippocampus capensis*) sampled from the Keurbooms River Estuary by DFFE: Fisheries Research and Development in 2021. (Photo: H Nieuwoudt).

2.4.4 Reptiles

The GRCWHS&NR has 69 reptile species recorded with georeferenced localities (records sourced from the CapeNature State of Biodiversity Database, iNaturalist https://www.inaturalist.org/ and ReptileMap http://vmus.adu.org.za/). Two species are extralimital, originating in the north-east of South Africa (*Hemidactylus mabouia* and *Lygodactylus capensis*). All of the terrestrial reptile species are listed as LC according to the IUCN criteria (IUCN 2020).

The presence of at least four species of threatened marine turtles (Table 2.12; Figure 2.23.) in the coastal nature reserves of this protected area is particularly noteworthy. Marine turtles are primarily threatened by fishing activities when they are caught and drowned as accidental by-catch (Wallace et al. 2011).

Table 2.12: Reptile species of conservation concern known to occur in the Garden Route Complex World Heritage Site and Nature Reserves.

Scientific Name	Common Name	Global IUCN Category (IUCN 2020)
Caretta caretta	Loggerhead turtle	VU (A2b)
Chelonia mydas	Green turtle	EN (A2bd)
Dermochelys coriacea	Leatherback turtle	VU (A2bd)
Eretmochelys imbricata	Hawksbill turtle	CR (A2bd)

The conservation of the terrestrial reptiles in the GRCWHS&NR depends on effective control of invasive alien woody plant species, appropriate fire-return intervals and preventing too much (>25%) of any of the protected areas burning in any one fire event. These management actions should be sufficiently measured and monitored under the vegetation and fire indicators to ensure persistence of the reptile diversity in the protected area. However, this is an association that should be tested.

Conservation of the marine turtles requires control of offshore fishing, removal of “ghost” fishing equipment and proper waste management (particularly of plastic pollution).

Figure 2.23: Loggerhead turtle hatchlings (*Caretta caretta*) being stabilized prior to rehabilitation at Two-Ocean's Aquarium. (Photo: C Hauvette).

2.4.5 Avifauna

The GRCWHS&NR has a wide range of bird habitats. Large areas of mountain fynbos can be found on the different sectors of the Outeniqua Cluster, with coastal/lowland fynbos occurring on Robberg, Goukamma and Buffalo Valley sectors, and patches of afromontane forest on the Witfontein and Keurbooms River sectors. In addition, there are also freshwater lake (Goukamma), riverine (Keurbooms River), estuarine, (Goukamma), and coastal (Robberg and Goukamma sectors) habitats, each adding a different suite of birds to the list for the GRCWHS&NR. Two hundred and forty-three species of birds have been recorded, which is a significant percentage of all species in the Western Cape Province. The only guild of species missing is comprised of birds inhabiting the dry Karoo areas further north.

Table 2.13 provides a list of the 23 threatened species that have been recorded within the boundaries of the GRCWHS&NR and some of these are illustrated in Figure 2.24. This protected area is, however, only of conservation significance for eight of these. The most important of these is the Cape cormorant (*Phalacrocorax capensis,* Figure 2.24), specifically the colony on Robberg. This is one of the ten largest colonies of the species and supports more than 1% of the global breeding population.

Table 2.13: Regionally and/or globally threatened bird species recorded within the Garden Route Complex World Heritage Site and Nature Reserves. * Denotes those species for which the protected area is important.

Species Name	**Scientific Name**	**Regional Threat Status** (Taylor et al. 2015c)	**Global Threat Status** (IUCN 2020)
African penguin	*Spheniscus demersus*	EN	EN
Black harrier	*Circus maurus*	EN	EN
Cape cormorant*	*Phalacrocorax capensis*	EN	EN
Martial eagle	*Polemaetus bellicosus*	EN	VU
African marsh-harrier*	*Circus ranivorus*	EN	LC
Cape gannet	*Morus capensis*	VU	EN
Knysna warbler	*Bradypterus sylvaticus*	VU	VU
African crowned eagle	*Stephanoaetus coronatus*	VU	NT
White-backed night-heron	*Gorsachius leuconotus*	VU	LC
African finfoot	*Podica senegalensis*	VU	LC
Caspian tern	*Sterna caspia*	VU	LC
Lanner falcon	*Falco biarmicus*	VU	LC
Striped flufftail*	*Sarothrura affinis*	VU	LC
Verreaux's eagle*	*Aquila verreauxii*	VU	LC
Cape rock-jumper	*Chaetops frenatus*	NT	NT
Knysna woodpecker*	*Campethera notata*	NT	NT
Protea seedeater*	*Crithagra leucopterus*	NT	NT
Half-collared kingfisher	*Alcedo semitorquata*	NT	LC
Bar-tailed godwit	*Limosa lapponica*	LC	NT
Curlew sandpiper	*Calidris ferruginea*	LC	NT
Eurasian curlew	*Numenius arquata*	LC	NT
Forest buzzard*	*Buteo trizonatus*	LC	NT
Ground woodpecker*	*Geocolaptes olivaceus*	LC	NT

Figure 2.24: Bird species of conservation concern that occur within the Garden Route Complex World Heritage Site and Nature Reserves. A: Cape rock jumper (*Chaetops frenatus*); B: Cape sugarbird (*Promerops cafer*); C: Verreaux's eagle (*Aquila verreauxii*); D: Cape cormorant (*Phalacrocorax capensis*); E: African penguin (*Spheniscus demersus*). (Photos: M de Villiers).

The coastal wetlands of the Western Cape are strongholds of the African marsh-harrier (*Circus ranivorus*) within the province (Taylor 2015a), and the coastal lakes between George and Knysna are thus important for the conservation of this species. Groenvlei Lake, in the Goukamma sector, forms part of this lake system and provides breeding and foraging habitat for this species.

Within the GRCWHS&NR, the striped flufftail (*Sarothrura affinis*) has only be recorded on the Outeniqua Cluster. It is a secretive species and has most probably been under-recorded in the GRCWHS&NR which may hold significant numbers of these birds. The importance of the protected areas for this species, especially the Outeniqua and Goukamma Clusters, should be ascertained during conservation surveys in suitable habitats.

The South African Red Data Book indicates that the GRCWHS&NR, most notably the Outeniqua Cluster, occurs within high-density areas of the Verreaux's eagle (*Aquila verreauxii*) distribution, i.e., areas where there is a reporting rate of ≥5% (Taylor 2015b). An analysis of the data from the South African Bird Atlas Project shows an average reporting rate for this species in the GRCWHS&NR of 7.1%, with areas in the Doringrivier and Ruitersbos sectors having reporting rates in the region of 11 and 14% respectively. While the data does not provide information on breeding, these relatively high reporting rates suggest that the GRCWHS&NR may contain several breeding pairs and/or form part of the foraging areas of breeding pairs.

The Knysna woodpecker (*Campethera notata*), endemic to South Africa, is restricted to coastal forests. Relatively high reporting rates for this species have been recorded for the Goukamma and Keurbooms River sectors, which fall in the area designated as high-density (reporting rates >15%) for the species (Peacock 2015).

The Protea seedeater (*Crithagra leucopterus*) is endemic to the Fynbos Biome. It mostly inhabits mountain fynbos and has mostly been recorded in the Outeniqua Cluster. Although reporting rates for some areas in this complex are relatively high, the species is probably under-reported because of the inaccessibility of certain areas. Visits and surveys undertaken to these areas should make a special attempt to search for the species and include it on the relevant SABAP2 (SABAP2 2020) data sheets.

Although the forest buzzard (*Buteo trizonatus*) and ground woodpecker (*Geocolaptes olivaceus*) are listed as regionally LC, both are globally NT. Reporting rates indicate that the GRCWHS&NR plays an important role in their conservation. Forest buzzards are inhabitants of the forest fringe and have been recorded at relatively high reporting rates throughout the protected area, except for the Annex Vlugt sector. Analysis of the entire South African data set for the species indicates that the stronghold for the species is in the Southern Cape. The GRCWHS&NR, therefore, will play a significant role in the conservation of the species. Although recorded at relatively high reporting rates in the Outeniqua Cluster, it is suspected that the ground woodpecker, like the Protea seedeater, is under-reported due to inaccessibility of the area.

The GRCWHS&NR is thus important for a number of threatened species, but its importance to other species may also become apparent as more information is gathered through surveys of areas that are difficult to access, and through increased vigilance for secretive species.

2.4.6 Mammals

2.4.6.1 Terrestrial mammals

Fifty-eight indigenous terrestrial mammal species (excluding escapees from nearby game farms) have been recorded on the GRCWHS&NR. These range from the tiny pygmy mouse (*Mus minutoides*) to the eland (*Tragelaphus oryx*). Three species are NT, three are VU and one is EN, while two are endemic and five near-endemic to the Western Cape Province (Table 2.14). In Figure 2.25 some of these are displayed. Some of the species that occurred historically but are no longer present in the area are African elephant (*Loxodonta africana*), African buffalo (*Syncerus caffer caffer*), hippopotamus (*Hippopotamus amphibius capensis*), Cape mountain zebra (*Equus zebra zebra*) and probably lion (*Panthera leo*) (Skead 2011).

Table 2.14: Priority mammal species of the Garden Route Complex World Heritage Site and Nature Reserves and the regional conservation status according to the 2016 South African Red Data Book (Child et al. 2016).

Scientific name	English name	Regional status	Provincial endemism	Eco-typical
Acomys subspinosus	Cape spiny mouse	LC	Endemic	
Aonyx capensis	African clawless otter	NT		
Bathyergus suillus	Cape dune molerat	LC	Endemic	
Chlorotalpa duthieae	Duthie's golden mole	VU	Near-endemic	
Chrysochloris asiatica	Cape golden mole	LC	Near-endemic	
Georychus capensis	Cape molerat	LC	Near-endemic	
Graphiurus ocularis	Spectacled dormouse	NT		
Myomyscus verreauxii	Verreaux's mouse	LC	Near-endemic	
Myosorex longicaudatus	Long-tailed forest shrew	EN	Near-endemic	
Oreotragus oreotragus	Klipspringer	LC		Yes
Panthera pardus	Leopard	VU		
Pelea capreolus	Grey rhebok	NT		Yes
Philantomba monticola	Blue duiker	VU		Yes
Raphicerus campestris	Steenbok	LC		Yes
Raphicerus melanotis	Cape grysbok	LC		Yes
Sylvicapra grimmia grimmia	Common duiker	LC		Yes
Tragelaphus sylvaticus sylvaticus	Southern bushbuck	LC		Yes

Predators

The only large predator still present in the GRCWHS&NR is the leopard (*Panthera pardus*, VU), which is found from the Outeniqua Mountains down to the coast. This keystone species regulates terrestrial ecosystems through its role as an apex predator. Main threats are unsustainable levels of persecution and illegal hunting, and additional threats are habitat fragmentation and habitat loss (Swanepoel et al. 2016). However, leopard genetic variability depends on gene flow (and thus dispersal) between populations over large areas (Swanepoel et al. 2016). The leopard population will thus be affected by off-reserve activities such as land transformation, and illegal practices such as snaring. In addition, the GRCWHS&NR also has a good diversity of small- to medium-sized carnivores which experience similar threats to leopard, e.g., bat-eared fox (*Otocyon megalotis*), caracal (*Caracal caracal*, an important mesopredator) and honey badger (*Mellivora capensis*).

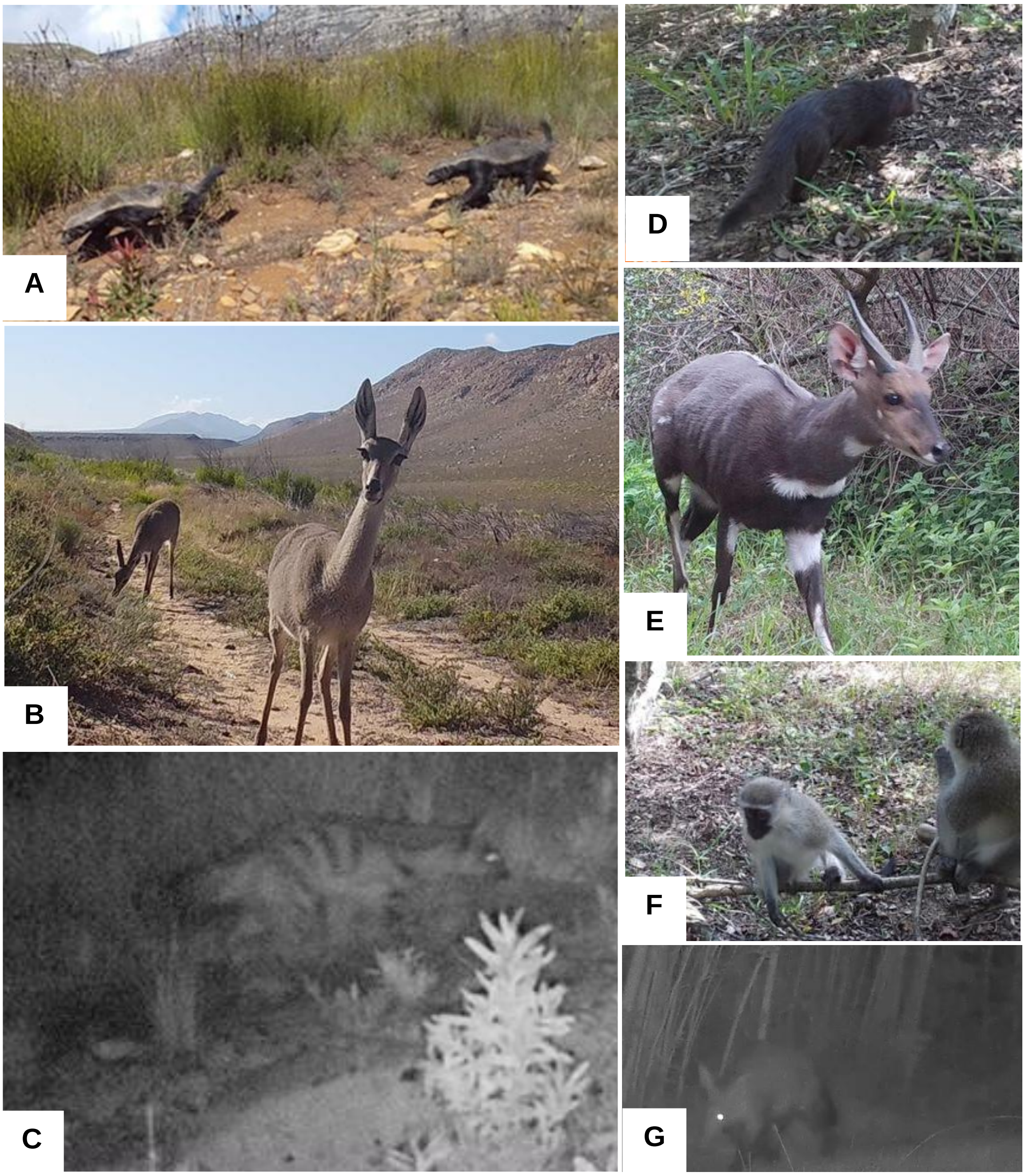

Figure 2.25: Mammal species recorded in the Garden Route Complex World Heritage Site and Nature Reserves. A: Honey badger (*Mellivora capensis*); B: Grey rhebok *Pelea capreolus*); C: Aardwolf (*Proteles cristata*); D: Water mongoose (*Atilax paludinosus*); E: Southern bushbuck (*Tragelaphus sylvaticus*); F: Vervet monkey (*Cercopithecus pygerythrus*); G: Aardvark (*Orycteropus afer*). (Photos: CapeNature).

Small game

There are relatively few game species on the GRCWHS&NR but most of these are ecotypical (i.e., comprise discrete populations below the level of subspecies that can be recognized on genetic, phenotypic or zoogeographic grounds) and are thus of conservation concern (Table 2.14). Some, such as common duiker (*Sylvicapra grimmia*) and klipspringer (*Oreotragus oreotragus*), are important contributors to leopard diets in the Western Cape (Swanepoel et al. 2016). Small game species are important indicators of the overall ecological state of the protected area. Their movement across the broader landscape is generally unimpeded and their persistence suggests resilience against urban edge effects. Other important game species in the GRCWHS&NR are grey rhebok (*Pelea capreolus*, NT, recorded in all the sectors of the Outeniqua Cluster; Figure 2.25) and blue duiker (*Philantomba monticola*, VU). Since 1971 there have been only three sightings of blue duiker on the Goukamma sector (last in 2015) and three on the Keurbooms River sector (last in 2006). The main threats to this species are loss of forest habitat due to coastal development and indigenous timber harvesting (Venter et al. 2016). Bushmeat poaching is also a threat to this and other small game species.

<u>Cape mountain zebra</u>

Cape mountain zebra (*Equus zebra zebra*) is globally (IUCN 2020) and regionally (Hrabar et al. 2016) listed as LC but is classified as EN in the Nature and Environmental Conservation Ordinance, 1974 (Ordinance 19 of 1974). The Cape mountain zebra metapopulation is fragmented, occurring on state and private land in the Western, Eastern and Northern Cape provinces, and intensive metapopulation management is needed for its continued protection. To this end, a Cape mountain zebra Biodiversity Management Plan (Birss et al. 2016) was gazetted in 2018, with CapeNature as the implementing authority. The plan focusses on actions and strategies to strengthen overall population performance, distribution and genetic diversity, to ensure overall population fitness and resilience of the metapopulation within the natural distribution range of the species. The reintroduction or relocation of Cape mountain zebra is an essential component of the BMP-s.

Cape mountain zebra used to occur along the Outeniqua Mountains but their numbers there declined from about 150 in 1930 to only three in 1967, largely due to hunting and persecution by farmers. One of the last three animals was captured and translocated to De Hoop Nature Reserve in 1970, and the other two disappeared (Moodley 2002). The historical occurrence of Cape mountain zebra in the Outeniquas suggests that the separation of the Gamkaberg and Kammanassie populations may be relatively recent and human-induced. In 2020, WWF-SA purchased the Zebraskop property which abuts the northern boundary of the Ruitersbos sector and extends northwards into the Klein Karoo. This provides an opportunity to bring Cape mountain zebra back to the Outeniquas, by linking the Gamkaberg WHS through Zebraskop to Ruitersbos on the Outeniqua WHS. This will benefit the Gamkaberg subpopulation in a number of ways and could potentially be used to make a major contribution to the Cape mountain zebra metapopulation.

A major threat to the Gamkaberg Cape mountain zebra is a lack of suitable habitat. Gamkaberg WHS comprises mainly upland fynbos, which has limited suitability for the seasonal migrations that the zebras must make (CapeNature 2020b). Over the past 20 years, Cape mountain zebra breeding success on Gamkaberg has generally been fairly low, except for periods when good summer rainfall follows fire and results in a grass growth flush (Tom Barry, pers. comm.; Figure 2.26). Expansion of the protected area through the incorporation of Zebraskop will increase the amount of suitable habitat and will thus benefit this subpopulation.

Figure 2.26: Cape mountain zebra mare and foal photographed on Gamkaberg World Heritage Site during 2021 following the 2017 fire. (Photo: CapeNature)

In addition, it has been suggested that the Zebraskop sector be used as a site for genetic mixing of the three distinct Cape mountain zebra genetic lineages: Gamkaberg, Kammanassie and Cradock. Historically, the Gamkaberg and Kammanassie subpopulations experienced a severe genetic bottleneck, and loss of genetic diversity is still a concern (Moodley & Harley 2005; Kotzé et al. 2019; CapeNature 2020b). It has been strongly recommended that these two subpopulations should be kept genetically "pure" for now but that mixing of these and the Cradock lineage should take place as a matter of urgency (Kotzé et al. 2019). Zebraskop could be used for this purpose by, for example, introducing Gamkaberg bachelor males with Cradock animals onto the property, or into an internal camp. The removal of some Gamkaberg males for a mixing programme will help to alleviate social stress in the main subpopulation as there is an excess of males on Gamkaberg.

Management actions associated with the introduction of Cape mountain zebra to Zebraskop include creation of a servitude over private land between Gamkaberg and Zebraskop, the removal of excess game from Zebraskop, particularly Plains zebra, regular fence patrols to prevent Cape mountain zebra escapes and hybridization with other equids, water provision, food provision (if animals are kept in an internal camp), invasive alien plant control, firebreak maintenance and monitoring. The latter includes monitoring of veld condition and threatened plant populations on Zebraskop, as well as monitoring of the Cape mountain zebra.

<u>Micromammals</u>

Micromammals play important ecological roles and can serve as indicators of ecosystem condition. They make up more than half of the species recorded on the GRCWHS&NR, however of the 28 species recorded, 10 were last observed at least 20 years ago and another six species were last seen more than a decade ago. A few of the more common micromammal species recorded during a recent survey are shown in Figure 2.27.

Some micromammal species recorded in the GRCWHS&NR are of conservation concern. The long-tailed forest shrew (*Myosorex longicaudatus*) is an EN species that is only known from six localities, including the Ruitersbos and Witfontein sectors (Baxter et al. 2016) where it was last recorded in 1996. This species was not trapped during a 2020 survey in the Ruitersbos area (De Villiers & Fourie 2021). *M. longicaudatus* is restricted to intact forest patches and is at risk from habitat loss and fragmentation, exacerbated by climate change (Baxter et al. 2016). Duthie's golden mole (*Chlorotalpa duthieae*, VU) is known from nine locations in Southern Cape Afrotemperate Forest (Bronner & Bennett 2016), one of which is the Goukamma sector (last recorded on the State of Biodiversity Database in 2004). About 60% of the coastal forest belt in which the western subpopulation of this species occurs (Wilderness to Tsitsikamma) is protected, but forest habitats at some locations outside protected areas are threatened by expanding coastal housing and tourism developments (Bronner & Bennett 2016). Spectacled dormouse (*Graphiurus ocularis*, NT) has only once been recorded on the Witfontein sector in 1985. This rare but widely occurring species is found in the sandstone formations of the Cape and is threatened by agricultural expansion and climate change (Wilson et al. 2016).

Until 2020, only four species of bat had been recorded in the GRCWHS&NR. The low number is due to the difficulty of recording and identifying bats rather than a true reflection of bat diversity. Three hours of surveying in a forest patch near Ruitersbos in 2020 using an ultrasonic recorder produced records of at least six species of insectivorous bat, four of which had not been recorded previously in the State of Biodiversity Database for the GRCWHS&NR (De Villiers & Fourie 2021).

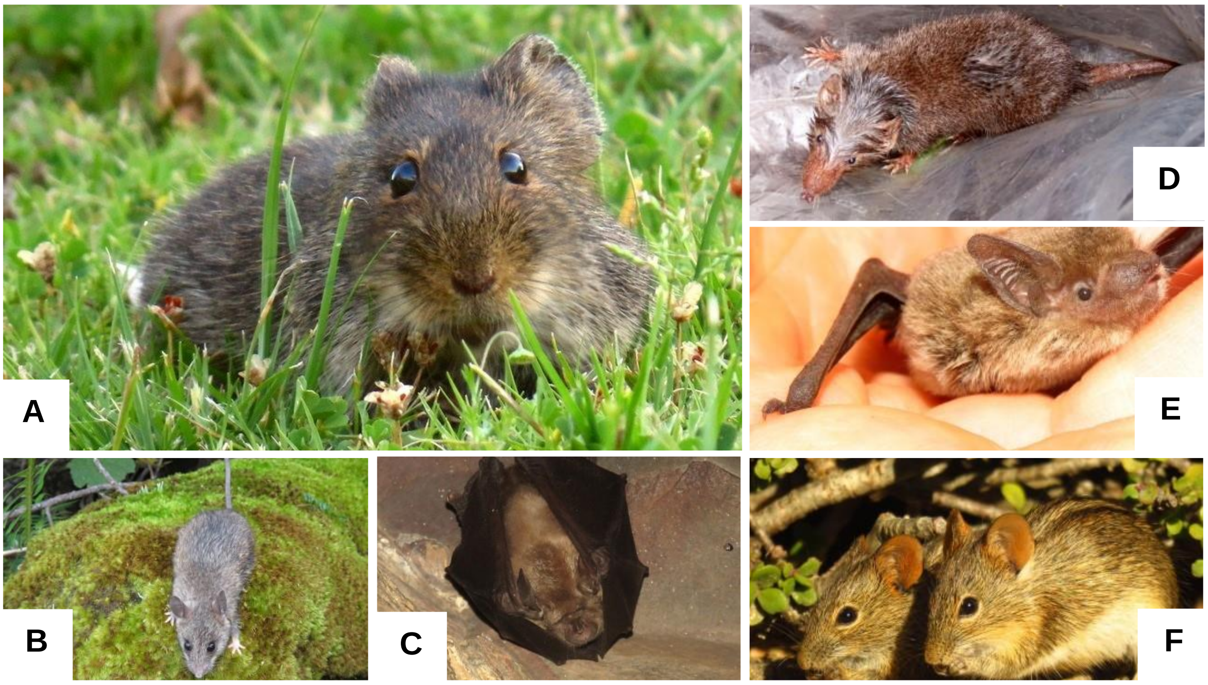

Figure 2.27: Some of the more common micromammals captured and released during small mammal surveys conducted on the Outeniqua Cluster in 2021. A: Vlei rat (*Otomys irroratus*) B: Namaqua rock mouse (*Micaelamys namaquensis*); C: Horse-shoe bat (*Rhinolophus* sp.); D: Greater red musk shrew (*Crocidura flavescens*); E: Cape serotine bat (*Neoromicia capensis*); F: Xeric four-striped grass mouse (*Rhabdomys pumilio*). (Photos: M de Villiers).

<u>Other ecologically important mammals</u>

The watercourses of the GRCWHS&NR provide habitat for Cape clawless otter (*Aonyx capensis*) listed as NT (Okes et al. 2016) and vlei rat (*Otomys irroratus*; Figure 2.27). Otters have been recorded in the Goukamma, Keurbooms River and Robberg sectors along the coast and also been observed at Ruitersbos and Doringrivier. These species will be impacted by upstream loss or deterioration of aquatic habitat and can be indicators of wetland health.

Some of the common and widespread but ecologically important species recorded in the GRCWHS&NR include Cape porcupine (*Hystrix africaeaustralis*) and aardvark (*Orycteropus afer*; Figure 2.25) both ecosystem engineers, rock hyrax (*Procavia capensis*, a food source for raptors such as Verreaux's Eagle) and baboon (*Papio ursinus*, an important seed disperser). Wide-ranging species such as aardvark and baboon can also serve as indicators of ecosystem health (Cadman 2016).

<u>Domestic animals</u>

Domestic animals that have been recorded in the GRCWHS&NR include domestic dog (*Canis familiaris*), cattle (*Bos taurus*), donkey (*Equus asinus*) and pig (*Sus scrofa*). There have been isolated records of two invasive alien species, i.e., black rat (*Rattus rattus*) in the Goukamma and Robberg sectors and house mouse (*Mus musculus*) in the Keurbooms River sector.

Potentially problematic species

Species which can become problematic at tourist facilities as a result of habituation are baboons, vervet monkeys (*Cercopithecus pygerythrus*; Figure 2.25) and genets (*Genetta* spp.). At Goukamma, the endemic Cape dune mole-rat (*Bathyergus suillus*) has been causing damage to infrastructure through its burrowing activities.

The only extralimital species recorded is blesbok (*Damaliscus pygargus phillipsi*) on Doringrivier, but this was probably an escapee from an adjacent game farm.

2.4.6.2 Marine mammals

A total of 20 marine mammals have been recorded in the GRCWHS&NR. Four have an IUCN threat status of NT or VU (IUCN 2020). Some of the marine mammals that are of conservation concern are shown in Figure 2.28.

From time to time, carcasses of both whale and dolphins wash up on the shores of the MPAs. These are recorded and morphometric measurements are taken for scientific research and monitoring. The sperm whale (*Physeter macrocephalus*; VU), which has been recorded in both Robberg and Goukamma MPAs has been as a result of strandings where the individuals were already dead.

The false killer whale (*Pseudorca crassidens*) has been recorded once in Goukamma MPA and is listed as NT. This species appears to have a widespread presence in tropical and semitropical oceanic waters. It has also been found in temperate waters, but these occurrences were possibly stray individuals, or associated with warm water events. The species generally does not go beyond 50°N and below 50°S and usually inhabits open oceans and deep-water areas, though it may frequent coastal areas near oceanic islands.

The Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), which is listed as NT has been recorded in both Goukamma and Robberg MPAs. Indo-Pacific bottlenose dolphins are very similar to common bottlenose dolphins in appearance. Common bottlenose dolphins have a reasonably strong body, moderate-length beak, and tall, curved dorsal fins, while Indo-Pacific bottlenose dolphins have a slenderer body build and their beak is longer and slenderer. Indo-Pacific bottlenose dolphins feed on a wide variety of fish and cephalopods (particularly squid) and live in groups that can number in the hundreds, but groups of five to 15 dolphins are most common. In some parts of their range, they associate with the common bottlenose dolphin and other dolphin species, such as the humpback dolphin.

The Indo-Pacific humpback dolphin (*Sousa chinensis*; Figure 2.28) is a species of humpback dolphin inhabiting coastal waters of the eastern Indian and western Pacific Oceans. It is listed as VU on the IUCN red list. An adult Indo-Pacific humpback dolphin is grey, white or pink and may appear as an albino dolphin to some. At birth, the dolphins are black. They change to grey, then pinkish with spots when young. Indo-Pacific humpback dolphins are sociable creatures and live in groups of three to four (Figure 2.28). Female dolphins become mature at ten years, and the males at 13 years. They usually mate from the end of summer to autumn and infant dolphins are usually born eleven months after the mating. Mature females can give birth every three years, and parental care lasts until their offspring can find food themselves.

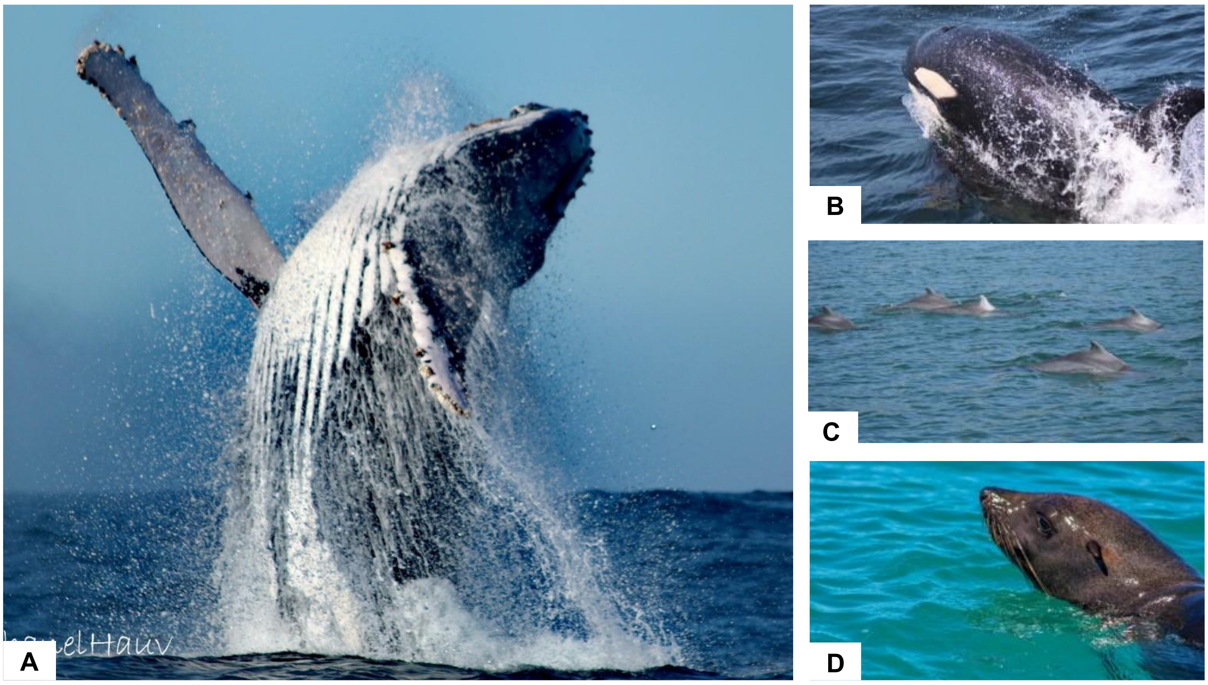

Figure 2.28: Marine mammals of conservation concern recorded in and around the Robberg Marine Protected Area. A: Humpback whale (*Megaptera novaeangliae*); B: Orca / Killer whale (*Orcinus orca*); C: Indo-Pacific humpback dolphin (*Sousa chinensis*); D: Cape fur seal (*Arctocephalus pusillus pusillus*). (Photos: C Hauvette).

There is a Cape fur seal (*Arctocephalus pusillus pusillus;* Figure 2.28) colony within the Robberg MPA and on Mossel Bay Seal Island. The Cape fur seal is listed as LC by the IUCN (2020). Between 2000 and 2009 the Robberg Peninsula was recolonized by Cape fur seals (Huisamen et al. 2011). During this time, the colony was deemed to be a non-breeding colony. Since then, the number of seals in the colony has been growing consistently and is now a breeding colony. The last three counts in 2018 and 2019 recorded 6 504 (June 2018), 4 404 (October 2018) and 9 000 (February 2019) seals in the colony. The latter count was the highest number of seals recorded to date and may have been as a result of a cold front in the area at the time of the count.

2.5 Heritage Context

Section 5 of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) outlines general principles for heritage resources management while Section 9 of the Act outlines responsibilities of the State and supported bodies.

2.5.1 Cultural and Palaeontological Heritage

Outeniqua Cluster. Both Khoi and the San inhabited the Outeniqua region for thousands of years, living off the land before the arrival of the Europeans. The San (Bushmen) were semi-nomadic hunter-gatherers and occasionally used fire techniques to “smoke animals” out of the forests during their hunting expeditions. The Khoi were pastoralists and frequently burned vegetation to allow their cattle to graze. Khoi-San hunters had a small impact on the wildlife due to their small numbers and primitive weapons. Upon arrival of the Europeans, Khoi clans became fragmented and ended up being employed by colonial farmers (Joubert 2018).

There are numerous magnificent rock art sites scattered throughout the Outeniqua Cluster, stretching from the Attaquaskloof area (Ruitersbos sector) in the west to the Groenkop area (Witfontein sector) in the east (Figure 2.29). More than 44 rock art sites have been assessed by Mr Hugo Leggatt who is affiliated with the South African Heritage Resource Agency (SAHRA) and most of these sites are found in overhang shelters or caves. Rock art paintings in the area are fascinating and portray Khoi-San tribesman, mermaids, ships, and various animals such as zebra, eland and elephant. Rock art in general is in danger of disappearing due to the degree of natural weathering, water seepage, fire, damage by stock using sites for shelter and the most immediate threat, that of people. Where public have unsupervised access, paintings or engravings are often damaged due to disrespect and a lack of knowledge of their meaning and value. It is essential that all known sites within the protected area are managed for preservation for future generations to understand the significance of their cultural heritage. Therefore, the rock art sites on the Outeniqua Cluster are not open to the public and access to these treasures is only granted to researchers and local Heritage Practitioners to prevent vandalism.

There are several historical passes that traverse the Outeniqua Mountains, some of which are still being used to carry high volumes of traffic daily. These passes have been documented in various books and articles. The Attaquaskloof Pass was the first pass that connected the coastal plain around Mossel Bay with the Klein Karoo and from 1752 to the turn of the 18th century was used by several celebrated early explorers, such as Thunberg, Sparrman, Swellengrebel, Van Plettenberg, Patterson, Muller and Holtzhauzen, Gordon and Van Reenen (Bell-Cross & Venter 1991). This pass was declared a National Monument in September 1995. The construction of the Cradock (in 1812) and Montaqu Passes (in 1847), linking George with Oudtshoorn reduced the use of Attaquaskloof Pass and in 1869 the Ruitersbosch Pass (Robinson Pass today) became the main route between Mossel Bay and Oudtshoorn. Montagu Pass was officially opened in January 1848 and could be traversed by ox-wagon in about three hours, which compared favourably with the one to three days it took to navigate the frightening Cradock Pass (Bell-Cross & Venter 1991). In 1972 Montagu Pass was declared a National Monument and is the oldest unaltered pass in South Africa (Marincowitz 1992). The arrival of the motor car and the increase in motor traffic between George and Oudtshoorn during World War II, urged the authorities to build a more direct pass between these towns. Construction on Outeniqua Pass started in 1943, mainly through using Italian prisoners of World War II. This pass took eight years to complete and was opened in September 1951 (Bell-Cross & Venter 1991). Building of the railway pass over the Outeniqua Mountains between George and Oudtshoorn was a mammoth task, starting in 1908 from the George side and in 1911 from the Oudtshoorn side. Construction required blasting through solid rock and the excavation of seven tunnels. It was completed in 1913 (Marincowitz 1992).

In addition, there are some historical buildings (the old Toll House and old hotel in Montaqu Pass, the old block house in Attaquaskloof Pass) located in the Outeniqua Cluster.

Figure 2.29: A range of rock art paintings created by the Khoi-San found in some of the caves of the Outeniqua Mountains depicting huntsmen, mermaids and antelope. (Photos: CapeNature.)

Goukamma Cluster. Evidence of the Khoi-San living in the area is noted by the abundant shell middens (food dumps), ostrich shells and pottery pieces found along the coastline.

Excavations of a series of archaeological sites along the southern coast of Africa have recovered items left behind by what may have been a progenitor population (Marean 2010). According to Marean (2010) the population size of *Homo sapiens* plummeted over much of the African continent because of cold and dry climatic conditions between 195 000 and 123 000 years ago. The planet was locked in an ice age during that period which claimed the animals and plants that humans ate. A group of people managed to survive the long glacial stage that lasted until about 123 000 years ago. One of the few areas where humans could have survived during this climate crisis is the southern coast of Africa, because it harbours an abundance of shellfish and edible plants. The combination of nutrient-rich shellfish and low-fibre, energy-laden carbohydrates from geophytes would have provided an ideal diet for early modern humans during this tough period. Discoveries at the archaeological sites along the southern coast and adjacent areas are now forming part of a greater ‘paleo landscape’ research project.

Surveys of palaeontological sites, especially of fossilised animal tracks, have been undertaken by Charles Helm during the last 10 years. According to Helm et al. (2018), concentrations of Late Pleistocene trace fossil sites along the Goukamma River have been documented that depict lion trackways, multiple elephant track sites, long-horned buffalo, medium-sized carnivore tracks, avian tracks, equid tracks, numerous artiodactyl tracks and burrow traces. In more recent surveys, multiple elephant track sites and possible trunk-drag impressions (Helm et al. 2021) together with two sites containing large tortoise tracks have also been recorded in the Goukamma WHS. Although the tortoise tracks are not large enough to place them into the length of true giant tortoises, they are considerably larger than tracks of the largest southern Africa tortoise of today (Helm et al. 2022). Dating studies of the inland and coastal sites are still required. Fortunately, the protected area status of Goukamma WHS and MPA enables the conservation of fossilised trackways, geo-heritage appreciation and education (Helm et al. 2018).

No areas of historic or cultural significance have been recorded on the Brenton Blue Butterfly sector.

Keurbooms River Cluster. There is archaeological evidence of human habitation at Robberg Peninsula dating back to 120 000 years ago (Rudner & Rudner 1974). Khoe-Khoe people lived in this area intermittently. Artefacts, bone fragments and stone-age tools from the 1970 excavations are being kept at the Plettenberg Bay office. Reserve staff are seeking to display these at the newly renovated Robberg Information Centre. One of the nineteen archaeological sites in the Robberg sector, the Nelson Bay Cave, is open to the public.

Robberg sector also contains a wide variety of vertebrate ichno-fossil sites which are either globally unique or of national or regional significance. Well preserved rhinoceros track sites together with natural cast artiodactyl tracks, small equid tracks and large elephant transmitted tracks confirm that Robberg is a site of special palaeontological significance in southern Africa (Helm et al. 2019).

Several Stone Age artefacts have been found scattered on the Keurbooms River sector, but no evidence of any settlement has been located to date. A section of the Old Cape Road runs through the Keurbooms River sector which is now being used as access to the slipway and stores. This road used to be part of the main road between Knysna and Gqeberha (Port Elizabeth) before the N2 National Road was built.

The first European residents were shipwrecked in the Portuguese vessel, São Gonçalo in 1630 near Robberg. During the following year while they were stranded, they exchanged produce with the local Khoe-Khoe. According to the South African Heritage Resource Agency (SAHRA), there are no known significant shipwrecks within the boundary of the MPA apart from the Athena (a Greek tuna fishing vessel) which sunk on 3 August 1967.

Prince Alfred's Pass between Knysna and Avontuur in the Langkloof traverses Annex Vlugt. This famous pass was built by Thomas Bain from 1862 to 1866 and was named after Queen Victoria's second son (Bell-Cross & Venter 1991; Marincowitz 1992; Meyer 1999a).

2.5.2 Living heritage

Living heritage or intangible cultural heritage relates to the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and individuals recognize as part of their cultural heritage. Living heritage is passed on from generation to generation in response to their environment, their interaction with nature and their history (UNESCO 2003).

In the local context of cultural tradition (spiritual and religious), there have been few cases where sangomas (traditional doctors) have formally requested to make use of the Goukamma MPA or estuary for initiating new sangomas. These applications were declined due to “user” conflict as initiations would have been performed along the Goukamma River in front of the tourism accommodation and close to the river mouth area. Depending on the cultural group, the initiation of sangomas would involve the beating of drums and singing, starting in the early hours of the morning and ending late in the evening which would clash or interfere with the activities of the over-night guests or day visitors who would be hiking, birding or fishing.

There are various medicinal plants in the GRCWHS&NR that the Rastafarian community make use of, but no formal agreements are currently in place to harvest medicinal plants from the GRCWHS&NR. A medicinal garden was established at the Witfontein sector previously, but this has unfortunately become neglected due to lack of interest.

2.6 Socio-Economic Context

In terms of the Municipal Systems Act, 2000 (Act No. 32 of 2000), municipalities are required to use integrated development planning to plot future development in their mandated management areas. The municipal Integrated Development Plan (IDP) sets the strategic and budget priorities for development and aims to co-ordinate the work of local and other spheres of government. The IDP should also address how the environment will be managed and protected and is supplemented by a Spatial Development Framework (SDF).

IDPs and SDFs are tools for integrating social, economic, and environmental issues. As biodiversity is a fundamental component of sustainable development, IDPs and SDFs offer an opportunity to ensure that biodiversity priorities are incorporated into municipal planning processes through consultation. In turn, the identification of biodiversity-related projects for the IDP can support local economic development and poverty alleviation. Municipalities within which the GRCWHS&NR occurs are illustrated in Appendix 2, Map 1.

Land use of the areas around the GRCWHS&NR vary from predominantly farming to forestry with commercial plantations, urban and formal conservation. The coastline within the complex is functionally well connected by the N2 freeway from Mossel Bay to Plettenberg Bay. Mossel Bay and George are the more industrial driven centres, with a strong emphasis on tourism. Plettenberg Bay, Knysna, Sedgefield, Wilderness, and Great Brak River are lifestyle tourism driven settlements. The proximity of the protected areas to urban environments complicates the management of these areas, increasing the risks of human wildlife conflict events and illegal activities. Plettenberg Bay is adjacent to Keurbooms River and Robberg WHS and Robberg MPA. Knysna borders the BBBSNR at Brenton on Sea and Sedgefield is close to Goukamma WHS and the Goukamma MPA. George is less than 1 km away from the Outeniqua WHS and Mossel Bay Seal Island is approximately 840 m off the coast from Mossel Bay.

Besides recreational marine activities, there are no significant commercial marine land use activities occurring immediately adjacent to the Robberg and Goukamma MPAs. A Single Point Mooring (SPM) marine loading facility owned by the Petroleum, Oil and Gas Corporation of South Africa Ltd., is however located approximately 2 500 m seawards of Mossel Bay Seal Island. The SPM is connected to the PetroSA refinery in Mossel Bay through an underwater pipeline which can handle a variety of liquids, including petroleum products as well as feedstock for the Gas to Liquid refinery. Petroleum products are generally sourced from the Mossel Bay oil wellfields 89 km off the coast of Mossel Bay or imported. There have been recent discoveries of significant gas deposits within the Outeniqua Basin (175 km off the coast of Mossel Bay), which could lead to the expansion of land-based processing facilities. These resources are likely to be transported via the SPM facility to the Gas to Liquid refinery, but this project is still under review and not yet commercially operational.

A major land use which borders the Outeniqua, Goukamma and Keurbooms River WHS is commercial forestry plantations. These commercial plantations primarily plant *Pinus* spp. Risk of fire to these plantations is high given the flammable nature of the adjacent indigenous vegetation and high levels of alien plant infestation. Approximately 5000 ha of pine plantation was burnt during the 2017 Knysna fire and 3000 ha during the 2018 George fires. Recent analysis of the future commercial viability of many of these plantations has shown that certain land parcels are not feasible to replant. Some of these areas will be transferred to CapeNature and SANParks for management as protected areas. Urban and industrial development is located along the coastal urban areas. Interspersed between the various towns, are numerous lifestyle and commercial farms, forestry plantations, privately owned conservation stewardship sites, national and provincial nature reserves (the majority of which are classified as World Heritage Sites). There are large commercial agriculture farms which grow strawberries, blueberries, avocado, citrus, and pasture for dairy cattle. The lifestyle farms generally undertake minimal agricultural activities. Land use north of the Outeniqua WHS in the Klein Karoo is focussed on game farming, commercial ostrich farming (near Zebraskop), hops, fruit orchards and vineyards in Waboomskraal and Herold (adjacent to Doringrivier and Camferskloof respectively), and small-scale stock farming (cattle, sheep and goats) in between.

The vast range of opportunities and diverse land use within the Garden Route District Municipality (GRDM) has resulted in approximately 140 informal settlements being established (which account for 15% of all households within the district). In total only 20% of the GRDM population is located inland and 80% of the district's 621 245 people (estimated to grow to 640 723 by 2024), are concentrated along the coastal regions. A breakdown of the socio-economic information of the local municipalities that the complex falls within is presented in Table 2.15. The GRDM IDP predicts a growth rate of 0.8%, despite this being the third largest district population within the Western Cape, the growth rate is significantly lower than the 1.8% provincial average.

Given the extent of urban centres relative to the protected areas, the most jobs in the area are located within the wholesale and retail trade, catering and accommodation sectors (24.7%), with finance, insurance, real estate and business services sectors contributing 17.3%, and community, social and personal services employing 15.3% of the employed. Since 2014 jobs have been shed in the agricultural, forestry and fishing sectors due to the prolonged drought and fires in the rural landscape. Sectors that reported the largest increases in jobs were the finance, insurance, real estate and business service sectors. It is clear from the various socio-economic analyses that upskilling of the labour force will be a key driver to reducing unemployment rates within the complex.

Table 2.15: Socio-economic information for the local municipalities relevant to the Garden Route Complex World Heritage Site and Nature Reserves. (* Note that figures include Hessequa and Kannaland Local Municipal data.)

Local Municipality	Number of Residents	Number of Households	Unemployment Rate (%)	Number of Indigent Households *
Bitou (2020)	67139	17532	17.8	1891
George (2020)	218381	56474	14.3	15832
Knysna (2020)	74979	16459	19.0	8780
Mossel Bay (2020)	95255	29517	15.3	10858
Oudsthoorn (2020)	91960	22468	17.7	6199

*Economically active people

None of the local planning tools however prepared the district for the Coronavirus pandemic known as COVID-19. By March 2020 the GRDM was producing daily situation reports on the extent of the pandemic. According to the Joint District and Metro Approach Implementation Plan (GRDM 2021), the extent of the impact of the pandemic on the economy of the complex has yet to be fully understood and assessed. Preliminary indications are that primary GRDM growth sectors have been significantly impacted, especially the tourism, hospitality and retail sectors. Primarily, COVID-19 directly impacted available cash flow for businesses (especially smaller companies), due to restrictions imposed by national regulations in response to the pandemic. It is however incredibly likely that the poverty headcount in the district will increase (for GRDM this is currently 40.5%), as the impact on the informal sector will likely be the more substantial. The implementation plan outlined the findings of a GRDM survey which interviewed small businesses owners within the district (GRDM 2021). The survey concluded that because of the COVID-19 pandemic, 37.54% of respondents were considering closing their businesses, and 51.32% are considering retrenching staff. The Western Cape Provincial Government has published a COVID-19 recovery plan (Western Cape Government 2021), with three priorities namely safety, dignity and well-being, and jobs. The aim of this plan (in the words of the Premier of the Western Cape), is to prevent the "…*second pandemic of unemployment, hunger and poverty.*"

The management of the GRCWHS&NR therefore has to strive towards implementing the various recovery plans, in particular a primary driver being that of job creation in order to help mitigate the unemployment and poverty rates. This is currently done through the central government Expanded Public Works Programme (EPWP) and Natural Resource Management (NRM) programmes together with the CapeNature ICM programme. The programmes strive to employ a high number of unskilled and semi-skilled youths (55%), women (55%) and disabled persons (2%). The threat of invasive alien plants to the protected area as described in section 2.3.1.3 provides for opportunities for employment within these programmes while simultaneously addressing ecological concerns.

CapeNature also strives to improve local economic development through the appointment and development of local services providers (Small, Medium and Macro Enterprises) in the conservation field e.g., fire suppression, maintaining firebreaks, roads, hiking trails and other infrastructure. A further aim of the employment of unskilled workers is to up-skill them through specific training sessions in order to be able to be permanently employed within various economic sectors. Strategies related to job creation and local economic development are described in section 10. These have been highlighted as a major contributing factor towards reaching and/or enhancing human well-being values within the zone of influence of the GRCWHS&NR (see section 6).

3 POLICY FRAMEWORK

CapeNature is subject to the framework of the Constitution of the Republic of South Africa (1996), national legislation including the NEM:PAA, National World Heritage Convention Act, 1999 (Act No. 49 of 1999) and all associated regulations and norms and standards for the management of protected areas in South Africa and all other relevant requirements as set out in the NEM:BA and the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008).

3.1 Purpose of Protected Area Management

The declaration of protected areas is part of a strategy to manage and conserve South Africa's biodiversity. Accordingly, the object of the management plan is to ensure the protection, conservation and management of the natural and cultural historic heritage in a manner that is consistent with the objectives of the NEM:PAA, and for the purpose for which protected areas were declared.

3.2 Guiding Principles

The following guiding principles underpin the management plan for the GRCWHS&NR:

- Articulate desired results in terms of conservation outcomes, not actions.
- Articulate how management responses will lead to desired results.
- Monitor progress towards achieving desired results.
- Consider monitoring programme design at the onset of planning.
- Consider expected outcomes of management at the outset of planning.
- Invest in management response appropriate to the risk.
- Adapt strategies based on lessons learnt, understanding that measuring effectiveness alone may not resolve uncertainty; data and analyses are necessary to guide management towards doing more of what works and less of what does not work.
- Share results to facilitate learning, acknowledging that although success is not a given, learning can be, through honest appraisal of efforts.

The GRCWHS&NR is also subject to the principles and provisions of relevant international treaties and conventions, national and provincial legislation and policy, and any local contractual or co-management agreements.

3.3 Strategic Adaptive Management

Strategic Adaptive Management integrates planning, management and monitoring to provide a framework for:

- testing assumptions;
- learning through monitoring and evaluation; and
- adapting strategies or assumptions.

Strategic adaptive management bridges management and decision science by systematically evaluating results and using this information in a community of practice (CMP 2020) enabling management to change course when it becomes evident that it is necessary, rather than waiting until the end of a strategy to determine whether an intervention worked (Conservation Coaches Network (CCNet 2012).

CapeNature has adopted, and applies, the Open Standards for the Practice of Conservation adaptive management framework (CMP 2020) as illustrated in Figure 3.1. The Conservation Standards facilitates strategic adaptive management through a systematic evidence-based participatory process with stakeholders (CMP 2020). The systematic approach makes explicit the links between goals, conservation targets, threats, strategies and actions, enabling management to define and measure success of their actions in the GRCWHS&NR over time.

The Conservation Standards framework is comprised of five stages (Figure 3.1):

- Conceptualising the protected area (i.e., defining the purpose of the protected area, establishing scope and vision; selecting conservation targets and assessing threats, and analysing the conservation situation (i.e., assessing contributing factors in terms of opportunities and challenges);
- Planning actions and monitoring (i.e., drafting the plan based on theories of change using results chains);
- Implementing actions and monitoring (i.e., drafting work plans, doing the work and monitoring the work);
- Analysing and using results to adapt (i.e., deciding if what was planned is working); and
- Capturing results, sharing and learning (i.e., learning and sharing what is learned).

The framework works on the rationale that effective conservation of carefully selected conservation targets will ensure the conservation of all indigenous biodiversity and cultural historic heritage within the GRCWHS&NR that in turn contributes to a functional landscape. At the same time, the rationale follows that healthy conservation targets deliver ecosystem services essential for human well-being. An assessment of the current condition of conservation targets serves as a baseline against which to measure condition over the next 10 years and guides the formulation goals and conservation strategies with associated objectives, indicators and work plans.

As such, step 1 of the adaptive management framework illustrated in Figure 3.1 is foundational to effective management of the area.

Conservation targets are classified as follows:

- Natural targets can be species, habitats or ecological systems, which collectively represent and encompass the biodiversity of the GRCWHS&NR. They can include the physical, natural features from which ecosystem services flow, benefitting humans in a variety of ways.
- Cultural historic targets are described in terms of the tangible features that collectively represent and encompass the cultural historic heritage of the GRCWHS&NR. They can also include the physical, cultural and/or historic features from which human well-being values are derived.
- Human well-being values are the intangible or non-material values derived from tangible values, and which collectively represent the array of human well-being needs dependent on natural and cultural features; they can be defined in terms of the benefits delivered to humans by healthy ecosystems, or by intact cultural or historical features.

Figure 3.1: Strategic Adaptive Management Framework adapted from The Open Standards for the Practice of Conservation (CMP 2020).

3.4 Protected Area Management Effectiveness

Management effectiveness evaluation is the assessment of how well a protected area is being managed, primarily the extent to which management is protecting values and achieving objectives (Hockings et al. 2015). The following questions underpin management effectiveness evaluation (Leverington & Hockings 2004):

- Is the protected area effectively conserving the values for which it exists?
- Is management of the area effective and how can it be improved?
- Are specific projects, interventions and management activities achieving their objectives, and how can they be improved?

The monitoring and evaluation framework applied to the GRCWHS&NR (illustrated in Figure 3.2 below) measures compliance and management effectiveness of the protected area in terms of the NEM:PAA and associated Norms and Standards for Protected Area Management. Management effectiveness is assessed over time using the Management Effectiveness Tracking Tool – South Africa (METT-SA) which is based on the six elements of good management:

- It begins with understanding the **context** of existing values and threats;
- progresses through **planning**;
- and allocation of resources (**inputs**);

- and as a result of management actions (**processes**);
- eventually produces products and services (**outputs**);
- that result in impacts or **outcomes**.

Management effectiveness is measured at the strategic level as a percentage, drawing upon the results of fine scale monitoring linked to management actions, objectives, goals and conservation targets articulated in this plan, see Figure 3.2. Management effectiveness includes the measurement of administrative processes such as capacity and budgets that, when adequate, are likely to result in positive conservation outcomes.

Mechanisms for monitoring and evaluation are built into each aspect of the Strategic Plan (see Section 10) through the inclusion of verifiable indicators of progress. The protected area monitoring and evaluation programme, supplementary to the management plan, monitors site level implementation of the plan, status of values and effectiveness of strategies. Results contribute to the Western Cape State of Biodiversity report, produced at five-year intervals.

Furthermore, management reports annually on implementation of the plan through CapeNature's Strategic Performance Management System. The Performance Management System ensures that implementation of the management plan is embedded in individual staff performance agreements.

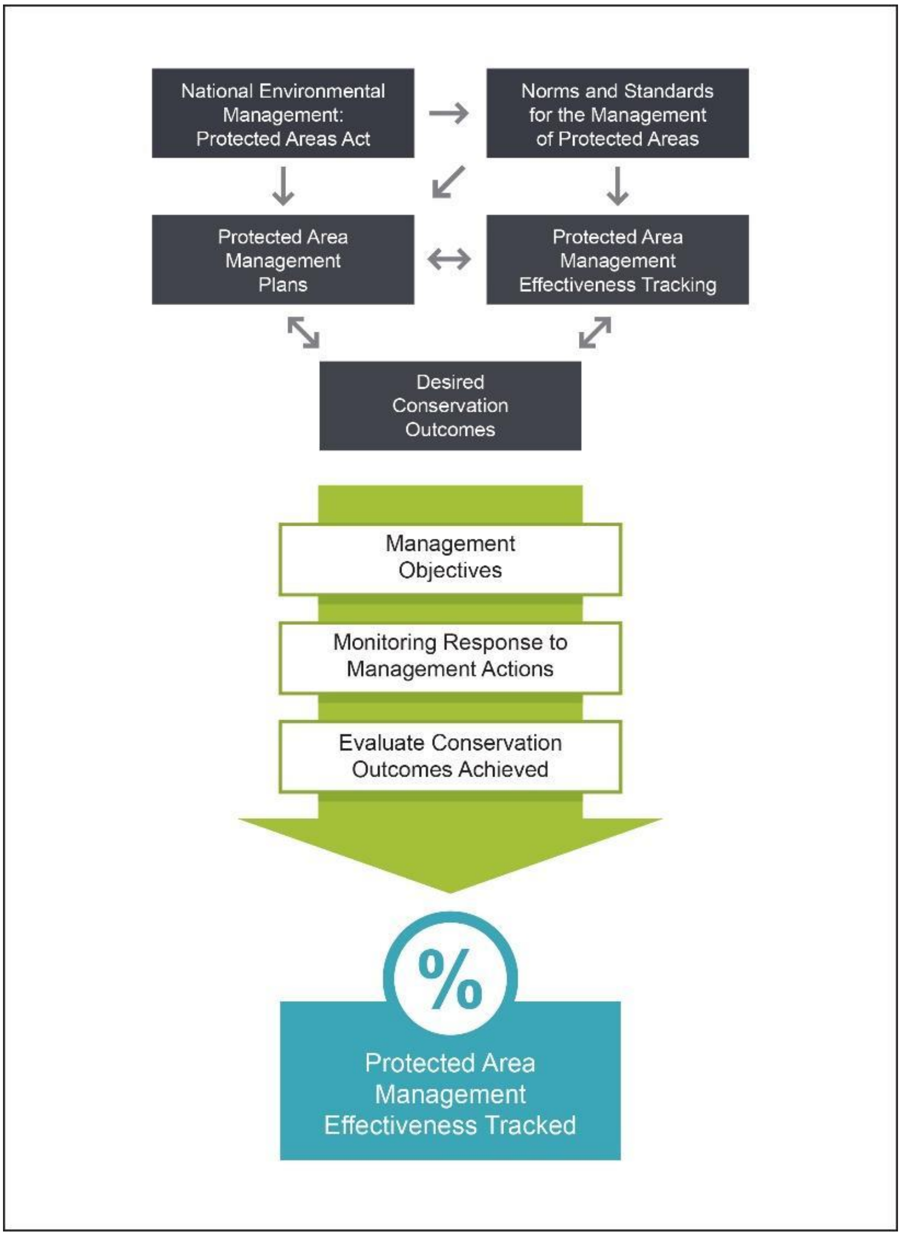

Figure 3.2: Protected Area Monitoring and Evaluation Framework.

3.5 Policy Frameworks

Protected area management is guided by CapeNature policies, procedures and guidelines for use across all of its components. Policies, procedures and guidelines applicable to this management plan are referenced here and in Section 10 (Strategic Plan).

3.5.1 Internal rules

In terms of Section 52 of NEM:PAA, as amended, the management authority of a nature reserve may, in accordance with prescribed Norms and Standards, make rules for the proper administration of the area.

In addition to the Regulations for the Proper Administration of Nature Reserves, as gazetted on 12 February 2012 in Government Gazette 35021, and Regulations for the Proper Administration of Special Nature Reserves, National Parks and World Heritage Sites, as gazetted on 28 October 2005 in Government Gazette 28181, the GRCWHS&NR implements the Nature Conservation Ordinance, 1974 (Ordinance No. 19 of 1974) and Provincial Notice 955 of 1975, as well as Regulations published under Government Notice 1111 in terms of the Marine Living Resources Act, 1998 (Act No. 18 of 1998). The Nature Conservation Ordinance will be repealed once the regulations in terms of the Western Cape Biodiversity Act, 2021 (Act No. 6 of 2021), which was signed by the premier on 10 November 2022, have been promulgated. This Act indicates that CapeNature together with DEA&DP are responsible for nature conservation and the protection, management and sustainable use of biodiversity and ecosystems in the province.

3.5.2 Financial

CapeNature is a Schedule 3C public entity responsible for nature conservation in the Western Cape. CapeNature is the executive arm of the Western Cape Nature Conservation Board, established in terms of the Western Cape Biodiversity Act, 2021 (Act No. 6 of 2021). The objectives of the Board as per the Board Act shall be:

- To promote and ensure nature conservation and deal pro-actively with related matters in the province;
- To render services and provide facilities for research and training that would inform and contribute to nature conservation and related matters in the province; and
- To generate income, within the framework of the applicable policy framework.

Funding for the entity comprises three main revenue streams. The majority of funding, which equates to approximately 80% of funding, is received in terms of a provincial allocation received in terms of Vote 9. Secondary funding, which is approximately the further 20%, is received from external donors and own revenue. Own revenue generation consists mainly of tourism income generated through activities and accommodation available on various nature reserves managed by the entity.

The entity prides itself on its strong internal controls, sound financial management and practicing of good corporate governance. Corporate governance within the entity embodies sound processes and systems and is guided by the Public Finance Management Act, 1999 (Act No. 1 of 1999) and the principles contained in the King 4 Report of Corporate Governance.

3.5.3 Safety and security

Business Continuity Plan: The CapeNature Business Continuity Plan establishes and provides emergency response procedures and protocols which need to be implemented should an event significantly disrupt the operations of the organisation, or an emergency situation is declared by management. The plan identifies critical services, how it will be maintained, how to minimise the impact, increase preparedness and initiate an effective response.

Integrated Compliance Plan: The Integrated Compliance Plan for the GRCWHS&NR details how compliance and enforcement will be implemented in the protected area in order to:

- Prevent biodiversity loss caused by human activities on the GRCWHS&NR through the implementation of active and passive compliance and enforcement operations.
- Ensure compliance with legislation through the monitoring of activities in the GRCWHS&NR.
- Address and combat illegal activities through the institution of criminal proceedings.
- Report illegal activities to the delegated authority where activities have a negative impact on the GRCWHS&NR (e.g., listed activities in terms of NEMA).

It is a dynamic reference document that is continually updated and improved, using the data that is gathered in the course of the implementation thereof in order to achieve the management objectives of the GRCWHS&NR.

Fire Protection Associations: CapeNature is obliged in terms of the National Veld and Forest Act to be a member of the local Fire Protection Associations. Within the Western Cape, five large Fire Protection Associations have been established that cover the whole area of the province. The protected areas in the GRCWHS&NR are members of the SCFPA. Fire Protection Associations are the primary partnership tool in veldfire management in South Africa.

Fire Management Plan: The Fire Management Plan is essentially a derivative and part of the Protected Area Management Plan. The latter details the objectives of the GRCWHS&NR and the Fire Management Plan use this information to detail how fire will be managed to ensure that the ecological objectives of the protected area are met. This includes the management of both wild and controlled fires.

Fire response plan: The fire response plan forms part of the Fire Management Plan and serves as an operational document for cooperative wildfire management in the GRCWHS&NR. This plan is compiled annually at regional level according to the CapeNature fire policy to ensure that there is complete co-operation at higher level. It includes updated names and telephone numbers of all contact persons, radio frequencies and emergency notifications.

3.5.4 Resource use

Resource utilisation is governed by CapeNature's Policy on consumptive use of wild flora from CapeNature-managed protected areas (CapeNature 2019). The policy implementation framework and protocol provide a guideline as to how access to the natural resources should be handled.

Nationally, the NEM: PAA Section 50 states that management authorities of protected areas, including World Heritage Sites may, subject to the management plan of the protected area or site, allow or enter into a written agreement with or authorise a local community inside or adjacent to the protected area or site, to allow members of the community to use in a sustainable manner biological resources in the protected area or site. Section 50, however, also states that an activity allowed in terms of this section may not negatively affect the survival of any species in or significantly disrupt the integrity of the ecological systems of the protected area or site.

CapeNature undertakes to build the capacity of Natural Resource Users and other relevant stakeholders on the sustainable utilisation of natural resources and its environmental regulatory framework in and outside protected areas.

For the GRCWHS&NR it has been recommended that no harvesting of indigenous species for commercial purposes within any of the Clusters should be considered, due to the impact of repeated short return interval fires on recruitment, seed production and the associated threats of climate change.

3.5.5 Biodiversity management

Catchment to Coast Strategy: Guided by the Provincial Biodiversity Strategy and Action Plan (2015-2025) and CapeNature's 5-year Strategy (2020-2025), the Catchment to Coast Strategy (2022-2026) aims to guide CapeNature's actions on improving, maintaining and restoring ecological infrastructure in priority areas to ensure ecological resilience and ecosystem functioning to provide benefits to people (CapeNature 2022e). The strategy focuses on key outcomes for terrestrial, freshwater (including rivers, wetlands and groundwater), estuaries and marine and coastal ecosystems, and is aligned to national and provincial plans. CapeNature's nature conservation mandate is not confined to within protected areas but throughout the province, and the Catchment to Coast Strategy will focus CapeNature resources to address priorities in the province.

The Catchment to Coast Strategy is aligned to national and provincial priorities and has four strategic goals to guide implementation, namely:

Goal 1: Conserve and restore biodiversity and ecological infrastructure to deliver ecosystem services that improve the quality of life for all people of the Western Cape Province.

Goal 2: Leveraging a collaborative investment into conservation and improved ecosystem functioning.

Goal 3: Enhance biodiversity capability through the implementation of strategic adaptive management to increase ecosystem resilience.

Goal 4: Enable reasonable and sustainable access to benefits and opportunities emanating from biodiversity, ecosystems, ecosystem services and ecological infrastructure.

Invasive Species Monitoring, Control and Eradication plans: Invasive Species Monitoring, Control and Eradication plans for the various Clusters of the GRCWHS&NR are compiled according to the requirements of the NEM:BA Alien and Invasive Species Regulations and Lists (Sept 2020). The plans aim to guide management actions to reduce infestation densities and rates of fauna and flora species through systematic integrated control methods.

Integrated Compliance Plan: The Integrated Compliance Plan for the GRCWHS&NR details how compliance and enforcement will be implemented in the protected area in order to achieve the management objectives and to minimise biodiversity loss due to anthropogenic causes.

Western Cape Protected Area Expansion Strategy (WCPAES): This strategy aims to expand the Western Cape Protected Area network to encompass a more representative and resilient suite of areas that support biodiversity and ecological infrastructure, especially those threatened species and ecosystems that remain as yet unprotected. There are several properties adjacent to the various parcels of the GRCWHS&NR that are listed as priority sites for protected area expansion.

Fencing and Enclosure of Game and Predators in the Western Cape Province Policy: All protected areas with game species are subject to the management guidelines outlined in the policy.

Game Translocation and Utilization Policy: All protected areas with game species are subject to the management guidelines outlined in the policy.

Management of large game: All large game species in the GRCWHS&NR will be dealt with according to the following principles:

- All game farms bordering the protected area that have extra-limital or historic alien animals, must be enclosed to the standards as stipulated in the CapeNature fencing policy. Protected area personnel must do regular inspections on the reserve side of the fence and escapees must be reported to the owner immediately.
- If the owner is in possession of a Certificate of Adequate Enclosure, they must be given reasonable time to remove the animals as soon as possible. Game animals escaping from properties without a valid Certificate of Adequate Enclosure are *res nullius* and must be dealt with accordingly. Conservation Managers must stipulate and regulate the actions to remove the animals (i.e., flying with a helicopter to recapture or to chase back).
- In cases where *res nullius* game animals enter the protected area, the Conservation Manager must report it immediately and a decision must be taken to either have the animals removed, culled or that they may remain on the protected area.
- All protected areas with game animals who wish to remove surplus animals, must follow protocol which includes approval at regional level (i.e., ecological meetings) and approval at corporate level through the formal submission process.
- Where alien invasive game (e.g., fallow deer) are observed in protected areas, Conservation Managers must take immediate action by removing these animals in a humane manner.

Damage-causing wild animals: CapeNature aims to ensure coexistence of humans and indigenous wild animals and considers human-wildlife conflict as situations where artificially induced interactions between humans and wildlife lead to situations requiring mitigation of loss, disturbance or damage. CapeNature requires that human-wildlife conflict is managed, taking into consideration all legal, ethical and welfare implications and that interventions are carried out within an ecologically sound framework (CapeNature position statement on human–wildlife conflict 2015).

CapeNature advocates the five-step approach to holistic wildlife management of damage causing wildlife namely (1) understanding the origin of the problem; (2) maintaining the correct attitude and respect towards the animal; (3) the responsible species must be identified correctly; (4) implement suitable mitigation measures; and (5) implement effective selective control as per the information contained in the "The Landowner's guide: human-wildlife conflict – sensible solutions to living with wildlife". (CapeNature 2015). This handbook supplies basic and cost-effective mitigation methods to landowners who report damage caused by wildlife. By implementing the suggested interventions and understanding the ecological role of each species, this will enable the Conservation Manager to deal with wildlife conflict situations both on and off protected areas.

Furthermore, the national predation management manual prepared by the Predation Management Forum is also available to give management guidance on dealing with predation problems on and off protected areas. CapeNature advocates the following broad best practice guidelines:

- All reports of predators found on protected areas and causing stock losses on neighbouring properties must be reported to and investigated by relevant CapeNature staff who will assist the landowner with mitigation management. All actions against predators must be actioned on the property where the losses occurred and not within the protected area. No hunting or pursuing of predators on any protected area is legally allowed.
- All other wildlife found on protected areas and causing losses or damage on neighbouring properties must be reported to and investigated by relevant CapeNature staff who will assist the landowner with mitigation management.
- Domestic animals (e.g., donkeys, goats, cattle, sheep and pigs) that roam onto protected areas from neighbouring properties must be addressed by relevant staff in conjunction with the local municipal authority through the draft National Animal Pounds Bill and/or any local authority bylaws.
- All feral animals (domestic animals that have become wild and without an owner) found within a protected area must be removed in a humane manner immediately.
- No confiscated, nuisance, damage-causing wildlife or rehabilitated wild animals may be released onto a protected area unconditionally.

3.5.6 Cultural resource management

CapeNature acknowledges that access to protected areas for traditional, spiritual, cultural and historical purposes has major benefits for people and accepts that protected areas have intrinsic and extrinsic use value for the people of the region. CapeNature therefore recognises the need to manage, conserve and promote natural assets for the benefit of all. CapeNature contributes towards the promotion of culture and heritage through the development and conservation of heritage resources as well as the facilitation of access.

Cultural Heritage Management plans are yet to be completed for all three clusters and endorsed by a Heritage Practitioner. However, all sites do carry out standardised monitoring as per CapeNature’s baseline monitoring manual.

Discovery of new sites are either through local contact or by operational staff conducting field work in an area and are recorded in the relevant CapeNature Heritage Inventory database for each protected area. Sites within the GRWHS&NR are monitored on an ad hoc basis by operational staff.

3.5.7 Neighbour relations

The National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998) places a duty on landowners to prepare and maintain firebreaks. Chapter 4, Section 12 (7) of the Act states that owners of adjoining land may agree to position a common firebreak away from a boundary. Firebreaks that have been repositioned off CapeNature boundaries must be documented in an official firebreak agreement between CapeNature and the relevant landowner. Firebreak agreements bind all parties over a five-year period (unless otherwise stated) and are renewable upon joint agreement from both parties.

Within the structure of CapeNature, firebreak registers are used as a management tool to assist with the prioritisation and maintenance schedule for each firebreak. The firebreak register is updated annually and indicates whether a firebreak has been realigned to aid with maintenance or fire suppression operations.

Where firebreaks are constructed by the protected area away from the protected area boundary it is required to have mutual agreements in place with the adjacent landowner, the signing of many of these agreements is still in process or need to be renewed.

The number of firebreak agreements for the GRCWHS&NR are briefly discussed below as per the 2021 firebreak registers for each cluster:

Outeniqua Cluster. The firebreak network for the Outeniqua Cluster is extensive and comprises 89 firebreaks. There are several firebreaks that need to be realigned to aid fire suppression and maintenance purposes. The firebreak agreements between DFFE and CapeNature along the southern slopes from the Kouma River to the Bergplaas area need to be finalised.

Goukamma Cluster. Goukamma's firebreak network comprises of 23 boundary firebreaks in total. Some of these firebreaks are features such as roads, rivers or indigenous forest.

Keurbooms River Cluster. There is one firebreak along the western boundary of Robberg, and two firebreaks along the northern and southern boundaries of Keurbooms River. Plans are in place to formalise a firebreak agreement between CapeNature, SANParks and MTO along the eastern boundary of the Keurbooms River Nature Reserve. CapeNature's Legal team are presently drawing up the paperwork to finalise this agreement. Firebreak agreements also need to be put in place for Annex Vlugt.

3.5.8 Research and development

The National Biodiversity Research Development and Evidence Strategy (2015-2025) highlights the increasing demand for knowledge and evidence to support policy and decision-making for the protection of biodiversity and the realisation of benefits from our natural resources. In response to this CapeNature developed an Ecological Surveillance, Monitoring and Research Framework (2022-2026) (CapeNature 2022f). The purpose of this framework is to provide the foundation for a biodiversity surveillance and monitoring system, in collaboration with its partners, that allows for provincial level reporting on key aspects of the State of Biodiversity to inform policies, support decision-making and to guide research. This provincial information will be provided to support national and global reporting on the State of Biodiversity.

Structured monitoring programmes need to be put in place and carried out consistently over time to monitor the state of biodiversity and ecosystem functioning. This allows tracking of ecosystem health and allows critical evaluation of management practices by employing an adaptive management cycle. Therefore, there is a focus on applied scientific research that is driven by management requirements. The strategy emphasises research and monitoring that measures biodiversity outcomes so that management can be clearly linked to the biodiversity and ecosystem function targets.

The guiding principles of the strategy are good science (robust and defensible), alignment with management requirements, taking an integrated management and ecosystems approach, employing a full monitoring lifecycle approach to planning and implementing monitoring programmes and considered (evidence-based) prioritisation of research and monitoring actions.

Key objectives of the Ecological Surveillance, Monitoring and Research Framework (2022-2026) (CapeNature 2022f) are to ensure:

- CapeNature is aligned with South Africa's national and international monitoring and reporting commitments.
- All data underpinning the 5-yearly Western Cape State of Biodiversity and Annual State of Conservation Report, including any national and international indicators that CapeNature contribute to, are clear and the methods of data collection, quality control and analysis are clear and repeatable across the four CapeNature Landscapes.
- Key biodiversity research required in the province is identified to contribute to understanding of the functioning of ecosystems, the impact of threats and to measure the effectiveness of management actions/interventions.

3.5.9 Access

CapeNature strives to establish a differentiated and leading brand of products in outdoor nature-based tourism across the Western Cape for all to enjoy. This is achieved by providing opportunities to the public and interacting in an environmentally responsible and sustainable manner specifically to:

- Optimise income generation for biodiversity conservation;
- Optimise shared growth and economic benefits, to contribute to national and provincial tourism strategies and transform the tourism operations within CapeNature; and
- Strengthening existing and developing new products with special attention to the provision of broader access for all people of the Western Cape.

Furthermore, CapeNature strives to increase and improve stakeholder awareness, understanding and participation in environmental conservation through:

- Developing the capacity of local people to meaningfully and responsibly participate in the management and enjoyment of the protected areas; and
- Educating relevant stakeholders and creating awareness around key environmental issues to increase knowledge about the environment, develop a deeper understanding about environmental principles and encourage environmentally conscious values that allow for more informed and environmentally responsible decision-making.

As part of its multi-sectoral approach, CapeNature aims to support the Western Cape Education Dept's efforts and will endeavour to collaborate with like-minded partners in pursuit of environmentally sustainable development goals as platforms for involving citizens and groups with the aim of expressing a "call to action". Behaviour change efforts will be optimised through targeting specific audiences with innovative, transformative, quality assured programmes and interventions.

3.5.10 Administrative framework

The Directorate: Conservation Operations is divided into two Regions, namely East and West. The East Region is divided up into two Landscapes, namely Landscape East and Landscape South. The entire GRCWHS&NR falls within Landscape East.

The GRCWHS&NR is supported primarily by Head Office, through the Landscape Office located in George, which also provides limited shared services. All Landscape administrative matters that affect the GRCWHS&NR are managed via Head Office in Cape Town.

Conservation Managers report to the Landscape Manager I of the Garden Route Area based at Outeniqua WHS. The GRCWHS&NR has three main operational centres, namely Outeniqua, Goukamma and the Keurbooms River Clusters.

In addition, based in George, there is an Off-Reserve Conservation Component (GRCWHS&NR Buffer Zones) which deals with compliance of environmental legislation (NEMA, Specific Environmental Management Acts and Provincial Legislation) and a Stakeholder Engagement Component which deals with communities and other partners in the landscape, as well as conducting environmental education and awareness to all stakeholders around conservation matters (Figure 3.3).

The staffing structure for the GRCWHS&NR is depicted in Figure 3.3.

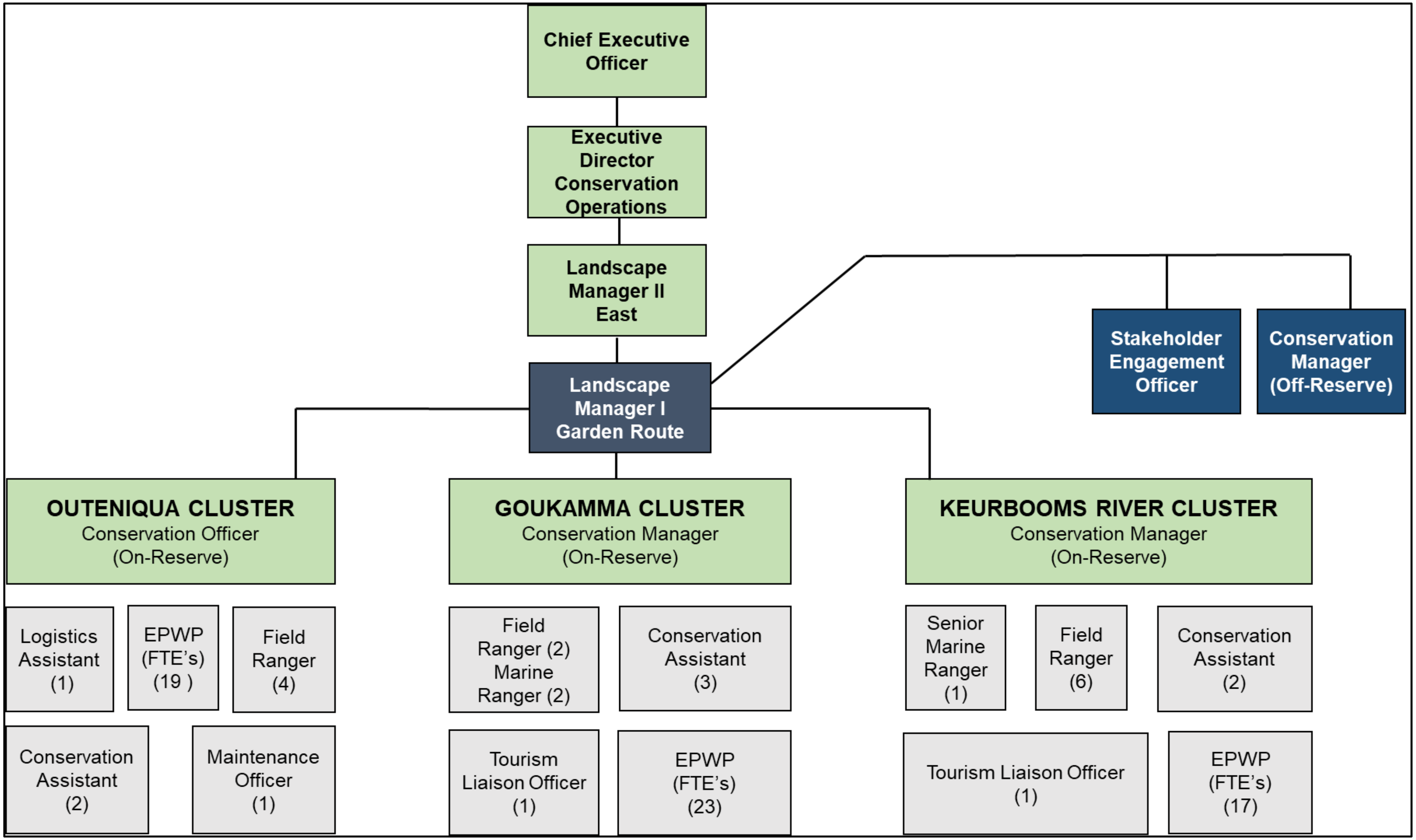

Figure 3.3: Approved 2022/2023 organogram for the Garden Route Complex World Heritage Site and Nature Reserves.

4 CONSULTATION

This section outlines procedures for public participation during the development of the management plan, including formal processes for public comment on the draft plan, and establishes procedures for public participation during the implementation phase of this plan (Figure 4.1).

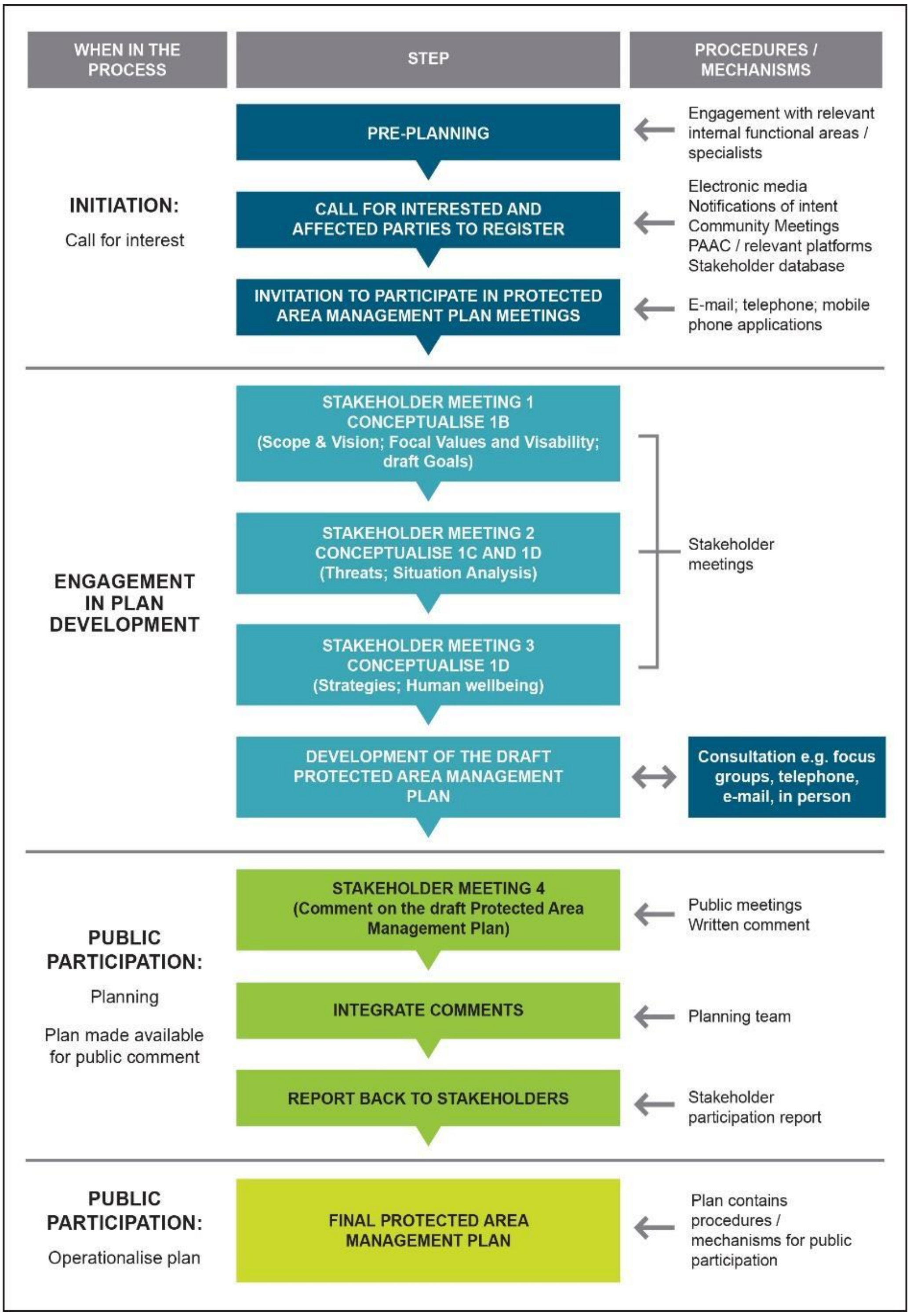

Figure 4.1: Process flow for Protected Area Stakeholder Engagement.

Stakeholder engagement takes place throughout the adaptive management cycle and enables public participation essential for sustainability, builds capacity and enhances responsibility. It promotes communication and the derivation of new information and/or expertise.

At the outset of the planning process for the GRCWHS&NR, a stakeholder analysis identified relevant internal and external stakeholders and defined the scope and purpose of engagement.

4.1 Stakeholder Engagement

4.1.1 Participatory planning

Several approaches to engaging internally and externally with stakeholders were applied, including structured facilitated workshops, meetings and the provision and circulation of information for input. Different stakeholders were engaged using varied approaches during the stages of the planning process, from gathering and sharing information, to consultation, dialogue, working groups, and partnerships. The degree of engagement was guided by the stakeholder analysis and in response to the need (i.e., transparency of process / expert opinion / buy-in and support, etc.).

During 2021 and 2022 a series of stakeholder workshops, coordinated and hosted by CapeNature, were held. A range of stakeholders representing individuals or agencies with an interest in, and / or knowledge / expertise of the landscape, and individuals or agencies with the capability to support the implementation of the GRCWHS&NR management plan were involved. Stakeholders included landowners and land managers (private and communal), and relevant land or resource management authorities. Workshops were aimed at developing a strategic framework for the GRCWHS&NR to help coordinate efforts in the landscape towards a common vision. The desired outcomes were to capacitate stakeholders in the understanding of the natural and cultural conservation targets in the protected area landscape and to identify mechanisms to maintain those values over time.

The outcomes of the above-mentioned process were precursors to the site-specific management planning process for the GRCWHS&NR and formed the foundation for smaller working groups towards the development of the management plan. The protected area management planning process was further facilitated by the core planning team comprised of CapeNature conservation managers, landscape conservation intelligence manager, landscape ecologist, ecological coordinator, GIS technician, stakeholder engagement officer and landscape managers. A series of workshops and core planning team meetings were held with relevant internal (e.g., scientists and specialists) and external stakeholders.

4.1.1.1 Key stakeholder groups engaged

- DFFE;
- SANParks;
- Western Cape Dept of Agriculture;
- Knysna Municipality;
- George Municipality;
- CREW;
- Brenton Blue Butterfly Management Committee;

- Garden Route District Fire Working Group;
- GRBR;
- Landmark Foundation;
- Regalis Environmental Services;
- Nelson Mandela University;
- Garden Route Environmental Forum (GREF);
- Wilderness and Lakes Environmental Action Forum;
- Grootbrak Conservancy;
- Western Heads – Goukamma Conservancy;
- National Resource User Groups (NRUGs);
- George Initiation and Environmental Forum;
- African Natural Medicine Association;
- Gourikwa Khoisan Stamhuis;
- CapeNature scientists, specialists and conservation management staff; and
- Protected Area Advisory Committee (PAAC) Forums for the Outeniqua, Goukamma and Keurbooms River Clusters.

4.1.1.2 Workshops and engagements

Stakeholder Workshops had the following key themes:

- Purpose: introducing stakeholders to planning for adaptive management; planning scope and vision;
- Assessment: capacitating stakeholders in adaptive management planning; selecting conservation targets and assessing the condition of conservation targets; threats assessment and conservation situation analysis;
- Planning actions: identifying strategies; developing theories of change and developing objectives and indicators; and
- Internal stakeholder engagement: scientific review and component review.

4.1.1.3 Working groups and other input opportunities

In instances where specific input was required or stakeholders and / or experts were unable to participate in workshops, smaller teams engaged and / or public meetings were facilitated to:

- Share workshop outputs and progress;
- Identify human well-being values; and
- Address relevant knowledge gaps for various key ecological attributes and indicators for specific focal values.

4.1.2 Procedures for Public comment

Cedarberg Conservation Services (t/a Footprint Environmental Services) were appointed by CapeNature in December 2022 to facilitate the Stakeholder Engagement Process for the GRCWHS&NR management plan.

The Stakeholder Engagement Process was formally initiated on 23 January 2023 by Footprint Environmental Services whereby members of the public and interested and affected parties were invited to register their interest and provide comment on the draft GRCWHS&NR protected area management plan.

Notifications inviting the public and interested and affected parties were distributed electronically via email and CapeNature's website. Notifications were also placed in the "George Herald", "Knysna Plett Herald" and the "Mossel Bay Advertiser" that cover the entire domain of the GRCWHS&NR. Notifications in the local newspapers were published in English and Afrikaans.

Hard copies of the draft management plan for the GRCWHS&NR were printed and placed at three public libraries in Mossel Bay, Sedgefield and Knysna. The draft GRCWHS&NR management plan was also available at the following CapeNature offices: George Regional office, Outeniqua office at Witfontein and the Keurbooms River office in Plettenberg Bay.

Electronic copies of the draft GRCWHS&NR management plan could be downloaded from CapeNature's website link https://www.capenature.co.za/carefornature/biodiversity/protected-area-management-plans/ which remained active for the entire Stakeholder Engagement Process that concluded on 23 February 2023.

The opportunity for providing comments and registering as interested and affected parties commenced from 23 January 2023 and concluded on 23 February 2023.

Registered interested and affected parties were invited to attend public meetings held in Plettenberg Bay (Piesang Valley Community Hall, 8 February 2023), Sedgefield (Smutsville Community Hall, 8 February 2023), George (CapeNature Regional office, 9 February 2023) and Mossel Bay (Great Brak River Municipal Hall, 9 February 2023), and provided the opportunity to provide information and express their opinion. Based on the comprehensive Stakeholder Engagement Process Report compiled by Footprint Environmental Services dated March 2023 outlining the entire public participation process, the GRCWHS&NR draft management plan was amended where appropriate and feedback was provided by Footprint Environmental Services to registered interested and affected parties.

Please refer to Appendix 3: Stakeholder Engagement Report for the GRCWHS&NR.

In addition, representatives of the reserve management committee gave presentations about the GCWHS&NR management plan at the Protected Area Advisory Committee meetings held at Goukamma (17 February 2022), Keurbooms River (31 March 2022 and 23 November 2022) and Outeniqua (15 April 2021, 18 February 2022 and 1 December 2022). Presentations were also given at the GREF on 21 June 2022 and at the Landscape Ecological Meeting on 2 December 2022. A breakdown of the stakeholder attendance at the above-mentioned meetings are as follows:

- Outeniqua WHS PAAC: 32 external stakeholders
- Goukamma WHS PAAC: 10 external stakeholders
- Keurbooms WHS PAAC: 19 external stakeholders
- GREF: 81 external stakeholders
- Landscape Ecological Meeting: 6 external stakeholders.

Attendance registers and minutes of these meetings were compiled and submitted to all participants.

4.1.3 Procedures for Participatory Implementation

4.1.3.1 Protected Area Advisory Committee

Participatory management is facilitated through structures such as PAAC with the aim of regular interaction with stakeholders and a mechanism to evaluate stakeholder feedback, to promote good neighbour relations and to influence beyond protected area boundaries.

The organisation of the PAAC for the GCWHS&NR is as follows:

- The Outeniqua, Goukamma and Keurbooms River PAACs meet bi-annually.
- Member representation will be allowed as long as it is in the interest of conservation and good governance.

4.1.3.2 Other mechanisms for stakeholder engagement

Enhancing engagement and participation by relevant stakeholders throughout the GRCWHS&NR is a key focus area going forward. Current structures for stakeholder engagement, additional to the PAAC, include:

- The Goukamma and Keurbooms River Estuary Advisory Forums. Estuary Advisory Forum meetings take place once every three months and include representatives from the Local Municipality (Bitou and Knysna), Garden Route District Municipality, DEA&DP, DFFE, Dept of Water and Sanitation, BGCMA and NGOs.
- The National People and Parks Programme implemented by CapeNature has established a regional structure in the area to enable community engagement. The primary objective is to link communities with relevant government departments that can assist with issues such as access for marine resource utilisation or for spiritual, recreational, educational, traditional and other purposes. The programme is also designed to capacitate communities with regards to relevant legislation, policies and regulations.

5 PURPOSE AND VISION

This section makes provision for CapeNature to manage the GRCWHS&NR exclusively for the purpose for which it was declared. It presents the vision, purpose, conservation targets and key threats foundational to developing the desired state for the protected area.

The desired state, articulated as goals in this management plan, defines the outcome of management and directs management within and beyond protected area boundaries. This serves as a foundation for appropriate ongoing monitoring and evaluation to assess management effectiveness.

5.1 Management Intent and Desired State

The GRCWHS&NR supports diverse and important habitats such as fynbos, indigenous forests, estuaries, rivers and marine environments for biodiversity conservation and is extensive enough to allow for the persistence of individual taxa and entire communities. The primary reasons for inclusion of the GRC WHS into the extension nomination for the CFRPA are to improve representation of vegetation types within the CFRPA, as well as to increase and improve the overall size, connectivity and integrity of the CFRPA, thus ensuring protection of an increased land area within the WHS. The protected area and associated nature reserves improve connectivity between the inscribed Swartberg Complex (including the Swartberg, Rooiberg-Gamkaberg, Kammanassie) and the coast, providing a mountain to coast conservation corridor, thereby increasing resilience in the face of global climate change and improving both biodiversity pattern and process of the inscribed CFRPA WHS (DEA 2015).

5.2 Purpose

Ruitersbos, Witfontein and Annex Vlugt (Langkloof State Forest) were demarcated as State Forests in Government Notices under various Forest Acts (refer to Section 2.1.1) which have now been replaced by the National Forests Act, 1998 (Act No. 84 of 1998). Doringrivier is a declared Wilderness Area and Zebraskop (WWF-SA land) is in the process of being proclaimed a Provincial Nature Reserve.

During the 1980s a landowner adjacent to the western boundary of Doringrivier applied to the state to purchase the property as he believed the land was being under-utilised. The planning department of the then Dept of Forestry requested inputs from the research department at Saasveld and a motivation was provided that the area is in fact of very high conservation value. A delegation from the head office of the Dept of Forestry subsequently visited the area and recommended that the property should be given the highest protected area status, resulting in it being declared Doringrivier Wilderness Area (Jan Vlok, pers. comm.).

The Western Cape Nature Conservation Board manages all these components as Provincial Nature Reserves. Together the state ownership and the management by the provincial conservation authority impart a high level of legal protection and conservation management to the area.

The Outeniqua Mountain Range is a significant water catchment area, providing a sustained flow of water of the highest quality water to the adjoining urban and rural communities. Due to its impressive size, ecological processes can still continue with ecological linkages to the east (Tsitsikamma Mountain Range), west (Langeberg Mountain Range), north (Gamkaberg, Rooiberg and Swartberg Mountains) and the Wilderness Lakes region to the south-east.

In the early 1900s the Buffalo Bay area at Goukamma and coastal strip westwards were reserved as a Forest Reserve. This land was known as the Buffalo Bay Forest Reserve which was reserved to control and reclaim drift sands in the area. Several fishermen were allowed to reside at Rowwehoek (Walker's Point) under permits from the Dept of Forestry in the early 1900s. It is likely that they utilised the intertidal zone at this time. Hunting licences were also issued from time to time in the area (Heinecken 1970). Removal of wild oysters on a commercial basis had been carried out for approximately 100 years. Oyster harvesting was not controlled on a quota and no accurate figures were kept. This was stopped when the coast was declared a MPA in 1990.

Parts of the reserve had reasonable grazing potential especially after fires, and were grazed by cattle, while other parts were planted with pines. The area around Groenvlei was used mainly for pasturage before the proclamation of the reserve. Between 1968 and 1970 large areas of the fynbos were cut on a rotational basis using a "bossieslaner" probably to promote grazing (Van der Merwe 1976). During the early 1940s *Acacia cyclops* (Rooikrans), *Acacia saligna* (Port Jackson) and *Ammophila anenaria* (Marram grass) were used in conjunction with indigenous seeds and plants to stabilise the mobile dunes in the area of the Goukamma Estuary. This natural drift sand area, forming a headland bypass system, was viewed by the Dept of Agriculture as a threat. This was due to upriver farming practices being compromised when floodplains "back flooded". The drift sands were stabilized from 1918 to 1939 by the Dept of Forestry. Since the reserve's inception in 1960, management efforts have concentrated on the removal of these alien plant species. During the 1970s, 1980s and early 1990s teams of chainsaw operators removed dense infestations of Rooikrans and Port Jackson in substantial areas. Biological control of Port Jackson was started in 1988 when the gall-forming fungus (*Uromycladium tepperianum*) was introduced to trees in the areas around the estuary. The fungus did very well on the Port Jackson. In 1994 the seed-feeding weevil (*Melanterius servulus*) was introduced on the Rooikrans but this biological control took a long time to reproduce and was not successful. When clearing re-started in 2004, 27 ha of dense adult Port Jackson was felled and burned in April 2005. Although many trees felled were infected, reserves of infected plants were left on the seaward side of the management road which runs parallel to the coast approximately 1 km from the pont crossing. Between the mid-1990s to 2004 low levels of alien clearing took place. Aliens, primarily Rooikrans and Port Jackson, continue to be removed today through the Working for Water (WfW) project. As eradication takes place, the area is colonised and vegetated by indigenous plants. Unfortunately, because of a substantial root base having been established, the drift sands will never function naturally again.

Goukamma Nature Reserve and MPA were declared to protect: (1) a major element in the morphology of the dune cordons; (2) flora communities regarded as unique or endemic and that represent the Southern Cape lowland-coastal vegetation type, of which only a relatively small percentage still exists in an untransformed state; (3) an endorheic coastal lake in South Africa which is viewed as an ecologically sensitive aquatic system; (4) best remaining examples of marshland communities along Groenvlei Lake; (5) an "as near as naturally managed" temporary open/closed estuary that flows into a partially protected MPA; and (6) a sub-tidal reef structure which supports resident Sparidae that are vulnerable to offshore angling pressure and intertidal invertebrate species that provide a food source for heavily utilised recreational shore angling species.

The BBBSNR was declared to save the Brenton Blue Butterfly from extinction as a result of a residential housing development in Brenton-on-Sea. The battle to save the butterfly is documented in detail in a publication of the Endangered Wildlife Trust, entitled '*The Brenton Blue Saga – a case study of South African biodiversity conservation'* (Steenkamp & Stein 1999). The Brenton Blue Butterfly Management Committee advises the management authority on management actions. This committee consists of representatives of the Wildlife and Environment Society of Southern Africa, Lepidopterists' Society of Africa, Knysna Municipality, SANParks, CapeNature and the Brenton Ratepayers Association. CapeNature is the management authority and implementing agent.

Keurbooms River Nature Reserve used to be managed as part of the Keurbooms River Forest Reserve prior to 1980. All the indigenous forests, plantations as well as Forest Reserves were managed by the DWAF during that period. The development and zoning of Forever Resorts was excluded from the Keurbooms River Nature Reserve as the management of public resorts was not part of the conservation mandate at the time. Keurbooms River was proclaimed a Provincial Nature Reserve to conserve Afromontane floodplain forest not formally conserved in any other protected area. The sand-spit on the eastern side of the Keurbooms River mouth is being managed as part of the nature reserve for the purpose of protecting the Kelp Gull breeding colony but has not been formally proclaimed.

Prior to 1980, Robberg Nature Reserve was managed as a Regional Services Council Nature Reserve. Except for an occasional clean-up of the car parking area, no other management activities took place on the reserve. As a result, a network of trails was trampled all over the peninsula with the inevitable erosion visible on various sites. Two families were also allowed to build stone huts on Robberg as part of a 99-year lease agreement. This agreement with the Van Rooyen and Thesen families came to an end with the transfer of the land to the then Provincial Administration of the Western Cape. The Van Rooyen family contested this decision in the Supreme Court but lost the case. Plettenberg Bay Angling Club also had a lease agreement for the lease of the Point and Fountain Shacks, but willingly transferred these huts to CapeNature as it was not financially feasible to retain them. In 2005 the Robberg Shack Conservation Group managed to secure funding to upgrade these facilities to ensure that CapeNature retains them in their original state. In 2007 the Point Shack was demolished by a storm surge. Today the Fountain Shack is managed as the only overnight accommodation facility on Robberg.

Acacia cyclops (Rooikrans) was planted on the rising-falling dune in the area known as Witsand to stabilize the moving dune to improve access to the Point. During the 1990s this exotic invader was removed, but due to the deposition of leaf litter over a period of nearly 40 years, the soil composition changed and the exotic plants were replaced by indigenous plants.

Robberg was proclaimed as a Provincial Nature Reserve in 1980. In 1999 Robberg Nature Reserve was also proclaimed a National Monument due to the 19 registered archaeological sites scattered over the length of Robberg. All these sites, with the exception of Nelson Bay Cave, are closed to the public.

In 1998 the Robberg MPA was proclaimed under the Marine Living Resources Act. Marine and Coastal Management (now DFFE: Oceans and Coast) proclaimed Marine Protected Areas all along the coast where terrestrial reserves and National Parks were in existence. Robberg MPA has a rich variety of coastal habitats, including rocky shores and reefs as well as sandy beaches. In 2000 the boundaries were amended to improve compliance management. This 2270 ha MPA surrounds Robberg Nature Reserve.

CapeNature manage the GRCWHS&NR in accordance with its organisational vision, and in accordance with the vision, goals and strategies derived in consultation with stakeholders, as set out in this section.

According to Section 17 of the NEM:PAA each protected area in the Complex is declared for one or more of the following purposes:

a) to protect ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes in a system of protected areas;
b) to preserve the ecological integrity of those areas;
c) to conserve biodiversity in those areas;
d) to protect areas representative of all ecosystems, habitats and species naturally occurring in South Africa;
e) to protect South Africa's threatened or rare species;
f) to protect an area which is vulnerable or ecologically sensitive;
g) to assist in ensuring the sustained supply of environmental goods and services;
h) to provide for the sustainable use of natural and biological resources;
i) to create or augment destinations for nature-based tourism;
j) to manage the interrelationship between natural environmental biodiversity, human settlement and economic development;
k) generally, to contribute to human, social, cultural, spiritual and economic development; or
l) to rehabilitate and restore degraded ecosystems and promote the recovery of endangered and vulnerable species.

The GRCWHS&NR were declared for a, b, c, d, e, f, g, h, i, k and l.

5.3 Vision

The vision for the GRCWHS&NR is:

The Garden Route Complex World Heritage Site and Nature Reserves conserve living landscapes and seascapes that represent the region's biodiversity and ecosystems through integrated management and partnerships for the benefit of all.

5.4 Conservation Targets

In consultation with stakeholders, natural and cultural historic conservation targets were identified, explicitly defined, and selected for their ability to represent the full suite of biodiversity and cultural historic heritage within the GRCWHS&NR.

Conservation targets are summarised in Table 5.1. Features considered to be nested within or catered for by the conservation of the conservation target, are noted. Key human well-being values derived from the tangible natural and cultural conservation targets are also noted. Since human well-being values are those components of well-being affected by the status of tangible natural or cultural values, their 'health' or status is not assessed separately but seen as contingent upon the status of the natural and cultural conservation targets selected.

Table 5.1: Summary of the Garden Route Complex World Heritage Site and Nature Reserves conservation targets and viability as at 2021.

Conservation Target	Description, Nested Values, Key Attributes & Associated Human well-being Values	Current Status
Fynbos Mosaics including indigenous Forests	**Description:** Comprising Fynbos, indigenous Forest, fire-dependant vegetation types and the associated flora and fauna species. **Nested values of note:** *Protea* indicator species populations; presence, distribution, and density of forest pioneer species (e.g., *Rapanea melanophloeos*, *Virgilia oroboides*, *Osteospermum* and *Euryops* species); presence of leopard, blue duiker, Cape grysbok and Cape sugarbird populations; presence of indicator frugivores, nectarivores, migratory and water birds. **Key attributes:** Fire regime, characteristic species, forest structure. **Associated human well-being value(s):** Sustained supply of clean, fresh and potable water; fresh supply of oxygen; habitat for biological ecosystems and species; pollination services; carbon storage; tourism and nature-based values and opportunities (scenic natural landscapes; sense of place; recreational activities); natural (horticultural, medicinal, genetic, food, building materials) products; soil formation and retention; flood control; spiritual and physical health.	**Poor to Fair**
Brenton Blue Butterfly	**Description:** Comprising of the CR PE, localised endemic Brenton Blue Butterfly (*Orachrysops niobe*) population at the BBBSNR. **Nested values of note:** *Orachrysops niobe* population; presence of *Indigofera erecta* plants; *Camponotus* species populations; mature *Pterocelastrus tricuspidatus* (Candlewood) population with canopy. **Key attributes:** Population size, adult food plant availability, ant species diversity, candlewood population, size of the protected area. **Associated human well-being value(s):** Habitat for biological ecosystems and species; pollination services; carbon storage; tourism and nature-based values and opportunities (scenic natural landscapes; sense of place; recreational activities); spiritual and physical health.	**Poor to Fair**
Freshwater Ecosystems	**Description:** Comprising of all natural perennial and seasonal streams and rivers, brack water rivers, floodplains, seeps, wetlands and Groenvlei Lake. **Nested values of note:** groundwater dependent ecosystems and species, lowland and high altitude wetlands and seeps, freshwater invertebrates, fish communities, riparian zone, rivers. **Key attributes:** wetland ecosystem health; intact wetland buffers; river flow regime; groundwater level; indigenous freshwater fish species composition; river health (invertebrate species composition);	**Fair to**

Conservation Target	Description, Nested Values, Key Attributes & Associated Human well-being Values	Current Status
	native vegetation structure; species composition within the riparian zone; mean annual rainfall; water quality. **Associated human well-being value(s):** Sustained supply of clean, fresh and potable water; groundwater replenishment; reservoirs for biodiversity; pollination services; nutrient and water cycling; soil formation; flood control; water and erosion regulation; freshwater and natural products; spiritual and physical health; tourism and nature-based values and opportunities (scenic natural landscapes; sense of place; recreational activities); climate change mitigation and adaptation.	Good
Coastal Ecosystems including Estuaries	**Description:** Comprising of natural dune systems to the highwater tide mark and includes the Goukamma and Keurbooms River estuaries and their respective riparian zones. **Nested values of note:** maintaining connectivity with the marine environment; acceptable level of waterborne pathogens for recreational use; dissolved oxygen levels ≥ 6 milligrams/litre; average salinity levels; fish assemblages comprising of estuarine residents, marine and estuarine breeders, obligate estuarine-dependents and estuarine associated species. **Key Attributes:** Water quantity (flow regime), water quality (salinity, dissolved oxygen, temperature, conductivity, concentrations of water borne pathogens); hydrodynamics (mouth state, tidal variation); riparian vegetation; community composition and biomass of microalgae; distribution and extent of macrophytes; macrofauna (invertebrates) community composition, abundance and richness; fish and avifaunal community composition, abundance and richness. **Associated human well-being value(s):** Habitat for coastal and estuarine fish species; tourism and nature-based values and opportunities (scenic natural seascapes; sense of place; recreational activities); flood control; spiritual and physical health; nutrient and water cycling; natural food source.	Fair to Good
Marine Ecosystems	**Description:** Comprising the area from the high tide water mark to the seaward boundaries of the Robberg and Goukamma MPAs. **Nested values of note:** Community and trophic level compositions of reef and surf zone fish species; relative abundance of black tail with other endemic reef fish species; species diversity in the rocky shore habitats; presence of priority limpet species; breeding success of Cape fur seals, African black oystercatchers and Cape cormorants. **Key attributes:** warm temperate reef fish communities; surf zone line fish; species composition; rocky shore zones; functional habitat connectivity; breeding success of priority marine mammals; breeding success of priority marine birds. **Associated human well-being value(s):** Habitat for marine fish, birds and mammal species; tourism and nature-based values and opportunities (scenic natural seascapes; sense of place; recreational activities); spiritual and physical health; nutrient and water cycling; natural food source; climate change mitigation and adaptation; mineral and energy resources.	Poor to Good
Cultural Heritage, scenic land- and seascapes	**Description:** Comprising of tangible heritage features such as rock art, artefacts, palaeontological sites, cultural historical sites, structures and roads, as well as the land and seascapes within the GRCWHS&NR and zone of influence. **Nested values of note:** National Monuments (e.g., Montagu, Cradock, Outeniqua, Robinson, Prince Alfred's Passes), historic	Good

Conservation Target	Description, Nested Values, Key Attributes & Associated Human well-being Values	Current Status
	buildings (Old Tol, block houses), rock art sites, palaeontological sites, structures (graveyards, old kraals) and Nelson Bay Cave. **Associated human wellbeing value(s):** Spiritual and physical health and cultural identity; tourism and nature-based values and opportunities; access and transport routes; educational values.	

As the public entity responsible for nature conservation in the Western Cape, CapeNature delivers a suite of core services to the public towards the following outcomes: resilient ecosystems; the promotion of local economic development, job creation and skills development; growing diversified nature-based revenue streams; access to environmental education, advocacy and education, and access to natural and cultural heritage.

Human well-being is articulated as an outcome of conservation and is illustrated in Table 5.2. These focus areas are essential to the effective execution of this management plan and achievement of goals.

Table 5.2: Human well-being values of the Garden Route Complex World Heritage Site and Nature Reserves.

Human Well-being Values	Description and Associated Benefits	Current Status
Water security and environmental resilience	**Description**: Healthy ecosystems protect and enhance the provision of water quality and quantity and contributes to the water resilience for the Breede-Gouritz catchment management area. **Key attributes:** Access to clean water in sufficient quantity.	**Fair**
Security from natural disasters	**Description**: A healthy and intact environment provides security from natural disasters such as wildfire, drought and flooding for the benefit of the target communities. **Key attributes:** Natural protection from flooding, environmentally sound development, mechanisms to enable coordinated disaster management.	**Good**
Freedom of choice and capacity to act independently, tourism and nature-based economic opportunities	**Description**: Socio-economic development is sustainably facilitated and maintained. Ecosystems are intact and healthy and thus add economic value to ecotourism products that are in line with zonation. **Key attributes:** Access to employment opportunities, access to capacity and skills development opportunities, tourism infrastructure, access to environmental awareness and education opportunities, mechanisms to enable tourism enterprises (e.g., small, medium and micro enterprises), intact ecosystems and abundant wildlife.	**Good**
Respect and care for the natural environment	**Description:** Provide an effective environmental education, awareness and interpretation programme that supports the values of the GRCWHS&NR and promotes respect and care for the natural environment. **Key attributes:** Intact ecosystems; advocacy; education and awareness.	**Good**

5.5 Threats

Protected area management aims to mitigate threats to conservation targets, either through direct threat mitigation, or through mitigation or management of a factor contributing to or driving the threat. Threats to conservation targets and the relevant contributing factors of key threats need to be described in sufficient detail to support effective planning and management.

Threats assessment influences the direction and effectiveness of management options. Rating threats according to scope, severity and irreversibility of impact facilitates the allocation of limited resources, simplifies complex scenarios and provides a systematic decision support method to focus efforts.

Table 5.3 provides a summary of conservation targets against key threats for the GRCWHS&NR.

Table 5.3: A summary rating of critical threats, highlighting the natural and cultural historic conservation targets at greatest risk within the Garden Route Complex World Heritage Site and Nature Reserves.

Conservation targets	Critical Threats	Threat Rating
Fynbos Mosaics including indigenous Forests	Indiscriminate fire / inappropriate fire regime; invasive alien plants; over-abstraction of surface and ground water; biological invasive alien organisms; invasive alien fauna (terrestrial); habitat fragmentation / transformation; telecommunication towers/high sites; hunting and collection of indigenous fauna; illegal and/or unsustainable harvesting of indigenous flora; climate change and extreme weather conditions (droughts, storms and flooding); illegal recreational activities; tourism developments on-reserve; garbage and solid waste.	**Very High**
Brenton Blue Butterfly	Inappropriate fire regime; habitat fragmentation / transformation; bush encroachment; climate change and extreme weather conditions (droughts, storms and flooding); invasive alien plants.	**Very High**
Freshwater Ecosystems	Invasive alien plants; climate change and extreme weather conditions (droughts, storms and flooding); habitat fragmentation / transformation; invasive alien fish; instream and riparian structures (dams, bridges, weirs, jetties); over-abstraction of surface and ground water; pollution: domestic, industrial, urban wastewater and oil spills; dams and water management / use.	**High**
Coastal Ecosystems including Estuaries	Habitat fragmentation / transformation; tourism developments on-reserve; fishing and harvesting of aquatic resources; indiscriminate fire / inappropriate fire regime; climate change and extreme weather conditions (droughts, storms and flooding); mining and quarrying; dams and water management / use; over-abstraction of surface water; pollution: domestic, industrial, urban wastewater and oil spills; instream and riparian structures (dams, bridges, weirs, jetties); invasive alien plants; invasive alien fish; invasive alien fauna (terrestrial); illegal recreational activities.	**Medium to High**

Conservation targets	Critical Threats	Threat Rating
Marine Ecosystems	Energy production (oil and gas drilling, oil exploration and mining); transportation and service corridors (shipping routes); fishing and harvesting of aquatic resources; illegal recreational activities; invasive alien fauna (marine); pollution: domestic, industrial, urban wastewater and oil spills; garbage and solid waste; climate change and extreme weather conditions (droughts, storms and flooding).	**Medium to High**
Cultural Heritage, scenic land and seascapes	Vandalism and theft to cultural heritage sites; indiscriminate fire; illegal recreational activities; climate change and extreme weather conditions (droughts, storms and flooding); telecommunication towers/high sites; mining and quarrying; energy production (oil and gas drilling, oil exploration and mining); garbage and solid waste; pollution: domestic, industrial, urban wastewater and oil spills; habitat fragmentation / transformation; invasive alien plants.	**Medium to High**

The results of the above threat rating highlighted the following key threats affecting the conservation targets of the protected area as outlined in Table 5.4 below:

- **Invasive alien plants (Very High):** Brenton Blue Butterfly, Fynbos mosaics (including indigenous forests), Freshwater ecosystems, Coastal ecosystems (including estuaries) and Cultural Heritage including scenic landscapes are all threatened by invasive alien plants. *Pinus*, *Hakea, Eucalyptus, Paraserianthes* and *Acacia* species are amongst the most problematic woody invasive species in all three clusters and the surrounding areas, although several other species, such as *Leptospermum laevigatum*, *Nerium oleander*, *Arundo donax*, *Solanum mauritinanum*, *Cortaderia* and *Rubus* species are also very problematic in the riparian and estuarine areas (see section 2.3.1.3). Virtually all the invasive alien plant species occurring in the GRCWHS&NR are fire-adapted and have a competitive advantage over indigenous plant species, and with every fire these species are stimulated to spread and recruit. An analysis of the densities and spread of invasive alien plants in the Outeniqua and Goukamma Clusters indicate an increase from before the massive 2017 and 2018 fires to present (see section 2.3.1.3). It is evident that the clearing projects are not keeping pace with the rate of reinfestation and as a result biodiversity and ecosystem services (particularly water security) are being compromised. Focussed alien plant clearing programmes by fully trained teams, supported by secured, dedicated funding for at least a 5 to preferably 10-year period need to be implemented in collaboration with all relevant partners to ensure an effective and sustained alien clearing programme (see section 2.3.1.3).
- **Indiscriminate fire / Inappropriate fire regime (High to Very high):** Too frequent, too large and out of season fires have severe ecological impacts. Over the past 10 years the size of fires has increased significantly (see section 2.3.1.4), resulting in very large proportions of the GRCWHS&NR consisting of young veld. Furthermore, most fires within the catchment areas have been caused by humans (see section 2.3.1.4) and resulted in large and uncontrollable fires, especially

during drought periods (heat, low rainfall) and excessive windy conditions. In addition, fires occur more frequently with large areas burning at too short return intervals and this is impacting negatively on indicator species, biodiversity, and potentially also on water supply (Esler et al. 2014). There is also a general lack of knowledge about the direct and indirect impacts of uncontrollable fires and enforcement is limited.

- **Biological invasive alien organisms (Very high)**: The Polyphagous Shot Hole Borer (PSHB) beetle (*Euwallacea fornicatus*) is native to Southeast Asia and was first detected in KwaZulu Natal in 2017. It is a tiny invasive beetle which has a symbiotic relationship with the fungus *Fusarium euwallaceae.* The fungus serves as a food source for the adults and their larvae. Trees that are susceptible to the fungal disease called *Fusarium* dieback eventually start to die (De Beer & Paap, 2021). Tell-tale signs that indigenous trees are affected by PSHB show reproductive tunnels or galleries in the trunks and branches of host trees; dark, wet staining; thick gumming; streaks of white powder or sawdust exuding from the holes and many dead branches with wilting leaves. The movement of infested wood from one area to another is a major concern. This species has already spread into the urban areas of the George, Knysna and Bitou Municipalities in the Southern Cape (Figure 5.1) and have caused significant tree mortalities. Important reproductive hosts include both exotic species such as *Acacia mearnsii*, *Acacia melanoxylon* and *Quercus robur* and indigenous species such as *Kiggelaria africana*, *Salix mucronata* and *Virgilia oroboides*. However, even though the beetle is not reproducing in 'non-reproductive hosts', some of these trees can still be killed by the fungus and includes species such as *Celtis africana*, *Ilex mitis*, *Olea europaea* subsp. *cuspidata* and *Protea mundii*. (De Beer & Paap 2021). All these species have been recorded within the GRCWHS&NR; therefore, the spread of the PSHB beetle into the protected areas needs to be monitored and recorded.

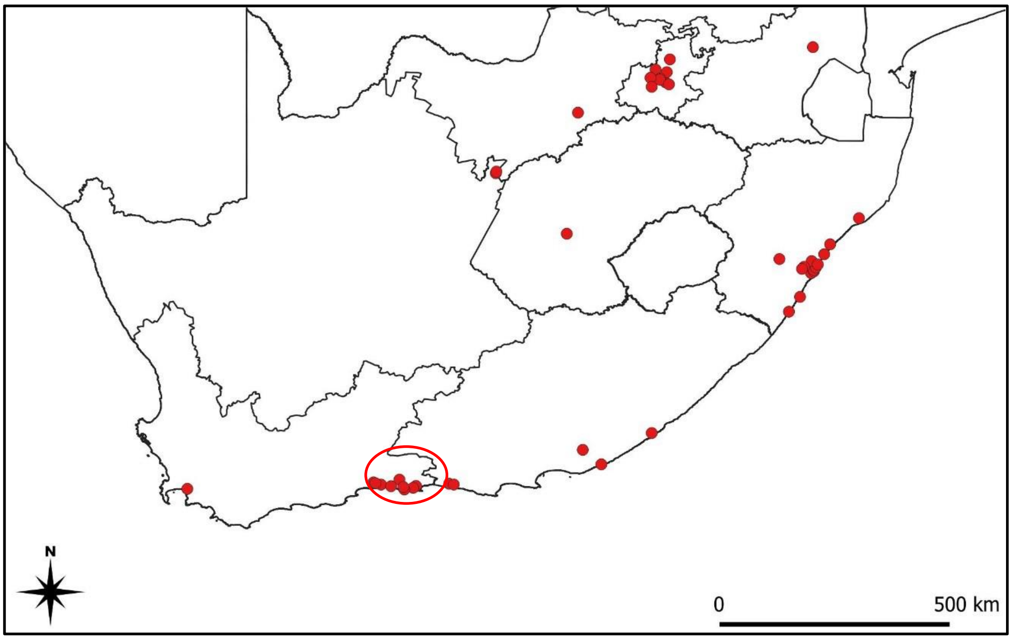

Figure 5.1: Polyphagous Shot Hole Borer (PSHB) beetle distribution recorded in South Africa. Note the presence in the Garden Route Area in the Bitou

(Greater Plettenberg Bay, Harkerville Forest), George (George, Wilderness) and Knysna (Knysna, Sedgefield) Municipal areas. (Map from Paap & De Beer 2021). (Note that this threat could also form part of the Invasive alien fauna (terrestrial & marine) threat, but it was decided to keep it separate due to the uncertainty of its spread and the current focussed attention on it within urban areas, especially where these areas are close to protected areas.)

- **Bush encroachment (Very high):** As a result of the small size of the BBBSNR and its proximity to adjacent housing developments ecological processes (fires and large animal disturbance) have been negatively affected. The entire reserve has become overgrown with thicket species through thicket building which have displaced the fynbos species in many respects (see section 2.3.1.2.2). *Indigofera erecta*, the foodplant of the Brenton Blue Butterfly, is a fire dependent species and its numbers have decreased because of the lack of fires and the gradual expansion of the thicket clumps. Recent research following the 2017 Knysna fire have indicated that almost all the thicket tree species are able to resprout and are resilient to high intensity fires (Strydom et al. 2020). They suggest that thicket may be vulnerable to frequent fires and that more research is needed in this regard.
- **Climate change and extreme weather conditions (High):** This affects all the focal values within the GRCWHS&NR. It has significant environmental, social, cultural and economic consequences for natural and social systems. There are clear indications of an increase in the frequency of extreme weather events (e.g., the extended drought in the Garden Route area from 2016-2019); occurrence of storm surges (e.g., May 2020, July 2022) and flash flooding in the area (e.g., November 2021); and the overall decreasing rainfall (see section 2.2.1). These conditions are supportive of increased fire sizes (e.g., the 2017 Knysna and 2018 George fires; see section 2.3.1.4) that are uncontrollable and burn for extended periods. The Conservation Standards (CMP 2020) focuses on climate adaptation by identifying threats to conservation targets and developing strategies to abate these threats, and in so doing, providing resilience to the impacts of climate change. Therefore, the importance of creating landscape and ecological corridors as a strategy to mitigate and adapt to the impacts of climate change is crucial. Addressing fire and water management challenges in a proactive manner and not supporting developments within areas prone to fires, storm surges and flooding would go a long way in mitigating the impacts of climate change.
- **Over-abstraction of ground- and surface water (High):** Pressures imposed by drought events, has led to an increasing use of groundwater to augment the water supply for urban and agricultural areas, posing a significant threat to this ecosystem in the future (e.g., the three boreholes drilled at Horseshoe bend above George during the 2010 drought period). It is expected that increased abstraction of groundwater will result in ecological impacts on freshwater (rivers and wetlands) and terrestrial ecosystems in the catchment. These potential impacts, together with the effects of climate change will affect ecosystems that are dependent on groundwater and/or aquifers. Development of the Blossoms Wellfield north of the Outeniqua Mountains to augment the water supply of Oudtshoorn is a special concern. This wellfield has a potential to impact on the catchments of the Klip, Doring, Brak, Ganskraal and Kammanassie Rivers. At Goukamma, eight production boreholes were drilled at Fairfield, north of Groenvlei Lake in 2017, to

irrigate a wet-deck consisting of stacks (4.5 m high, 24 m wide and extending over a distance of 3 km) of pine logs that were harvested by PG Bison following the 2017 Knysna fire. Abstraction reached a peak at around 5 ML/day in June 2019 but has since dropped as the size of the wet-deck reduced (Parsons & Morris 2022). Numerous concerns have been raised by various stakeholders about the impact of the abstraction on the water level of Groenvlei, which is known to be dependent on groundwater recharge and rainfall. The water level of Groenvlei is measured on a daily basis by Dept of Water and Sanitation. There appears to be a relationship between the water level of Groenvlei and rainfall given that rainfall accounts for 72% of the input into the system. According to Parsons and Morris (2022), groundwater has less of an influence on the water level of Groenvlei and the monitoring of the response of the aquifer to pumping from the Fairview Wellfield showed that the groundwater inflow into the wetland remained constant, during and after the wet-deck operation. This monitoring, however, needs to continue.

Reduction in river flow as a result of over-abstraction of surface water and groundwater is a threat. Several of the municipalities are pumping water from rivers to replenish dams or weirs during dry months. Most of these activities are not monitored for impact. To supplement the water supply to Plettenberg Bay, the DWAF (now Dept of Water and Sanitation) approved the increase in abstraction from the Keurbooms River from 8.46 to 14.8 ML/day. Of great concern is the fact that this approval was granted based on a desk-top determination of the ecological reserve for the estuary. One of the conditions stipulated in the approval was that pumping must be ceased when the flow at the weir is less than 300 l/s. This condition is however not adhered to, especially during peak season. This abstraction affects both the water flow and quality of the estuary. Bitou Municipality is in the process of applying to build an off-channel dam to store the abstracted water. The Keurbooms-Bitou Estuarine Management Committee has therefore indicated that a comprehensive ecological reserve study needs to be undertaken before any further proposals are considered. Other rivers that are abstracted from in the GRCWHS&NR and its zone of influence are the Piesang River to supply the Roodefontein dam (also impacting the estuary), the Groot Brak River to the Wolwedans dam, the Groot River to the Ernest Robertson dam, the Swart River to the Garden Route dam, the Klip River to a dam near Zebra, and several other rivers to supply private dams around the protected area.

Monitoring the flow regime of strategically selected rivers within the GRCWHS&NR, would provide information regarding the flow patterns linked to for example invasive alien plant clearing in the catchment or water use from the land parcels (see section 2.3.2). This in turn will highlight the importance of adaptive and sustainable management of our freshwater ecosystems, especially in relation to the ecosystem services that the GRCWHS&NR provides with regards to water provision. It is particularly important considering the current and future effects of climate change.

- **Habitat fragmentation / transformation (Medium):** The Garden Route is a major tourist and retirement area. Urban areas are expanding, and housing and holiday developments are rapidly increasing and putting pressure on natural resources. This leads to habitat fragmentation and transformation. Some of the protected areas, such as Robberg, Keurbooms River, Goukamma and the Brenton Blue Butterfly sector, are limited in size. As a result, natural ecological processes (e.g., fires in fire-dependent habitat types; animal movement passageways for forage, seed dispersal and disturbance; predator migration routes; sand movement corridors; etc.), that maintain the species richness within the protected areas have been impacted. The destruction caused by the 2017 Knysna fire highlighted the impacts of habitat fragmentation on fire dependent ecosystems. Edge-effects of developments adjacent to protected areas are also evident (e.g., human intrusion and disturbance; domestic pets entering or hunting in natural areas; garden plants escaping into protected areas; dumping of waste; etc.).

- **Invasive alien fauna (including fish) (Medium):** Invasive alien fish affect indigenous fish species through predation and competition for resources and can cause localised extinction of native species (see section 2.4.3). Other invasive alien (extra-limital) animals (such as impala, nyala, etc.) are a threat as they compete with indigenous animals for habitat and food resources. These species require active interventions to prevent invasions.

- **Illegal and/or unsustainable harvesting of indigenous flora and hunting/collection of indigenous fauna (Medium):** Both threats rank medium for now and are applicable to biological resource use. International and local demand of indigenous fauna and flora for commercial, subsistence, medicinal and valuable collector's items is increasing significantly. Bark-stripping of indigenous trees (*Rapanea melanophloeos*, *Olinia ventosa* and *Gonioma kamassi*) is threatening indigenous forest patches as the damage caused to the trees (total ring-barking) is so excessive that the species are unable to recover and eventually die standing. The over-harvesting of *Cyclopia intermedia* (bergtee) and *C. subternata* (vleitee) within the zone of influence has resulted in decreased population sizes and poor seedling recruitment following fires. Landowners are being encouraged to cultivate these species through the South African Honeybush Tea Association and the Honeybush Community of Practice. Other important fynbos species such as *Protea*, *Erica* and *Brunia* spp. are also being illegally harvested for the flora trade. Harvesting for the medicinal plant trade is also increasing. Mammals such as leopard, bushbuck, bushpig, porcupine, genet, mongoose and chacma baboon are being hunted by means of illegal and unselective gin trapping and/or snaring for the prevention of human-wildlife conflict, bush-meat trade and food provision due to poverty. The illegal pet trade is significantly impacting populations of indigenous snakes, tortoises and lizards and is mainly driven by international demand. Unfortunately, the excessive demand for specific fauna and flora species and/or their by-products is contributing to the loss of species and/or populations. Ineffective monitoring or the lack of enforcement are contributing factors to indigenous fauna and flora being illegally harvested within the zone of influence.

- **Fishing and harvesting of aquatic resources (Medium):** According to DEFF (2020; now DFFE) the national stock status and fishing pressure of linefish such as yellowtail, santer, slinger, carpenter and roman is optimal and are not over-exploited, however, species such as the seventy-four, red steenbras and dageraad have been severely over-exploited and may never recover. Both Goukamma and Robberg MPA permit shore angling. This is a major attraction for fisherman as they are allowed to fish from the shore within these two marine protected areas. Unfortunately, the increase in numbers of fisherman to these MPAs may have a negative impact on fish life-cycles due to undersize fishing and exceeding daily bag limits. Special mention here are the reef species (Sparids) that reach sexual maturity much later in their life cycle compared to the pelagic species which reach sexual maturity faster.

Table 5.4: Rating of key threats applicable to the Garden Route Complex World Heritage Site and Nature Reserves.

Threats	Associated Conservation Targets	Summary Threat rating
Invasive alien plants	Brenton Blue Butterfly; Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Cultural Heritage, scenic land- and seascapes.	**Very High**
Indiscriminate fire / Inappropriate fire regime	Brenton Blue Butterfly; Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Cultural Heritage, scenic land- and seascapes.	**High to Very High**
Biological alien organisms	Fynbos Mosaics including indigenous Forests.	**Very High**
Bush encroachment	Brenton Blue Butterfly.	**Very high**
Climate change and extreme weather conditions (droughts, storms and flooding)	Brenton Blue Butterfly; Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Marine Ecosystems; Cultural Heritage, scenic land- and seascapes.	**High**
Over-abstraction of surface water	Fynbos Mosaics including indigenous Forests; Freshwater Ecosystems; Coastal Ecosystems including Estuaries.	**High**
Over-abstraction of ground water	Fynbos Mosaics including indigenous Forests; Freshwater Ecosystems.	**High**
Habitat fragmentation / transformation	Brenton Blue Butterfly; Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Cultural Heritage, scenic land- and seascapes.	**Medium**
Invasive alien fauna (fish)	Freshwater Ecosystems; Coastal Ecosystems including Estuaries.	**Medium**
Invasive alien fauna (terrestrial & marine)	Brenton Blue Butterfly; Fynbos Mosaics including indigenous Forests; Coastal ecosystems including Estuaries; Marine ecosytems.	**Medium**

Threats	Associated Conservation Targets	Summary Threat rating
Illegal and/or unsustainable harvesting of indigenous flora	Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Cultural Heritage, scenic land- and seascapes.	**Medium**
Fishing and harvesting of aquatic resources	Coastal ecosystems including Estuaries; Marine ecosystems.	**Medium**
Hunting and or collection of indigenous fauna	Fynbos Mosaics including indigenous Forests; Cultural Heritage, scenic land- and seascapes.	**Medium**
Transportation and service corridors (shipping routes)	Marine Ecosystems; Cultural Heritage, scenic land- and seascapes.	**Medium**
Energy production (oil and gas drilling, oil exploration and mining)	Marine Ecosystems; Cultural Heritage, scenic land- and seascapes.	**Medium**
Pollution: domestic, industrial, urban wastewater and oil spills	Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Marine Ecosystems; Cultural Heritage, scenic land- and seascapes.	**Medium**
Garbage and solid waste	Coastal Ecosystems including Estuaries; Marine Ecosystems.	**Medium**
Vandalism and theft to Cultural Heritage Sites	Cultural Heritage, scenic land- and seascapes.	**Medium**
Mining and quarrying	Coastal Ecosystems including Estuaries; Cultural Heritage, scenic land- and seascapes.	**Medium**
Instream and riparian structures (dams, bridges, weirs, jetties)	Freshwater Ecosystems; Coastal Ecosystems including Estuaries.	**Low**
Illegal recreational activities	Fynbos Mosaics including indigenous Forests; Coastal Ecosystems including Estuaries; Marine Ecosystems; Cultural Heritage, scenic land- and seascapes.	**Low**
Telecommunication towers/high sites	Fynbos Mosaics including indigenous Forests; Cultural Heritage, scenic land- and seascapes.	**Low**
Tourism developments on-reserve	Freshwater Ecosystems.	**Low**
Human intrusion and disturbance	Fynbos Mosaics including indigenous Forests.	**Low**
Agro-industry plantations	Coastal Ecosystems.	**Low**

5.6 Goals

Clear and measurable outcome-based goals, strategies and objectives are fundamental for the assessment of protected area management effectiveness and to the whole process of management itself. Based on the viability and threats assessment, a desired future condition was established for conservation targets and core service areas by setting measurable, time-bound goals directly linked to the values and their key attributes.

Goals of the Garden Route Complex World Heritage Site and Nature Reserves:

To maintain the healthy ecological infrastructure that supports life on earth and climate change resilience, management needs to achieve the following:

1. By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.

2. By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the Protea indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.

3. By 2033 surveys and monitoring of the Brenton Blue Butterfly within the Brenton Blue Butterfly Special Nature Reserve and other potential habitats have continued to confirm the conservation status of the species and healthy* populations of the food plant (*Indigofera erecta*) are maintained within proclaimed nature reserves. **More than 1000 individuals.*

4. By 2033 the ecosystem health condition of all wetlands in the GRCWHS&NR is near-natural with good wetland buffers and Groenvlei is at least a “C” condition (moderately modified). (Wetlands include seepage areas.)

5. By 2033 river flow of abstracted rivers is maintained above 80%.

6. By 2033 all rivers within the GRCWHS&NR are maintained in a healthy state* to support fish species of conservation concern. *Rivers that support macro-invertebrate species communities represent an ASPT of 6-8 with >50% of expected fish species present in at least two age classes and have a natural flow regime.

7. By 2033 an established groundwater monitoring programme exists to improve the understanding of groundwater dependent ecosystems.

8. By 2033 all rivers within the GRCWHS&NR have been surveyed and the status of all fish CBAs determined.

9. By 2033 there is an improved understanding of the population dynamics of the carp population in Groenvlei Lake and a self-sustaining removal program in place, based on the ecological assessment results and recommendations.

10. By 2033 all domestic livestock, extra-limital and invasive faunal species* are removed or appropriately managed within the GRCWHS&NR. **Invasive faunal species in the MPAs will be managed appropriately and not necessarily removed.*

11. By 2033 biodiversity and ecosystems, and sustainable and regulated resource use are in accordance with applicable legislation, CapeNature policies and procedures.

12. By 2033 the estuarine health index category is maintained or improved for the Goukamma estuary to Category A/B or B and the Keurbooms estuary to Category A/B*. **A = Unmodified, approximates natural condition; B = Near-natural with few modifications.*

13. By 2033 the health* of the intertidal and inshore zones of the Goukamma and Robberg Marine Protected Areas is maintained at the current baseline state (good). **Stable populations of identified indicator species of the Agulhas sandy inshore habitats and stable adult-to-juvenile ratios of African black oystercatchers.*

14. By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. **Goukamma = 71 species; Robberg = 64 species.*

15. By 2033 the Cape fur seal populations at Robberg and Mossel Bay Seal Island are persistent and breeding.

16. By 2033 an integrated compliance and enforcement programme is being implemented.

17. By 2033 the natural and scenic land and seascapes are recognized and preserved as important landscape features providing ecosystem services that support human wellbeing.

18. By 2033 all forestry exit areas and other identified state land have been transferred and secured into the conservation estate and three priority properties will have signed stewardship agreements within priority corridors.

19. By 2033 anti-litter, energy and water saving campaigns within the GRCWHS&NR are contributing towards a healthy environment.

20. By 2033 all human disturbance to heritage features within the GRCWHS&NR is limited to maintain, or where feasible, improve condition.

21. By 2033 any land invasions/occupations or disturbance within the GRCWHS&NR are dealt with swiftly and effectively resolved*. **Within 12-24 hrs; occupants and structures removed within legal timeframes.*

Achieving human well-being, derived from healthy responsibly-managed ecological infrastructure and heritage, requires that:

21. By 2033 access to environmentally responsible infrastructure*, intact ecosystems and optimal biodiversity adding economic value to ecotourism products and socio-economic development is sustainably facilitated and maintained. (**Aligned with the zonation scheme.*)

22. By 2033 the GRCWHS&NR provides managed opportunities for accessing nature and nature-based activities in a manner which is not harmful to the natural environment.

23. By 2033 the coordinated disaster management plan will promote and facilitate security from natural disasters, for example (but not limited to) wildfire, drought and flooding for the benefit of the target communities.

24. By 2033 the GRCWHS&NR will, through integrated catchment management, protect and enhance the provision of water quality and quantity contributing to the water resilience for the Breede-Gouritz catchment management area.

5.7 Sensitivity Analysis

Sensitivity analysis based on the GRCWHS&NR's biodiversity, heritage and physical environment is a key informant for spatial planning and decision-making in protected areas. Sensitivity analysis aims to:

- Highlight areas containing sensitive biodiversity and heritage features;
- Inform all infrastructure development e.g., location of management and tourism buildings and precincts, roads, trails, firebreaks;
- Facilitate holistic reserve planning and zonation; and
- Support conservation management decisions and prioritisation of management actions.

At the regional scale, sensitivity mapping also allows for direct comparison of sites both within and between protected areas to support organisational planning across CapeNature's protected areas network. The process elevates:

- Sites with the highest regional conservation value;
- Areas where human access or disturbance will have a negative impact on biodiversity or heritage, and specific environmental protection is required;
- Areas where physical disturbance or infrastructure development will cause greater environmental impacts, and / or increasing construction and maintenance costs;
- Areas where there is a significant environmental risk to infrastructure; and
- Areas that are visually sensitive and need to be protected to preserve the aesthetic quality of the visitor's experience.

Sensitivity analysis provides decision-support to ensure that the location, nature and required mitigation for access, utilisation and infrastructure development in the protected area are guided by the best possible landscape-level biodiversity and heritage informants. The process is transparent, relying on defensible expert-derived information and scientific data. Sensitivity maps do not replace site-level investigation, although do allow for rapid assessment of known environmental risks, guiding planning to minimise negative impacts.

Sensitivity analysis uses a hierarchical approach. The method uses the premise that if a portion of the landscape is demarcated as highly sensitive in one of the categories considered in analysis then, regardless of the sensitivity in other categories, that portion is elevated as highly sensitive in the overall scoring. The approach thus allocates the highest allocated sensitivity in any of the input categories as the ultimate sensitivity class for that particular portion. As new and improved data become available, these data can be included.

Biodiversity, heritage and physical features are rated on a standard scale of one to five, where one represents ‘no’ or ‘minimal sensitivity’ and five indicates ‘maximum sensitivity’ (see Figure 5.2). Additional features such as visual sensitivity, fire risk and transport costs can be included. Higher scores represent areas that should be avoided for conventional access and infrastructure development, or where a specific strategy is applicable relative to sensitivity. A score of five typically represents areas where mitigation for conventional access or infrastructure development would be extensive, costly or impractical enough to be avoided at all costs or features so sensitive that they represent a ‘no go’ area.

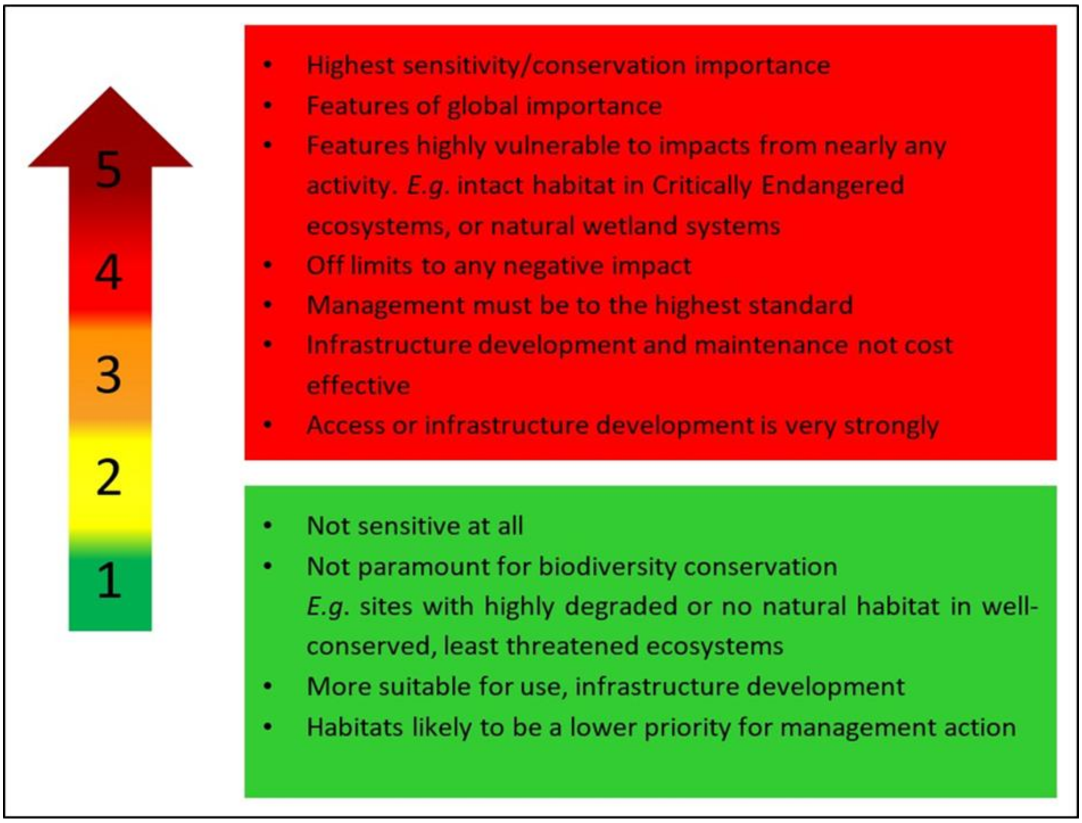

Figure 5.2: CapeNature method for sensitivity scoring and synthesis.

Physical, biodiversity and heritage features included in the sensitivity analysis for the GRCWHS&NR are presented in Table 5.5.

Table 5.5: Physical, biodiversity and heritage sensitivities included in the sensitivity analysis of the Garden Route Complex World Heritage Site and Nature Reserves.

Category		Dataset	Criteria	Sensitivity score	
PHYSICA	**Slope** (degrees) (GR_slope20_classes _tm23.shp)	Slope calculated from 20m resolution digital elevation model	Effectively off-limits for infrastructure development due to extreme risk of erosion and instability, or extreme engineering mitigation and associated construction costs required.	Highest sensitivity > 30°	5

Category		Dataset	Criteria	Sensitivity score	
		(Due to other sensitivity factors in the coastal reserves, it wasn't necessary to do slopes at 5 m.)	Strongly avoid for infrastructure development – cut and fill or other difficult and expensive construction method required. Appropriate engineering mitigation essential to prevent erosion and slope instability. Highest initial and on-going cost due to slope stabilization and erosion management required.	High sensitivity 20°-30°	4
			Avoid for road, trail and firebreak construction if possible. Severe erosion will develop on exposed and unprotected substrates. Pave roads and tracks and ensure adequate drainage and erosion management is implemented. May provide good views.	Moderate sensitivity 10°-20°	3
			Low topographic sensitivity, likely still suitable for built infrastructure. Use of gentle slopes may provide improved views or allow access to higher areas.	Low sensitivity 5°-10°	2
			Preferred areas for any built infrastructure, lowest risk of erosion or instability, lowest construction and on-going maintenance costs.	Lowest sensitivity 0°- 5°	1
	Geology	None included, due to soil erodibility input from Vlok map.	No special features identified for inclusion.	Highest sensitivity	5
	Soil erodibility (GR_veg_vlok_2014_soil_tm23.shp)	Soils and erosion were assessed by Jan Vlok. Vegetation unit statuses based on Reyers & Vlok (2008) and assessment done by Pence (2016).	Marine dunes and drift sands habitat types are the most vulnerable to soil erosion due to limited soil retention capacity, as a result of sparse vegetation cover and root systems. Soils are fine and silty and stones are generally lacking. These habitats include Kleinkrantz Drift Sands and Hartenbos Primary Dune.	Highest sensitivity	5
			Aquatic ecosystems (estuarine, rivers and floodplains, wetlands, dune sand and perennial streams) are highly sensitive to erosion but are adapted to periodic flooding. The systems listed are Wilderness Estuary & Wetlands, River and Floodplain (Gouritsrivier, Olifants, Garden Route, and Groot Brak), Rondevlei Sandplain Fynbos, Sedgefield Sandplain Fynbos and Thicket Fynbos, Moordkuils-, Tsitsikamma-, E-Langeberg-, Keurbooms River- and Outeniqua Perennial Stream.	High sensitivity	4
			Ericaceous, Mesic Proteoid, Waboomveld, Proteoid / Coastal mosaic with grassy fynbos, Coastal mosaic with thicket, Asteraceous mosaic thicket and forest, Subalpine, Arid Mosaic Asbosveld, Proteoid Quartz Grassy Fynbos, and Dune Thicket Mosaic Forest	Moderate sensitivity	3

	Category	Dataset	Criteria	Sensitivity score	
			habitat types are more densely vegetated and/or quite stony to assist with soil retention.		
			Afromontane Forests/Plateau, Coastal Dune Milkwood, Coastal Riverine, Arid Proteoid, Grassy fynbos, Sandolien Mosaic Renosterveld, and Dune Thicket Mosaic Littoral habitat types usually have dense root systems and good vegetation cover to retain soil.	Low sensitivity	2
			Sandolien habitat types generally have a good and dense perennial vegetation cover with well-developed root systems that retain soil.	Lowest sensitivity	1
BIODIVERSITY	**Rivers** (GR_Rivers50_ buff_ tm23.shp)	1: 50 000 NGI Rivers	Within 200 m of perennial river.	Highest sensitivity	5
			Within 100 m of non-perennial river.	High sensitivity	4
	Wetlands & Seeps (GR_NBA2018_Wetlands_plus_buf200m_tm23.shp)	NBA2018 wetlands (Van Deventer et al. 2018). Springs locality at Robberg, provided by reserve management.	Wetlands and seeps, extracted from the NBA 2018, inland aquatic (freshwater) realm. This layer included only natural wetlands.	Highest sensitivity	5
			Within 200 m of wetlands and seeps. Also, 200 m buffer around spring at Robberg.	High sensitivity	4
	Red-Listing Ecosystems (RLE) (Previously referred to as Ecosystems Threat Status) (GR_NBA2018_Terr_Coast_RLE_tm23.shp)	Red-Listing Ecosystems as done for the NBA 2018; Terrestrial & integrated coast layer (SANBI 2006-2018)	**Terrestrial** - CR – NONE **Coastal** – CR - Knysna Sand Fynbos	Highest sensitivity	5
			Terrestrial - EN – Swellendam Silcrete Fynbos **Coastal** – EN - Agulhas Sheltered Rocky Shore, Western Agulhas Bay	High sensitivity	4
			Terrestrial - VU – Garden Route Shale Fynbos **Coastal** – VU - Agulhas Exposed Rocky Shore, Agulhas Inner Shelf Mosaic, Agulhas Island, Agulhas Very Exposed Rocky Shore, Warm Temperate Large Temporarily Closed	Moderate sensitivity	3
			Terrestrial - NT – NONE Coastal – NT – NONE **Marine** – NT – Agulhas Sandy Mid Shelf	Low sensitivity	2
			Terrestrial - LC – Central Coastal Shale Band Vegetation, Montagu Shale Renosterveld, North Outeniqua Sandstone Fynbos, South Outeniqua Sandstone Fynbos, Southern Afrotemperate Forest, Tsitsikamma Sandstone Fynbos, Uniondale Shale Renosterveld Terrestrial - Not assessed – Non-terrestrial (Estuarine Functional Zone) **Coastal** – LC - Agulhas Dissipative Intermediate Sandy Shore, Agulhas Intermediate Sandy Shore, Agulhas	Lowest sensitivity	1

Category		Dataset	Criteria	Sensitivity score	
			Mixed Shore, Cape Seashore Vegetation, Goukamma Dune Thicket, Hartenbos Dune Thicket, Southern Cape Dune Fynbos		
	Rivers (GR_Rivers50_ buff_ tm23.shp)	Protection Levels as done for the NBA2018; Terrestrial & integrated coast layer (SANBI 2006-2018).	**Terrestrial** - Not Protected – NONE **Coastal** – Not Protected – NONE	High sensitivity	4
			Terrestrial - Poorly Protected –Garden Route Shale Fynbos, Montagu Shale Renosterveld, North Outeniqua Sandstone Fynbos, Swellendam Silcrete Fynbos, Uniondale Shale Renosterveld **Coastal** – Poorly Protected - Hartenbos Dune Thicket, Knysna Sand Fynbos, Southern Cape Dune Fynbos, Western Agulhas Bay	Moderate sensitivity	3
			Terrestrial - Moderately Protected – NONE **Coastal** – Moderately Protected - Agulhas Exposed Rocky Shore, Agulhas Inner Shelf Mosaic, Agulhas Intermediate Sandy Shore, Agulhas Mixed Shore, Agulhas Sheltered Rocky Shore, Agulhas Very Exposed Rocky Shore, Warm Temperate Large Temporarily Closed **Marine** – Moderately Protected – Agulhas Sandy Mid Shelf	Low sensitivity	2
			Terrestrial - Well Protected – Central Coastal Shale Band Vegetation, South Outeniqua Sandstone Fynbos, Southern Afrotemperate Forest, Tsitsikamma Sandstone Fynbos **Terrestrial** - Not assessed – Non-terrestrial (Estuarine Functional Zone) **Coastal** – Well Protected - Agulhas Dissipative Intermediate Sandy Shore, Agulhas Island, Cape Seashore Vegetation, Goukamma Dune Thicket	Lowest sensitivity	1
	Fine-scale vegetation unit statuses (GR_veg_vlok_2014_constat_tm23.shp)	Vegetation habitat was assessed by Jan Vlok. Vegetation unit statuses based on Reyers & Vlok (2008) and assessment done by Pence (2016).	CR – Kleinplaat- & Wolwedans Grassy Fynbos, Rondevlei Dune Sandplain Fynbos, Tsitsikamma Perennial Stream, Herold Renoster-Sandolienveld.	Highest sensitivity	5
			EN – Arid Mosaic Asbosveld, Coastal Dune Milkwood and Ekebergia, Grassy and Montane Fynbos Mosaic Afromontane Forest, Uplands Grassy Fynbos, Garden Route River and Floodplain.	High sensitivity	4

Category		Dataset	Criteria	Sensitivity score	
			VU – Coastal Mosaic & Quartz Grassy Fynbos, Montane Mesic Proteoid, Proteoid Mosaic Thicket and Grassy Fynbos, Moordkuils & Outeniqua perennial stream, Dune Thicket mosaic Forest, Sandolien, Gouritsrivier, Olifants & Groot Brak river and floodplain.	Moderate sensitivity	3
			Threatened – None	Low sensitivity	2
			LT – Afromontane mountain & plateau, Arid Proteoid, Drift Sands, Forest thicket asteraceous mosaic, Coastal Mosaic Thicket and Riverine, Dune Sandplain Fynbos and Mosaic Thicket, Dune Thicket Mosaic Littoral, Estuary, Grassy Fynbos, Fynbos Mesic Proteoid, Montane Ericaceous, Montane Mesic Proteoid Perennial stream, Primary Dune, SANDOLIEN mosaic Renosterveld, Subalpine Fynbos, WABOOMVELD, Waboomveld mosaic Forest, Wetlands.	Lowest sensitivity	1
	Grazing / browsing sensitivity (GR_veg_vlok_2014_grazing_tm23.shp)	Grazing / browsing was assessed by Jan Vlok. Vegetation unit statuses based on Reyers & Vlok (2008) and assessment done by Pence (2016).	Rivers and floodplains.	Highest sensitivity	5
			Fouriesberg- and Herold Renoster-Sandolienveld. High sensitivity 4	High sensitivity	4
			Forest-Waboomveld, Waboomveld, Groenvlei Coastal Forest, Herolds Bay Littoral-Thicket, Knysna Enon Fynbos, Rondevlei- and Sedgefield Sandplain Fynbos, Sedgefield Thicket Fynbos, Tsitsikamma Forest Fynbos	Moderate sensitivity	3
			Wilderness Estuary and Wetlands, Fynbos-Forest, Forest-Thicket, Thicket-Fynbos, Grassy Fynbos, Fynbos-Sandolienveld, Perennial Streams, Asbos-Gwarrieveld.	Low sensitivity	2
			Proteoid and Arid Proteoid Fynbos, Drift Sands, Ericaceous, Forest, Mesic Proteoid Fynbos, Subalpine Fynbos, Primary dune.	Lowest sensitivity	1

Category		Dataset	Criteria	Sensitivity score	
	Rare and endangered plant species (GR_allthrspp_CREW_SOB_buf5m_tm23.shp)	Rare and endangered plant spp extracted from CapeNature Biodiversity DB, All threatened Species (SANBI 2017).	All plant species rated as CR, Critically Rare, EN, NT, Rare or VU. Point localities buffered by 5 m.	Highest sensitivity	5
	Special habitat areas (GR_Special_Habitats_tm23.shp)	Areas captured based on input from reserve staff.	Various areas of special habitat for (i) cape fur seals on the Mossel Bay Seal Island which is a food source for Great White sharks, (ii) newly established Cape cormorant colony, and (iii) colony of Pansy Shells (sea urchins), offshore at depths of 4 to 10 m.	Highest sensitivity	5
HERITAGE	**Archaeological & cultural sites** (GR Heritage_ sites_buf100m_tm23.shp)	Cultural and Heritage Sites (CapeNature Infrastructure register).	Heritage sites as extracted from the reserve's infrastructure register. Included also archaeological sites from topo maps 1:50 000 (only one listed). Converted the spreadsheet coordinates to a point layer, and then buffered by 100 m. Also, buffered the historic pass by 100 m.	Highest sensitivity	5

The sensitivity of the GRCWHS&NR is shown in Appendix 2, Maps 12a-f and the proportions of areas captured by each of the main features contributing to the analysis are summarised in Tables 5.6, 5.7 and 5.8.

Outeniqua Cluster. A total of 86.5 % of the Outeniqua Cluster has a high to very high sensitivity (Table 5.6), with the key drivers being slope sensitivity (55.6%) and rivers (58.5%). In this instance therefore, the sensitivity analysis has been dominated by the steep topography of this mostly mountainous terrain and river gorges (Appendix 2, Map 12a). Only 15.5% of area scored as "low or lowest" sensitivity on the basis of slope. In terms of soil erodibility 71.3% of the protected area has a moderate sensitivity.

Although the sensitivities of, for example, the ecosystem threat status and fine-scale vegetation status are very low across the protected area (scored 99.8% and 74.7% respectively as "lowest sensitivity"), due to the methodology the majority of the protected area (86.5%) has been scored as "high to highest sensitivity" largely because of highest sensitivity scorings in the proximity to rivers and the slope categories. Most of the area scored low to lowest for grazing / browsing sensitivity because the habitat types in the mountainous areas occur mostly on nutrient-poor soils and have limited grazing potential.

Table 5.6: Summary of total and percentage area captured by the main features contributing to the sensitivity analysis of the Outeniqua Cluster and illustrated in Appendix 2, Map 12a.

Score	Total sensitivity score		Main features										
	Area (ha) = **47,799.4**	% of total	**Slope sensitivity** % of total	**Soil erodibility (Vlok map)** % of total	**Rivers** % of total	**Wetlands and Seeps** % of total	**Ecosystems threat status per vegetation type** % of total	**Protection levels per vegetation type** % of total	**Fine-scale vegetation status (Vlok map) % of total**	**Grazing / browsing sensitivity (Vlok map) % of total**	**Species of special concern** % of total	**Special habitats** % of total	**Heritage** % of total
Witfontein, Doringrivier, Ruitersbos & Zebraskop sectors													
1		-	5.3	1.0	-	-	99.8	71.8	74.7	63.7	-	-	-
2	30.0	0.1	10.2	12.7	-	-	-	-	-	16.1	-	-	-
3	6,429.0	13.4	28.8	71.3	-	-	0.1	28.2	21.4	14.4	-	-	-
4	22,469.1	47.0	33.3	15.1	40.1	11.7	0.1	-	0.7	4.9	-	-	-
5	18,871.3	39.5	22.3	-	18.4	2.8	-	-	3.2	0.8	0.03	-	0.6

Goukamma Cluster. The sensitivity of Goukamma, Buffalo Valley, Goukamma MPA, Brenton Blue Butterfly and the Mossel Bay Seal Island sectors are summarised in Table 5.7 and spatially illustrated in Appendix 2, Maps 12b&c.

A total of 49.1% of the Goukamma Cluster (including Buffalo Valley, the MPA and Brenton Blue Butterfly sectors) has a moderate sensitivity (Table 5.7), with the key drivers being ecosystem threat status (48.3%) and sensitivity to grazing/browsing (17.5%). The Agulhas Inner Shelf Mosaic within the MPA is classified as VU, and the Wilderness Forest Thicket vegetation unit on Goukamma and Buffalo Valley is listed as VU.

Soil erodibility contributes to 20.8% to the "high sensitivity" of the protected area (Appendix 2, Map 12b,c). Aquatic ecosystems (estuarine, rivers and floodplains, wetlands, dune sand and perennial streams) are highly sensitive to erosion but are adapted to periodic flooding. In terms of the terrestrial vegetation units, Rondevlei Sandplain Fynbos, Sedgefield Sandplain Fynbos and Sedgefield Thicket Fynbos scored high for soil erodibility.

A total of 92% of the protected area falls within the "low or lowest sensitivity" on the basis of slope. This is largely influenced by the MPA where the Agulhas Sandy Mid Shelf has a gentle slope of 5˚-10˚. Goukamma River and Groenvlei Lake respectively contribute 5.4% and 11.2% to the high and very high sensitivity categories.

Brenton Blue Butterfly sector scored "highest sensitivity" because of the CR Knysna Sand Fynbos that occur in the protected area.

Mossel Bay Seal Island has a "highest sensitivity" of 100% because of the presence of special habitat for Cape fur seal.

Keurbooms River Cluster. The sensitivity of the Keurbooms River Cluster is summarised in Table 5.8 and shown in Appendix 2, Maps 12d,e,f.

About 96% of the Keurbooms River and Annex Vlugt sectors is regarded as "moderate to high sensitivity" due to steepness of the slopes (50.8%) and the rivers (83.9%). Only a small proportion (3.9%) of the protected area falls within the low to moderate sensitivity category, based on sensitivity to soil erosion. A total of 54.6% is "moderate" to "highest sensitivity" due to the threat status of fine-scale vegetation types (Uplands Grassy Fynbos - EN; Piesang River Fynbos Forest - VU; Knysna Enon Fynbos - VU, Tsitsikamma Forest Fynbos - EN, Tsitsikamma Perennial Stream - CR).

For Robberg and the MPA, 79.5% of the protected area is classified as "moderate to high sensitivity" based on the EN ecosystem threat status of the Western Agulhas Bay, and the VU status of the Agulhas Inner Shelf Mosaic. In addition, the Agulhas Dissipative Intermediate Sandy Shore ecosystem status is CR. Very steep slopes of more than 30° are limited to the peninsula (3.3%), while the topography of the MPA (93.4%) is between 0°-5°.

Table 5.7: Summary of total and percentage area captured by the main features contributing to the sensitivity analysis for the Goukamma Cluster and illustrated in Appendix 2, Maps 12b&c.

Score	Total sensitivity score		Main features										
	Area (ha) = **894.9**	% of total	**Slope sensitivity** % of total	**Soil erodibility (Vlok map)** % of total	**Rivers** % of total	**Wetlands and Seeps** % of total	**Ecosystems threat status** % of total	**Protection levels per vegetation type** % of total	**Fine-scale vegetation status (Vlok map)** % of total	**Grazing / browsing sensitivity (Vlok map)** % of total	**Species of special concern** % of total	**Special habitats** % of total	**Heritage** % of total
Goukamma, Buffalo Valley, Goukamma MPA & Brenton Blue Butterfly sectors													
1	189.6	2.3	85.2	-	-	-	37.6	32.1	22.4	3.3	-	-	-
2	1,548.6	18.7	6.8	2.3	-	-	14.1	67.7	-	10.9	-	-	-
3	4,068.6	49.1	5.6	5.7	-	-	48.3	0.2	6.1	17.5	-	-	-
4	1,531.7	18.5	2.2	20.8	3.3	4.6	-	-	2.2	-	-	-	-
5	948.1	11.4	0.2	3.3	2.1	6.6	0.0	-	1.3	0.4	0.02	-	0.4
Mossel Bay Seal Island sector													
1		-	100.0	-	-	-	-	100.0	-	-	-	-	-
2		-	-	-	-	-	-	-	-	-	-	-	-
3		-	-	-	-	-	100.0	-	-	-	-	-	-
4		-	-	-	-	-	-	-	-	-	-	-	-
5	0.5	100.0	-	-	-	-	-	-	-	-	-	100.0	-

Table 5.8: Summary of total and percentage area captured by the main features contributing to the sensitivity analysis for the Keurbooms River Cluster and illustrated in Appendix 2, Maps 12d,e,f.

Score	Total sensitivity score		Main features										
	Area (ha) = **894.9**	% of total	**Slope sensitivity** % of total	**Soil erodibility (Vlok map)** % of total	**Rivers** % of total	**Wetlands and Seeps** % of total	**Ecosystems threat status** % of total	**Protection levels per vegetation type** % of total	**Fine-scale vegetation status (Vlok map)** % of total	**Grazing / browsing sensitivity (Vlok map)** % of total	**Species of special concern** % of total	**Special habitats** % of total	**Heritage** % of total
Keurbooms River & Annex Vlugt sectors													
1		-	17.8	-	-	-	98.5	98.5	44.4	17.8	-	-	-
2	5.7	0.6	11.8	45.8	-	-	-	-	-	64.4	-	-	-
3	29.1	3.3	19.6	35.8	-	-	1.5	1.5	24.2	7.9	-	-	-
4	374.8	41.9	24.3	18.4	47.8	27.5	-	-	28.1	-	-	-	-
5	485.3	54.2	26.5	-	36.1	8.0	-	-	3.3	9.9	0.03	-	-
Robberg and Robberg MPA sectors													
1	15.4	0.5	93.4	-	-	-	9.1	7.7	6.2	1.0	-	-	-
2	387.0	13.8	1.1	2.4	-	-	12.7	46.7	-	3.0	-	-	-
3	936.2	33.3	2.2	3.3	-	-	31.7	45.6	0.3	2.4	-	-	-
4	1,296.8	46.2	1.9	-	-	0.3	46.5	-	-	-	-	-	-
5	173.1	6.2	1.4	0.7	-	-	-	-	-	-	0.01	3.6	0.9

6 ZONING PLAN

This section outlines the zoning plan for the GRCWHS&NR. The protected area forms part of a planning matrix and locating the GRCWHS&NR in terms of the municipal integrated development plan is aimed at minimising conflicting development in either the protected area or the neighbouring municipal area.

The primary objective of the zoning plan is to establish a coherent spatial framework within and around the GRCWHS&NR to guide and co-ordinate conservation, tourism and visitor experience, access and utilisation, and stakeholder and neighbour relations.

Zoning is intended to minimise user conflict by separating potentially conflicting activities such as wildlife viewing, recreational activities and tourism accommodation, whilst ensuring that activities and utilisation continues in appropriate areas and do not conflict with the goals and objectives of the protected area.

6.1 The Garden Route Complex World Heritage Site and Nature Reserves in the context of Municipal Integrated Development Planning

The GRCWHS&NR is located within the GRDM. The protected area stretches over five of the seven different local municipalities within the GRDM, namely Bitou, Knysna, George, Mossel Bay and Oudtshoorn.

A Spatial Development Framework (SDF) is compiled by a municipality to satisfy legislative requirements and to illustrate current and desired future land uses spatially across the region. The SDF outlines policies and guidelines to be followed by the municipality in terms of decision-making. It also links into the Integrated Development Plan (IDP) in terms being a spatial representation of the municipal budget. IDPs are compiled for a five-year period and revised annually, by all municipalities in South Africa and municipal SDFs are revised on a five-year cycle. SDFs need to consider a wide range of informants and budget for implementation of SDF projects needs to be allocated through municipal IDPs.

There are thus six different IDPs and SDFs within which the GRCWHS&NR is located. The content of these plans needs to be considered in terms of alignment between statutory initiatives, management of the protected areas and identification of risks and interventions required. These informants are also used in determining the zone of influence and determining potential threats and opportunities to the various protected areas. There is also the opportunity to identify projects and interventions that need to be included in the IDPs and SDFs where appropriate and within the legislated stakeholder engagement processes these are listed in Table 6.1.

Table 6.1: List of various municipalities within which GRCWHS&NR is located, aspect in IDP proposed for rectification, as well as proposed intervention with CapeNature.

Municipality	Aspect in IDP to be addressed	Proposed Intervention
Garden Route District Municipality	Proactive Environmental Education programme and invasive alien clearing programme required. Various fire	Integrate with CapeNature operations.

Municipality	Aspect in IDP to be addressed	Proposed Intervention
	management interventions and improved partner collaboration.	
Bitou Local Municipality	Proactive Environmental Education programme required and invasive alien clearing programme. Expansion of urban settlements need to ensure protection of sensitive ecosystems.	Integrate with CapeNature operations and the WCBSP.
Knysna Local Municipality	Proactive Environmental Education programme and invasive alien clearing programme required.	Integrate with CapeNature operations and assist with identifying priority areas for clearing.
George IDP	Invasive alien clearing programme needed. Housing projects must remain outside watercourses and their buffers/flood line and sensitive ecosystems.	Integrate with CapeNature operations and the WCBSP.
Mossel Bay IDP	Densification plans need to remain outside sensitive areas.	Integrate with CapeNature operations risk assessments must be conducted for all proposed expansion and alignment of developments to the WCBSP.
Oudtshoorn Local Municipality	Proactive Environmental Education programme and invasive alien clearing programme required, declaration of sensitive stewardship sites needs to proceed.	Integrate with CapeNature operations.

6.1.1 Garden Route District Municipality Spatial Development Framework (2017-2022) and Integrated Development Plan

In 2018 the Eden District Municipality changed its name to the Garden Route District Municipality and for the purposes of this plan will be referred to as the GRDM. The Eden (now GRDM) SDF was compiled in 2017 (Eden District Municipality 2017) and used the Western Cape Biodiversity Spatial Plan (Pool-Stanvliet et al. 2017) as one of its key informants for development planning and delineation of core spatial planning categories. The SDF acknowledges formal protected areas, stewardship sites, Forest Nature Reserves, CBAs and Ecological Support Areas (ESAs) as being important for the protection of biodiversity and ecosystem services.

The SDF used a process of policy foundation to guide its vision and completion through four district strategies. Given the sensitive ecosystems of the district the primary strategy regarding the environment was: “The economy is the environment; a strategy founded on the principle that a sustainable economy relies on a healthy environment in the Garden Route”. The SDF also identifies climate shifts and erosion of biodiversity as a trend and dynamic that needs to be addressed. The plan focuses on how climate change has increased the frequency and significance of disasters, and how ecosystem degradation has the most significant impacts on rural poor communities. These trends have had a significant negative economic impact on the districts fiscus.

Improving access to water and ensuring the district is a leader regarding climate change adaption strategies were highlighted within the SDF as key policy decisions. The district acknowledged that the costs of climate change related disasters will increase and therefore climate change responses need to be incorporated into planning processes to limit such expenses. To address challenges related to the lateral spread of settlements resulting in biodiversity loss, densification of settlements is required. Other threats to biodiversity highlighted in the plan include pollution and the spread of alien vegetation.

Alien vegetation spread is a threat that needs to be mitigated to reduce fire risk, improve disaster management and water availability. The SDF outlines how the municipality needed to expand on its alien invasive species management plans. However, no projects were outlined in the IDP to address the threat of alien invasive species.

The level of alien invasive species infestation throughout the GRDM elevates the regions fire risk significantly as can be seen from the large 2018 George and 2017 Knysna fires. The SDF proposed that areas of high veld fire risk and asset protection zones needed to be identified and incorporated into municipal planning. The district also planned to advocate for eco-estates to ensure ecological fire regimes are implemented at the correct intervals and to encourage landowners to join the SCFPA. Vacant properties which have a high fire risk, need to be identified and measures put in place to enhance management and mitigate against the fire risk posed by these properties. In general, the district IDP provides some resources to accommodate the fire programme, however proactive education programmes are needed to reduce the risk and funds are required to implement alien invasive plant removal operations throughout the district.

6.1.2 Bitou Local Municipality Spatial Development Framework (2021–2026) and Integrated Development Plan

The entire Keurbooms River Cluster including the Annex Vlugt, Keurbooms River, Robberg and Robberg MPA sectors fall within the Bitou Local Municipality (BLM). The BLM SDF was compiled in 2021 (Bitou Municipality 2021) and used much of the GRDM SDF and WCBSP (2017) as key informants. In line with other SDFs for the district, the BLM adopted and recommended the application of the Western Cape Provincial Guidelines (2019), but there were subtle differences between the associated Spatial Planning Categories (SPC) and the recommended categories of the WCBSP (2017). BLM SDF has included formal nature reserves, private nature reserves, forest nature reserves and CBA category 1 under the Core 1 Spatial Planning Categories. Detailed development guidelines have been provided for these areas, with no further loss of these areas were considered. Core 2 areas consisted of CBA 2 and ESA 1 areas, as prescribed by the WCBSP (2017). The subtle difference is for Buffer 1 areas, which consist of ESA 2 and Other Natural Area (ONA), which differs from the WCBSP (only having Buffer 1 areas consist of ONA). Buffer 2 area consists of the non-WCBSP categories of ONA natural and ONA degraded. The BLM does align agriculture and settlements with No Natural Remaining categories, within the rural landscape setting, however within the proposed urban edge, there unfortunately appears to be a direct conflict in terms of proposed SDF planning categories and the WCBSP (2017).

Given the locations of the Garden Route National Park, and the CapeNature-managed Keurbooms River Cluster, BLM SDF does however recommend seven different conceptual ecological corridors, linking these with other protected areas, listed in the SDF. According to the WCPAES (CapeNature 2021), one of CapeNature's areas of expansion is the Robberg Coastal Corridor Protected Environment, which coincidently is also one of the BLM conceptual ecological corridors highlighted in the SDF. Additional corridors which are proposed to link up with CapeNature protected areas include the Robberg Vlei corridor, and the Piesang Valley corridor near Robberg. For the Keurbooms River the Bitou Wetland and Upper Keurbooms conceptual ecological corridors are proposed. In order to protect such corridors, the BLM proposed a Fiscal Benefits Project, which would provide benefits through tax incentives for landowners declaring protected areas within these conceptual corridors. BLM will also allow such rural landowners a limited degree of development rights (to finance conservation efforts) through consent use applications depending on the size of the property. Lastly an estimated cost of the registration of Lookout Local Authority Nature Reserve (a Bitou Stewardship site) is listed on the IDP, but budget and cost of the project are yet to be determined.

Fires, flood lines and development along the coastline all have guidelines defined in the BLM SDF. These informants will all need to be considered prior to approving development applications and where flood lines have yet to be determined, development setback lines are defined. BLM will encourage landowners to join the SCFPA and will aim to track down landowners of vacant properties that are a fire risk. Alien vegetation management mechanisms are highlighted as threats to biodiversity, exacerbating fires, flood risks and directly impacting the municipality's water supply. The BLM will seek to implement NEM:BA guidelines, and the need for a BLM Alien Invasive Management Plan is highlighted in the SDF and an approximate budget is supplied for the compilation of such plans in the IDP (Bitou Municipality 2022).

The BLM SDF aims to promote a use-controlled environment or precision farming to minimise the impact of farming practises on the natural environment and limited water resources. Finally, the SDF also seeks for the BLM to partner with agencies such as CapeNature, SANParks and the Natures Valley Trust to intensify environmental education initiatives.

Large conceptual projects considered in the SDF include the N2 bypass road around the town of Bitou and the formalisation of several of the informal settlements surrounding the various towns in the BLM. The largest proposed township establishments will be Green Valley, New Horizons, Ebenezer and Kwanokhutula, as well as the Kurland township formalisation near the Crags. Many of these are green field developments and will conflict with WCBSP proposed land use and therefore may require the implementation of biodiversity offsets in terms of the Environmental Impact Assessment processes.

6.1.3 Knysna Local Municipality Spatial Development Framework (2020-2025) and Integrated Development Plan

Most of the Goukamma Cluster falls within the extent of the Knysna Local Municipality (KLM). During 2017 a large fire burnt several residences and much of the municipal area, including the majority of the Goukamma WHS and the entire BBBSNR. This natural disaster contributed to a policy establishment in the KLM SDF (Knysna Municipality 2020), that aims to mitigate the risk of environmental disasters through only permitting appropriate land use, especially along the coastline and areas that would minimise wildfire risk and impact. In addition, the policy seeks to drive rehabilitation of sensitive habitats, as well as aquatic resources and protection of the functionality of protected areas, which will indirectly also maintain the viewsheds and scenic landscape of the KLM. Several guidelines in the SDF are linked to this policy and require funding from the municipal IDP (Knysna Municipality 2017).

The KLM SDF used the WCBSP (2017) and Western Cape Provincial Guidelines (2019) key informants when it was recently completed in 2020. The fundamental difference between the KLM and BLM SDFs are that the KLM urban edge was delineated much closer to the edges of town and therefore there was less conflict between the KLM SPCs and the WCBSP (2017) recommended SPCs. Less detail was supplied compared to other SDFs, but Core, Buffer and Transitional areas were defined and aligned with WCBSP.

KLM SDF did propose the development of a Municipal Open Space Network (yet to be implemented in the IDP). This network was labelled the Central Park proposal. The park is proposed to be located along the eastern slopes of the Knysna River valley above the town suburbs of Knysna. The aim of the Central Park proposal is to promote the non-motorised transport network and reduce habitat fragmentation, while including active and passive recreational spaces. In addition to the Central Park proposal, KLM seeks to actively support the expansion of the Garden Route National Park and CapeNature’s stewardship programme.

In general, the KLM SDF has a strong environmentally driven focus, with several guidelines linked to its environmentally friendly policies. The IDP also states how the KLM needs to draft an Invasive Plant Control Plan (approved by authorities) and conduct initial alien clearing on several municipal properties throughout the KLM. KLM currently provides herbicide assistance to private landowners and skills training.

A significant challenge for the KLM is the volume of pollution that enters the Knysna Estuary through either solid waste or sewage. In response to this the KLM has hired approximately 40 people to clear solid waste from the Knysna River estuary and SANParks are championing the estuary pollution management committee with KLM and GRDM. National grant funding has also been made available to upgrade the wastewater treatment works. The funding will also seek to increase community access to basic ablution facilities, increase frequency of cleaning out of pollution conduits, implement a bacteria warning system in the estuary, increase rates of water quality sampling and number of sampling points, as well as providing a more reliable refuse collection system and increasing the cleaning rates of otherwise inaccessible areas, which inevitably drain into the estuary. There are several challenges in the KLM such the wastewater treatment works and pollution challenges and the need to increase the extent of proactive environmental education, as well as the KLM stewardship programme, however, the KLM SDF and IDP aims to address many of these. To conclude the KLM SDF and IDP have a significant environmentally driven focus, which if implemented correctly, will benefit CapeNature managed areas within the KLM.

6.1.4 George Local Municipality Spatial Development Framework (2019-2024) and Integrated Development Plan

Much of the Outeniqua Cluster extent (majority of the Doringrivier and entire Witfontein sectors), is within the George Local Municipality (GLM). The GLM SDF (George Municipality 2019) included the WCBSP (Pool-Stanvliet et.al. 2017) as a key informant in their planning and decision-making. The GLM SDF aligned the WCBSP categories with their spatial planning category.

Water resources are prioritised and the GLM retains the freshwater habitat which is under threat from urbanisation. The GLM SDF promotes "a respectful relationship between people and the natural systems on which they depend". This is achieved by protecting all watercourses so that they remain natural and restricting development around rivers and wetlands. The Garden Route dam is an important water source and buffer area for water provision. Raising of the spillway is listed as a priority water project in the GLM SDF and was completed in 2020.

The GLM SDF includes policies that prioritise protection of natural resources and ecosystem functioning. Furthermore, Biodiversity Stewardship is proposed as a mechanism to consolidate areas (such as remnant CBAs and formally protected areas) and to keep ecological corridors functional and intact. The GLM SDF supports CapeNature's Protected Areas Expansion and Biodiversity Stewardship Programme. The stewardship programme is promoted to secure conservation worthy land, subject to ground-truthing. By consolidating threatened ecosystems (both terrestrial and aquatic) and landscape connectivity, the GLM SDF ensures incompatible developments are not proposed around these natural and protected areas.

GLM understands the impacts of climate change and has an objective to buffer the impact to strengthen the growth and resilience of George. Furthermore, the GLM SDF includes policies to mitigate the impacts of climate change. These adaptation measures are aimed at protecting river corridors, integrated coastal management, and veld fire management.

Alien clearing is recognised as a challenge and the GLM SDF promotes the eradication of alien vegetation programmes, but a budget has not been allocated to prioritise the eradication of invasive alien species.

The Disaster Management Policy Framework is an important Sector Plan for GLM, and fire, which is the greatest risk, is a main priority. The GLM SDF acknowledges fire as an important ecological process and provides policies that include mitigation for veldfire risk and areas in fire prone zones. Some of this mitigation includes encouraging landowners in fire prone areas to join the SCFPA and ecological burns are encouraged as conditions for Eco-estates to maintain the fire regime at the correct intervals.

The IDP captures the vision of GLM as 'a city for a sustainable future' of which 5 strategic goals were identified (George Municipality 2022). Strategic Goal 2 is relevant to the GLM SDF, as it focuses on safe, clean, and green which ensures the natural environment is not negatively impacted. This goal also focuses on developing a greener city.

The IDP acknowledges the protection and management of biodiversity. This protection must be through a green network which aligns with both regional and national biodiversity corridors, link watercourses (i.e., rivers and wetlands), CBAs and other remaining green areas, and provide economic opportunities associated with tourism, responsible harvesting, and recreation.

Water has a vital role in the continuing existence and health of ecosystems and the IDP prioritises the protection of water resources and water catchment areas. This can be achieved by removing invasive alien species. The IDP promotes the eradication, monitoring and control of invasive alien vegetation and recommends assistance be obtained from CapeNature or Working for Water.

The IDP mentioned drought, fire (wildfires), alien invasive species, severe storms, floods, road incidents, and civil unrest amongst the top vulnerabilities. Several plans are included to mitigate these impacts and to prepare for natural disasters.

In terms of projects the GLM has several wastewater and priority water projects and priority public sector projects associated with the Depts of Human Settlement Development, and of Education and Health. In addition, stormwater upgrade and road maintenance projects are also included.

6.1.5 Mossel Bay Local Municipality Spatial Development Framework (2018-2023) and Integrated Development Plan

Mossel Bay Seal Island (part of the Goukamma Cluster), as well as the Ruitersbos Sector (part of the Outeniqua Cluster), fall within the extent of Mossel Bay Local Municipality (MBLM). The MBLM SDF (Mossel Bay Municipality 2022a) explored integrating their SDF to an Environmental Management Framework (EMF). The MBLM SDF has incorporated the WCBSP (Pool-Stanvliet et.al. 2017) and aligned this with the EMF and allocated the appropriate spatial planning categories. Broad land use guidelines for Core 1b (i.e., CBA) Environmental Management Zones allows for restricted tourism development.

MBLM aims at conserving all the rivers, wetlands, estuaries, natural vegetation, scenic landscapes, and agricultural resources. This is done to support rural tourism and agricultural economic growth and employment. By conserving the natural resources, the MBLM achieves its spatial vision, which is to create a long-term, sustainable land use pattern.

The main components of the MBLM SDF comprises of providing agricultural tourism opportunities and ecosystem services in the form of pristine catchment areas that provides quality water and conserving biodiversity.

MBLM is focused on conserving their rivers, all watercourses and ecological corridors and promotes restricted urban development along the coastal strip with the main urban expansion at Aalwyndal. The SDF restricts development and agricultural activity near watercourses or up to the 1:100-year flood line.

MBLM has a densification plan which poses a challenge to environmental factors such as biodiversity, water quality and quantity of river systems, public open space requirements and areas for economic activity. The MBLM SDF explores the option of wind farms and states various aspects such as slope, rocky areas, geology and soils, watercourses (surface hydrology and groundwater), and vegetation must be investigated. Furthermore, solar energy generation for household, rainwater harvesting, and sanitation systems based on the sustainable principles are promoted.

The MBLM SDF emphasises the rehabilitation of mined areas as these areas, once rehabilitated post-mining, can be used as conservation areas or for eco-tourism, agricultural, or urban development.

The municipality has several environmental programmes such as Environmental Education and Awareness and the construction of perimeter fencing at the Diosma Reserve. These projects will be expanded under the Expanded Public Works Programme.

The IDP (Mossel Bay Municipality 2022b) indicated an invasive alien clearing plan was developed and it is unclear whether this plan is implemented by MBLM. Ecological informants are included, however the MBLM must standardise their approach to incorporating these spatial layers in their planning documents both within and outside of urban areas.

6.1.5 Oudtshoorn Local Municipality Spatial Development Framework (2020–2025) and Integrated Development Plan

Several sections of the Outeniqua Cluster fall within the extent of the Oudtshoorn Local Municipality (OLM). These sectors include Doringrivier, Ruitersbos and Zebraskop. The OLM SDF (Oudtshoorn Municipality 2020) recognises these CapeNature protected areas, as well as other officially recognised protected areas such as Private Nature Reserves, private Mountain Catchment Areas, stewardship sites and conservancies. Several game reserves are however also delineated as protected areas in the OLM SDF. CR, EN and VU habitats are defined in the OLM SDF as requiring protection, and priority corridors were identified adjacent to the greater Oudtshoorn area. The establishment of a proclaimed nature reserve stewardship site outside of De Rust is listed as a project and mentioned in the IDP, however no budget was placed in the current IDP to pursue the project (Oudtshoorn Municipality 2021).

The OLM correctly assigned SPC to the CBA and ESA areas as per the WCBSP (2017) which is aligned with the WCPG (2019), however unfortunately the extent of the Oudtshoorn, De Rust and Dysseldorp urban edges are significantly larger in size than other Garden Route municipalities have delineated. This could lead to the possible loss of sensitive habitat, should development proceed within the entire extent of those urban edges.

OLM SDF defined protecting and enhancing the natural systems as a strategy of their spatial concept. Agriculture is a primary economic driver for the OLM which over the years, has often led to environmental degradation of the rural parts of the OLM. Within the SDF, it is stated that development of agricultural land is required to take cognisance of environmental considerations to ensure growth is sustainable. Water resilient methods are encouraged along with the use of drought resistant crops and farming techniques that do not undermine the ecological integrity of the ecosystems. This is particularly important to protect the riparian habitats that have been historically targeted due to their alluvium soils and proximity to water. The OLM SDF also seeks to further ground truth and delineate 1:100-year flood lines and limit any new development on steep slopes greater than 1:4. Where flood lines have not yet been delineated, guidelines to keep development outside of prescribed buffers are provided. This is of particular importance in the Klein Karoo where flash flooding events are prevalent. The monitoring of groundwater resources is stated as a requirement to ensure sustainable use, and developing water and sanitation infrastructure that recycle water, as well as promoting household and farm-scale rainwater harvesting is listed as guidelines to promote water resilience.

Alien invasive species are listed as threats to biodiversity and noted as contributing to increasing fire risks and decreasing water availability. The OLM SDF aims to initiate and support alien vegetation eradication programmes, especially in urban and river catchment or fire management areas, while encouraging private landowners to do the same. Budget allocations have been set aside for technical services for the Blossoms groundwater project and to the EPWP allocated to CapeNature for alien vegetation management and protected area management infrastructure to benefit community members from various municipal wards.

6.2 Protected Area Zonation

The primary function of the GRCWHS&NR is to conserve biodiversity. However, other functions such as ensuring access and providing benefits to neighbouring communities and local economies may conflict with this primary function.

The zonation plan is thus a standard framework and set of formal guidelines to balance conservation, access and utilisation within the protected area, and is informed by sensitivity analysis.

Zonation:

- Is foundational to planning and development within the GRCWHS&NR;
- Provides a framework for development of the GRCWHS&NR;
- Recognises the purpose for which the GRCWHS&NR is established;
- Ensures ecosystem resilience by limiting human intrusion in the landscape;
- Mitigates user conflict and minimises the impact of utilisation on natural and cultural heritage through access and activity management;
- Accommodates a range of activities ensuring that nature-based recreation and experiences for solitude do not conflict with social and environmental requirements or needs; and
- Confines development within the GRCWHS&NR to areas deemed appropriate to tolerate transformation without detracting from sense of place.

CapeNature's zonation categories, illustrated in Table 6.2, are derived from existing protected area zonation schemes worldwide, to develop a coherent scheme that provides for visitor experiences, access and conservation management needs.

Table 6.2: Guide to CapeNature conservation management zones.

Zonation Category	Explanation
Wilderness / Wilderness (declared)	Areas with pristine landscape, sensitive areas or threatened ecosystems. Very limited access.
Primitive	Areas providing natural landscape, solitude and limited access. Normally a buffer area to wilderness zones.

Zonation Category	Explanation
Nature Access	Providing easy access to natural landscape. Includes areas with roads and trails, and access to popular viewing sites and other sites of interest.
Development – Low intensity	Area with existing degraded footprint. Providing primarily self-catering accommodation and camping, environmental education facilities.
Development – High intensity	Area extensively degraded. Providing low and/or higher density accommodation, and maybe some conveniences such as shops and restaurants.
Development – Management	Location of infrastructure and facilities for reserve administration and management.
Development – Production	Commercial or subsistence farming (applicable to privately owned and managed nature reserves).
Development – Private Areas	Private dwellings and surrounds (only applicable to privately owned and managed nature reserve).
Species / Habitat / Cultural Protection	Areas for protection of species or habitats of special conservation concern.
Cultural Species / Habitat Visual Natural Resource Access	Special management overlays for areas requiring specific management interventions within the Species / Habitat / Cultural Protection Zone.

The following underlying decision-making rules are applied in determining zones:

1. Strike a balance between environmental protection and development of the GRCWHS&NR to meet broader economic and social objectives of the protected area.
2. Consider existing development footprints and tourism access routes based on:
   - The principle that all else being equal, an existing transformed site is preferable to a green fields site from a biodiversity perspective;
   - Increasing costs the further developments are from existing infrastructure;
   - The socio-economic benefit of existing tourism nodes and access routes; and
   - Infrastructure design and services with due consideration of conservation targets.
3. Where existing development nodes, tourist sites and access routes occur in areas with high sensitivity-value, associated zonation must aim to confine the development footprint as much as possible and preferably within the existing transformed site.

4. Sites with high biodiversity sensitivity value are put into stronger protection zones and peripheral development is favoured.

A summary of the zonation scheme applicable to the GRCWHS&NR is depicted in Table 6.3 and illustrated in Appendix 2, Maps 13a-f.

Table 6.3: Summary of CapeNature zonation categories applicable to the Garden Route Complex World Heritage Site and Nature Reserves.

Zonation Category	Explanation
Wilderness	The entire Doringrivier sector (as designated) except for the road zoned as Development Management and the eastern part of the Witfontein sector (including Tierkloof to Geloofskop). There is limited access to these entirely natural areas providing opportunities for solitude. None of the other sectors qualify for Wilderness zonation due to their small sizes.
Primitive	All the protected areas (including Mossel Bay Seal Island) in the GRCWHS&NR were zoned primitive except for the areas zoned for wilderness (part of Witfontein and Doringrivier), species habitat (Brenton Blue Butterfly sector), development areas (both low intensity and management) and nature access.
Nature Access	For all the protected areas within the GRCWHS&NR the following public roads with unrestricted access were buffered by 25 m and zoned as nature access, except for areas zoned as development; • N2 National Road running past Groenvlei; • Road cutting through the Goukamma sector leading to Buffalo Bay; • N2 National Road crossing the river at the Keurbooms River sector; • Prince Alfred's Pass traversing Annex Vlugt;. • Outeniqua Pass between George and Oudtshoorn and Robinson Pass between Mossel Bay and Oudtshoorn traversing the Outeniqua Cluster. **Outeniqua Cluster:** • Railway line across the Witfontein sector, buffered by 10 m. No servitude information provided with SG data. • All jeep tracks crossing the Ruitersbos (Attaquaskloof), Zebraskop, and Witfontein sectors were buffered by 10m. The following areas were digitized: **Goukamma Cluster:** • Goukamma river estuary that cuts through the sector; • Entire Groenvlei Lake; • Area next to the road running past Groenvlei that appears to be open to public; • Roads leading to Groenvlei and jetties;

Zonation Category	Explanation
	• Road that is proposed as the "new" entrance to the Goukamma sector, running from the tar road, through Buffalo Valley to the existing tourism facilities (2.5m buffer). **Keurbooms River Cluster:** • Keurbooms River estuary (open water) from main road to Whiskey Creek 5km upstream; • On Robberg all trails are buffered by 2.5 m as well as the path to the lighthouse and surround. Fishing sites accessed from paths off the main trail.
Development – Low intensity	The following areas were digitized: **Goukamma Cluster:** • Various chalets and picnic area at Goukamma station; • Reservoir; • Proposed overnight 12-bunk hiking hut near Oysterbeds; • Existing three chalets for tourism at Buffalo Valley; • At Groenvlei the small existing and future developments of chalets. **Keurbooms River Cluster:** • Day visitors picnic areas; • Boat launching facility; • Proposed campsite; • Proposed self-catering accommodation; and • Possible restaurant and/or conference venue; • Robberg parking area; • Robberg ablution facility; • Robberg information centre; • Robberg road leading to parking area; • Robberg gate house.
Development – Management	The following areas were digitized: **Outeniqua Cluster:** • Doringrivier – management road from east to donga, including a small section running north across boundary in far west of reserve, buffered by 2.5 m; • Witfontein exit area – office and staff housing complex (forestry exit land). Various telecommunication towers and tracks leading to them, buffered by 2.5 m. Track leading to Tierkop hut (buffered 2.5 m); • Ruitersbos – office complex and access road (forestry exit land), telecommunication tower, reservoir and tracks leading to these, buffered by 2.5 m. **Goukamma Cluster:** • Office complex and staff housing; • Proposed track leading to private property on the east;

Zonation Category	Explanation
	• Servitude access 2.5 m buffer; • Buffalo Valley - staff housing near national road along northern border (Weltevrede near vlei); • Road (buffered by 2.5 m) leading to staff housing on west side of vlei (Weltevrede north); • Groenvlei - staff housing. **Keurbooms River Cluster:** • Stores and boat house.
Species / Habitat / Cultural Protection	Brenton Blue Butterfly sector harbours a special habitat area for the CR Brenton Blue Butterfly.
MPA – Restricted zone	Goukamma Marine Protected Area: • Extent of MPA outside 100m buffer from high water mark. • Goukamma river upstream from reserve falling within MPA. Robberg Marine Protected Area: • Extent of MPA from high water mark.
MPA – Controlled zone	Goukamma MPA: 100m buffer from high water mark.

6.3 Protected Area Zone of Influence

CapeNature seeks to maximise positive influences and / or minimise direct and indirect negative pressures on values, with the aim of ensuring the persistence of species and biodiversity in general. Activities managed include those that might have direct impacts on values, and those that have only indirect effects, often at considerable distance from the location where the activity takes place.

The zone of influence is a mechanism that recognises and activates the abovementioned principle. Three key informants (Figure 6.1) used to delineate the zone include:

- Viability of conservation targets;
- Threats assessment; and
- Protected area sensitivity and zonation.

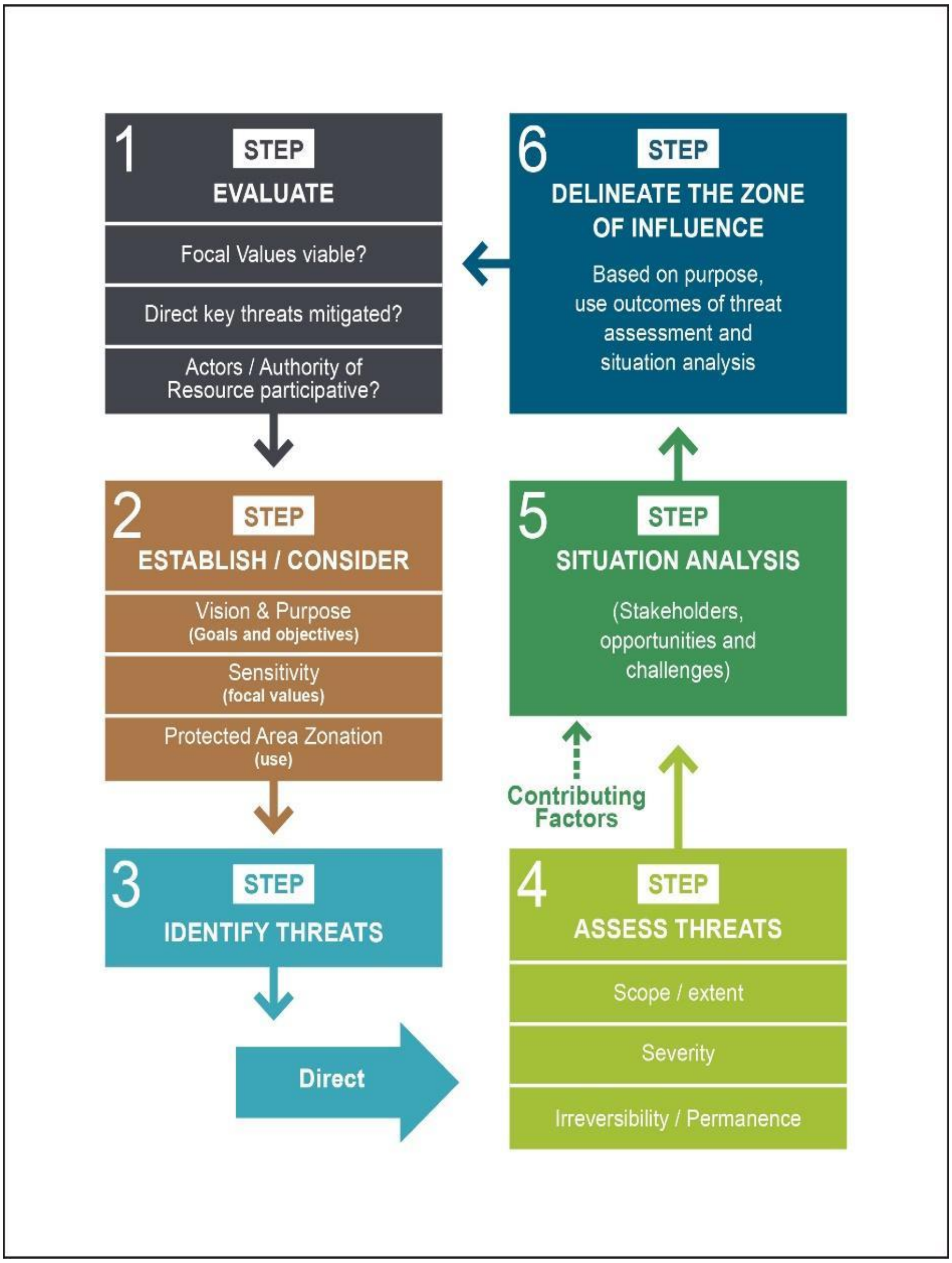

Figure 6.1: Process flow for the delineation of the zone of influence.

The zone of influence is a non-legislated area spatially depicted around the GRCWHS&NR. The zone ultimately aims to facilitate strategic stakeholder engagement by linking key stakeholders to prioritised influences to promote an ecologically functional landscape that supports goals and objectives of the protected area, and enhances the benefits derived from the GRCWHS&NR. The process of delineation helps to identify:

1) Actions to directly restore a value or mitigate a threat;
2) Actions designed for people to continue positive behaviours or halt direct threats; and/or
3) Actions to address enabling conditions.

The zone of influence is thus:

- A tool to guide resource allocation and investment outside of the GRCWHS&NR;
- A tool to marry stakeholder engagement / authorities of resource to activities;
- A spatial prioritisation of where to support compatible land and water use, and positive behaviours;
- A spatial prioritisation of where to collaborate and with whom;
- A mechanism to prioritise support to landowners or managers of priority landscapes; and
- All-encompassing mechanism that includes all or part of a buffer zone as prescribed in terms of legislative frameworks and conventions.

The spatial features used in the zone of influence calculation are rated on a standard scale of one to four: Low (1), Medium (2), High (3), and Very high (4). These ratings are assigned to each input feature within the zone of influence. Higher scores represent areas where many features overlap, elevating the necessity to engage stakeholders and positively influence neighbour relations and / or activities.

Table 6.4 lists the features, criteria and rating applied to delineate the zone of influence of the GRCWHS&NR. Appendix 2, Maps 14a-f illustrate the zone of influence for the GRCWHS&NR.

The PSHB beetle invasion in parts of the Garden Route scored “very high”, affecting 2.5% of the zone of influence. Infestations have been recorded in wooded areas and urban gardens (see section 5.5).

Fire hazards and over-abstraction of surface and groundwater are the features that scored a ‘high’ rating impacting on 2.3% and 4.8% of the zone of influence respectively (Table 6.4). Over-abstraction of water has a high impact on the water sources, recharge areas and aquifers in the mountain catchments.

Extreme weather conditions (droughts, storm surges and flooding) linked to climate change and dense stands of invasive alien plants and plantations bordering the protected areas (source of reinfestation) also received a ‘high’ rating and affect 0.1% and 21.9% of the zone of influence respectively (Table 6.4).

Table 6.4: The criteria used for defining the zone of influence of the Garden Route Complex World Heritage Site and Nature Reserves.

Feature	Criteria	Rating	Zone area (ha)	% of zone
Fragmentation through new agriculture / urban expansion	Identify areas with high or very high potential for both land capability (arable land) and grazing capacity (Collett 2017), adjacent or within close proximity within the defined buffer. Both these layers are available from the Dept of Agriculture (Elsenburg) and are also on CapeFarmMapper. No areas within the buffer for the GRCWHS&NR are high or very high potential. Only areas of moderate potential arable or non-arable but moderate potential grazing occur in the area. Intersected these areas with the remnants layer (Pence 2017) of 2016, which was updated using the 2019 fields layer (Crop Estimates Consortium 2019). Removed areas falling within protected areas and areas falling within the urban edges (DEA&DP 2016).	Medium (2)	8 216.6	1.9
Fire hazards (high fire frequency)	Inappropriate fire frequency due to anthropogenic fires. Areas adjacent to protected areas were identified for fire risk due to high ignitions and fire frequency. Every year the protected areas run through an exercise to determine fire hotspot areas based on various factors such as frequent ignitions and causes. This is one of the layers used to identify fire hazards. In addition, (i) from the veld age layer the areas with a fire frequency of 5 and more were extracted, (ii) used the areas derived where fires occurred more than once in 12 years, and (iii) plantations within 1 km buffer from the reserve boundary. Digitized an area around where the above elements accumulate.	High (3)	9 934.0	2.3
Urban, commercial and industrial developments	Expansion of urban areas, and commercial and industrial developments near protected areas. Mainly a threat of urban expansion of Mossel Bay, George, Knysna, and Plettenberg Bay due to their proximity to the nature reserves. Buffered the towns by 1500 m.	Medium (2)	45 530.8	10.5
Mining and quarry	Mining and quarrying pose a threat to coastal ecosystems including estuaries, cultural heritage, scenic land- and seascapes. Extracted from the Land use Database all properties where there was mining and/or quarry applications.	Medium (2)	1 164.1	0.3
Water pollution from agriculture activities	Areas where there is possible water pollution due to agricultural activities near rivers. Mainly pollution through nutrients entering the Goukamma Estuary from cows grazing in fields adjacent to river.	Low (1)	101.5	0.0
Pollution: domestic, industrial, urban wastewater and oil spills	Possible pollution (domestic, industrial, urban wastewater or oil spills) of rivers along major passes where accidents occur (oil spills), pollution in Bietou river from urban area and sewerage works, and wastewater from treatment plants at Ruitersbos and Friemersheim. Then also where rivers are pushing oil out near Mossel Bay that could reach Mossel Bay Seal Island.	Low (1)	1 574.0	0.4

Feature	Criteria	Rating	Zone area (ha)	% of zone
Invasive alien fish	Rivers identified for low level of conservation intervention due to the presence of threatened fish species as a preventative measure (timeous intervention should invasion occur). All rivers with their origin at or in the protected areas as well as rivers running through the protected areas were selected.	Medium (2)	2 045.7	0.5
Over abstraction of water (surface and groundwater)	The abstraction of water that impact the protected areas. This has a high impact on the water source areas as well as major estuaries.	High (3)	20 670.7	4.8
Dam and Water management / instream and riparian structures	Municipalities pumping water from rivers to replenish dams or weirs during dry months. Most of these activities are not monitored for impact. The following known rivers that are impacted; from Piesang River for Roodefontein dam (also impacting the estuary), from Groot Brak River for Wolwedans dam, from Groot River for Ernest Robertson dam, from Swart River for Garden Route dam, and from Klip River for Waboomskraal canal next to road.	Medium (2)	533.9	0.1
Biological organisms	Invasion of the PSHB beetle in parts of the Outeniqua. Areas where this infestation were observed (or likely) are the southern slopes of Outeniqua in wooded areas on adjacent farms, along the Montagu Pass (either side approx. 500 m buffer) on southern slopes in wooded areas, riverine areas with tall vegetation, frequently used picnic areas where firewood is used, and urban areas (mainly George) with urban gardens (trees and bush). Generated a probable area outline using the adjacent cadastre properties, buffer area around the Montagu Pass, riverine areas and the George urban area. Used these delineated areas to extract natural wooded land, and urban bush / trees from the National Land Cover 2020.	Very high (4)	10 596.4	2.5
Climate change	Climate change and extreme weather conditions (droughts, storm surges and flooding). The following features derived from the draft Eden Climate Modelling Laboratory were used to delineate areas that will be impacted by climate change: (i) erosion at intervals 20, 50, 100 years, (ii) wave run-up at intervals 10, 20, 50, 100 years, (iii) blow out areas, (iv) dune fields, and (v) high water mark.	High (3)	606.8	0.1
Illegal resource use	Illegal resource use, which include various unregulated human activities such as over-grazing by livestock, illegal harvesting of fauna and flora, informal human settlement encroachment, and dumping (garbage and solid waste). The layer was generated by buffering human settlements by 1500 m.	Low (1)	74 793.4	17.3

Feature	Criteria	Rating	Zone area (ha)	% of zone
Vandalism of cultural sites	Incidences of vandalism of cultural heritage sites. This occurred particularly along the Montagu Pass. Vandalism includes theft of signage, graffiti, "tolhuis" vandalism, etc. Buffered the Montagu Pass by 100 m where it enters the Witfontein sector.	Medium (2)	160.3	0.0
Illegal access and harvesting	Many roads and paths leading into protected areas are used for illegal access and illegal harvesting of fauna and flora. Buffered roads and footpaths leading into the protected areas by 25 m.	Medium (2)	1 935.7	0.4
Illegal recreational access	Illegal recreational activities from neighboring land (several places along boundary of Witfontein), such as quadbikes and scramblers, illegal construction of footpaths, and illegal camping in the forest. Digitized area along southern border of reserve where there is a high concentration of existing footpaths.	Low (1)	2 113.2	0.5
Illegal hunting	Illegal hunting and picking activities occur in the Outeniqua Cluster. Areas provided from the compliance plans include (i) hunting and flower picking, baboon cages and predator trapping in forest and fynbos at Ruitersbos, (ii) hunting and trapping at Doringrivier, and (iii) hunting and flower picking at Waboomskraal (Witfontein sector).	Low (1)	6 629.3	1.5
Illegal fish and harvesting of marine resources	Area identified for illegal bait and mud/sand prawn collections and illegal fishing are mainly within the MPAs at Goukamma and Robberg. The areas provided as part of the hotspots mapped for the compliance plans all fall within the MPA boundaries. Threat rating of medium (2). Therefore, these areas were not included as part of the zone of influence.	Not included	Not included	
Transportation, service corridors (shipping routes) and energy production (oil and gas drilling)	Impact on marine ecosystems and seascapes due to shipping route past the Mossel Bay Seal Island. The approximate distance from the island to the harbour is 4 km. Energy production through oil and gas drilling exploration and mining that has a negative impact on marine mammals. Generated a 5 km buffer area around the island and mooring point.	Medium (2)	3 244.2	0.8
Bush encroachment	Impact on the special habitat of the CR Brenton Blue Butterfly (*Orachrysops niobe*) through bush encroachment. Digitized thicket area northeast of reserve where encroachment extent from.	Medium (2)	10.3	0.0

Feature	Criteria	Rating	Zone area (ha)	% of zone
Invasive alien plants (IAP)	Stands of invasive alien plants or plantations within a radius of the protected area is a source of re-infestation into (and from) the protected area. Extracted the class Planted Forest from the Landcover 2020 done by GTI. Deleted very remote small patches manually. Used the National Invasive Alien Plant Survey, done by Kotze et al. (2010). Extracted grid cells for which a percentage abundance of IAPs was recorded. Intersected these grids with cadastre units falling within 3km from any reserve boundary. Removed transformed areas. As this layer is quite old, the 2016 remnants layer was used to remove transformed areas. Even though this layer is dated 2010, the probability of it still being a good indication of status-quo is very high.	High (3)	94 677.3	21.9
Game farming – invasive fauna	The threat of game farming adjacent to reserves can stem from introduction of extra-limited game species or fencing that limits the movement of natural wild species. Extracted all game farms adjacent to the protected area boundary from the Western Cape Game Database, last updated in November 2017. The game farm near Plettenberg Bay area poses higher threat due to escaping of fallow deer from the old antler farm. Property requires regular certificate of adequate enclosure inspections.	Low (1) Medium (2)	2823.7 1491.5	0.7 0.3
Forest Nature Reserves	Forest nature reserves extracted from the NBA 2018 protected areas layer. Three areas were listed, namely Attasquas Kloof, Sinclair and Whiskey Creek. Included designated forest nature reserves adjacent to the protected areas within the GRCWHS&NR.	Low (1)	719.8	0.2
Local Authority Nature Reserves	Included all the adjacent local authority nature reserves into the zone of influence. Two local authority nature reserves are proclaimed, namely Katrivier and Van Kervel. Extracted these from the NBA 2018 protected areas layer.	Low (1)	86.4	0.0
Stewardship sites	Select the stewardship sites that have direct land- and/or water management responsibilities and that contribute to protected area values and appropriate protected area design (connectivity and extent). Extracted all the signed and designated stewardship sites that are adjacent and those connected to them (forming a clump). Included Protected Environment area extracted from the NBA 2018 protected areas layer.	Low (1)	13 304.4	3.1
Private Nature Reserves	Private Nature Reserves formally declared and verified during 2020 survey. Extracted the areas from the NBA 2018 protected areas layer and compared them against the verified private nature reserves layer received.	Low (1)	354.0	0.1

Feature	Criteria	Rating	Zone area (ha)	% of zone
National Parks	The Garden Route National Park contains various scattered land parcels throughout the complex. All the land parcels were included as they form corridors between the CN protected areas included in the complex. Extracted the areas from the NBA 2018 protected areas layer.	Low (1)	100 166.3	23.2
Areas identified in PAES (Conservation Action Plan map)	Include areas identified for the protected areas expansion strategy, called the CAP map, March 2019. Extracted all the adjacent properties and those connected to them (forming a clump).	Low (1)	12 271.8	2.8
Coastal areas and small corridor around MPAs	For this area, there was also a coastal corridor delineated as part of the Gouritz Initiative project in 2004. This area has a high threat of development in highly sensitive vegetation types. Clipped the corridor falling within the 10 km buffer. Digitized a small corridor around MPAs included in the complex.	Low (1)	10 490.5	2.4
Special projects / areas (adjacent to reserve boundaries or in another province)	Gouritz Initiative – Sensitive koppies - Within the coastal plain, between Riversdale and Mossel Bay, there are two priority areas for koppies identified by J. Vlok and R. Cowling. For the GRCWHS&NR area two koppies areas have been identified between Herbertsdale and the sea (between Hartenbos and Grootbrakrivier). These koppies support geophytes and small succulent plants, many of which are highly localized endemics, and are also under threat. Cut off the area along the catchment between Gouritz and Hartenbos.	Low (1)	36 450.2	8.4

7 ACCESS AND FACILITIES

This section describes infrastructure and procedures necessary for management of the GRCWHS&NR, inclusive of operations and visitors. It provides information on access facilities, operational facilities, control measures as well as commercial and community use.

7.1 Public Access and Management

Public access points to the GRCWHS&NR are listed in Table 7.1 and illustrated in Appendix 2, Maps 15a-e.

Table 7.1: Managed public access points to the Garden Route Complex World Heritage Site and Nature Reserves.

Locality	Name	Type of Access	Activity
Outeniqua Cluster			
Witfontein sector	Below Tolberg	Uncontrolled access	**Public** - recreation for birding, hiking, mountain biking activities, trail running. **CapeNature** – operational and ecological activities.
Witfontein sector	Rondebossie	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Witfontein sector	Outeniqua Pass	4 x Uncontrolled access points via the Outeniqua Pass (N9/N12)	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness, access route to the Klein Karoo. **CapeNature** – operational and ecological activities.
Witfontein sector	Montagu Pass	4 x Uncontrolled access points via the Montagu Pass	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness, access route to the Klein Karoo. **CapeNature** – operational and ecological activities.
Witfontein sector	Tierkloof road	Uncontrolled access point	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness, **CapeNature** – operational and ecological activities.
Witfontein sector	Camferskloof gates	2 x Uncontrolled access points	**Public** - recreation for birding, hiking, picnicking, trail running. **CapeNature** – operational and ecological activities.
Witfontein sector	Camferskloof eastern gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Witfontein sector	Camferskloof northern gate (below Camferskloofberg)	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Witfontein sector	Camferskloof seed orchid	Controlled access via Glendoorn farm (locked gate) to permanent protea plots	**CapeNature** – operational and ecological activities.
Witfontein sector	Witfontein plantation office gate	Controlled access (locked gate)	**Public** - recreation for birding, hiking, picnicking, education and awareness. **CapeNature** – operational and ecological activities.

Locality	Name	Type of Access	Activity
Witfontein sector	Witfontein Plantation Roads	4 x Uncontrolled access points via contour roads	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness. **CapeNature** – operational and ecological activities. **Sentech Tower Lookout** – Communication mast.
Witfontein sector	Railway line	2 x Uncontrolled access via the railway line	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Witfontein sector	George Peak vertical trail	Uncontrolled access	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Witfontein sector	Tonnelbos Trail	Uncontrolled access via the Tonnelbos trail	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Witfontein sector	Vandalen's Peak	4 x Uncontrolled access via the Tierkop trail	**Public** - recreation for birding, hiking, mountain biking, trail running, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Witfontein sector	Afgunst	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Witfontein sector	Herold Wines	3 x Controlled access points via Herold Wines (locked gate)	**Public** - recreation for birding, hiking, trail running. **CapeNature** – operational and ecological activities.
Witfontein sector	Tierkop	2 x Controlled access points for vehicles. Open access to hikers & cyclists via Saasveld Campus to Tierkop hiking trail	**Public** - recreation for birding, hiking, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Witfontein sector	Groenkop gate	Controlled access via SANParks property (locked gate)	**Public** - recreation for birding, hiking, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Witfontein sector	Geloofskop gate	2 x Controlled access points (locked gate)	**CapeNature** – operational and ecological activities.
Witfontein sector	Bergplaas south gate	Controlled access to Louvain gate (via south)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Attaquaskloof, Die Naald	9 x Controlled access points via Rietfontein Game Farm (African Oryx Safaris)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Bonniedale gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Perdekop gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.

Locality	Name	Type of Access	Activity
Ruitersbos sector	Geelhoutvlei plantation (A13)	5 x Uncontrolled access points via Geelhoutvlei plantation	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Kouma gate	Uncontrolled access	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Schaapplaas gate	Uncontrolled access	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Habitat Nursery	Uncontrolled access	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Robinson Pass	8 x Uncontrolled access points via Robinson Pass	
Ruitersbos sector	Bosmansrivier area	5 x Uncontrolled access points	
Ruitersbos sector	Ruitersbos office main gate	4 x Uncontrolled access points	**Public** - recreation for birding, hiking, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Ruitersbos sector	Monument gate	Uncontrolled access	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Lookout gate 1	Controlled access to the Kouma trail (locked gate)	**Public** - recreation for birding, hiking, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Ruitersbos sector	Lookout gate 2	Controlled access (locked gate)	**Public** - recreation for birding, hiking, picnicking, education and awareness. **CapeNature** – operational and ecological activities.
Ruitersbos sector	Lookout gate 3	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Moordkuils gate (M5)	2 x Controlled access points (locked gate)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Moordkuils gate (Pine grove)	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Stinkhoutbos	Uncontrolled access	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Moerasrivier	4 x Controlled access points (locked gate)	**CapeNature** – operational and ecological activities.
Ruitersbos sector	Perdebond gate (Cornel Fourie)	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Zebraskop sector	Zebraskop main gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Zebraskop sector	Zebraskop gate 2 (Saffraanrivier)	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.

Locality	Name	Type of Access	Activity
Zebraskop sector	Zebraskop gate 3 (Elandskloof)	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Ruitersbos sector		Controlled access (locked gate)	
Doringrivier sector	Grootnek (D12) gate	3 x Controlled access points (locked gate)	**CapeNature** – operational and ecological activities.
Zebraskop sector	Zebrasfontein west gate	2 x Controlled access points (locked gate)	**CapeNature** – operational and ecological activities.
Zebraskop sector	Zebrasfontein east gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Doringrivier sector	D12 North gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Doringrivier sector	Waboomskraal	5 x Controlled access points (locked gate) via Waboomskraal North farm	**CapeNature** – operational and ecological activities.
Doringrivier sector	Waboomskraal	Controlled access via Imbeza Farm	**Public** - recreation for birding, hiking, picnicking. **CapeNature** – operational and ecological activities.
Doringrivier sector	Waboomskraal main gate	Controlled access (locked gate)	**Public** - recreation for birding, hiking, picnicking, trail running, mountain biking, education and awareness. **CapeNature** – operational and ecological activities.
Goukamma Cluster			
Goukamma sector	Western 4 x 4 access gate	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Goukamma sector	Groenvlei Station	Uncontrolled access to Groenvlei Lake	**Public** – tourism accommodation. **CapeNature** – operational and ecological activities.
Goukamma sector	Western Groenvlei Lake - Lake Pleasant	Uncontrolled access to Groenvlei Lake	**Public** – recreation for birding, canoeing, swimming, freshwater angling. **CapeNature** – operational and ecological activities.
Goukamma sector	Western Groenvlei Lake - Lake Pleasant Caravan Park	Uncontrolled access to Groenvlei Lake	**Public** – recreation for birding, canoeing, swimming, freshwater angling **CapeNature** – operational and ecological activities.
Goukamma sector	Groenvlei Lake slipway/jetty N2	Open access to Groenvlei Lake	**Public** – recreation for birding, canoeing, swimming, freshwater angling **CapeNature** – operational and ecological activities.

Locality	Name	Type of Access	Activity
Goukamma sector	Groenvlei N2 Old house	Uncontrolled access	**CapeNature** –operational purposes only.
Goukamma sector	Groenvlei N2 Mielie Rug	Controlled access (locked gate)	**CapeNature** –operational and ecological activities.
Goukamma sector	Eastern access from Ganzvlei 208	Controlled access (locked gate)	**CapeNature** –operational and ecological activities.
Goukamma sector	Buffalo Bay R346 public road	Open access	**Public** - access to Buffalo Bay (tarred road).
Buffalo Valley sector	Buffalo Valley access road	Controlled access (locked gate)	**Public** - tourism accommodation (Buffalo Valley), recreation for birding, canoeing, swimming, hiking. **CapeNature** – operational and ecological activities.
Buffalo Valley sector	Buffalo Valley eastern section	Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Goukamma sector	Goukamma eastern section along the northern boundary	Controlled access (locked gate)	**CapeNature** - operational and ecological activities.
Goukamma sector	Eastern section	Controlled access (locked gate)	**CapeNature** - operational and ecological activities.
Goukamma sector	Goukamma main gate	Controlled access (locked gate)	**Public** - tourism accommodation, recreation for birding, canoeing, swimming, hiking, picnicking, angling, education and awareness. **CapeNature** – operational and ecological activities.
Brenton Blue Butterfly sector	Brenton Blue Butterfly entrance	Open access	**Public** - education and awareness. **CapeNature** – operational and ecological activities.
Mossel Bay Seal Island sector	Mossel Bay Seal Island	Controlled access (by boat)	**DFFE (O&C)** – monitoring activities.
Keurbooms River Cluster			
Keurbooms River Nature Reserve	Keurbooms River main gate	Controlled access (locked gate)	**Public** - tourism accommodation (Whiskey Creek Hut), recreation for birding, canoeing, swimming, hiking, picnicking, angling education and awareness.

Locality	Name	Type of Access	Activity
			CapeNature – operational and ecological activities.
Keurbooms River Nature Reserve	Keurbooms River Bridge	Uncontrolled access to reserve by boat – access via 7 other slipways	**Public** - tourism accommodation (Whiskey Creek Hut), recreation for birding, canoeing, swimming, hiking, picnicking, angling education and awareness.
Keurbooms River Nature Reserve	Uplands	Controlled access via private property of Okkie Vermeulen Controlled access (locked gate)	**CapeNature** – operational and ecological activities.
Robberg Nature Reserve	Robberg main gate	Controlled access (locked gate)	**Public** - tourism accommodation (Fountain shack), recreation for birding, canoeing, swimming, hiking, picnicking, angling education and awareness. **CapeNature** – operational and ecological activities.

Demarcated coastal access points are listed in Table 7.2 and illustrated in Appendix 2, Maps 15b,c,d.

Table 7.2: Demarcated coastal access points within the Garden Route Complex World Heritage Site and Nature Reserves.

Locality	Name	Type of Access	Activity
Goukamma Marine Protected Area	Platbank	Open access to MPA and beach from Platbank parking area	**Public** – recreation for birding, hiking, swimming, snorkelling, marine resource utilisation (shore angling). **CapeNature** - operational and ecological activities
Goukamma Marine Protected Area	North Goukamma Estuary	Open access	**Public** – recreation for birding, hiking, swimming, snorkelling, marine resource utilisation (shore angling). **CapeNature** - operational and ecological activities
Goukamma Marine Protected Area	Goukamma Estuary	Open access	**Public** – recreation for birding, hiking, swimming, snorkelling, marine resource utilisation (shore angling). **CapeNature** - operational and ecological activities
Goukamma Marine Protected Area	Rowwehoek	Open access to MPA and beach via Rowwehoek parking area	**Public** – recreation for birding, hiking, swimming, snorkelling, marine resource utilisation (shore angling). **CapeNature** - operational and ecological activities
Goukamma Marine Protected Area	Buffalo Bay	Open access to MPA and beach via Buffalo Bay parking area	**Public** – recreation for birding, hiking, swimming, snorkelling, marine resource utilisation (shore angling). **CapeNature** - operational and ecological activities
Keurbooms River Estuary	Keurbooms River main gate	Controlled access (locked gate)	**Public** - recreation for birding, canoeing, swimming, picnicking, angling education and awareness. **CapeNature** – operational and ecological activities.
Robberg Marine Protected Area	Robberg main gate	Controlled access (locked gate)	**Public** – recreation for birding, hiking, swimming, snorkelling, marine resource utilisation (shore angling). **CapeNature** - operational and ecological activities

7.2 Airfields and Flight Corridors

Section 47 of the NEM:PAA stipulates prescriptions for the use of aircraft in a World Heritage Site.

Denneoord Emergency Airstrip is situated on the outskirts of George, along the southern slope of the Outeniquas. It is approximately 5.36 km east of the Witfontein Office Complex. The airbase is operated by Working on Fire and is a dedicated emergency airbase for firefighting purposes within the Garden Route District Municipal Area. Five aeroplanes and a chopper are stationed for the fire season. The airbase comprises of a 1000 m x 30 m runway, a 20 m diameter helipad, a firebase office, hangars, taxiways and a water refilling point. Flights are monitored by Air Traffic Control at the George Airport to ensure pilots adhere to the relevant standard operating procedures.

George Airport is situated approximately 9 km south-west from the Witfontein office complex. In 2016 a 200 m^2 solar plant was installed to become the first airport to be solar powered. Domestic flights take place between Cape Town International Airport and OR Tambo International Airport. Approximately 700 000 passengers per year make use of the George Airport to enjoy the scenic beauty of the Garden Route. The AIFA George Base flight school also operates from the George Airport and uses the George Airport Control Tower and is permitted to fly within the George general flying area of approximately 930 square nautical miles east and 850 square nautical miles west of the airport. Airspace above the Outeniqua WHS is restricted to 2 500 ft.

Plettenberg Bay Airport is a small airport situated 4.5 km north-west of Robberg with two domestic flight routes from Cape Town and OR Tambo International Airports. The airspace above Robberg is utilized by larger aircraft carriers from SA Airlink and CEM Air. Smaller fixed winged aircraft and helicopters that take off from the Plettenberg Bay Airport normally fly around Robberg. Airspace above Robberg is restricted to 2 500 ft. However, aircraft usually fly very low over Robberg and as such impact negatively on the nesting coastal birds and Cape fur seal pups.

7.3 Facilities for Vessels

Goukamma Cluster. A slipway, built on municipal land which provides launching facilities for boats into the MPA is situated in Buffalo Bay and managed on behalf of CapeNature by the Buffalo Bay Ski Boat Club.

Keurbooms River Cluster. The Central Beach surf launch site in Plettenberg Bay provides access to the Robberg MPA and surrounding areas for ski boats and tourism operated watercraft. CapeNature management staff make use of this launch site to conduct counts of the Cape fur seal and Cape cormorant colonies that nest and breed along the sheer cliffs of the Robberg Peninsula.

The Keurbooms River launching site is used by the public to launch their boats to access the sea via the estuary. Access to the sea via the river mouth is limited and can be extremely dangerous depending on the tide. Low tides limit access to the sea and high tides provide access via the Keurbooms River mouth.

There are a number of legal slipways along the Keurbooms River estuary that provide access to the sea and estuary for residents, angling club members or clients. These legal slipways are at Forever Resorts, Keurbooms Lagoon Caravan Park and at some private/residential developments.

7.4 Administrative and other facilities

Infrastructure and associated building maintenance requirements are captured and managed in both the protected area infrastructure register and the CapeNature User Asset Management Plan (U-AMP). The U-AMP is updated and submitted to Provincial Treasury and the Western Cape Dept of Transport and Public Works (DTPW) on an annual basis. DTWP conducted conditional assessments for all protected area Complexes and highlighted priority requirements that informed the U-AMP. CapeNature implements and funds scheduled maintenance and emergency repairs. DTPW has allocated funding for road upgrades across all CapeNature protected areas for a period of three years ending in 2022.

Major infrastructure is illustrated in Appendix 2, Maps 16a-g.

7.4.1 Roads / Jeep Tracks

Outeniqua Cluster. The main access roads to the Outeniqua Cluster are the Outeniqua Pass (N9/N12), Montagu Pass (via Herold) and Robinson Pass (R328). All three mountain passes connect the Garden Route to the Klein Karoo. The Outeniqua Pass provides access to the Pass to Pass hiking trail and provides majestic viewpoints of the Outeniqua Mountains along its course. Robinson Pass connects Mossel Bay with Oudtshoorn. The Ruitersbos Office complex can be accessed via this road as well as the Kouma hiking trail routes situated on the southern slopes of the Outeniqua Mountains. Robinson Pass is also managed by Western Cape Dept of Transport. Witfontein Office complex is accessed via the Montagu Pass from the George side.

All three passes carry large volumes of traffic resulting in road kills of small mammals and birds. Additionally, these routes also contribute towards increased environmental crime activities taking place within the WHS such as illegal harvesting of indigenous flora, illegal transportation of fauna and flora, illegal hunting, untimely fires (discarding of cigarettes) and most recently the illegal use of hiking trail routes by motocross bikes.

Roads within the Outeniqua Cluster are mainly jeep tracks and are exclusively used for management purposes with a 4x4 vehicle. Jeep tracks are also used by trail runners, hikers and mountain bike enthusiasts. Day-to-day maintenance of jeep tracks falls under the management of the Outeniqua Cluster with regular assessments and maintenance being carried out by the EPWP and ICM programmes. These tracks require regular maintenance, particularly on steep slopes and after fires as water run-off increases from adjacent slopes. Due to the high risk of soil erosion the grading of jeep tracks within the protected area is not allowed.

Unfortunately, the general condition of jeep tracks within the Outeniqua Cluster have become deteriorated and maintenance work has fallen behind. In certain areas decades of successive layers of gravel have been completely eroded down to bedrock and will require complete rebuilding (Ivan Donian, pers. comm.). This will be very costly, as suitable gravel is very scarce in the Garden Route. Furthermore, access to certain areas require traversing jeep tracks across forestry exit areas and these are in an even worse condition, particularly after the heavy rains of November 2021. Some tracks (e.g., to Tierkop) are impassable, even for a 4x4 vehicle as it will damage the vehicles. In certain areas neighbouring landowners have fenced off servitude roads and access is no longer possible (e.g., eastern access to Doringrivier). All these management tracks require urgent attention, as their poor condition poses a serious risk to access for fire-fighting and invasive alien vegetation management.

Goukamma Cluster. The main access roads to the Goukamma Cluster are the N2 freeway that runs along part of the northern boundary of Goukamma; the R346 public road to Buffalo Bay which cuts across the eastern part of the protected area, and the public road which provides access to the beach and MPA on the western side.

The N2 freeway falls under the management of SANRAL. A proposal by SANRAL to toll this road has been on the table for several years. Part of the proposal is to construct a toll gate near Groenvlei Lake. There is serious concern about road kills along the N2 near Groenvlei Lake. Medium to large mammals (such as honey badgers, otters, etc.) are killed on the N2, when they are trying to cross the road to move inland or to move in the other direction, particularly at the eastern and western limits of the lake where they try to get around the lake. A formal meeting with SANRAL and the local authority needs to be set up to discuss the possibility of constructing underpasses for these species.

The R346 is a tarred road and maintained by the provincial Dept of Transport. The section of the road that cuts through Goukamma near the estuary has been a continuous problem because of damage caused to the road and other infrastructure every time there is an excessive flooding event, not to mention the threat to the estuary (erosion, oil spillage, etc.). The main problem is the fact that the section of the road is located within the floodplain of the Goukamma River.

The western public access road (DR1594) which leads from the N2 to the beach and MPA on the western side is a gravel road managed by the Garden Route District Municipality. The first 350 m of the road was tarred in 1968 at the cost of a previous owner of the Lake Pleasant Chalets and Lodges. Since then, the tarred portion has become narrower and busier with each passing year. A request has been received from neighbouring landowners to appeal to the district municipality to upgrade this road. Furthermore, there are ownership issues with the two roads linking this public road with the western gates of Goukamma. The ownership of these roads is currently uncertain and this needs to be clarified. If not, this could cause problems in the future if the legal parameters of these roads, their use and their maintenance are not established.

Roads within the Goukamma and Buffalo Valley sectors are mostly gravel and are accessible by all vehicles, except low slung sedans. These are public roads that are used by tourists to access the protected area. Day-to-day maintenance of these roads falls under the management of the protected area while larger maintenance projects fall under the DTPW and are included in the User Asset Management Plan (U-AMP)

Jeep tracks are exclusively used for management purposes and are only accessible by 4x4 vehicles. Due to the high risk of soil erosion, grading of jeep tracks within Goukamma and Buffalo Valley is not allowed. Regular assessments and maintenance work are conducted as part of the ICM programme. The management track on Goukamma is currently overgrown with *Acacia* spp. and is not accessible by vehicle without causing damage. The verges and even the ‘middelmannetjie’ have become encroached by trees (Ivan Donian, pers. comm.). This needs to be urgently addressed as access to the area for fire and invasive alien vegetation management purposes is critical.

Brenton Blue Butterfly sector has no internal roads due to its small size. The northern and southern boundaries are bound by public tar roads and are maintained by Knysna Municipality.

Keurbooms River Cluster. The only road within the Robberg sector is the 400 m paved access road to the visitor's parking area. The old access roads to the Thesen's and Fourie Huts have been closed and are being rehabilitated.

The gravel road to the public slipway at Keurbooms River is accessible by all vehicles. This is the only public road used by tourists to access the river area. The road leading through the picnic area at the Keurbooms River bridge to Alkantmooi Boutique Hotel is a secondary road which is maintained by the Garden Route District Municipality.

Jeep tracks on the Keurbooms River sector are exclusively used for management purposes and are only accessible by 4x4 vehicles. Regular assessments and maintenance work are conducted by the EPWP teams employed by CapeNature.

The historical Prince Alfred's Pass linking Plettenberg Bay with Avontuur in the Langkloof cuts across the Annex Vlugt sector.

7.4.2 Hiking trails

Outeniqua Cluster. Hiking trails that weave through the Witfontein sector include the Cradock Pass, Cradock Peak, George Peak, Tierkop, Bergplaas-George Dam to Tierkop trails. All of these are day trails and are accessible from the Witfontein office. A hiking permit is issued at the entrance gate and informs users of hiking safety. The Pass to Pass, Camferskloof and Vensterberg trails are accessible from the Outeniqua Pass where there is no permitting system in place. This is a concern as there is very little control, and during peak seasons some visitors do not abide by 'leave no trace' principles, and erect structures, paint rocks, litter, drive with scramblers on the trails, etc. Doringrivier circular trail starts at the Waboomskraal gate located on the northern side of the Outeniqua Mountain Range and is approximately 14 km in length. The Kouma trail on the Ruitersbos sector is accessible from the Robinson Pass and is approximately 14 km in length. The Tierkop, Attaquaskloof and Moordkuils overnight trails have all been closed.

Unfortunately, the condition of most trails (e.g., George Peak, Cradock Peak, Cradock Pass, Pass to Pass, Sputnik to Camferskloof, Vensterberg) has deteriorated due to erosion and lack of regular maintenance, especially after heavy rainfall events. Some are even visible from a distance (Ivan Donian, pers. comm.). Several illegal hiking trails have been formed by various users. This is becoming problematic as the trail network is increasing with new trail routes being cut, damaging flora and resulting in erosion. Cradock Pass, Pass to Pass and Tierkop trails are being illegally used by motocross bikes which is contributing to erosion and trail widening. Although some of the new trails/routes are on forestry exit areas/no-man's land they will become a management burden to the new management authority, most likely CapeNature (Ivan Donian, pers. comm.).

Goukamma Cluster. Goukamma has a network of day hiking trails providing access for hikers to the remote areas and other popular tourist sites. Hikers have a choice of six day-trails, namely: the Galjoen trail along the coastline (12 km); Bush Pig trail (6.5 km), Porcupine trail (13.5 km); Cape Clawless Otter trail (6.5 km) and the Blombos Trail with varying lengths. Trails are vulnerable to erosion due to the substrate largely being sandy and particularly prone to erosion at sites with steep slopes. Annual maintenance is conducted as part of ICM. Minor maintenance is carried out by the EPWP staff.

Keurbooms River Cluster. There is only one trail consisting of 3 circular routes on Robberg, namely the Gap (2.1 km), Witsand (5.5 km) and Point (9.2 km) trails totalling a maximum of 9 km in length. Problematic areas on the trails are assessed regularly and maintained to prevent erosion/trampling. Trail profile monitoring is conducted annually to ensure that problematic areas are addressed appropriately.

There are currently no hiking trails on the Keurbooms River sector. The new tourism development will possibly include a hiking trail that has been assessed by the Conservation Manager and Landscape Ecologist. There was an old trail on the plateau area of the protected area that was accessed from Forever Resorts. Plans are in place by the new manager of Forever Resorts to reopen it. This trail will only be accessed by guests staying at Forever Resorts.

7.4.3 Buildings

Buildings of the GRCWHS&NR are designed and utilised for operations, staff accommodation and tourism. The provincial DTPW no longer budgets for maintenance of CapeNature infrastructure as per schedules outlined in the U-AMP. CapeNature needs to budget for this. In cases where DTPW have assisted with project management as well as specifications for projects, CapeNature has been responsible for the payment of the infrastructure/ maintenance as well as improvements.

Outeniqua Cluster. There is a large entrance gate to the Witfontein office complex which is manned seven days a week by EPWP staff. There is a main office with toilet facilities, eleven staff houses, a storeroom, vehicle parking area, High Altitude Team office in the form of two containers, a dormitory with ablution facilities, herbicide store, kitchen and the Witfontein training academy conference room. For the Ruitersbos sector, there is one office, vehicle garage, storeroom and six staff houses. The overnight hiking huts at Tierkop, Camferskloof and Attaquaskloof are closed to the public but are still being maintained by CapeNature. The recently acquired Zebraskop property contains a large store, toilet and braai area.

Goukamma Cluster. The main entrance gate to the Goukamma sector located on the Buffalo Bay Road is manned seven days a week by EPWP staff. There are toilet facilities located at the main gate and next to the tourism information centre that are utilized by day visitors. The tourism information centre is utilized by CapeNature staff for larger meetings and for environmental education and awareness raising events. There is one main office (previously staff accommodation) with a garage, herbicide store, carports, a number of storerooms, laundry and a tourism officer house. In terms of tourism accommodation units there are three rondawels and the previous office that has been converted into two accommodation units. Further along the Goukamma River, situated on the Buffalo Valley property, there are three accommodation units, one staff house and one storeroom. On the Groenvlei side of the sector, there is a bush camp, student or inspection quarters, pump house and a manager's house.

There is no infrastructure on Mossel Bay Seal Island.

Keurbooms River Cluster. For Keurbooms River, there is an entrance gate that is manned seven days a week by an outsourced security company, public toilet facilities and ten shaded picnic sites with braai and water facilities. There is also a storeroom, boathouse and fuel store. The Whiskey creek overnight hut accommodates ten guests and is situated approximately 6.5 km up the Keurbooms River on the western bank. The hut is solar powered with rainwater harvesting tanks.

Robberg has spectacular viewing decks, public toilets, a visitor information kiosk and picnic facilities next to the parking area. The Fountain shack accommodates eight guests and is the only overnight facility on Robberg.

The office complex is located in the town of Plettenberg Bay, corner of Beacon Way and Zenon Street where all management activities (ecological and operational) are arranged for the Cluster. There is a boat house with three garages and a manager's house.

There are no buildings on Annex Vlugt.

7.4.4 Fences

The 2017 Knysna and 2018 George fires destroyed many fences throughout the complex. Fortunately for wild animals that had to flee from these fires, fencing repairs were delayed. This meant that there was enough time for these animals to move back into the protected area to re-establish home ranges and territories before a new fence barrier was erected. Most fences have been repaired after the fires through the ICM Programme and repairs are planned for annually during the IWP process.

Outeniqua Cluster. The Witfontein office complex is fenced with a 2.1m bonnox fence and razor wire to prevent unauthorised access. The majority of the Outeniqua Cluster has been spanned with 1.4 standard fencing except for the adjoining Zebraskop sector and adjoining game farm, Goeie Hoop at D12 north which both have 2.4 m game fences. The northern boundary fence line from the Waboomskraal gate to the D6 *Protea* plot site was damaged by previous fires in 2011 and 2015 and has never been replaced. This northern fence line of Doringrivier together with the Camferskloof fence line on the Witfontein sector need to be replaced. Due to the expanse of Outeniqua WHS, fences that are not in good condition unfortunately allow for unauthorised access and illegal activities to take place.

Goukamma Cluster. All fences are constructed to a standard height of 1.4 m for boundary demarcation. The fences along the north-eastern and western boundaries are being monitored and maintained. The northern boundary fence line of Groenvlei was recently repaired by DTPW and therefore in good condition. The western boundary of Groenvlei is not fenced however very thick vegetation and reeds form a natural barrier to prevent unauthorised access along the road verge. In 2018, a new fence line was built along the entire eastern section of the protected area which had been damaged during the 2017 fire. The only section where fences are not in a good condition is the southern boundary between CapeNature and the Buffalo Bay Caravan Park. Boundary fences shared with properties which stock livestock are intact and are being maintained by the relevant landowners.

The northern and southern boundaries of the BBBSNR have been demarcated with a wooden fence whereas the eastern and western boundaries are residential properties with boundary walls. Fence patrols are carried out on an ad hoc basis while staff are in the area while conducting other activities.

Keurbooms River Cluster. The office complex has been fenced off with a galvanised 1.8 m palisade fence. On the north-western boundary between Robberg and Robberg Beach End development, the fence was removed also to allow for migration of small mammals, with only a fence between Robberg and the property of Mr van Niekerk, to keep dogs out of the WHS.

All internal fences have been removed on the Keurbooms River sector. Boundary fences shared with properties where game has been introduced are intact and are being maintained by the relevant landowners. The protected area remains largely unfenced except at Hanglip and at Uplands, which occasionally results in tourism, operational, or ecological problems.

There is no boundary fence at Annex Vlugt.

7.4.5 High sites

CapeNature monitors all high sites for negative environmental impacts and illegal radio repeaters and other communication structures on an annual basis. High sites impact on the scenic landscape and on rare and threatened plant species found only in high altitude areas. The use of concrete to anchor these structures has a detrimental effect on the adjacent fynbos vegetation, because the concrete is alkaline and leaches into the acidic fynbos soils, resulting in a change in vegetation composition over time.

A decision has been taken that no new sites will be considered for communication masts or structures.

Outeniqua Cluster. On Outeniqua alone there are six registered high sites on Cradock Peak, Geloofskop, Tierkop, Outeniqua Pass, Robinson Pass and at Attaquaskloof. The Sentech tower at Power is located on DFFE land. Most of these sites are utilized for radio and cellular network communications in the area by different users.

There is great concern about the expansion and proliferation of the masts and structures on Cradock Peak, and the amount of litter (building rubble, rolls of old fibre glass/waterproofing sheets, debris, etc.) left on the site (Ivan Donian, pers. comm.).

Goukamma Cluster. Trigonometric Beacon 233 was registered as a high site for Goukamma. The site was used as a weather station and as a radio repeater site by CapeNature. Unfortunately, due to solar panel theft on two occasions, the radio repeater had to be removed and the weather station was damaged in the 2017 fire.

Keurbooms River Cluster. The Cape Seal Lighthouse is a registered high site on Robberg sector.

All high site partners are listed in Table 7.5.

7.4.6 Signage

Signboards are located at all major vehicle and hiking trail entrance points to the GRCWHS&NR. Directional signage to CapeNature protected areas are in place on all relevant provincial roads.

Trail information, directional and indemnity signage is in place at the starting points of all overnight and day trails. GPS co-ordinates and km readings are provided at various points along these trails. WHS descriptor, fire prohibition, command, general notice and generic safety signs are located at strategic sites on all protected areas. Campsite markers are placed at each campsite as well as a campsite layout sign. Do's and don'ts as well as evacuation signs are placed in strategic places to prevent injury or loss of life. Unfortunately, many signboards in the Outeniqua Cluster have been vandalised due to the proximity of the protected area to surrounding residential areas leading to unauthorised activities and therefore have to be replaced more frequently. There is a need to install, improve or replace signage at various trails, parking and picnic sites within the GRCWHS&NR. This would be an ideal opportunity to promote the WHS status of the protected areas and to advocate the leave no trace principle.

7.4.7 Utilities

7.4.7.1 Water supply

Outeniqua Cluster. Witfontein office complex is supplied with water from a fountain which collects into two cement reservoirs. From these reservoirs water is pumped into a purification system and then supplied to the office and housing complex. This water system is maintained by CapeNature. Mossel Bay Municipality supplies water to the Ruitersbos office and staff housing complex. Rainwater harvesting tanks of 5 000 L capacity have also been placed at both office complexes and staff accommodation for water use.

Goukamma Cluster. Potable water is abstracted from a six-point spike at approximately 30 m distance from the Goukamma Estuary for use at Goukamma station. Although slightly salty, this water is used in all facilities. The existing rainwater reticulation system at the Goukamma station has been upgraded for drinking water purposes.

Water for domestic use (ablutions) is currently extracted from the Groenvlei Lake into two reservoirs above the bush camps for use at the Groenvlei station. This water is not potable and rainwater is used for drinking. It is envisaged to upgrade the existing rainwater reticulation system when the new proposed development takes place.

A separate water system exists on Buffalo Valley. Potable water is extracted from a borehole on the property and supplies all Buffalo Valley facilities with water.

Keurbooms River Cluster. The Keurbooms River picnic sites are supplied with water pumped from the Keurbooms River. The Whiskey Creek overnight hut has 40 000 L rainwater tank capacity which supplies water to visitors but from time-to-time river water is pumped from the Keurbooms River during peak periods or during low rainfall periods. The office complex in town has municipal water supply.

7.4.7.2 Electricity supply

Eskom supplies electricity to the Outeniqua, Goukamma, Robberg and Keurbooms office stations. There are no solar powered systems currently in place for the Outeniqua Cluster. All tourism visitor facilities at Goukamma are supplied with electricity by means of solar systems. The Fountain shack on Robberg is dependent on solar and wind generated power and the Whiskey creek hut on Keurbooms River is solar powered.

7.4.7.3 Waste management

Outeniqua Cluster. Waste from the Witfontein office complex is transported by the staff to the George municipal waste site on a weekly basis. It is kept in a wire cage that is supposed to be wild animal proof but from time to time the baboons do have access and raid the wire cage. Management needs to improve this structure and educate the staff and Working on Fire teams to keep it closed to prevent baboon raids. Ruitersbos office waste removal is collected by the Mossel Bay Municipality every Wednesday.

Sewage systems at Witfontein are septic tanks which are cleaned by the George Municipality every second month. The septic tank systems at Ruitersbos are cleaned once every six months.

Goukamma Cluster. All waste from Goukamma is disposed of at the municipal waste transfer site in Knysna. Primate-proof refuse bins are available at all overnight accommodation units and picnic sites.

There are two types of sewerage treatment systems on the Goukamma. At Groenvlei the units are connected to a biolytic system and at Goukamma and Buffalo Valley there are septic or conservancy tanks with French drain soak-aways.

Keurbooms River Cluster. Waste from the Plettenberg Bay office complex and Keurbooms River is removed by the Bitou Municipality. At Robberg, primate-proof refuse bins are available at the public parking area and at The Gap. Waste is collected daily and stored in a cubicle at the parking area, from where it is taken to the municipal registered dumping site once a week.

It is policy to use animal proof dustbins at all management and tourism development sites to prevent pollution and discourage wild animals from raiding dustbins.

The toilets at the Keurbooms River picnic sites are supplied with water from the Keurbooms River. Robberg has a municipal water connection which leads to the public toilets at the car park, with a holding tank (5 000 L capacity) located behind the toilet facilities. Currently the sewage system consists of a conservancy tank near the public parking area. The tank is pumped out on a regular basis by the Bitou Municipality to prevent unnecessary spillage and overflows. This conservancy tank will be replaced with a link to the municipal sewage system. The Fountain shack has a waterless enviro-loo system and is dependent on rainwater with 30 000 L storage tanks.

7.4.8 Visitor facilities

Outeniqua Cluster. There are no formal picnic areas at Witfontein or Ruitersbos and day visitors may request permission from the Conservation Officer to use the open area alongside the office complex. Day visitors to the Witfontein and Ruitersbos sectors make use of the toilet facilities at the offices.

Goukamma Cluster. Water sports, swimming, fishing, birding, hiking and picnicking are the most popular recreational activities in Goukamma, Buffalo Valley and the MPA. Facilities include a gate kiosk where canoes and paddleboats are hired out to day visitors. There are a number of picnic spots with picnic tables and braai facilities situated along the banks of the Goukamma River. From time to time the picnic area is under water when the river mouth is closed for long periods. Two toilet facilities are available to all visitors, one situated at the main entrance and the other alongside the information centre.

Keurbooms River Cluster. The facilities at the Keurbooms River bridge consists of a gate kiosk, public slipway and jetty, canoe hire facility, outdoor classroom, ten picnic sites, toilets and braai facilities. Upstream from the Keurbooms River bridge there are three separate picnic sites along the riverbank with toilet and braai facilities.

For Robberg there are two braai facilities on one of the viewing decks, toilets, kiosk, and picnic tables on all viewing decks.

7.5 Commercial Activities

Due to the scenic and rugged terrain of the GRCWHS&NR, many adventure companies plan events that criss-cross through the protected area, appealing to many outdoor enthusiasts. CapeNature is fortunate to have developed good working relations with many commercial partners that make use of the protected areas, while contributing significantly to human wellbeing. Commercial and management agreements are listed in Table 7.3.

Table 7.3: Commercial activities and management agreements applicable to the Garden Route Complex World Heritage Site and Nature Reserves.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected	Conditions of use
Outeniqua Cluster					
21/08/2021	Mountain biking event: Cape Pioneer Trek	Attaquaskloof / Doringrivier Momentum Health Henco Rademeyer	1 day event	Ruitersbos (Attaquaskloof) & Doringrivier sectors	All terms and conditions as set out in Event application.
26/06/2021	Trail running event: The George Mountain Ultra Trail (MUT)	Zane Schmahl EB Events PTY (Ltd)	1 day event	Witfontein sector	All terms and conditions as set out in Event application.
18/10/2020	Hiking: Pink Trees	Adri van Nieuwenhuizen	1 day event	Witfontein sector	All terms and conditions as set out in Event application.
Keurbooms River Cluster					
01/10/2022	Fixed Term Contract: Ferry Service for visitors	Forever Resorts	4 years & 11 months	Keurbooms River sector	All terms and conditions as set out in MOA.
31/03/2023	Fixed Term Contract: Ferry Service Concession	Keurbooms River Ferries	Extended to 31/03/2024	Keurbooms River sector	All terms and conditions as set out in Agreement with Concessionaire.
06/12/2019	Fixed Term Contract	Southern Ambition Consulting (Pending Robberg Shop)	Extended to 06/06/2023	Robberg and MPA sectors	Kiosk operation.
01/12/2022	Fixed Term Contract: Gate Guarding & Access control at Entrance Gates	Black Moon Investment t/a Blue Bay Guards	1 year (30/11/2023)	Keurbooms River and Robberg sectors	All terms and conditions as set out in Agreement with Concessionaire.
01/01/2023	Fixed Term Contract: Cleaning of Fountain Shack & Whiskey Creek Cabin Tourism Facilities	Rodney Manuel	3 years (31/12/2025)	Keurbooms River and Robberg sectors	All terms and conditions as set out in Agreement with Concessionaire.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected	Conditions of use
01/12/2022	Fixed Term Contract (Abseiling activity)	Adventure Zone Garden Route	10 years	Robberg sector	All terms and conditions as set out in Agreement with Concessionaire.

7.6 Community Use

IFSM NPC consists of a group of volunteers that approached CapeNature in 2018 to remove common carp from Groenvlei Lake by means of bow-hunting. To date approximately 20 tons of invasive carp have been removed by means of bow-hunting, gill, seine and fyke netting. During 2020, the COVID-19 pandemic created financial pressure on local communities due to an increased unemployment rate and people not being able to work during the different levels of lockdown. The IFSM team approached Gift of the Givers during this period who indicated a willingness to get involved with the distribution of fresh harvested carp to the local community of Sedgefield. There are two Memorandum of Agreements (MOA), each stipulating the duties and responsibilities of each party, indemnifies CapeNature and highlights operational protocol. CapeNature grants approval to the IFSM to harvest carp from Groenvlei Lake and ensures that harvested carp from Groenvlei Lake will be made available to the Gift of the Givers for distribution to communities in need. Both these agreements are valid for a period of three years.

Community management agreements for the GRCWHS&NR are listed in Table 7.4.

Table 7.4: Community activities and management agreements applicable to the Garden Route Complex World Heritage Site and Nature Reserves.

Date of Agreement	Type of Agreement	Community	Duration of Agreement (years)	Resource utilised	Conditions of use
28/07/2021	IFSM NPC	Sedgefield	3 years (27/07/2024)	Common Carp (*Cyprinus carpio*)	Refer to MOA
30/08/2021	Waqful Waqifin Foundation t/a Gift of the Givers Foundation	Sedgefield, Knysna, Ruigtevlei	3 years (29/08/2024)	Common Carp (*Cyprinus carpio*)	Refer to MOA

7.7 Servitudes

A number of servitudes and management agreements exist for the GCWHS&NR where the respective entities are provided access to or through land managed as part of the protected area. This also includes formal agreements with partner organisations in terms of management activities, such as firefighting, clearing of invasive alien plants and restoration work. Current servitudes and management agreements are listed in Table 7.5 and mapped in Appendix 2, Maps 15a-e where relevant.

Table 7.5: Servitudes and formal agreements applicable to the Garden Route Complex World Heritage Site and Nature Reserves.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected	Conditions of use
Outeniqua Cluster					
Unknown	Internet repeater station	Cloud Connect Networks CC	Unknown	Cradock Peak	Establishing a wireless internet repeater station on Cradock Peak in the Outeniqua Mountains.
Unknown	Radio repeater station	Dept of Public Works	Unknown	Ruitersbos	The co-use of Western Cape Nature Conservation Board (WCNCB) radio repeater station and hut on Ruitersbos in Outeniqua (Witfontein) State Forest. (REF: 6544/0337)
Unknown	Radio repeater station	Hilbert Electronics	Unknown	Cradock Peak	Temporary right for the co-use and maintenance of an existing radio repeater station (2 antennas, 2 solar panels attached to each antenna as well as 2 separate solar panels) at Cradock Peak in Outeniqua State Forest. CR 21 and CR 33
Unknown	Visual Communication	Illustration Trading Company	Unknown	Below George Peak	Temporary right to erect and maintain an illuminated cross on Cradock Peak in the Outeniqua State Forest.
Unknown	Internet repeater station	J S Hauman	Unknown	Cradock Peak	Establishing a wireless internet repeater station on Cradock Peak in the Outeniqua Mountains
Unknown	Radio repeater station	FLEETCALL Trucking System	Unknown	Cradock Peak	Temporary right to accommodate an additional system (Fleetcall Trucking System) on the existing radio site and fourteen (14) additional solar panels on Cradock Peak in the Outeniqua State Forest
Unknown	Cellular Telephone Network	VODACOM	Unknown	Ruitersbos	Temporary right to erect and maintain a 6m mast on top of existing cellular base station and erect additional room to store the equipment on the Ruitersbos State Forest
Unknown	Cellular Telephone Network	VODACOM	Unknown	Ruitersbos	Temporary right for the installation and maintenance of a microcell, power supply link as well as an antenna at the lookout building of MTN on Ruitersbos State Forest. Reference BS 9530
Unknown	Water use	Ashley Dyers	Unknown	Camferskloof	Temporary Right for the impoundment of water at Camferskloof in the Outeniqua Nature Reserve.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected	Conditions of use
Unknown	Water use	Jacques & Irene Cullen	Unknown	Attaquaskloof	Permanent pipeline from the Kamma River (Elandskloof) to the Paardekop farm for farming and household use.
Unknown	Water use	DFFE	Unknown	Ruitersbos, Bosmansrivier	Pipeline from Bosmansrivier to Ruitersbos farming communities.
06/04/2021	Western Cape Nature Conservation Board & SCFPA Memorandum of agreement	SCFPA	3 years	Outeniqua	Provision of firefighting services to CapeNature and management of Working on Fire teams.
27/11/2019	Western Cape Nature Conservation Board & The Friends of the Old Toll House Memorandum of agreement	Friends of the Old Toll House	3 years	Outeniqua, Montagu Pass	Memorandum of Agreement between CapeNature and Friends of the Old Toll House to promote and maintain the cultural heritage of the site and for ultimate use and enjoyment of visitors.
19/03/2021	Zebraskop Management lease agreement	WWF-SA	99-year lease	Zebraskop	Conservation management use.
01/08/2019	DFFE: Nature Resource Management (DFFE: NRM); CapeNature Terrestrial, Ecosystems, Special and Wetland projects	DFFE: NRM	3 years	Outeniqua	Terrestrial invasive plant clearing project.
Goukamma Cluster					
06/04/2021	Western Cape Nature Conservation Board & SCFPA Memorandum of agreement	SCFPA	3 years	Goukamma	Provision of firefighting services to CapeNature and management of Working on Fire teams.
23/01/2004	Milkwood Downs Management lease agreement	WWF-SA	99-year lease	Groenvlei	Milkwood Downs property (Portion 38 (Portion of Portion 33) of Ruygte Vally 205). Conservation management use.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected	Conditions of use
01/08/2019	DEA: Nature Resource Management (DEA: NRM); CapeNature Terrestrial, Ecosystems, Special and Wetland projects	DEA: NRM	3 years	Goukamma	Terrestrial invasive plant clearing project.
Keurbooms River Cluster					
27/10/2010	Radio repeater station	SANParks and National Sea Rescue Institute	Open-ended	Robberg	The co-use of CapeNature's Radio repeater site and to use CapeNature's hut for storage, free of charge at the Robberg Nature Reserve.
00/00/1950	National Marine Safety	PORTNET	Continuous	Robberg	Maintain the Cape Seal Lighthouse
06/04/2021	Western Cape Nature Conservation Board & SCFPA Memorandum of agreement	SCFPA	3 years	Outeniqua	Provision of firefighting services to CapeNature and management of Working on Fire teams.

8 EXPANSION STRATEGY

Protected area expansion in South Africa is guided by the National Protected Area Expansion Strategy (NPAES) (DEA 2016). In response to the NPAES, CapeNature has produced a WCPAES for the period 2020-2025 (CapeNature 2021).

Mechanisms for protected area expansion include the promotion of stewardship options on private land in collaboration with landowners, regularising existing private nature reserves, and the consolidation of state land managed by conservation authorities such as municipalities and CapeNature as formal protected areas. The WCPAES has not highlighted priority marine zones for expansion, and planning for protected area expansion into the marine environment is guided by the NPAES and the Marine Spatial Plan. The Marine Spatial Plan has been developed to facilitate responsible use and management of the sea space, minimise conflict amongst existing sea space users, prevent habitat degradation and to ensure proper planning for future activities. Goukamma and Robberg MPAs fall within the Southern Marine Planning Area which is one of four smaller bio-geographic areas that serve as planning units (DFFE 2022).

Protected Area Expansion in the Garden Route is informed by the 2020-2025 WCPAES (CapeNature 2021) and priority areas for protected area expansion are based on the provincial map of CBAs contained in the WCBSP (Pool-Stanvliet et al. 2017).

To be an integral part of the long-term vision of the Protected Area Network in the Western Cape, the Garden Route will adopt the principles of the 2020-2025 WCPAES:

“Protected area expansion must occur within priority biodiversity areas, not all hectares are equal, plan for what is needed and align operations accordingly, not vice versa and partner up.”

All sites considered must be measured against the themes driving the protected area expansion in the 2020-2025 WCPAES:

- CR ecosystems;
- Under-protected ecosystems and strategic landscapes;
- Essential habitat for selected species;
- Marine, estuarine, and coastal systems; and
- Freshwater ecosystems.

The mechanisms applicable to the Garden Route are stewardship via both proactive and reactive means, the transfer of desirable forestry exit lands and other state-owned land into conservation, declaration of admiralty reserves as protected areas, the declaration and extension of MPAs and extending ‘no-take’ zones, and Other Effective Area-based Conservation Measures (OECMs).

The terrestrial protected area network priorities for the Garden Route are to:

- Secure at least one ‘special’ (unique, threatened and under-protected) freshwater ecosystem within the Garden Route District Municipality;
- Protect the Garden Route Granite Fynbos, Mossel Bay Shale Renosterveld and other highly threatened ecosystems which were identified as high risk, under-protected terrestrial ecosystems in the Western Cape;

- Complete regularisation of proclamation of verified and validated 'old' Private Nature Reserves in terms of NEM:PAA; and
- Ensure that all protected areas are listed in the National Protected Areas register as required by NEM:PAA.

The expansion maps for the GRCWHS&NR are shown in Appendix 2, Maps 17a-f. Note the location of stewardship sites, private nature reserves and active conservancies in relation to the CBAs and ESAs.

Focus areas for expansion that have been identified for each cluster include the following:

Outeniqua Cluster:

- Formalise land transfer and assignment of CapeNature as management authority for forestry exit areas;
- Formalise legal status of State Forest land;
- Assess condition of no-man's land areas adjacent to Outeniqua WHS and investigate possible measures to address management challenges; and
- Expand habitat for Cape mountain zebra along northern slopes of Outeniqua Mountains.

Goukamma Cluster:

- Prioritize regularisation of Private Nature Reserves along western boundary of the Goukamma sector;
- Pursue partnership opportunities of securing high priority properties in collaboration with NGOs as a mechanism to expand the protected area network;
- Provide support to existing contract nature reserves adjacent to CapeNature protected areas (e.g., Knysna Municipal property next to BBBSNR);
- Negotiate with local authority regarding acquiring/managing Ptn 1 of the Farm Walker Point 215; and
- Formalise estuary areas identified for protection.

Keurbooms River Cluster:

- Demarcate property and formalise assignment as management authority of Seabird Breeding Colony at Keurbooms River mouth;
- Extend the Robberg Coastal Corridor Protected Environment by declaring and providing support to all the properties already signed-up;
- Formalise estuary areas identified for protection; and
- Initiate discussions regarding the transfer of Annex Vlugt to SANParks.

In addition, there are several registered conservancies within the zone of influence of the GRCWHS&NR. Conservancies fall in the OECM category that includes areas that are not formally protected by law, but informally safeguarded by the current owners and users, and managed at least partially for biodiversity conservation (CapeNature 2021). A Garden Route Conservancy Forum was established by CapeNature several years ago and meetings are convened at least once a year. This forum provides a platform for the conservancies to share knowledge, showcase projects and to encourage partnerships. It needs to be emphasised that conservancies are voluntary agreements between various landowners to improve biodiversity management and sustainable resource use on their respective properties and are driven and maintained by the landowners, and not CapeNature. However, CapeNature provides indirect support to these conservancies in the form of advice and information-sharing. It is acknowledged that conservancies are the building blocks for the establishment of future conservation areas.

The **MPA network focus** is to:

- Establish formal protection under NEM:PAA or the Western Cape Biodiversity Act for the extension of Goukamma MPA and Keurbooms (extension) which were identified as priority estuaries in the 2015-2020 WCPAES.
- Work with DFFE to enhance protection and management by re-zoning Goukamma and Robberg MPAs to increase the proportion of 'no-take' areas.
- Secure key gaps in the protection of provincial coastal habitats and ecological processes (including admiralty lands).
- Develop and implement management plans for declared MPAs.

9 CONCEPT DEVELOPMENT PLAN

The concept development plan sets out the long-term plan for the development of the GRCWHS&NR in keeping with the purpose of the protected area and with due consideration for protected area expansion and the zoning plan.

Tourism products and related infrastructure developments in CapeNature are considered investments and are intended to:

- Harness and enhance the income generation potential of protected areas with a view to achieving long term business sustainability;
- The provision of safe, informative and purpose-built access to protected areas;
- To enhance the operational efficiency and management of the protected areas.

9.1 Project Selection

Organisationally potential tourism product developments are selected based on internal consultation and approval where factors such as appropriateness, environmental authorisation, financial feasibility, and the apparent return on investment are considered. Where external approvals for developments are required, these are sought from the relevant authorities prior to the commencement of any development activities (Figure 9.1).

CapeNature may elect to operate tourism products and services internally, or via other mechanisms described in the Public Finance Management Act, 1999 (Act No.1 of 1999) such as concessions or public private partnerships.

Figure 9.1: Concept Development Plan Framework.

9.2 Methodology

Tourism products and infrastructure within CapeNature protected areas are designed to be sensitive to their locations and are intended as prime examples of responsible and sustainable commercial developments. These include: off-grid bulk water and energy services; passive design efficiencies; enhanced resource utilisation and resource-saving features. Tourism developments aim to comply with prevailing zonation schemes and sensitivity analysis unless approval to the contrary has successfully been sought.

Wherever possible, tourism products, developments and services are intended to provide training and employment opportunities to communities within and surrounding the protected area.

9.3 Infrastructure Management and Development

9.3.1 Development nodes

Outeniqua Cluster. CapeNature has formally requested the DTPW to relocate the George Office premises from the York Park Building in George to the Witfontein office complex. The following development upgrades are proposed for the Witfontein sector:

- Upgrading of management infrastructure;
- Construction of additional office space;
- Creation of additional day visitor and reserve parking areas; and
- Upgrade of electrical, water and sewerage infrastructure.

These upgrades are likely to be subject to an Environmental Impact Assessment in terms of the NEMA regulations and a rezoning in terms of municipal legislation.

Goukamma Cluster. The proposed upgrades to the Groenvlei station of the Goukamma sector will be undertaken over two phases. Phase 1 will comprise four parts and are as follows:

- Part 1: Construction of a new gate house and internal road upgrades;
- Part 2: Administrative, staff and backpackers' accommodation upgrades;
- Part 3: Bush camp chalets upgrade (construction of two one-bedroom units and one two-bedroom unit on existing footprints; removal and upgrade of boardwalks to units; removal of existing ablution facility);
- Part 4: New parking area.

According to the DFFE, the applicability of the NEMA, Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) relating to the above-mentioned proposed upgrades (Phase 1: Part 1 – Part 4) at the Groenvlei station do not trigger any listed activities.

Phase 2 will comprise the construction of 8 tourism units and a new package plant and water treatment area. Activities to be undertaken during this phase are listed in terms of NEMA EIA Regulations, 2014. An application for Environmental Authorization (the Basic Assessment Process) is required for the above.

In addition, the Eco-tourism and Access programme is proposing the development of a 12-bed overnight hiking accommodation near the Oysterbeds. This proposal, however, is still subject for internal review, specialist input as well as environmental authorisation in terms of NEMA.

Other applicable legislation and considerations relevant for the proposed developments are:

- NEM:BA - Protected trees that are located on site will require a permit prior to their disturbances, pruning or removal.
- Environmental Conservation Act 73 of 1989, the Outeniqua Sensitive Coastal Areas Extension Regulations (R1528 of 27 November 1998) – As the entire site

falls within the Outeniqua Sensitive Coastal Area Extension, all proposed upgrades that are not listed will be subjected to an application and accompanying EIA report, which will be submitted separately to the checklist and will be covered by an EIA for the Phase 2 activities.

Keurbooms River Cluster. The following new developments (Figure 9.2) have been proposed for the Keurbooms River sector but are still subject for internal review, specialist input as well as environmental authorisation:

- Construction of 16 new campsites;
- Construction of 8-12 new self-catering units within degraded forest habitat;
- Possible restaurant and conference facility; and
- Upgrading of the day visitor and picnic sites.

Due to the erosion of the river embankment at the picnic area, it has been proposed to construct a gabion structure to stabilise the embankment. This would require an EIA in terms of the NEMA regulations.

Figure 9.2: Proposed new developments for the Keurbooms River sector.

9.3.2 Service supply routes

Keurbooms River Cluster. The current sewage conservancy tank at the Robberg parking area is inadequate during peak visitor periods with regular sewage overflows. The Municipal honey sucker has had to be arranged more regularly by management to clean out the conservancy tanks. A Basic Assessment Report for the construction of a new gravity outfall sewer has been submitted to DFFE by HilLand Environmental Practitioners. The project entails the installation of a gravity outfall sewer line from the existing ablution facility located on Robberg to the nearest Bitou Municipality sewer network manhole.

9.3.3 Visitor facilities

Keurbooms River Cluster. There is a need to increase the parking for visitors at Robberg. The vegetation adjacent to the existing parking area is, however, very sensitive due to the proximity of highly threatened plant species to the site. It has thus been suggested to look at other proposals to accommodate the increased day visitor numbers, e.g., by providing parking outside of Robberg along the access road or making use of a shuttle service.

10 STRATEGIC PLAN

This section presents the Strategic Plan for the GRCWHS&NR. The strategic plan was derived from an assessment of the conservation situation, inclusive of the biological environment and the social, economic, cultural and institutional systems that influence values. Strategic intervention points formed the basis for developing strategies; using results chains to test theories of change and establish short to medium term objectives. From these, detailed actions with timeframes were developed to guide implementation, monitoring and evaluation.

Strategies are aimed at:

- Conservation target restoration / stress reduction;
- Behavioural change / threat reduction; and
- Establishing / promoting enabling conditions.

A summary of selected strategies and objectives for the GRCWHS&NR is provided in Table 10.1. Thereafter the 14 identified strategies with details regarding the associated actions and timeframes are presented.

CapeNature will lead the implementation of the management plan, although achieving the vision requires coordinated effort. Stakeholder groups and organisations identified in the strategic plan are key role players in successful delivery of this management plan.

Table 10.1: Summary of strategies and objectives for the Garden Route Complex World Heritage Site and Nature Reserves.

Threat(s) abated	Strategy Type	Strategy	Objectives
Invasive alien plants	Focal value restoration/threat reduction	**Strategy 1:** Through partnerships address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.	**Objective 1.1:** By 2023 and beyond, CapeNature has revised, updated and been implementing the long-term alien invasive clearing plan for the GRCWHS&NR with relevant management authorities.
Inappropriate fire regimes Climate change and extreme weather conditions (droughts, storms and flooding)	Focal value restoration/threat reduction	**Strategy 2:** In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GCWHS&NR and zone of influence.	**Objective 2.1:** By 2023 ecologically sound fire management principles inform integrated fire management operations within the GCWHS&NR and zone of influence. **Objective 2.2:** By 2023 consistently improve and maintain awareness raising of the direct and indirect impacts of fires with relevant partners (e.g., FPA, District Municipality, Forums, Farmers Associations, Conservancies and Working on Fire).
Bush encroachment / Inappropriate fire regimes *(resulting in foodplant reduction)*	Focal value restoration/threat reduction	**Strategy 3:** In collaboration with relevant specialists and research institutions monitor the Brenton Blue Butterfly population and habitat and implement appropriate management actions within the BBBSNR.	**Objective 3.1:** By 2023 and beyond relevant monitoring of the Brenton Blue Butterfly population and foodplant is being implemented. **Objective 3.2:** By 2025 the role and importance of natural animal disturbances that reduce thicket encroachment within the BBBSNR have been investigated /researched.

Threat(s) abated	Strategy Type	Strategy	Objectives
Over-abstraction of surface water Instream and riparian structures (dams, bridges, weirs, jetties) Pollution: domestic, industrial, urban wastewater and oil spills Climate change and extreme weather conditions.	Threat reduction	**Strategy 4:** Through partnerships address agricultural and urban (including industrial) water use best practice, pollution incidents and compliance within the zone of influence.	**Objective 4.1:** By 2023 and beyond CapeNature in collaboration with partners advocate water use best practice (including agricultural, urban and industrial) and compliance within the GRCWHS&NR & zone of influence. **Objective 4.2:** By 2025 align disaster response plans to effectively deal with pollution incidents in collaboration with partners within the GRCWHS&NR and zone of influence.
Over-abstraction of ground water Climate change and extreme weather conditions (droughts, storms and flooding).	Threat reduction	**Strategy 5:** Determine through partnerships and collection of empirical evidence the impact of groundwater abstraction on groundwater dependent ecosystems.	**Objective 5.1:** By 2023 partnerships with relevant monitoring agencies (e.g., South African Environmental Observation Network – SAEON) are established and maintained to obtain relevant data on groundwater dependent ecosystems. **Objective 5.2:** By 2025 groundwater dependent ecosystems within the GRCWHS&NR have been identified and monitoring of these are initiated to determine baseline before abstraction of groundwater commences. **Objective 5.3:** By 2023 and beyond water abstraction quantity and quality of boreholes within the GRCWHS are being monitored by CapeNature and boreholes situated on adjoining properties are being monitored by landowners.

Threat(s) abated	Strategy Type	Strategy	Objectives
Alien invasive fish	Focal value restoration / threat reduction	**Strategy 6**: Through partnerships implement alien invasive fish control in Groenvlei Lake and relevant management actions in priority rivers.	**Objective 6.1:** By 2023 the GRCWHS&NR has implemented an alien fish control plan in Groenvlei Lake that is aligned to legislation informed by risk assessments and surveys.
Biological alien organisms Alien invasive fauna *(excl. fish)*	Focal value restoration/threat reduction	**Strategy 7:** Through partnerships and extension work, address alien invasive, domestic and extra-limital fauna within the GRCWHS&NR and its zone of influence in line with relevant legislation and policies (Agriculture, DFFE, DEA&DP and research institutions).	**Objective 7.1:** By 2025 and beyond in partnership with relevant stakeholders assess the extent of biological invasions within the GRCWHS&NR & zone of influence. **Objective 7.2:** By 2026 and beyond address invasive faunal species control through the development and implementation of an invasive alien species control plan (i.e., domestic animals such as donkeys, goats, horses, cattle, extra-limital game species, etc.).
Loss of terrestrial and marine biodiversity through human activities. Hunting and/or collection of indigenous fauna. Harvesting of indigenous flora.	Focal value restoration/threat reduction	**Strategy 8:** Ensure the conservation of biodiversity and ecosystems and the sustainable and regulated use of resources within the GCWHS&NR and its zone of influence through the development and strengthening of partnerships.	**Objective 8.1:** By 2023 CapeNature develops and implements a natural resource management and utilisation strategy to ensure sustainable and regulated resource use within the terrestrial, aquatic and marine ecosystems. **Objective 8.2:** By 2023 and beyond engage with relevant partners and stakeholders regarding the value of conserving biological resources and maintaining healthy ecosystems through raising awareness and encouraging compliance.

Biological resource use Fishing and harvesting of aquatic resources Hunting and or collection of indigenous fauna Illegal and/or unsustainable harvesting of indigenous flora	Focal value restoration/threat reduction	**Strategy 9:** Address illegal and unsustainable resource utilisation practices within the GRCWHS&NR and its zone of influence through partnerships, extension work and enforcement actions (DFFE: Oceans & Coasts, SANParks, SAPS, DFFE, Stewardship sites).	**Objective 9.1:** By 2023 and beyond, knowledgeable, and experienced staff members engage with relevant partners and stakeholders regarding the value of conserving biological resources and maintaining healthy ecosystems through raising awareness and encouraging voluntary compliance. **Objective 9.2:** By 2023 revise and implement the integrated compliance plan in collaboration with partners and set specific targets. **Objective 9.3:** By 2025 CapeNature develops and implements a natural resource management and utilisation strategy to ensure sustainable and regulated resource use. **Objective 9.4:** By 2030 develop ecological carrying capacity guidelines for different habitat types. **Objective 9.5:** By 2023 CapeNature has ensured that non-compliant game farmers identified within the zone of influence of the GRCWHS&NR are compliant with the relevant legislation and policies.

Threat(s) abated	Strategy Type	Strategy	Objectives
Land clearing *(inappropriate agricultural and tourism developments).* Riparian and instream modifications Telecommunication towers/high sites. Energy production developments *(oil and gas exploration and drilling, wind and solar energy farms).* Illegal recreational activities Climate change and extreme weather conditions (droughts, storms and flooding).	Focal value restoration/threat reduction	**Strategy 10:** Through partnerships and extension work, address illegal and inappropriate agricultural, tourism, urban, industrial, communication and energy production developments within the GRCWHS&NR and its zone of influence. (Dept Agriculture: Western Cape (LandCare), Dept Water & Sanitation, Breede Gouritz Catchment Management Agency, Dept Environmental Affairs & Development Planning, DFFE: Oceans & Coasts)	**Objective 10.1:** By 2023 the GRCWHS&NR and zone of influence is integrated into Municipal Land Use Planning products and developments within protected areas are environmentally and legally compliant. **Objective 10.2:** By 2023 water use planning and management operations are aligned with the objectives of the GRCWHS&NR. **Objective 10.3:** By 2023 and beyond energy production applications are reviewed and monitored to mitigate negative impacts on terrestrial and marine biodiversity.
Climate change and extreme weather conditions *(droughts, storms and flooding)* Habitat fragmentation / transformation Mining and quarrying Transportation and service corridors *(shipping routes)*	Enabling conditions	**Strategy 11:** Promote and implement the WCPAES in collaboration with relevant partners to support ecological processes and maintain living land and seascapes (through the establishment of ecological buffer areas and corridors).	**Objective 11.1:** By 2023 and beyond identify, secure and protect conservation worthy areas and properties surrounding the GRCWHS&NR in line with the WCPAES.

Threat(s) abated	Strategy Type	Strategy	Objectives
Garbage and solid waste Tourism developments on-reserve Climate change and extreme weather conditions (droughts, storms and flooding).	Enabling conditions	**Strategy 12:** Promote the values of a healthy environment for the benefit of present and future generations within the GCWHS&NR and zone of influence through partnerships.	**Objective 12.1:** By 2024 CapeNature, through awareness raising and partnerships, develops and implements an anti-litter and energy and water-saving campaign (leave no trace) for the GRCWHS&NR and zone of influence.
Vandalism and theft to Cultural Heritage Sites	Threat reduction	**Strategy 13:** Through partnerships share, evaluate and enhance the management and protection of cultural and natural heritage values both internally and externally.	**Objective 13.1:** By 2025 engage with relevant partners and stakeholders regarding the value of cultural and natural heritage sites through raising awareness and encouraging compliance.
Human intrusions and disturbance	Enabling conditions	**Strategy 14:** Through partnerships monitor and manage land invasions/occupations and disturbance within the GRCWHS&NR and zone of influence (SAPS, PAAC, Local Municipalities, SANParks, TransNet and SANRAL).	**Objective 14.1:** By 2025 and beyond active and effective partnerships are in place to address land invasions and disturbances within the GRCWHS&NR and zone of influence.

Strategic Action Plan for the Garden Route Complex World Heritage Site and Nature Reserves

10.1 Strategy 1: Invasive alien species management - flora

INVASIVE ALIEN SPECIES MANAGEMENT - FLORA					
STRATEGY 1:	Through partnerships address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.				
THREATS:	• Invasive alien plants.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators / Outputs**	**References / Existing Procedures**
Objective 1.1: By 2023 and beyond, CapeNature has revised, updated and been implementing the long-term alien invasive clearing plan for the GRCWHS&NR with relevant management authorities.	**Eradicate alien and invasive vegetation species on an on-going basis.** • Revise and update the invasive alien plants database and maps for the GRCWHS&NR and zone of influence. • Ensure that the HAT sites are clearly differentiated and included in the database and maps. • Ensure that the Management Unit Clearing Plan is incorporated into the Invasive	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Landscape Managers (L1 & L2); Program Manager - Natural Resource Management; Landscape Conservation Intelligence Manager; Integrated Catchment Specialist.	Annually	Updated Invasive Alien Species Control Plan (Reserve specific) which have projected treatment dates, appropriate methodologies and responsibilities and accountabilities identified and projected.	Invasive Alien Species Control Plans.

INVASIVE ALIEN SPECIES MANAGEMENT - FLORA					
STRATEGY 1:	Through partnerships address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.				
THREATS:	• Invasive alien plants.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators / Outputs**	**References / Existing Procedures**
	Alien Plant plan which informs the IWP and IAPO. • Prioritise invasive alien plant clearing operations in the IAPO based on the current infestation levels, age of the vegetation and accessibility. • Prioritise removal in collaboration with partners (Working for Water, Working on Fire, High Altitude Teams, Municipality and Volunteer groups). • Ensure that contractors carry out clearing operations effectively according to agreed specifications. • Include annual maintenance of relevant infrastructure (roads,				

INVASIVE ALIEN SPECIES MANAGEMENT - FLORA					
STRATEGY 1:	Through partnerships address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.				
THREATS:	• Invasive alien plants.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators / Outputs**	**References / Existing Procedures**
	trails, management paths, etc.) in the IWP and IAPO of all protected areas and ensure compliance with norms and standards by contractors and staff. • Implement the IAPO.				
	Monitor and prioritise alien vegetation on and adjacent to the GRCWHS&NR to inform adaptive management strategies. • Update and maintain invasive alien plant database and adapt clearing strategies as needed in collaboration with neighbouring landowners. • Monitor the costs, impact and effectiveness of implementation	**Lead:** Landscape Manager (L1); Conservation Manager (On-Reserve). **Enablers:** Program Manager - Natural Resource Management; Landscape Conservation Intelligence	Year 1-10	IWP; Updated database and maps; MIS Reports.	Invasive Alien Plant management resource strategy; IAPO; Monthly/weekly planning and reporting.

INVASIVE ALIEN SPECIES MANAGEMENT - FLORA					
STRATEGY 1:	Through partnerships address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.				
THREATS:	• Invasive alien plants.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators / Outputs**	**References / Existing Procedures**
	of clearing and compile progress report.	Manager; Capability Manager: Integrated Catchments; Restoration Ecologist.			
	Implement biological control as a method of invasive alien plant management. • Monitor the presence and success of existing biological control agents and identify additional release sites where applicable. • Release new biological control agents for additional species where and when applicable. • Monitor success of releases. **Prevent the introduction of invasive alien species from neighbouring landowners.**	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Program Manager - Natural Resource Management; Landscape Conservation Intelligence Manager; Capability Manager: Integrated Catchments; Restoration Ecologist.	Year 1-10	Presence/absence monitoring of biological control agents; biodiversity survey sheet reports.	Monthly/weekly planning and reporting; Biocontrol Strategy

INVASIVE ALIEN SPECIES MANAGEMENT - FLORA					
STRATEGY 1:	Through partnerships address the negative impacts that invasive alien vegetation has on fire regimes, biodiversity and water availability within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 invasive alien plant infested areas that are 25% or less will be reduced to densities of less than 1%, those that are between 25 and 50% to densities of 10% or lower, and those that are between 50 and 100% to densities of less than 25%.				
THREATS:	• Invasive alien plants.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators / Outputs**	**References / Existing Procedures**
	• Ensure surrounding landowners are aware of relevant legislation. • Provide guidance to neighbouring landowners regarding the control of invasive alien plants. • Promote a buffer zone of 100 m adjacent to protected areas to limit the infestation of invasive alien plants from neighbouring properties. • Report non-compliance to DFFE.				

10.2 Strategy 2: Fire Management

FIRE MANAGEMENT					
STRATEGY 2:	In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the *Protea* indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.				
THREATS:	• Inappropriate fire regimes • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 2.1: By 2023 ecologically sound fire management principles inform integrated fire management operations within the GRCWHS&NR and zone of influence.	**Compile and implement an ecologically sound integrated fire management plan for the GRCWHS&NR and zone of influence in collaboration with relevant partners.** • Update and implement Fire Protection and Reaction Plans including risk assessments, Eco sensitive and Special Management Zone mapping and fire management maps. • Assess appropriateness of current firebreak network and re-align where appropriate, based on negotiated firebreak agreements with neighbours.	**Lead:** Landscape Manager (L1 & L2); Conservation Manager (On-Reserve). **Enablers:** Capability Manager: Integrated Catchments; IC Specialist Disaster & Climate Response; IC Specialist; Landscape Conservation Intelligence Manager; Landscape Ecologist.	Year 1-10	Fire reports; veld age maps; firebreak registers; pre-fire audit reports and fire de-briefing minutes; maps; meeting minutes; firebreak agreements; portfolio of evidence; awareness interventions	Veldfire Management Policy; Guidelines;, SOGs; Fire break register; ICM-APO.

FIRE MANAGEMENT					
STRATEGY 2:	In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the *Protea* indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.				
THREATS:	• Inappropriate fire regimes • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	• Construct priority firebreaks according to firebreak register schedule and keep updated. • Conduct a pre-fire fire audit. season • Complete fire reports as stipulated and map all fires on QGIS. • Conduct de-briefing sessions after each fire and keep records (including a Portfolio of Evidence).				
	Allow for adaptive management towards natural fire processes to occur without negatively impacting on safety and infrastructure. • Determine and incorporate TPCs and related fire-fighting actions towards ecologically sound fire regimes in fire	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Landscape Manager (L1 & L2); Capability Manager: Integrated Catchments; IC Specialist Disaster & Climate Response; IC Specialist; Landscape	Year 1-10	Veld age maps; hotspot and ecological sensitivity maps including infrastructure information and maintenance schedules.	Fire Management Policy and Guidelines; IWP & IAPO.

FIRE MANAGEMENT					
STRATEGY 2:	In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the *Protea* indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.				
THREATS:	• Inappropriate fire regimes • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	mapping products for use during fire-fighting activities. • Update Infrastructure risk assessments and maintenance schedules for incorporation into fire mapping products and IAPO. • Implement Incident Command System management principles and processes during veldfires or other disasters. • Ensure that ecological principles are incorporated during fire-fighting planning in Incident Command System.	Conservation Intelligence Manager; Capability Manager: Conservation Innovation.			
	Determine and implement thresholds of potential concern and related mitigating actions and ensure their implementation for fire management on the GRCWHS&NR.	**Lead:** Conservation Manager (On-Reserve); Landscape Ecologist. **Enablers:** Capability Manager: Integrated Catchments; IC	Year 1-10	Permanent *Protea* and post-fire monitoring data sheets; hotspot and ecological sensitivity	Fire Management Policy and Guidelines; Baseline Data Collection and

FIRE MANAGEMENT					
STRATEGY 2:	In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the *Protea* indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.				
THREATS:	• Inappropriate fire regimes • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	• Establish a series of permanent *Protea* plots in accordance with the ecological matrix. • Conduct permanent *Protea* plot monitoring. • Conduct post-fire regeneration monitoring 12-18 months after fires. • Set and monitor TPCs based on *Protea* monitoring data collected and identify hotspot areas where fires need to be kept out for ecological reasons. • Investigate faunal thresholds of potential concern.	Specialist Disaster & Climate Response; IC Specialist; Landscape Conservation Intelligence Manager; Ecologist Flora.		maps; veld fire response plan.	Monitoring Manual; Ecological Matrix.
Objective 2.2: By 2023 consistently improve and maintain awareness raising of the direct and indirect impacts of fires with relevant partners (e.g., FPA, District	**Establish and maintain partnerships to improve fire management on the GRCWHS&NR and its zone of influence.**	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Capability Manager: Integrated Catchments; IC Specialist Disaster &	Year 1-10	FPA membership and meeting minutes; FMU plans; East Region Veld Fire Response Plan.	Fire Management Policy and Guidelines; FPA Operational Rules and Guidelines.

FIRE MANAGEMENT					
STRATEGY 2:	In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the *Protea* indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.				
THREATS:	• Inappropriate fire regimes • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Municipality, Forums, Farmers Associations, Conservancies and Working on Fire).	• Attend and participate in and where necessary facilitate and coordinate FPA and FMU meetings. • Implement FPA strategies and FMU action plan where applicable. • Ensure compliance with legislation (i.e., firebreaks and agreements in place). • Respond to all fires within the GRCWHS&NR and the zone of influence and according to the fire response plan.	Climate Response; Landscape Conservation Intelligence Manager; Stakeholder Engagement Officer.			
	Wildfires as a result of human negligence are reduced. • In collaboration with partners, create and implement a fire awareness programme for neighbouring communities and	**Lead:** Conservation Manager (On-Reserve); Stakeholder Engagement Officer. **Enablers:** IC Specialist; Senior Manager	Annually	Media products (videos, AFIS map, radio broadcasting, posters, etc.).	CapeNature Media Engagement Policy

FIRE MANAGEMENT					
STRATEGY 2:	In collaboration with partners promote and implement ecologically sound fire management through integrated fire management operations and awareness raising within the GRCWHS&NR and zone of influence.				
GOALS:	• By 2033 the veld age will be in an ecologically healthy condition. For Outeniqua and Keurbooms River, 50% of the *Protea* indicator species have flowered more than three times; 80% of fires have occurred in the correct fire season and the size of 90% of single fires would not have exceeded 5000 ha for the Outeniquas, 200 ha for Goukamma and Keurbooms River and 50 ha for Robberg.				
THREATS:	• Inappropriate fire regimes • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	landowners, visitors and staff members.	Regional People & Conservation; Compliance & Enforcement Specialist; Landscape Conservation Intelligence Manager.			

10.3 Strategy 3: Brenton Blue Butterfly Management

BRENTON BLUE BUTTERFLY MANAGEMENT					
STRATEGY 3:	In collaboration with relevant specialists and research institutions monitor the Brenton Blue Butterfly population and habitat and implement appropriate management actions within the BBBSNR.				
GOALS:	• By 2033 surveys and monitoring of the Brenton Blue Butterfly within the BBBSNR and other potential habitats have continued to confirm the conservation status of the species and healthy* populations of the food plant (*Indigofera erecta*) are maintained within proclaimed nature reserves. *More than a 1000 individuals. (*The ants and candlewoods were excluded as a goal as the team decided that if the butterfly and food plant are present then the ants are likely to be present as well.*)				
THREATS:	• Bush encroachment. • Inappropriate fire regimes (results in foodplant reduction).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 3.1: By 2023 and beyond relevant monitoring of the Brenton Blue Butterfly population and foodplant is being implemented.	**Implement monitoring.** • Participate in bi-annual surveys for Brenton Blue Butterfly (November & February). • Assist with monitoring of foodplant within the BBBSNR and on adjacent municipal land.	**Lead:** Conservation Manager (On-Reserve). **Enablers**: Landscape Conservation Intelligence Manager; Landscape Manager (L1); Ecologist Fauna.	Years 1-10	Records of surveys.	SOB database; Ecomatrix planning.
Objective 3.2: By 2025 the role and importance of natural animal disturbances that reduce thicket encroachment within the protected area have been researched.	**Engage research institutions.** • Investigate alternative options of managing bush encroachment other than using fire in collaboration with partners.	**Lead**: Landscape Conservation Intelligence Manager. **Enablers**: Landscape Manager (L1); Conservation Manager (On-Reserve); Ecologist Fauna.	Year 1-3	Records of engagement with university(s), Brenton Blue Butterfly Management Committee; research project proposals and reports.	Management Committee meetings & minutes; CapeNature Surveillance, Monitoring and Research Framework 2022-2026.

10.4 Strategy 4: Biodiversity and Ecosystem Management – Surface Water

<table>
<tr><td colspan="6">BIODIVERSITY AND ECOSYSTEM MANAGEMENT - SURFACE WATER</td></tr>
<tr><td>STRATEGY 4:</td><td colspan="5">Through partnerships address agricultural and urban (including industrial) water use best practice, pollution incidents and compliance within the zone of influence.</td></tr>
<tr><td>GOALS:</td><td colspan="5">• By 2033 the ecosystem health condition of all wetlands in the GRCWHS&NR is near-natural with good wetland buffers and Groenvlei is at least a “C” condition (moderately modified). (Wetlands include seepage areas.)
• By 2033 river flow of abstracted rivers is maintained above 80%.
• By 2033 all rivers within the GRCWHS&NR are maintained in a healthy state* to support fish species of conservation concern. *Rivers that support macro invertebrate species communities represent an ASPT of 6-8 with >50% of expected fish species present in at least two age classes and have a natural flow regime.</td></tr>
<tr><td>THREATS:</td><td colspan="5">• Over-abstraction of surface water.
• Dams and water management / use.
• Instream and riparian structures (dams, bridges, weirs, jetties).
• Pollution: domestic, industrial, urban wastewater and oil spills.
• Climate change and extreme weather conditions (droughts, storms and flooding).</td></tr>
<tr><th>Objectives</th><th>Actions</th><th>Responsibility</th><th>Time-frame</th><th>Measurable Indicators</th><th>Existing Procedures</th></tr>
<tr><td>Objective 4.1: By 2023 and beyond CapeNature in collaboration with partners advocates water use best practice (including agricultural, urban and industrial) and compliance within the GRCWHS&NR & zone of influence</td><td>Conserve and protect rivers.
• Identify or establish an appropriate forum to engage with relevant partners, communities and landowners.
• Monitor the health of priority rivers using SASS 5 and record abstraction points.
• Determine any actions necessary as a result of SASS results and abstraction points (includes fishes).</td><td>Lead: Integrated Catchment Specialist.
Enablers: Conservation Manager (On-Reserve); Landscape Manager (L1); Freshwater Ecologist.</td><td>Year 1-10</td><td>Annual reports on findings; monitoring and field reports.</td><td>Ecological Matrix; CapeNature Monitoring Protocol for Freshwater Ecosystems; Wetland Ground-truthing Field Form.</td></tr>
</table>

BIODIVERSITY AND ECOSYSTEM MANAGEMENT - SURFACE WATER					
STRATEGY 4:	Through partnerships address agricultural and urban (including industrial) water use best practice, pollution incidents and compliance within the zone of influence.				
GOALS:	• By 2033 the ecosystem health condition of all wetlands in the GRCWHS&NR is near-natural with good wetland buffers and Groenvlei is at least a "C" condition (moderately modified). (Wetlands include seepage areas.) • By 2033 river flow of abstracted rivers is maintained above 80%. • By 2033 all rivers within the GRCWHS&NR are maintained in a healthy state* to support fish species of conservation concern. **Rivers that support macro invertebrate species communities represent an ASPT of 6-8 with >50% of expected fish species present in at least two age classes and have a natural flow regime.*				
THREATS:	• Over-abstraction of surface water. • Dams and water management / use. • Instream and riparian structures (dams, bridges, weirs, jetties). • Pollution: domestic, industrial, urban wastewater and oil spills. • Climate change and extreme weather conditions (droughts, storms and flooding).				
	• Comment on proposed developments involving water abstraction.				
	Conserve and rehabilitate wetlands. • Initiate desktop assessment of wetlands that are potentially affected by surface water abstraction. • Start verification process of CBA and National Wetlands Map 5 information for updates of the digital wetland spatial layers for the GRCWHS&NR.	**Lead:** Freshwater Ecologist. **Enablers:** Capability Manager: Integrated Catchments; Restoration Ecologist; Conservation Planner; Capability Manager: Conservation Innovation.	Year 1-10	Maps and reports.	

BIODIVERSITY AND ECOSYSTEM MANAGEMENT - SURFACE WATER					
STRATEGY 4:	Through partnerships address agricultural and urban (including industrial) water use best practice, pollution incidents and compliance within the zone of influence.				
GOALS:	• By 2033 the ecosystem health condition of all wetlands in the GRCWHS&NR is near-natural with good wetland buffers and Groenvlei is at least a "C" condition (moderately modified). (Wetlands include seepage areas.) • By 2033 river flow of abstracted rivers is maintained above 80%. • By 2033 all rivers within the GRCWHS&NR are maintained in a healthy state* to support fish species of conservation concern. **Rivers that support macro invertebrate species communities represent an ASPT of 6-8 with >50% of expected fish species present in at least two age classes and have a natural flow regime.*				
THREATS:	• Over-abstraction of surface water. • Dams and water management / use. • Instream and riparian structures (dams, bridges, weirs, jetties). • Pollution: domestic, industrial, urban wastewater and oil spills. • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objective 4.2: By 2025 align disaster response plans to effectively deal with pollution incidents in collaboration with partners within the GRCWHS&NR and zone of influence.	**Report and monitor pollution incidents in the GRCWHS&NR and zone of influence.** • Refer problems related to water pollution events/incidences to relevant authorities (Depts of Transport, Agriculture, Garden Route District Municipality, BGCMA, DFFE and DEA&DP). • Ensure recommended actions are taken and follow-up monitoring is implemented.	**Lead:** Conservation Manager (On-Reserve); Freshwater Ecologist. **Enablers:** Landscape Manager (L1); Capability Manager: Integrated Catchments; Marine & Coasts Specialist; Restoration Ecologist; Landscape Conservation Intelligence Manager.	Year 1-10	Reports and monitoring data collected; minutes of meetings.	Disaster response plan; National Oil spill Response Plan; National Oiled Wildlife Response Plan; Zone Oil spill plans.

10.5 Strategy 5: Biodiversity and Ecosystem Management - Groundwater

BIODIVERSITY AND ECOSYSTEM MANAGEMENT - GROUNDWATER					
STRATEGY 5:	Determine through partnerships and collection of empirical evidence the impact of groundwater abstraction on groundwater dependent ecosystems.				
GOALS:	• By 2033 an established groundwater monitoring programme exists to improve the understanding of groundwater dependent ecosystems.				
THREATS:	• Over-abstraction of groundwater. • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 5.1: By 2023 partnerships with relevant monitoring agencies (e.g., South African Environmental Observation Network – SAEON) are established and maintained to obtain relevant data on groundwater dependent ecosystems.	**Engage with relevant partners and monitoring agencies (SAEON, UCT) regarding research projects and obtaining data on groundwater dependent ecosystems.** • Identity relevant partners / monitoring agencies. • Initiate engagement sessions to establish a support network.	**Lead:** Integrated Catchment Specialist. **Enablers:** Conservation Manager (On-Reserve); Landscape Manager (L1); Freshwater Ecologist. Capability Manager: Integrated Catchments; Landscape Conservation Intelligence Manager; Freshwater Ecologist.	Year 1-10	Annual reports on findings; monitoring and field reports.	Ecological Matrix; CapeNature Monitoring Protocol for Freshwater Ecosystems; Wetland Ground-truthing Field Form.
Objective 5.2: By 2025 groundwater dependent ecosystems within the GRCWHS&NR have been identified and monitoring of these are initiated to	**Mitigate the impacts of groundwater abstraction on the reserve**. • Identify and map wetlands within the GRCWHS&NR.	**Lead:** Freshwater Ecologist **Enablers:** Conservation Manager (On-Reserve); Capability Manager:	Year 1-10	Map of wetlands and seeps; groundwater monitoring protocol and database; Estuary water quality monitoring protocol.	Ecological Matrix; Wetland Ground-truthing Field Form.

BIODIVERSITY AND ECOSYSTEM MANAGEMENT - GROUNDWATER					
STRATEGY 5:	Determine through partnerships and collection of empirical evidence the impact of groundwater abstraction on groundwater dependent ecosystems.				
GOALS:	• By 2033 an established groundwater monitoring programme exists to improve the understanding of groundwater dependent ecosystems.				
THREATS:	• Over-abstraction of groundwater. • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
determine baseline before abstraction of groundwater commences.	• Implement monitoring of groundwater dependent ecosystems according to accepted protocol.	Integrated Catchments; Landscape Conservation Intelligence Manager; Restoration Ecologist; Conservation Planner; Capability Manager: Conservation Innovation.			
Objective 5.3: By 2023 and beyond water abstraction quantity and quality of boreholes within the GRCWHS are being monitored by CapeNature and boreholes situated on adjoining properties are being monitored by landowners.	**Monitor groundwater abstraction and quality.** • Obtain and analyse abstraction data from BGCMA. • Obtain groundwater abstraction points and data (quantity and quality) of boreholes situated adjacent to the GRCWHS&NR. • Ensure that CapeNature boreholes are secured with relevant equipment to monitor abstraction and groundwater recharge rates to be compliant.	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Freshwater Ecologist; Landscape Conservation Intelligence Manager; Capability Manager: Integrated Catchments.	Year 1-10	Spring monitoring data sheets and graphs.	CapeNature Groundwater Monitoring Protocol.

10.6: Strategy 6: Invasive Alien Species Management - Fish

INVASIVE ALIEN SPECIES MANAGEMENT - FISH					
STRATEGY 6:	Through partnerships implement alien invasive fish control in Groenvlei Lake and relevant management actions in priority rivers.				
GOALS:	• By 2033 all rivers within the GRCWHS&NR have been surveyed and the status of all fish CBAs determined. • By 2033 there is an improved understanding of the population dynamics of the carp population in Groenvlei Lake and a self-sustaining removal program in place, based on the ecological assessment results and recommendations.				
THREATS:	• Invasive alien fish.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 6.1: By 2023 the GRCWHS&NR has implemented an alien fish control plan in Groenvlei Lake that is aligned to legislation informed by risk assessments and surveys.	**Conduct fish surveys to determine indigenous fish diversity.** • Conduct fish surveys in priority rivers. • Record all alien and indigenous fish species occurring within the GRCWHS&NR.	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Ecologist Fauna; Landscape Conservation Intelligence Team; Capability Manager: Biodiversity Conservation.	Every 5 years	SOB/Population database; Fish survey reports.	CapeNature Freshwater Fish Monitoring and Baseline data collection protocol; SASS 5; Ecological Matrix.
	Prioritise management actions to address invasive fish species within the GRCWHS&NR. • Monitor populations of alien fish in Groenvlei Lake. • Continue with implementation of Groenvlei Carp fish control project. • Measure success of control methods utilised.	**Lead:** Conservation Manager (On-Reserve) **Enablers:** Ecologist Fauna; Landscape Conservation Intelligence Manager; Landscape Manager (L1).	Years 1-10	SOB/Population database; minutes of stakeholder meetings or correspondence received; species management plan including assessment of viability of alien fish management interventions.	CapeNature Freshwater Fish Monitoring and Baseline data collection protocol; SASS 5; Ecological Matrix; Invasive Alien Species Monitoring, Control and Eradication Plan.

	• Create awareness and involve external stakeholders. • No introduction of alien invasive fish species within Groenvlei Lake and rivers (within GRCWHS&NR) will be allowed.				

10.7 Strategy 7: Invasive Alien Species Management - Fauna

INVASIVE ALIEN SPECIES MANAGEMENT - FAUNA					
STRATEGY 7:	Through partnerships and extension work, address alien invasive, domestic and extra-limital fauna within the GRCWHS&NR and its zone of influence in line with relevant legislation and policies (Agriculture, DEA: Oceans and Coasts, DEA&DP and research institutions).				
GOALS:	• By 2033 all domestic livestock, extra-limital and invasive faunal species* are removed or appropriately managed within the GRCWHS&NR. **Invasive faunal species in the MPA's will be managed appropriately and not necessarily removed.*				
THREATS:	• Alien invasive fauna (terrestrial and marine). • Biological alien invasive organisms (especially PSHB)				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 7.1: By 2025 and beyond in partnership with relevant stakeholders assess the extent of biological invasions within the GRCWHS&NR & zone of influence.	**Determine the extent of biological infestations within the terrestrial and marine environments.** • Ensure that staff receive appropriate training to identify species that are invasive. • Conduct surveys to determine presence of invasive alien fauna (including shot-hole borer beetle and marine invasive species). • Engage with relevant stakeholders and partners to be aware of infestations within the GRCWHS&NR and zone of influence.	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Landscape Manager (L1); Marine & Coasts Specialist; Ecologist Fauna; Landscape Conservation Intelligence Manager.	Year 1-10	SOB/Population database.	Invasive Alien Species Monitoring, Control and Eradication Plan; Partner program implementation plans and procedures.
Objective 7.2: By 2026 and beyond address invasive faunal species control through the development and implementation of an invasive	**Prevent the introduction of alien and invasive species.** • No domestic livestock or other alien fauna (including extra-limital game species) will be	**Lead:** Conservation Managers (On- & Off-Reserve).	Year 1-10	SOB/Population database; Western Cape Game Database (WCGDB);	Ecological Plan of Operations; Ecological matrix; Biodiversity Surveys.

INVASIVE ALIEN SPECIES MANAGEMENT - FAUNA					
STRATEGY 7:	Through partnerships and extension work, address alien invasive, domestic and extra-limital fauna within the GRCWHS&NR and its zone of influence in line with relevant legislation and policies (Agriculture, DEA: Oceans and Coasts, DEA&DP and research institutions).				
GOALS:	• By 2033 all domestic livestock, extra-limital and invasive faunal species* are removed or appropriately managed within the GRCWHS&NR. **Invasive faunal species in the MPA's will be managed appropriately and not necessarily removed.*				
THREATS:	• Alien invasive fauna (terrestrial and marine). • Biological alien invasive organisms (especially PSHB)				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
alien species control plan (i.e., domestic animals such as donkeys, goats, horses, cattle, extra-limital game species, etc.).	permitted in the GRCWHS&NR and will be removed. • Source and provide local firewood for tourism purposes.	**Enablers:** Landscape Manager (L1); Capability Manager: Biodiversity Conservation; Compliance and Enforcement Specialist; Manager: Ecotourism and Access.		Tourism income.	
	Control alien and invasive species within the GRCWHS&NR on an on-going basis. • Record alien fauna (including extra-limital game species) occurring within the GRCWHS&NR. • Monitor populations of alien fauna and compile removal plan.	**Lead:** Conservation Manager (On-Reserve). **Enablers:** Conservation Manager (Off-Reserve); Landscape Manager (L1); Capability Manager: Biodiversity Conservation;	Year 1-10	SOB/Population database; Western Cape Game Database (WCGDB).	Ecological Plan of Operations, Ecological matrix, Biodiversity Surveys.

INVASIVE ALIEN SPECIES MANAGEMENT - FAUNA					
STRATEGY 7:	Through partnerships and extension work, address alien invasive, domestic and extra-limital fauna within the GRCWHS&NR and its zone of influence in line with relevant legislation and policies (Agriculture, DEA: Oceans and Coasts, DEA&DP and research institutions).				
GOALS:	• By 2033 all domestic livestock, extra-limital and invasive faunal species* are removed or appropriately managed within the GRCWHS&NR. **Invasive faunal species in the MPA's will be managed appropriately and not necessarily removed.*				
THREATS:	• Alien invasive fauna (terrestrial and marine). • Biological alien invasive organisms (especially PSHB)				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	• Implement removal plan. • In the case of domestic livestock these will be removed by arrangement with the rightful owner. • Measure success of control methods utilised. • Create awareness and involve external stakeholders.	Compliance and Enforcement Specialist; Team Leader: Learning & Awareness.			

10.8 Strategy 8: Biodiversity and Ecosystem Management – Sustainable resource use

BIODIVERSITY AND ECOSYSTEM MANAGEMENT – SUSTAINABLE RESOURCE USE					
STRATEGY: 8	Ensure the conservation of biodiversity and ecosystems and the sustainable and regulated use of resources within the GCWHS&NR and its zone of influence through the development and strengthening of partnerships.				
GOALS:	• By 2033 biodiversity and ecosystems, and sustainable and regulated resource use are in accordance with applicable legislation, CapeNature policies and procedures. • By 2033 the estuarine health index category is maintained or improved for the Goukamma estuary to Category A/B or B and the Keurbooms estuary to Category A/B*. **A = Unmodified, approximates natural condition; B = Near-natural with few modifications* • By 2033 the health* of the intertidal and inshore zones of the Goukamma and Robberg Marine Protected Areas is maintained at the current baseline state (good). **Stable populations of identified indicator species of the Agulhas sandy inshore habitats and stable adult-to-juvenile ratios of African black oystercatchers.* • By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. **Goukamma = 71 species; Robberg = 64 species.* • By 2033 the Cape fur seal populations at Robberg and Mossel Bay Seal Island are persistent and breeding.				
THREATS:	• Loss of terrestrial and marine biodiversity through human activities. • Hunting and/or collection of indigenous fauna. • Harvesting of indigenous flora.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 8.1: By 2023 CapeNature develops and implements a natural resource management and utilisation strategy to ensure sustainable and regulated resource use within the terrestrial, aquatic and marine ecosystems.	**Ensure that biodiversity resource inventories are in place.** • Compile species inventories as prioritised by ecological matrix according to relevant protocols. • Identify species of conservation concern and prioritise species for monitoring.	**Lead:** Conservation Manager (On-Reserve). **Enablers**: Landscape Manager (L1); Landscape Conservation Intelligence Manager; Capability Manager: Biodiversity	Years 2-10	SOB database; Threatened species databases.	Ecological matrix; Ecological protocol for collecting data; CapeNature SOB report.

BIODIVERSITY AND ECOSYSTEM MANAGEMENT – SUSTAINABLE RESOURCE USE					
STRATEGY: 8	Ensure the conservation of biodiversity and ecosystems and the sustainable and regulated use of resources within the GCWHS&NR and its zone of influence through the development and strengthening of partnerships.				
GOALS:	• By 2033 biodiversity and ecosystems, and sustainable and regulated resource use are in accordance with applicable legislation, CapeNature policies and procedures. • By 2033 the estuarine health index category is maintained or improved for the Goukamma estuary to Category A/B or B and the Keurbooms estuary to Category A/B*. **A = Unmodified, approximates natural condition; B = Near-natural with few modifications* • By 2033 the health* of the intertidal and inshore zones of the Goukamma and Robberg Marine Protected Areas is maintained at the current baseline state (good). **Stable populations of identified indicator species of the Agulhas sandy inshore habitats and stable adult-to-juvenile ratios of African black oystercatchers.* • By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. **Goukamma = 71 species; Robberg = 64 species.* • By 2033 the Cape fur seal populations at Robberg and Mossel Bay Seal Island are persistent and breeding.				
THREATS:	• Loss of terrestrial and marine biodiversity through human activities. • Hunting and/or collection of indigenous fauna. • Harvesting of indigenous flora.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
		Conservation; Marine & Coasts Specialist.			
	Identify species that are targeted for resource use. • Develop and implement a strategy to address the need in collaboration with relevant user groups and partners. • Engage with private landowners regarding granting access to local communities for harvesting (e.g., MTO).	**Lead:** Conservation Managers (On- & Off-Reserve). **Enablers:** Landscape Manager (L1); Landscape Conservation Intelligence Manager; Marine & Coasts Specialist.	Year 2	SOB database; PAAC engagements and minutes; stakeholder engagement database.	PAAC meetings; Farmer's Associations; NRUGS; Estuary Advisory Forums.

<table>
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• By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. *Goukamma = 71 species; Robberg = 64 species.
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<tr><td>Objectives</td><td>Actions</td><td>Responsibility</td><td>Time-frame</td><td>Measurable Indicators</td><td>Existing Procedures</td></tr>
<tr><td></td><td>Ensure that a monitoring programme is being implemented in collaboration with relevant partners (CREW, BirdLife SA, Animal Demography Unit, Endangered Wildlife Trust, DFFE: Oceans & Coasts, etc.).
• Develop and implement monitoring programme in collaboration with partners.</td><td>Lead: Conservation Manager (On-Reserve); Landscape Manager (L1).
Enablers: Landscape Conservation Intelligence Manager; Capability Manager: Biodiversity Conservation; Marine & Coasts Specialist.</td><td>Year 1 - 10</td><td>SOB database; Threatened species databases; Animal Demography Unit databases.</td><td>Ecological matrix; Ecological monitoring protocol.</td></tr>
</table>

BIODIVERSITY AND ECOSYSTEM MANAGEMENT – SUSTAINABLE RESOURCE USE					
STRATEGY: 8	Ensure the conservation of biodiversity and ecosystems and the sustainable and regulated use of resources within the GCWHS&NR and its zone of influence through the development and strengthening of partnerships.				
GOALS:	• By 2033 biodiversity and ecosystems, and sustainable and regulated resource use are in accordance with applicable legislation, CapeNature policies and procedures. • By 2033 the estuarine health index category is maintained or improved for the Goukamma estuary to Category A/B or B and the Keurbooms estuary to Category A/B*. **A = Unmodified, approximates natural condition; B = Near-natural with few modifications* • By 2033 the health* of the intertidal and inshore zones of the Goukamma and Robberg Marine Protected Areas is maintained at the current baseline state (good). **Stable populations of identified indicator species of the Agulhas sandy inshore habitats and stable adult-to-juvenile ratios of African black oystercatchers.* • By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. **Goukamma = 71 species; Robberg = 64 species.* • By 2033 the Cape fur seal populations at Robberg and Mossel Bay Seal Island are persistent and breeding.				
THREATS:	• Loss of terrestrial and marine biodiversity through human activities. • Hunting and/or collection of indigenous fauna. • Harvesting of indigenous flora.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 8.2: By 2023 and beyond engage with relevant partners and stakeholders regarding the value of conserving biological resources and maintaining healthy ecosystems through raising awareness and encouraging compliance.	**Implement an awareness raising campaign regarding the value of conserving biological resources and maintaining healthy ecosystems.** • Develop awareness raising information materials and roll-out strategy in conjunction with partners. • Implement awareness raising strategy with partners.	**Lead**: Conservation Managers (On- & Off-Reserve). **Enablers**: Landscape Manager (L1); Landscape Conservation Intelligence Manager; Marine & Coasts Specialist; Team Leader: Learning & Awareness.	Year 2 - 10	Awareness raising materials; minutes of stakeholder engagements; maps showing degraded areas; restoration protocols.	PAAC meetings; Farmer's Associations; NRUGS; GREF; Biosphere Reserve Forums; FPA Forum; Estuary Advisory Forums.

BIODIVERSITY AND ECOSYSTEM MANAGEMENT – SUSTAINABLE RESOURCE USE					
STRATEGY: 8	Ensure the conservation of biodiversity and ecosystems and the sustainable and regulated use of resources within the GCWHS&NR and its zone of influence through the development and strengthening of partnerships.				
GOALS:	• By 2033 biodiversity and ecosystems, and sustainable and regulated resource use are in accordance with applicable legislation, CapeNature policies and procedures. • By 2033 the estuarine health index category is maintained or improved for the Goukamma estuary to Category A/B or B and the Keurbooms estuary to Category A/B*. **A = Unmodified, approximates natural condition; B = Near-natural with few modifications* • By 2033 the health* of the intertidal and inshore zones of the Goukamma and Robberg Marine Protected Areas is maintained at the current baseline state (good). **Stable populations of identified indicator species of the Agulhas sandy inshore habitats and stable adult-to-juvenile ratios of African black oystercatchers.* • By 2033 marine fish community composition* and trophic levels, where feasible, are maintained at a good to very good status. **Goukamma = 71 species; Robberg = 64 species.* • By 2033 the Cape fur seal populations at Robberg and Mossel Bay Seal Island are persistent and breeding.				
THREATS:	• Loss of terrestrial and marine biodiversity through human activities. • Hunting and/or collection of indigenous fauna. • Harvesting of indigenous flora.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	Address degraded ecosystems through restoration projects. • Identify and ensure that degraded areas are mapped. • Develop and implement restoration protocols in collaboration with relevant partners (e.g., Working for Land, Working for Water, Restore Eden Project).	**Lead:** Conservation Manager (On-Reserve); Landscape Manager (L1). **Enablers:** Landscape Conservation Intelligence Manager; Restoration Ecologist; Marine & Coasts Specialist.	Year 1-10	Maps and restoration protocols.	Ecological Matrix; Integrated Workplans; Estuary Governance Tools.

10.9 Strategy 9: Integrated compliance and enforcement

INTEGRATED COMPLIANCE AND ENFORCEMENT					
STRATEGY: 9	Address illegal and unsustainable resource utilisation practices within the GRCWHS&NR and its zone of influence through partnerships, extension work and enforcement actions (DEA: Oceans & Coasts, SANParks, SAPS, DFFE, Stewardship sites).				
GOALS:	• By 2033 an integrated compliance and enforcement programme is being implemented.				
THREATS:	• Fishing and harvesting of aquatic resources. • Hunting and/or collection of indigenous fauna. • Illegal and/or unsustainable harvesting of indigenous flora. • Illegal recreational activities.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 9.1: By 2023 and beyond, knowledgeable and experienced staff members engage with relevant partners and stakeholders regarding the value of conserving biological resources and maintaining healthy ecosystems through raising awareness and encouraging voluntary compliance.	**Ensure that staff members are capacitated to engage with landowners and members of the public regarding sustainable resource use practices and compliance.** • Provide training to relevant staff to engage with relevant partner organisations and landowners regarding sustainable resource use and value of conservation. • Grow support for the GRCWHS&NR by conducting awareness raising programmes aimed at addressing identified issues.	**Lead:** Conservation Managers (On- & Off-Reserve). **Enablers:** Landscape Manager (L1); Capability Manager: Biodiversity Conservation; Compliance & Enforcement Specialist; Marine & Coasts Specialist.	Year 1 - 10	Number of EMIs trained and appointed; Number of Peace Officers trained and appointed.	Criminal Procedure Act, 1977 (Act No. 51 of 1977); Bill of Rights; Constitution of SA; NEMA, NEM:BA, NEM:PAA; Western Cape Biodiversity Act, 2022; Integrated Compliance Plan.

INTEGRATED COMPLIANCE AND ENFORCEMENT					
STRATEGY: 9	Address illegal and unsustainable resource utilisation practices within the GRCWHS&NR and its zone of influence through partnerships, extension work and enforcement actions (DEA: Oceans & Coasts, SANParks, SAPS, DFFE, Stewardship sites).				
GOALS:	• By 2033 an integrated compliance and enforcement programme is being implemented.				
THREATS:	• Fishing and harvesting of aquatic resources. • Hunting and/or collection of indigenous fauna. • Illegal and/or unsustainable harvesting of indigenous flora. • Illegal recreational activities.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 9.2: By 2023 revise and implement the integrated compliance plan in collaboration with partners and set specific targets.	**Implement and revise the integrated compliance plans.** • Update the integrated compliance plan by identifying relevant annual actions. • Engage and gain support from judiciary to strengthen biodiversity cases and interpretation of relevant legislation. • Establish working relations to ensure support for biodiversity related cases. • Provide EMI and Peace Officer training to relevant staff applicable to their function and mandate.	**Lead:** Conservation Managers (On- & Off-Reserve). **Enablers:** Landscape Managers (L1 & L2); Capability Manager: Biodiversity Conservation; Compliance & Enforcement Specialist; Conservation Stewardship Specialist; Landscape Conservation Intelligence Manager; Marine & Coasts Specialist.	Year 1 - 10	Minutes of meetings; stakeholder engagement database.	PAAC meetings; Farmer's Associations; NRUGS; FPA Forum; Biodiversity Protection Forum.

INTEGRATED COMPLIANCE AND ENFORCEMENT					
STRATEGY: 9	Address illegal and unsustainable resource utilisation practices within the GRCWHS&NR and its zone of influence through partnerships, extension work and enforcement actions (DEA: Oceans & Coasts, SANParks, SAPS, DFFE, Stewardship sites).				
GOALS:	• By 2033 an integrated compliance and enforcement programme is being implemented.				
THREATS:	• Fishing and harvesting of aquatic resources. • Hunting and/or collection of indigenous fauna. • Illegal and/or unsustainable harvesting of indigenous flora. • Illegal recreational activities.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 9.3: By 2025 CapeNature develops and implements a natural resource management and utilisation strategy to ensure sustainable and regulated resource use.	**Identify species that are targeted for resource use.** • Develop and implement a strategy to address the need in collaboration with relevant user groups and partners. • Engage with private landowners regarding granting access to local communities for harvesting.	**Lead:** Conservation Managers (On- & Off-Reserve); Landscape Manager (L1). **Enablers:** Landscape Conservation Intelligence Manager; Regional Manager: People and Conservation; Marine & Coasts Specialist.	Year 2	SOB database; PAAC engagements and minutes; stakeholder engagement database.	PAAC meetings; Farmer's Associations; NRUGS; Estuary Advisory Forums.
Objective 9.4: By 2030 develop ecological carrying capacity guidelines for different habitat types.	**Develop ecological carrying capacity guidelines for different habitat types.** • Engage with relevant specialists and partners to revise and incorporate ecological carrying capacity based on the fine scale	**Lead:** Landscape Manager (L1). **Enablers:** Landscape Conservation Intelligence Manager; Conservation Manager (Off-Reserve); Team	Year 7	Revised ecological carrying capacity guidelines; Stakeholder engagement database.	Cape Farm Mapper; CapeNature Game Stocking Extension Tool.

INTEGRATED COMPLIANCE AND ENFORCEMENT					
STRATEGY: 9	Address illegal and unsustainable resource utilisation practices within the GRCWHS&NR and its zone of influence through partnerships, extension work and enforcement actions (DEA: Oceans & Coasts, SANParks, SAPS, DFFE, Stewardship sites).				
GOALS:	• By 2033 an integrated compliance and enforcement programme is being implemented.				
THREATS:	• Fishing and harvesting of aquatic resources. • Hunting and/or collection of indigenous fauna. • Illegal and/or unsustainable harvesting of indigenous flora. • Illegal recreational activities.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	vegetation habitat types into decision support tools. • Carry out awareness raising of revised guidelines in collaboration with relevant partners (Dept Agriculture: LandCare, etc.).	Leader: Learning & Awareness.			
Objective 9.5: By 2023 CapeNature has ensured that non-compliant game farmers identified within the zone of influence of the GRCWHS&NR are compliant with the relevant legislation and policies.	**Identify non-compliant game farmers within the zone of influence.** • Recommend remedial actions and monitor implementation.	**Lead:** Conservation Managers (On- & Off-Reserve); Landscape Manager (L1). **Enablers:**; Capability Manager: Biodiversity Conservation; Compliance and Enforcement Specialist.	Year 1 - 10	List of non-compliant game farmers; remedial action reports.	WCGDB; GTUP.

10.10 Strategy 10: Regional Integrated Planning and Cooperative Governance

REGIONAL INTEGRATED PLANNING AND COOPERATIVE GOVERNANCE					
STRATEGY: 10	Through partnerships (Dept Agriculture: Western Cape (LandCare), Dept Water & Sanitation, Breede Gouritz Catchment Management Agency, Dept Environmental Affairs & Development Planning, DEA: Oceans & Coasts) and extension work, address illegal and inappropriate agricultural, tourism, urban, industrial, communication and energy production developments within the GRCWHS&NR and its zone of influence.				
GOALS:	• By 2033 the natural and scenic land and seascapes are recognized and preserved as important landscape features providing ecosystem services that support human wellbeing.				
THREATS:	• Land clearing (inappropriate agricultural and tourism developments). • Riparian and instream modifications. • Telecommunication towers/high sites. • Energy production developments (oil and gas exploration and drilling, wind and solar energy farms). • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 10.1: By 2023 the GRCWHS&NR and zone of influence is integrated into Municipal Land Use Planning products and developments within protected areas are environmentally and legally compliant.	**Conserve the unspoilt natural land and seascape of the GRCWHS&NR and zone of influence.** • Ensure that protected areas and priority corridors (BSP) are incorporated into the Municipal SDFs and other governmental planning initiatives and products. • Ensure that infrastructure development (including high sites) is legally compliant, non-obtrusive and environmentally friendly within specific identified	**Lead:** Conservation Managers (On- & Off-Reserve). **Enablers:** Landscape Conservation Intelligence Manager; Mainstream Specialist; Conservation Planning Specialist; Marine & Coasts Specialist.	Year 1- 10	SDF; Environmental authorisations; comments submitted on developments; infrastructural development within specified zones; U-AMP.	Biodiversity Spatial Plan; Protected Area Expansion Plan; Marine Expansion Plan; NEMA; Conservation Development Framework; IWP; IAPO.

REGIONAL INTEGRATED PLANNING AND COOPERATIVE GOVERNANCE					
STRATEGY: 10	Through partnerships (Dept Agriculture: Western Cape (LandCare), Dept Water & Sanitation, Breede Gouritz Catchment Management Agency, Dept Environmental Affairs & Development Planning, DEA: Oceans & Coasts) and extension work, address illegal and inappropriate agricultural, tourism, urban, industrial, communication and energy production developments within the GRCWHS&NR and its zone of influence.				
GOALS:	• By 2033 the natural and scenic land and seascapes are recognized and preserved as important landscape features providing ecosystem services that support human wellbeing.				
THREATS:	• Land clearing (inappropriate agricultural and tourism developments). • Riparian and instream modifications. • Telecommunication towers/high sites. • Energy production developments (oil and gas exploration and drilling, wind and solar energy farms). • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	zones and maintained according to U-AMP schedule. • Provide comments on developments that may impact on the GRCWHS&NR and zone of influence.				
Objective 10.2: By 2023 water use planning and management operations are aligned with the objectives of the GRCWHS&NR.	**Ensure the objectives of the GRCWHS&NR inform water use planning products and management operations.** • Provide input and comments for Water Use Licence Applications (WULA) and other developments impacting on water resources.	**Lead:** Conservation Manager (On- & Off-Reserve). **Enablers:** Landscape Conservation Intelligence Manager; Capability Manager: Integrated Catchment Manager; Freshwater Ecologist.	Year 1 – 10	Comments submitted on WULA and other applications.	National Water Act; Breede Gouritz Catchment Management Agency, NEMA; WC Biodiversity Act, 2022.

REGIONAL INTEGRATED PLANNING AND COOPERATIVE GOVERNANCE					
STRATEGY: 10	Through partnerships (Dept Agriculture: Western Cape (LandCare), Dept Water & Sanitation, Breede Gouritz Catchment Management Agency, Dept Environmental Affairs & Development Planning, DEA: Oceans & Coasts) and extension work, address illegal and inappropriate agricultural, tourism, urban, industrial, communication and energy production developments within the GRCWHS&NR and its zone of influence.				
GOALS:	• By 2033 the natural and scenic land and seascapes are recognized and preserved as important landscape features providing ecosystem services that support human wellbeing.				
THREATS:	• Land clearing (inappropriate agricultural and tourism developments). • Riparian and instream modifications. • Telecommunication towers/high sites. • Energy production developments (oil and gas exploration and drilling, wind and solar energy farms). • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 10.3: By 2023 and beyond energy production applications are reviewed and monitored to mitigate negative impacts on terrestrial and marine biodiversity.	**Ensure that the BSP, PAES plans inform decision-making processes, policies and energy production projects.** • Represent CapeNature at the Garden Route Municipal Coastal Committee. • Provide comments on applications that may impact on the GRCWHS&NR and zone of influence.	**Lead:** Conservation Managers (On- & Off-Reserve). **Enablers:** Landscape Manager (L1); Landscape Conservation Intelligence Manager; Marine & Coasts Specialist.	Year 1 – 10	Comments submitted on applications.	BSP; PAES; Marine Expansion Plan; NEMA; WC Biodiversity Act, 2022.

10.11 Strategy 11: Legal Status and Reserve Expansion

LEGAL STATUS AND RESERVE EXPANSION					
STRATEGY: 11	**Strategy 11:** Promote and implement the WCPAES in collaboration with relevant partners to support ecological processes and maintain living land and seascapes (through the establishment of ecological buffer areas and corridors).				
GOALS:	• By 2033 all forestry exit areas and other identified state land have been transferred and secured into the conservation estate and three priority properties will have signed stewardship agreements within priority corridors.				
THREATS:	• Climate change and extreme weather conditions (droughts, storms and flooding). • Habitat fragmentation / transformation: degradation of landscapes. • Transportation and service corridors (shipping routes).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 11.1: By 2023 and beyond identify, secure and protect conservation worthy areas and properties surrounding the RCWHS&NR in line with the PAES.	**Ensure all land parcels, marine protected areas and estuaries have legal conservation status in terms of NEM:PAA.** • Formalise legal status of State Forest land, Exit Areas and Estuary areas identified for protection. • Formalise demarcation and initiate proclamation process of the Seagull Breeding Colony south of Keurbooms River. • Finalise regularisation of priority Private Nature Reserves. • Initiate discussions regarding the transfer of Annex Vlugt to SANParks. • Ensure that all protected areas are listed in the National Protected Areas register as required by NEM:PAA.	**Lead:** Landscape Manager (L2). **Enablers:** Landscape Manager (L1); Conservation Stewardship Specialist; Conservation Manager (On-Reserve); Marine & Coasts Specialists.	Year 1 – 10	National Protected Areas Register. Government Gazette Notices.	NEM:PAA; Deeds Office; Government Gazette; WCPAES.

LEGAL STATUS AND RESERVE EXPANSION					
STRATEGY: 11	**Strategy 11:** Promote and implement the WCPAES in collaboration with relevant partners to support ecological processes and maintain living land and seascapes (through the establishment of ecological buffer areas and corridors).				
GOALS:	• By 2033 all forestry exit areas and other identified state land have been transferred and secured into the conservation estate and three priority properties will have signed stewardship agreements within priority corridors.				
THREATS:	• Climate change and extreme weather conditions (droughts, storms and flooding). • Habitat fragmentation / transformation: degradation of landscapes. • Transportation and service corridors (shipping routes).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	Identify priority properties for expansion in line with WC PAES. • Identify potential stewardship agreements with surrounding landowners in line with priority corridors. • Maintain stewardship agreements with relevant landowners. • Ensure sufficient staff in place to carry out stewardship responsibilities in the landscape zone of influence. • Establish formal protection for extension of Goukamma MPA and Keurbooms estuary. • Enhance protection and management by re-zoning Goukamma and Robberg MPAs to increase the proportion of 'no-take' areas.	**Lead:** Landscape Managers (L1 & L2). **Enablers:** Conservation Managers (On- & Off-Reserve); Landscape Conservation Intelligence Manager; Conservation Stewardship Specialist; Marine & Coasts Specialist.	Year 1 – 10	Total hectares added to conservation estate; number of appointed stewardship staff.	PAES.

LEGAL STATUS AND RESERVE EXPANSION					
STRATEGY: 11	**Strategy 11:** Promote and implement the WCPAES in collaboration with relevant partners to support ecological processes and maintain living land and seascapes (through the establishment of ecological buffer areas and corridors).				
GOALS:	• By 2033 all forestry exit areas and other identified state land have been transferred and secured into the conservation estate and three priority properties will have signed stewardship agreements within priority corridors.				
THREATS:	• Climate change and extreme weather conditions (droughts, storms and flooding). • Habitat fragmentation / transformation: degradation of landscapes. • Transportation and service corridors (shipping routes).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
	Ensure that protected area boundaries are demarcated and known by reserve management, neighbouring landowners and public. • Compile updated map showing reserve boundaries with GPS points. • Ensure that boundaries are clearly demarcated.	**Lead:** Landscape Manager (L1). **Enablers:** Conservation Manager (On-Reserve); Team Leader: Land Affairs: Legal Services; Capability Manager: Biodiversity Conservation; General Manager: Ecotourism and Access.	Year 1 - 3	Map showing reserve boundaries; physical beacons set up in field; signage.	CN boundary verification process; METTs.

10.12 Strategy 12: Biodiversity and Ecosystem Management – Environmental Health

BIODIVERSITY AND ECOSYSTEM MANAGEMENT – ENVIRONMENTAL HEALTH					
STRATEGY 12:	Promote the values of a healthy environment for the benefit of present and future generations within the GRCWHS&NR and zone of influence through partnerships.				
GOALS:	• By 2033 anti-litter, energy and water saving campaigns within the GRCWHS&NR are contributing towards a healthy environment.				
THREATS:	• Garbage and solid waste. • Tourism developments on-reserve. • Climate change and extreme weather conditions (droughts, storms and flooding).				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 12.1: By 2024 CapeNature, through awareness raising and partnerships, develops and implements an anti-litter and energy and water-saving campaign (leave no trace) for the GRCWHS&NR and zone of influence.	**Develop and implement anti-litter and energy and water-saving projects.** • Promote and advocate leave no trace principles at tourism sites, trails and roads within the GRCWHS&NR in collaboration with partners (Municipalities, Dept of Transport, tourism bureaus). • Ensure that recycling projects are in place throughout the GRCWHS&NR (offices, staff housing facilities and tourism facilities). • Raise awareness amongst all staff members to lead by example regarding reduction in the using of single use items, waste, energy use and water use (‘practice what we preach’).	**Lead:** Landscape Managers (L1 & L2). **Enablers:** Conservation Manager (On-Reserve); General Manager: Ecotourism & Access; Manager: Ecotourism & Access; Marine & Coasts Specialist.	Year 1 - 10	Number of clean-up events; electricity use bills.	Leave no trace principles.

10.13 Strategy 13: Cultural Heritage and Resource Management

CULTURAL HERITAGE RESOURCE MANAGEMENT					
STRATEGY: 13	Through partnerships share, evaluate and enhance the management and protection of cultural and natural heritage values both internally and externally.				
GOALS:	• By 2033 all human disturbance to heritage features within the GRCWHS&NR is limited to maintain, or where feasible, improve condition.				
THREATS:	• Vandalism and theft to Cultural Heritage Sites.				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 13.1: By 2025 engage with relevant partners and stakeholders regarding the value of cultural and natural heritage sites through raising awareness and encouraging compliance.	**Develop and implement cultural heritage management plans.** • Compile, finalise and implement the cultural heritage management plans for the GRCWHS&NR. • Provide access to local guides to carry out awareness raising to enable them to benefit from tourism opportunities. • Regulate access to cultural heritage sites by signing agreements with partners (Tolhuis, SAHRA and research institutions).	**Lead:** Landscape Manager (L1). **Enablers:** Conservation Manager (On-Reserve); Manager: Ecotourism & Access.	Year 3	Cultural heritage management plans; stakeholder engagement database.	CapeNature Heritage Inventory; Integrated Awareness Work Plan.

10.14 Strategy 14: Biodiversity and Ecosystem Management – Land invasions and disturbance

BIODIVERSITY AND ECOSYSTEM MANAGEMENT – LAND INVASIONS AND DISTURBANCE					
STRATEGY 14:	Through partnerships monitor and manage land invasions/occupations and disturbance within the GRCWHS&NR and zone of influence (SAPS, PAAC, Local Municipalities, SANParks, TransNet and SANRAL).				
GOALS:	• By 2033 any land invasions/occupations or disturbance within the GRCWHS&NR are dealt with swiftly and effectively resolved*. * *Within 12-24 hrs; occupants and structures removed within legal timeframes.*				
THREATS:	• Human intrusions and disturbance				
Objectives	**Actions**	**Responsibility**	**Time-frame**	**Measurable Indicators**	**Existing Procedures**
Objective 14.1: By 2025 and beyond active and effective partnerships are in place to address land invasions and disturbances within the GRCWHS&NR and zone of influence.	**Address land invasions and disturbances effectively.** • Engage with relevant local authorities and determine the roles and responsibilities of each. • Update the integrated compliance plan to include the threats of human intrusions and disturbance. • Implement CapeNature's strategy to deal with land invasions and disturbances.	**Lead:** Landscape Managers (L1 & L2). **Enablers:** Conservation Manager (On-Reserve); Manager: Ecotourism & Access; General Manager: Strategy, Governance & Risk.	Year 1-10	Records of invasion or disturbance incidents; Records of engagements with partners.	CapeNature Strategy: Unlawful occupation of protected areas 2020.

11 COSTING

This section provides an overview of costing and fund allocation for strategies. It outlines the existing financial resources (current budget), funding shortfalls, sources of alternate funding and future financial projections.

11.1 Finance and Asset Management

In line with the legal requirement, the strategies identified for implementation within the GRCWHS&NR, to achieve the desired state, have been costed below.

The GRCWHS&NR will adhere to the guiding principles listed below:

- Responsibly manage the allocation of budget, revenue raising activities and expenditure;
- Ensure solid financial management supporting the achievement of the objectives of this plan; and
- Compliance with the Public Finance Management Act, 1999 (Act No. 1 of 1999) as well as CapeNature's financial policies and procedures.

A budget was derived based upon the activities in this management plan. When estimating the costing, the following items were considered:

- Those costs and associated resources which could be allocated to specific activities and which were of a recurring nature;
- Those costs and associated resources which could be allocated to specific activities but which were of a once-off nature;
- Unallocated fixed costs (water, electricity, phones, bank fees, etc.);
- Maintenance of infrastructure; and
- Provision for replacement of minor assets, (furniture, electronic equipment, vehicles, etc.).

11.1.1 Income

CapeNature's budget is funded by the Medium-Term Expenditure Framework (MTEF) allocation, other government grants and generated from own revenue sources derived from commercial activities. Any surplus revenue generated is used to fund shortfalls in management costs across the organisation.

CapeNature has overhead costs relating to support services such as human resources, marketing and eco-tourism, finance, biodiversity support, conservation services, people and conservation, legal services, etc. which is not allocated to individual protected area complexes and must also be funded through grant funding or own revenue generated.

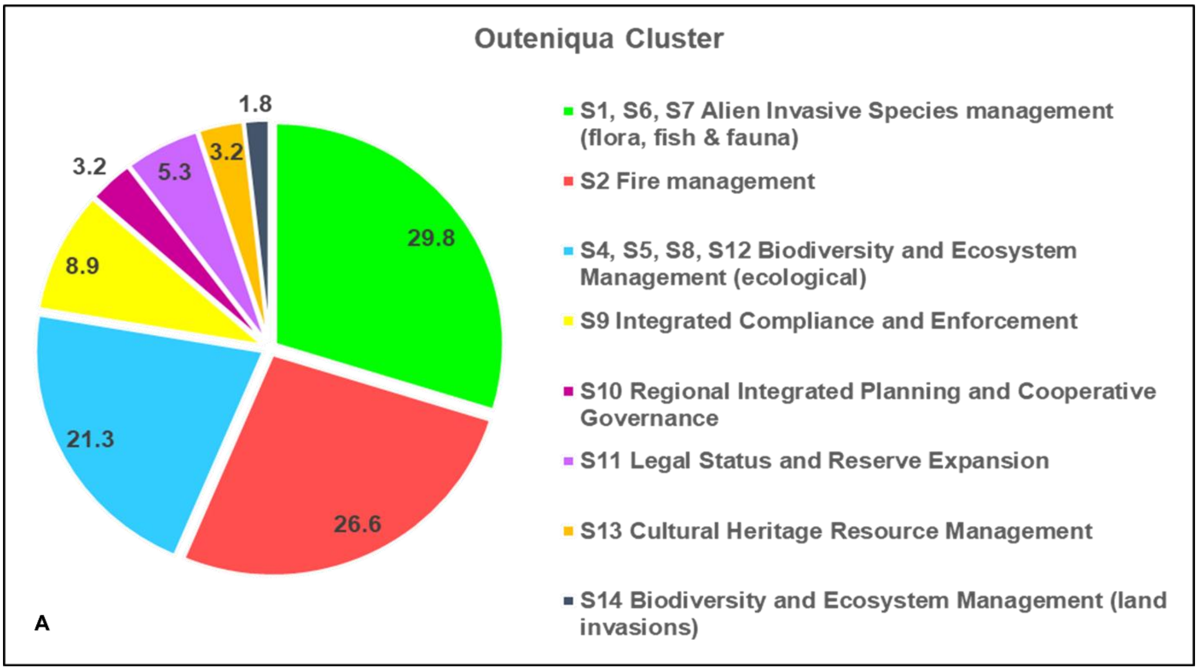
This management plan is a 10-year plan, and thus straddles multiple MTEF periods that impact on actual budget allocation and projection. Due to the challenging fiscal position the country faces and additional strain brought on by the COVID-19 pandemic, the organisation is facing budget cuts and reduced tourism income that will have to be considered during the implementation of this management plan.

Total projected budget for 2023/24 is **R 18 259 615.56.**

11.1.2 Expenditure

11.1.2.1 Recurring costs

Annual direct costs may include staff, transport and travel, stores and equipment and fixed costs. This expenditure is split according to strategies as illustrated in Figures 11.1 and 11.2.



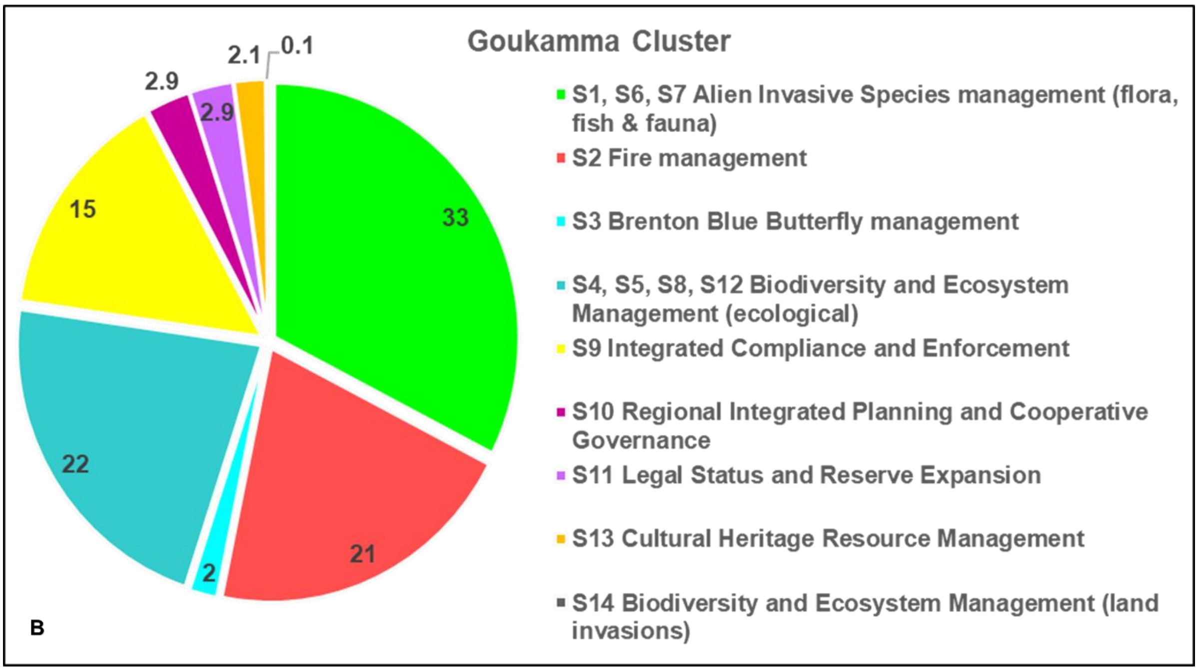
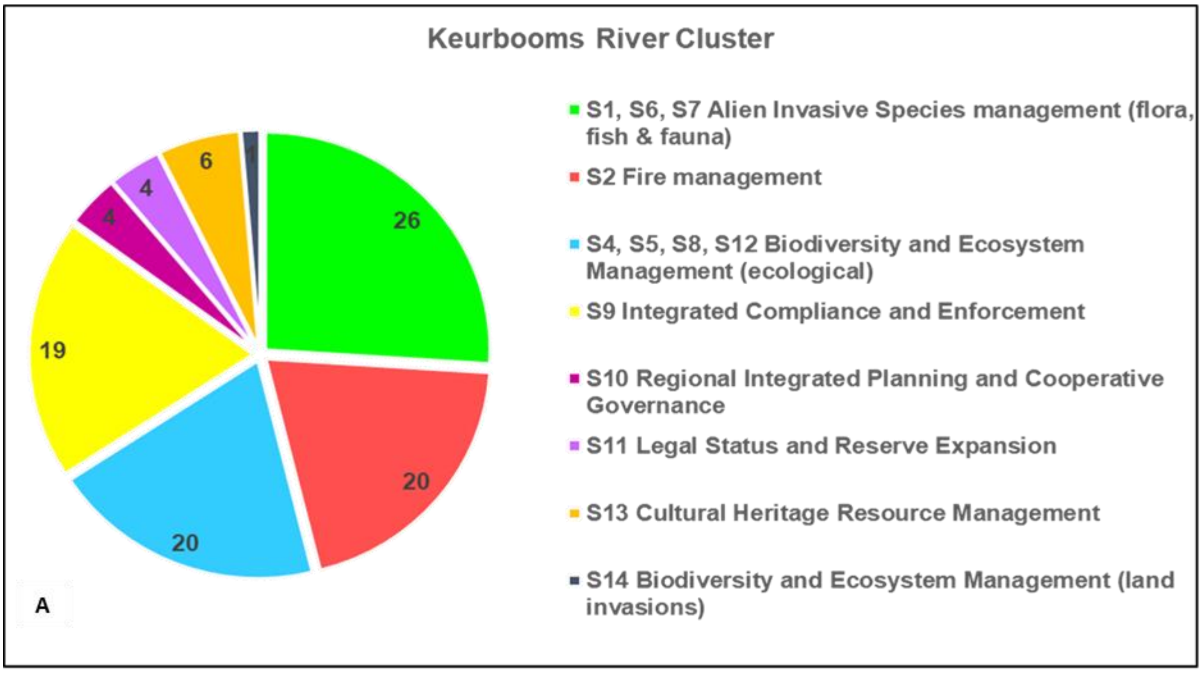


Figure 11.1: Estimated proportion of annual operational costs for the Outeniqua (A) and Goukamma (B) Clusters for 2022/2023 aligned with the identified and prioritised strategies.



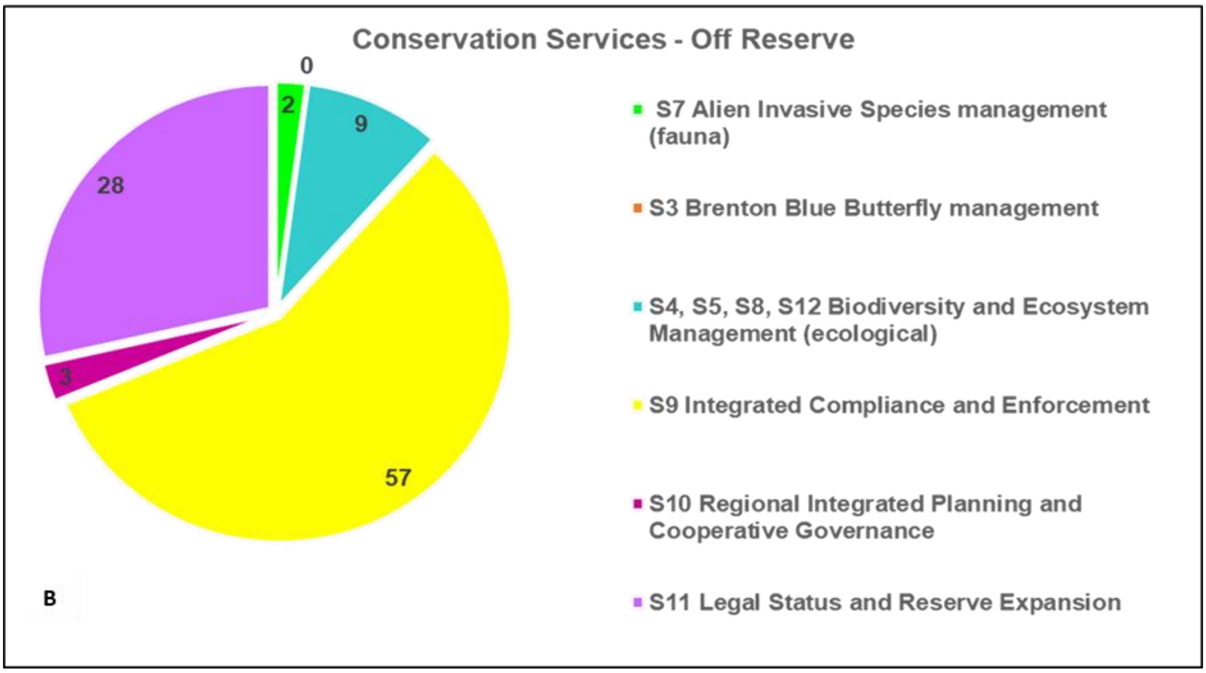


Figure 11.2: Estimated proportion of annual operational costs for the Keurbooms River Cluster (A) and Conservation Services-Off Reserve (B) for 2022/2023 aligned with the identified and prioritised strategies.

11.1.2.2 Once off costs

In addition to the recurring costs there might be once-off replacement costs of assets, e.g., tractor, firefighting equipment, field equipment, etc. that are aligned with the life span of the relevant assets being replaced.

11.1.2.3 Maintenance

An annual earmarked allocation is provided for the development of new, and upgrades and maintenance of tourism infrastructure. Tourism projects are prioritised across all CapeNature facilities and maintenance is scheduled accordingly.

11.1.2.4 Summary

It is estimated that the GRCWHS&NR will require an annual operating budget of R18 259 615.56 for 2023/24, increasing at a projected annual rate of 10%.

11.1.2.5 Implications

Unsuccessful securing of external funding and replacement of crucial capital equipment could lead to potential shortfall and will have a negative impact on strategies throughout. Further reductions in organisational budget can be expected during the management plan cycle. The implications of this being that the strategic plan may not be fully achieved. Available funding will have to be prioritised accordingly.

A zero-based budget approach is needed to determine the true financial needs of the GRCWHS&NR.

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APPENDIX 1: Table 1: Land parcels that comprise World Heritage Sites, Special Nature Reserve and Marine Protected Areas in the Garden Route Complex World Heritage Site and Nature Reserves.

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
WORLD HERITAGE SITE											
Outeniqua Cluster: WitfonteinSector (WHS Extension)											
T4581/1942	Camfer Kloof	96	Remaining Extent	2020.358	George	C0270000000 0009600000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T1694/1954	Malgaskraal	142	Remaining Extent	2215.542	George	C0270000000 0014200000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T1694/1954	Malgaskraal	142	3	0.165	George	C0270000000 0014200003	Transnet LTD	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T1694/1954	Malgaskraal	142	4	0.445	George	C0270000000 0014200004	Transnet LTD	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
G37/1951	Annex Afgunst River	100	Remaining Extent	386.337	George	C0270000000 0010000000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
G43/1939	Boven Lange Valley	128	Remaining Extent	3321.542	George	C0270000000 0012800000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
G182/1950	North Station	129	Remaining Extent	992.712	George	C0270000000 0012900000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
G182/1950	North Station	130	Remaining Extent	985.542	George	C0270000000 0013000000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
No information	Erf 19872	19872	0	242.025	George	C0270002000 1987200000	RSA	Proclamation underway			State Forest Nature Reserve
Unregistered State Land clipped	Outeniquaberge	352	1	7173.786	George	C0270000000 0035200001	RSA	Proclamation underway			State Land

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
Outeniqua Cluster: Doringrivier Sector (WHS Extension)											
T13744/1942	Modderaas Kloof	132	Remaining Extent	1713.685	George	C0270000000 0013200000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T13744/1942	Modderaas Kloof	133	Remaining Extent	2310.490	George	C0270000000 0013300000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
Unregistered State Land	Bad Hope	219	Remaining Extent	733.590	Oudtshoorn	C0540000000 0021900000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
Unregistered State Land	Bad Hope	221	Remaining Extent	408.156	Oudtshoorn	C0540000000 0022100000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T13744/1942	Klein Moerasrivier Spruiten	218	1	1801.412	Oudtshoorn	C0540000000 0021800001	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T13744/1942	Kandelaars and Doornrivier Spruiten	222	Remaining Extent	1370.718	Oudtshoorn	C0540000000 0022200000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T13744/1942	Zebrafontein	220	Remaining Extent	3157.816	Oudtshoorn	C0540000000 0022000000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
Outeniqua Cluster: Ruitersbos Sector (WHS Extension)											
T4774/1937	Rooi-Hoogs-Kloof	15	Remaining Extent	1801.338	Mossel Bay	C0510000000 0001500000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T34734/1996	Ruiterbosch	17	Remaining Extent	671.569	Mossel Bay	C0510000000 0001700000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T5697/1937	Groot-Hoek	19	Remaining Extent	3202.901	Mossel Bay	C0510000000 0001900000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T13708/1937	Schaap-Plaats	69	1	301.197	Mossel Bay	C0510000000 0006900001	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
T4774/1937	Molen Rivier	72	Remaining Extent	350.355	Mossel Bay	C0510000000 0007200000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T14198/1962	Fouriesberg	204	1	2307.968	Oudtshoorn	C0540000000 0020400001	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T3397/1942	Eende Kraal	205	Remaining Extent	2443.743	Oudtshoorn	C0540000000 0020500000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T3397/1942	Osse Hoek	206	Remaining Extent	1160.809	Oudtshoorn	C0540000000 0020600000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T35/1886	Ruitersberg	207	Remaining Extent	176.989	Oudtshoorn	C0540000000 0020700000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T14198/1962	Paarde Vleiberg	203	Remaining Extent	581.085	Oudtshoorn	C0540000000 0020300000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T12108/1964	Paardekop	13	Remaining Extent	736.357	Mossel Bay	C0510000000 0001300000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T12108/1964	Paardekop	13	2	177.855	Mossel Bay	C0510000000 0001300002	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T4773/1937	Bosch-Berg	20	Remaining Extent	1860.859	Mossel Bay	C0510000000 0002000000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T3330/1937	Koumas Hoek	16	Remaining Extent	1533.458	Mossel Bay	C0510000000 0001600000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T38/1938	Forest Reserve	64	1	784.184	Mossel Bay	C0510000000 0006400001	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T4774/1937	Koumas-Kloof	63	4	78.589	Mossel Bay	C0510000000 0006300004	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
Goukamma Cluster: Goukamma Sector (WHS Extension)											
T14585/1980	Moerasfontein	204	7	6.755	Knysna	C0390000000 0020400007	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T14585/1980	Moerasfontein	204	8	0.578	Knysna	C0390000000 0020400008	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T14585/1980	Moerasfontein	204	9	3.055	Knysna	C0390000000 0020400009	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T14585/1980	Moerasfontein	204	10	3.707	Knysna	C0390000000 0020400010	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T54400/1987	Ruygte Vally (Milkwood Downs)	205	38	5.678	Knysna	C0390000000 0020500038	WWF-SA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T23372/1964	Ruygte Vally	205	39	10.981	Knysna	C0390000000 0020500039	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T23201/1974	Ruygte Vally	205	81	18.414	Knysna	C0390000000 0020500081	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T19650/1967	Ruygte Vally	205	111	94.103	Knysna	C0390000000 0020500111	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T26351/1974	Ruygte Vally	205	112	20.187	Knysna	C0390000000 0020500112	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T9519/1976	Ruygte Vally	205	114	4.962	Knysna	C0390000000 0020500114	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T10197/1991	Groen Vallei	207	Remaining Extent	442.731	Knysna	C0390000000 0020700000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
No information	Groen Vallei	207	1	0.774	Knysna	C0390000000 0020700001	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T6018/1963	Ganzvlei	208	18	827.936	Knysna	C0390000000 0020800018	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T45552/1984	Ganzvlei	208	23	31.091	Knysna	C0390000000 0020800023	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T14585/1980	Ganzvlei	208	26	112.401	Knysna	C0390000000 0020800026	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
T2637/1980	Ganzvlei	208	27	4.879	Knysna	C0390000000 0020800027	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
Unregistered State Land	Buffalo Bay Forest Reserve	211	Remaining Extent	759.521	Knysna	C0390000000 0021100000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
G11/1947	Walker's Point	215	Remaining Extent	359.993	Knysna	C0390000000 0021500000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
Keurbooms River Cluster: Robberg Sector (WHS Extension)											
T58614/1983	Robbeberg	454	Remaining Extent	230.903	Knysna	C0390000000 0045400000	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site
Keurbooms River Cluster: Keurbooms River Sector (WHS Extension)											
Unregistered State Land	Keurbooms River Forest Reserve	522	Remaining Extent	1068.379	Knysna	C0390000000 0052200000	RSA	1980/01/04	1/1980	Government Gazette Notice 1	Provincial Nature Reserve
Unregistered State Land	Keurbooms River Forest Reserve	522	3	13.434	Knysna	C0390000000 0052200003	RSA	2022/12/02	2816/2022	Government Gazette Notice 47632	World Heritage Site

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
SPECIAL NATURE RESERVE											
Goukamma Cluster: Brenton Blue Butterfly Special Nature Reserve											
T77861/1991	Brenton on Sea	434	Erf 434/0	0.129	Knysna	C0390002000 0043400000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	435	Erf 435/0	0.356	Knysna	C0390002000 0043500000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	436	Erf 436/0	0.127	Knysna	C0390002000 0043600000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	437	Erf 437/0	0.108	Knysna	C0390002000 0043700000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	438	Erf 438/0	0.122	Knysna	C0390002000 0043800000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	439	Erf 439/0	0.114	Knysna	C0390002000 0043900000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	440	Erf 440/0	0.117	Knysna	C0390002000 0044000000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T51160/1997	Brenton on Sea	442	Erf 442/0	0.092	Knysna	C0390002000 0044200000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	443	Erf 443/0	0.077	Knysna	C0390002000 0044300000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	444	Erf 444/0	0.085	Knysna	C0390002000 0044400000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	445	Erf 445/0	0.108	Knysna	C0390002000 0044500000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
T77861/1991	Brenton on Sea	446	Erf 446/0	0.078	Knysna	C0390002000 0044600000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	447	Erf 447/0	0.131	Knysna	C0390002000 0044700000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
T77861/1991	Brenton on Sea	451	Erf 451/0	0.119	Knysna	C0390002000 0045100000	RSA	2003/07/04	939/2003	Government Gazette Notice 25134	Special Nature Reserve
MARINE PROTECTED AREAS											
No information	Goukamma Marine Protected Area			4111.129			RSA	1990/07/27 1990/10/26 (amended)	1810/1990 2497/1990 (amended)	Government Gazette Notice 12667 and amended Notice 12805	Marine Protected Area
No information	Goukamma Marine Protected Area Extension (including Goukamma Estuary)			6927.833			RSA	Extension of MPA including Estuary still to be proclaimed			Marine Protected Area
No information	Robberg Marine Protected Area			3169.241			RSA	1990/07/27 1990/10/26 (amended)	1810/1990 2497/1990 (amended)	Government Gazette Notice 12667 and amended Notice 12805	Marine Protected Area

APPENDIX 1: Table 2: Land parcels that comprise State Forest Nature Reserves, Provincial Nature Reserves, Forestry Exit Areas and Island Nature Reserves in the Garden Route Complex World Heritage Site and Nature Reserves.

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
Outeniqua Cluster											
T29673/2020	Zeebras Kop	190	Remaining Extent	2500.219	Oudtshoorn	C0540000000 0019000000	WWF-SA	Proclamation underway			Provincial Nature Reserve
T29673/2020	Zeebras Kop	190	5	1217.583	Oudtshoorn	C0540000000 0019000005	WWF-SA	Proclamation underway			Provincial Nature Reserve
T29673/2020	Saffraanrivier	255	Remaining Extent	1300.104	Oudtshoorn	C0540000000 0025500000	WWF-SA	Proclamation underway			Provincial Nature Reserve
Outeniqua Cluster: Forestry Exit Land											
T13400/1937	Stinkhoutbos	18	Remaining Extent	255.306	Mossel Bay	C0510000000 0001800000	RSA				Forestry Exit Area
Unregistered	Farm 61	61	Remaining Extent	229.220	Mossel Bay	C0510000000 0006100000	RSA				Forestry Exit Area
T4728/1937	Bosmansrivier	61	6	1.217	Mossel Bay	C0510000000 0006100006	RSA				Forestry Exit Area
Unregistered	Farm 61	61	16	50.121	Mossel Bay	C0510000000 0006100016	RSA				Forestry Exit Area
Unregistered	Bosmansrivier	61	14	4.033	Mossel Bay	C0510000000 0006100014	RSA				Forestry Exit Area
Unregistered	Koumaskloof Bosmansrivier	61	13	1.918	Mossel Bay	C0510000000 0006100013	RSA				Forestry Exit Area
Unregistered	Pilgrims Rest	64	3	7.623	Mossel Bay	C0510000000 0006400003	RSA				Forestry Exit Area
T4727/1937	Oude Leeuw Kloof	49	Remaining Extent	297.057	Mossel Bay	C0510000000 0004900000	RSA				Forestry Exit Area
T4730/1937	De Watergeut	48	3	53.414	Mossel Bay	C0510000000 0004800000	RSA				Forestry Exit Area
Unregistered	De Watergeut	48	Remaining Extent	222.818	Mossel Bay	C0510000000 0004800000	RSA				Forestry Exit Area
Unregistered	Outeniquaberge	352	1	9304.493	George	C0270000000 0035200001	RSA				Forestry Exit Area
Unregistered	Farm 345	345	Remaining Extent	547.717	Mossel Bay	C0510000000 0034500000	RSA				Forestry Exit Area

Title Deed	Farm Name	Farm No.	Ptn No.	Extent (ha)	Registration Division	SG Code	Landowner	Proclamation Date	Proclam-ation Number	Government Gazette Notice	Status
Unregistered	Malgaskraal	142	10	63.474	George	C0270000000 0014200010	RSA				Forestry Exit Area
Unregistered	Malgaskraal	142	9	663.178	George	C0270000000 0014200009	RSA				Forestry Exit Area
Unregistered	Molen River	72	2	267.293	Mossel Bay	C0510000000 0007200002	RSA				Forestry Exit Area
T13559/1937	Forest Reserve	68	3	45.681	Mossel Bay	C0510000000 0006800003	RSA				Forestry Exit Area
T56838/1991	Paardekraal	67	13	1.793	Mossel Bay	C051000000 0006700013	RSA				Forestry Exit Area
T4774/1937	Paardekraal	67	6	82.994	Mossel Bay	C0510000000 0006700006	RSA				Forestry Exit Area
T4774/1937	Paardekraal	67	2	218.244	Mossel Bay	C0510000000 0006700002	RSA				Forestry Exit Area
T4774/1937	Kouma-Kloof	63	1	303.738	Mossel Bay	C0510000000 0006300001	RSA				Forestry Exit Area
Goukamma Cluster											
T93237/1995	Weltevrede	214	1	177.100	Knysna	C0390000000 0021400001	Buffalo Valley Trust (G Thesen)	Proclamation underway			Contract Nature Reserve
T93237/1995	Weltevrede	214	2	214.124	Knysna	C0390000000 0021400002	Buffalo Valley Trust (G Thesen)	Proclamation underway			Contract Nature Reserve
No information	Mossel Bay Seal Island Nature Reserve			3.307	Mossel Bay		RSA	1988/03/18	23/1988	Government Gazette Notice 4524	Island Nature Reserve
Keurbooms River Cluster											
T2981/1994	Annex Vlugt	257	Remaining Extent	475.323	Uniondale	C0770000000 0025700000	RSA	2006/05/05	28797/ 2006	Government Gazette Notice 596 (2006/05/05)	State land released from State Forest

APPENDIX 2: Maps of the Garden Route Complex World Heritage Site and Nature Reserves.

Map 1: Location and extent of the Garden Route Complex World Heritage Site and Nature Reserves.

Map 2a: Topography of the Outeniqua Cluster.
Map 2b: Topography of Goukamma, Buffalo Valley, Goukamma MPA and the Brenton Blue Butterfly (insert) sectors.
Map 2c: Topography of the Mossel Bay area with insert showing details of Mossel Bay Seal Island.
Map 2d: Topography of the Keurbooms River sector.
Map 2e: Topography of Robberg and Robberg Marine Protected Area.
Map 2f: Topography of Annex Vlugt.

Map 3a: Geology of the Outeniqua Cluster.
Map 3b: Geology of Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors.
Map 3c: Geology of the Keurbooms River sector.
Map 3d: Geology of the Robberg sector.
Map 3e: Geology of the Annex Vlugt sector.

Map 4a: Vegetation of the Outeniqua Cluster based on the SA Vegetation Map (SANBI 2006-2018).
Map 4b: Vegetation of Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors based on SA Vegetation Map (SANBI 2006-2018).
Map 4c: Vegetation of the Keurbooms River sector based on SA Vegetation Map (SANBI 2006-2018).
Map 4d: Vegetation of the Robberg sector based on the SA Vegetation Map (SANBI 2006-2018).
Map 4e: Vegetation of the Annex Vlugt sector based on the SA Vegetation Map (SANBI 2006-2018).

Map 5a: Fine-scale vegetation map of Outeniqua Cluster (Vlok et al. 2005, 2008; Vlok & De Villiers 2007).
Map 5b: Fine-scale vegetation map of Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors (Vlok et al. 2008).
Map 5c: Fine-scale vegetation map of the Keurbooms River sector (Vlok et al. 2008).
Map 5d: Fine-scale vegetation map of the Robberg sector (Vlok et al. 2008).
Map 5e: Fine-scale vegetation map of the Annex Vlugt sector (Vlok et al. 2008).

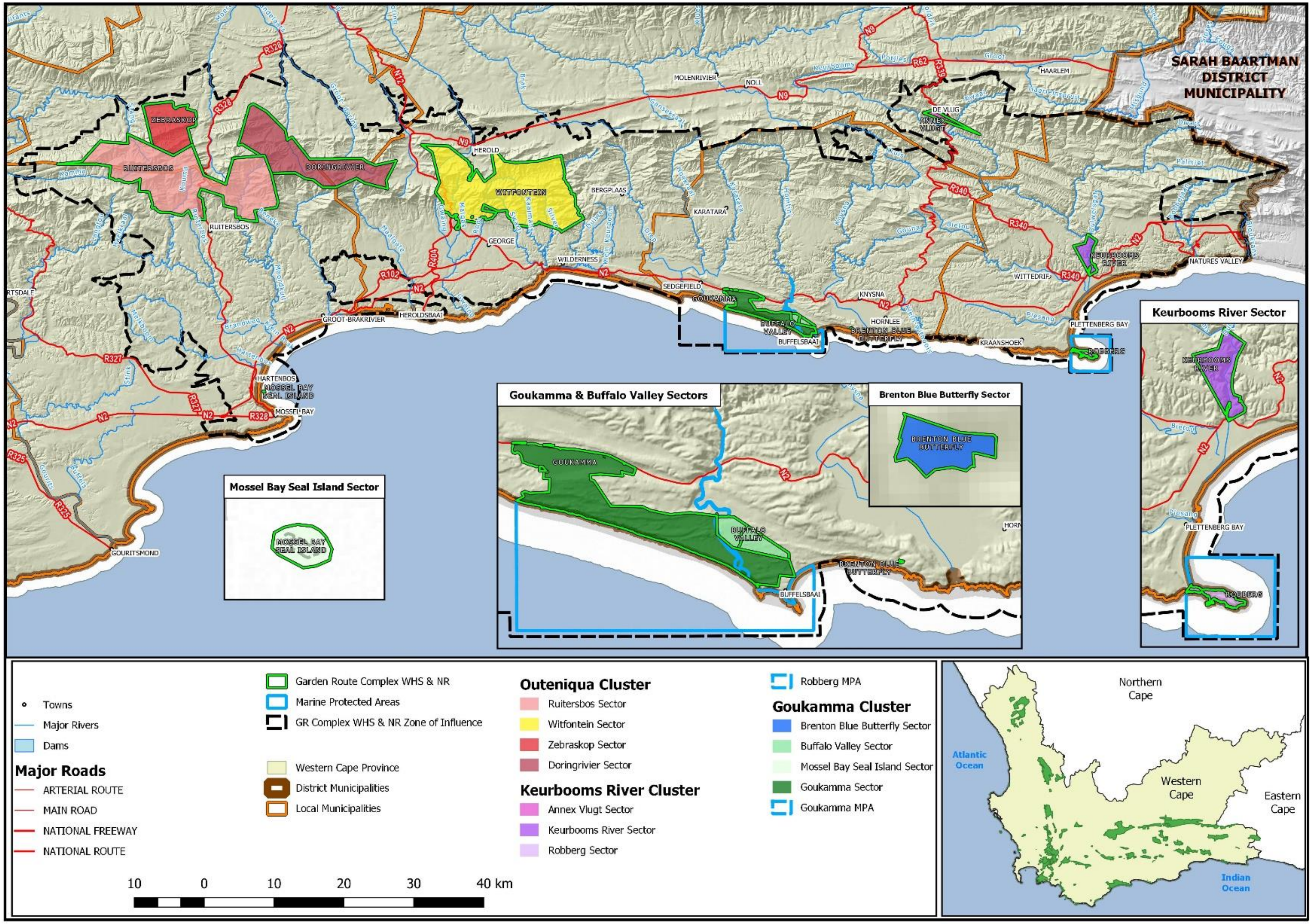
Map 6a: Invasive alien plant densities of Outeniqua Cluster.
Map 6b: Invasive alien plant densities of the Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors.
Map 6c: Invasive alien plant densities of the Keurbooms River sector.
Map 6d: Invasive alien plant densities of the Robberg sector.
Map 6e: Invasive alien plant densities of the Annex Vlugt sector.

Map 7: Location of plantations and no-man's land in relation to the GRCWHS&NR and the Garden Route National Park.

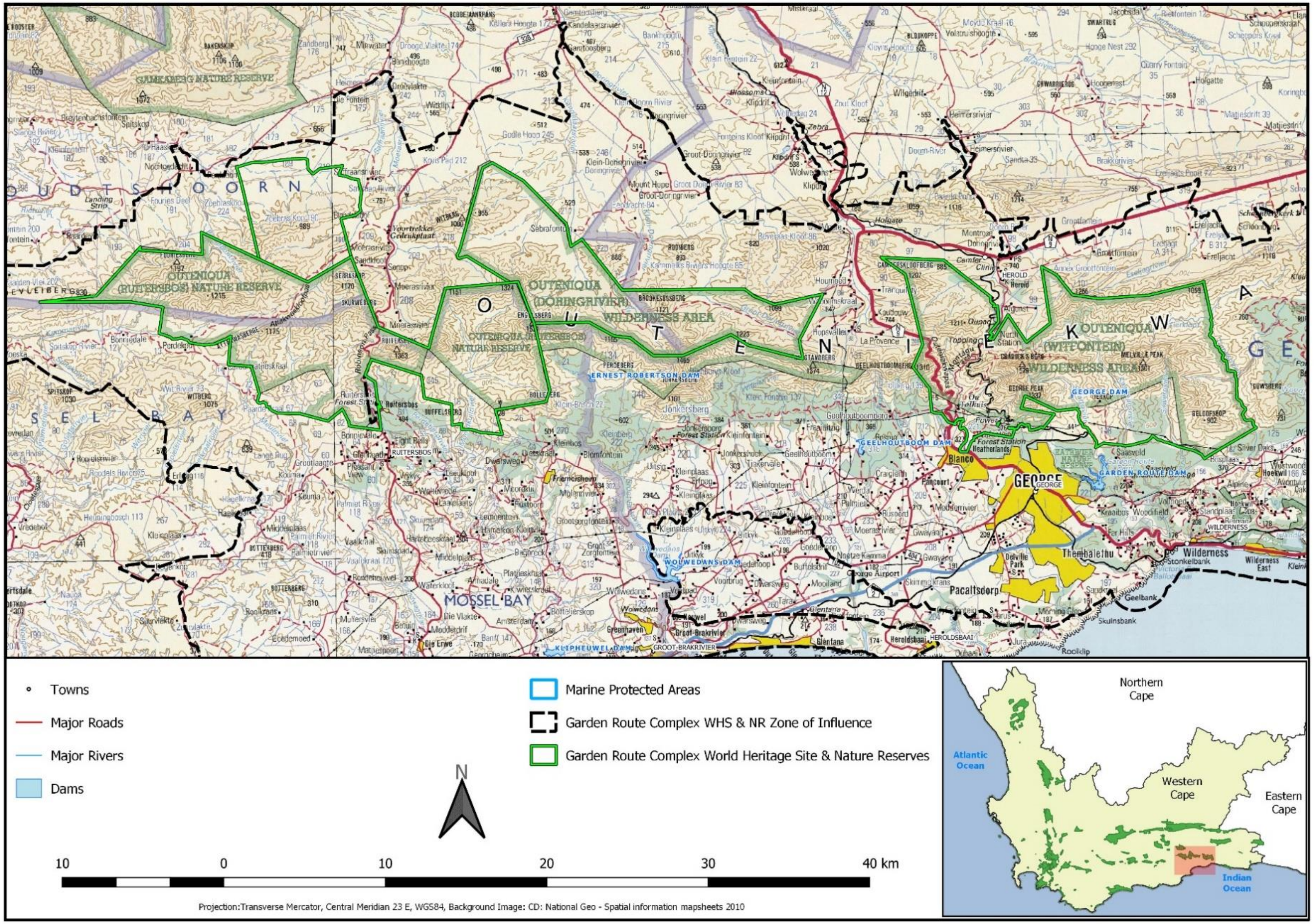
Map 15a: Access points to and servitudes on the Outeniqua Cluster.
Map 15b: Access points to and servitudes on the Goukamma Cluster.
Map 15c: Access points to and servitudes on the Keurbooms River sector.
Map 15d: Access points to and servitudes on the Robberg and Robberg MPA sectors.
Map 15e: Access points to and servitudes on the Annex Vlugt sector.

Map 16a: Infrastructure on the Outeniqua Cluster.
Map 16b: Infrastructure on the Ruitersbos sector of the Outeniqua Cluster.
Map 16c: Infrastructure on the Witfontein sector of the Outeniqua Cluster.
Map 16d: Infrastructure on the Goukamma Cluster.
Map 16e: Infrastructure on the Keurbooms River sector.
Map 16f: Infrastructure on the Robberg sector.
Map 16g: Infrastructure on the Annex Vlugt sector.

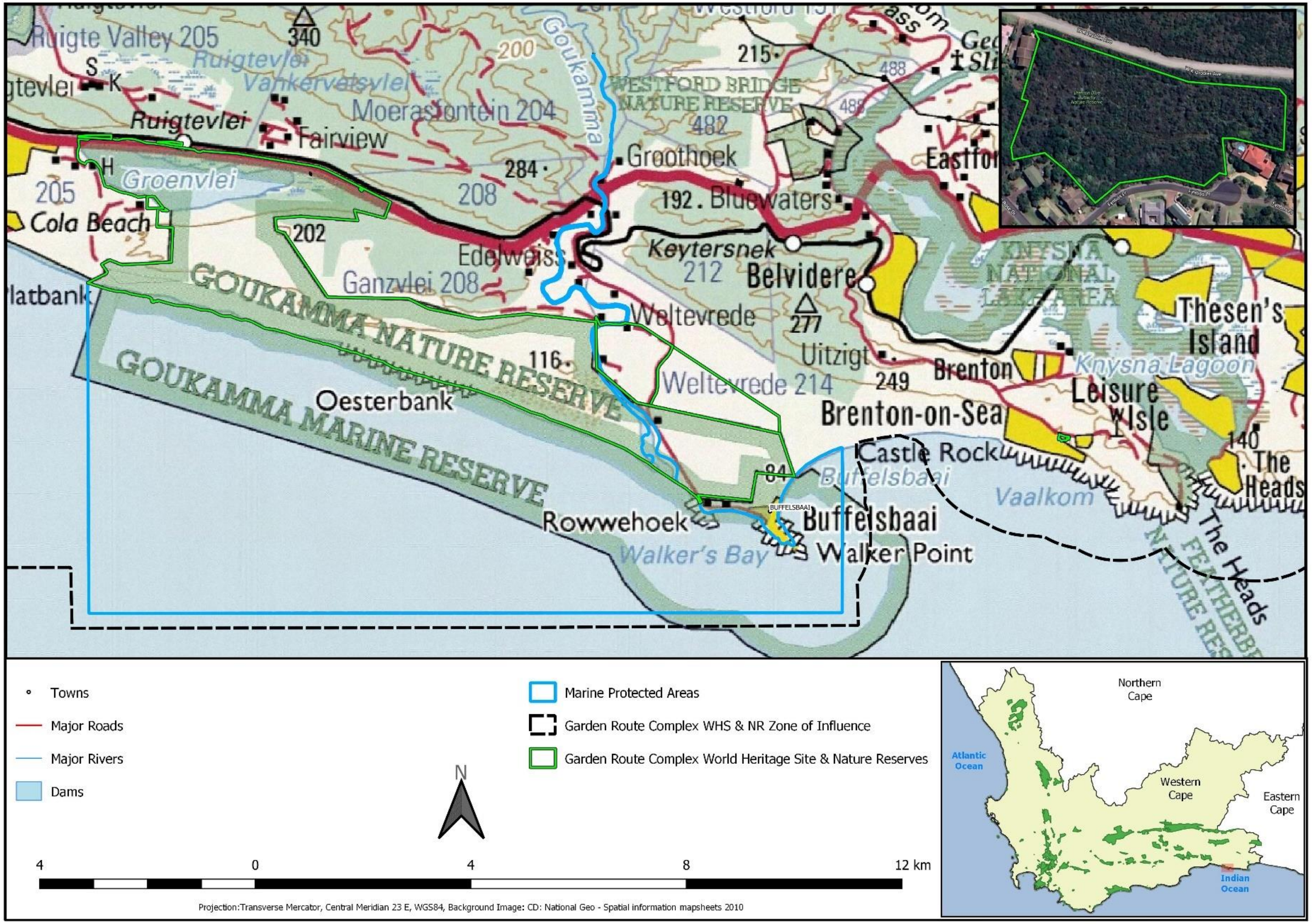
Map 17a: Expansion of the Outeniqua Cluster.
Map 17b: Expansion of the Goukamma Cluster.
Map 17c: Expansion of Keurbooms River sector.
Map 17d: Expansion of Robberg sector.
Map 17e: Expansion of Annex Vlugt sector.



Map 1: Location and extent of the Garden Route Complex World Heritage Site and Nature Reserves.

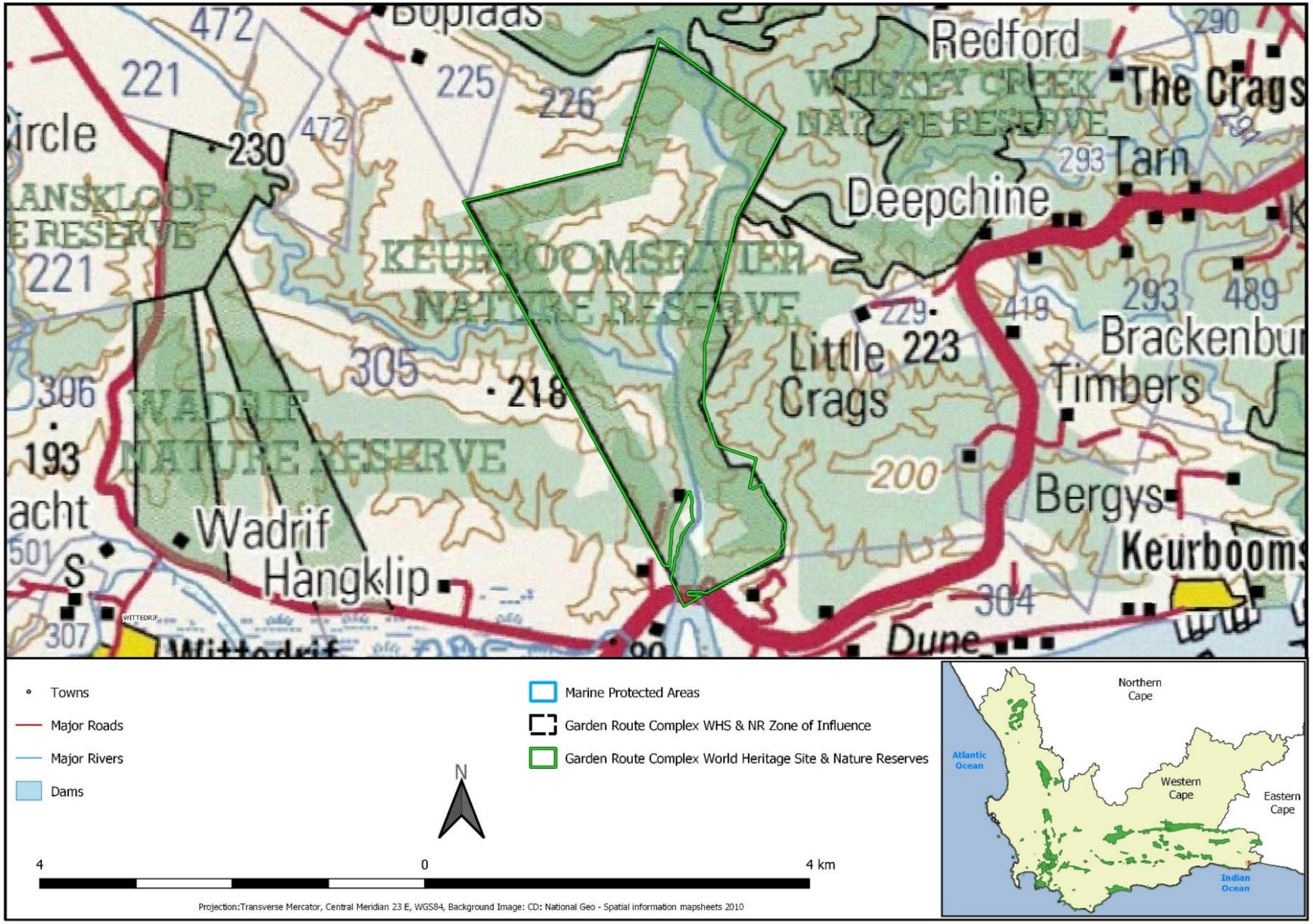


Map 2a: Topography of the Outeniqua Cluster.

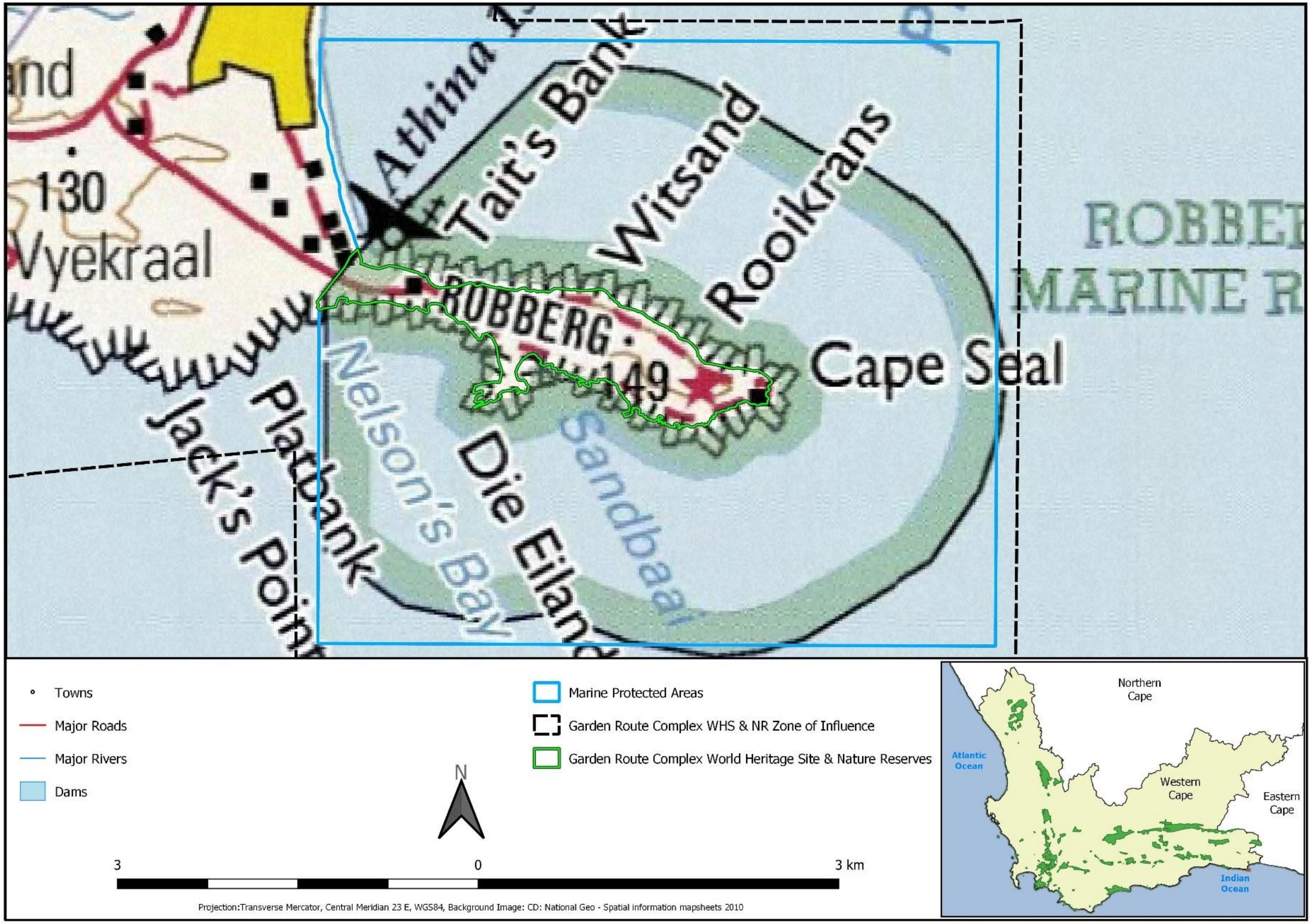


Map 2b: Topography of Goukamma, Buffalo Valley, Goukamma MPA and the Brenton Blue Butterfly (insert) sectors.

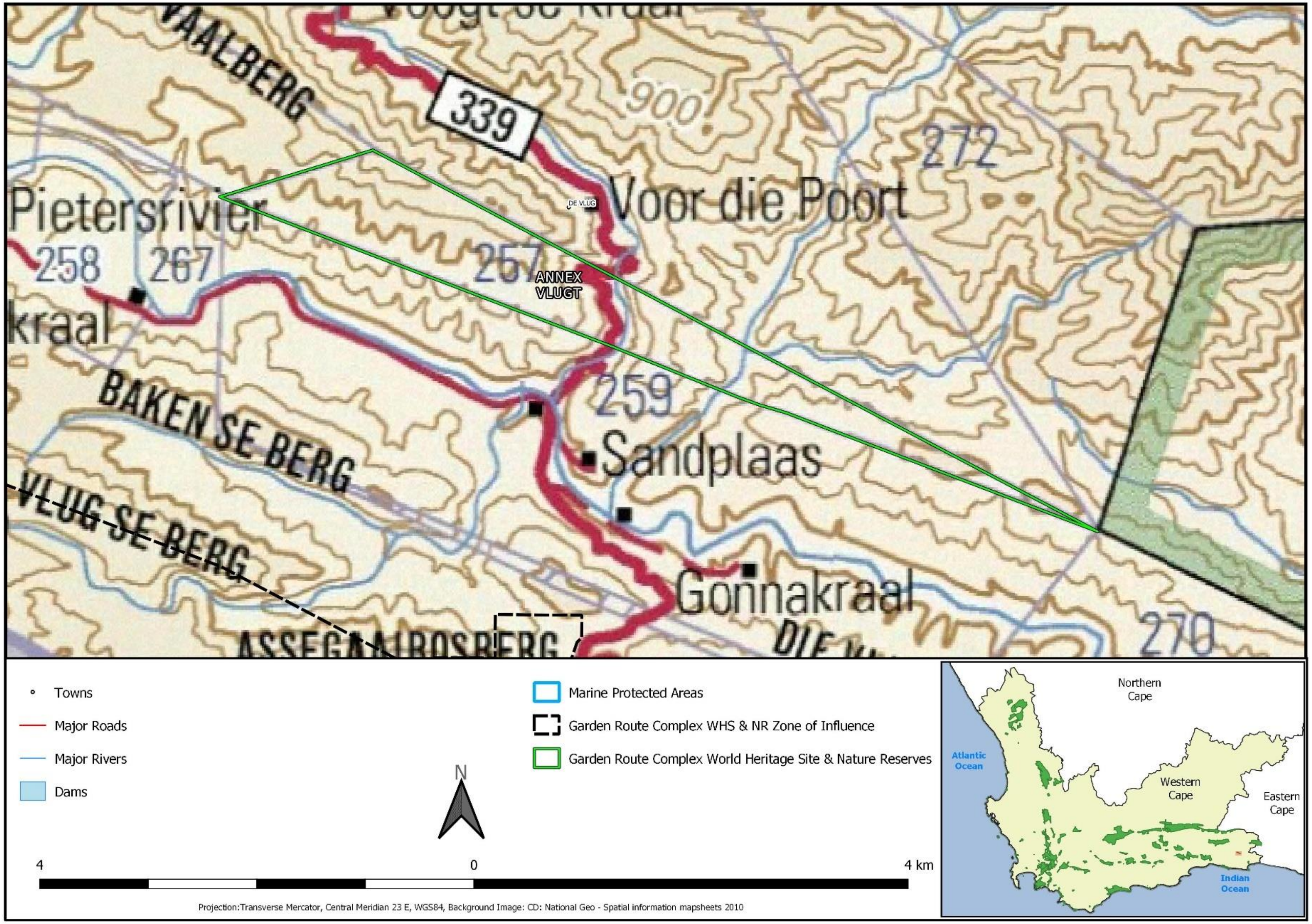
Map 2c: Topography of the Mossel Bay area with insert showing details of Mossel Bay Seal Island.



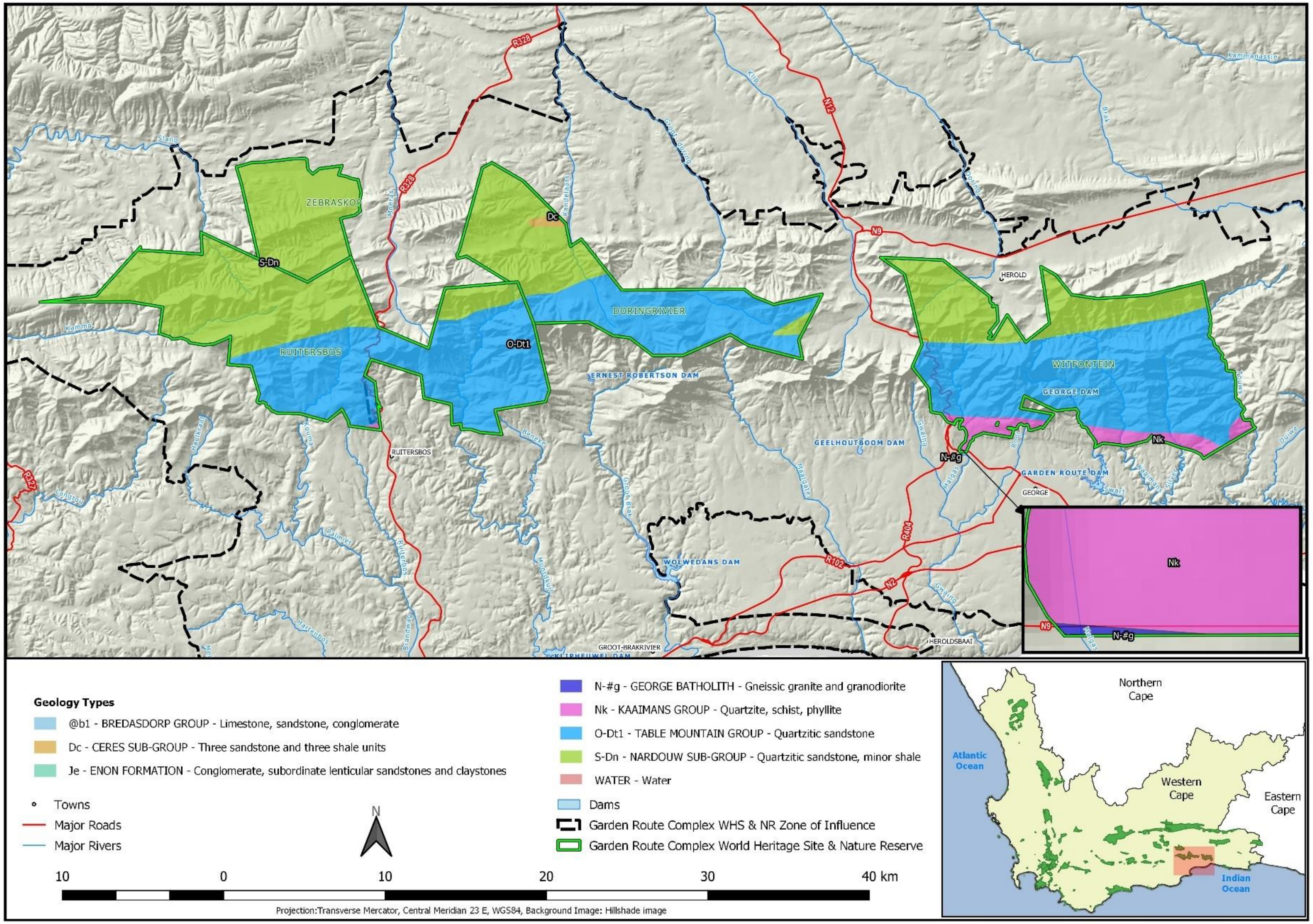
Map 2d: Topography of the Keurbooms River sector.



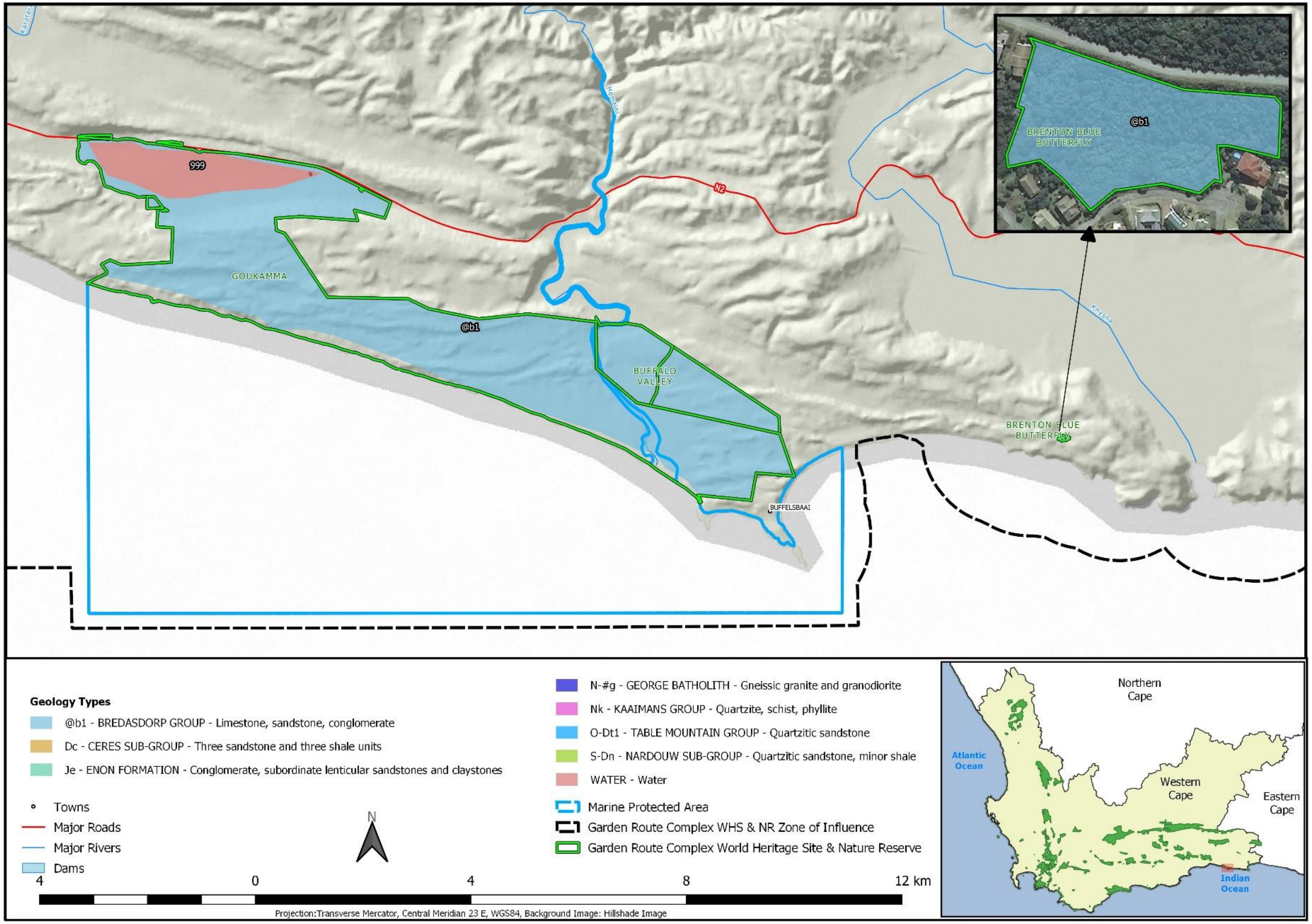
Map 2e: Topography of Robberg and Robberg Marine Protected Area.



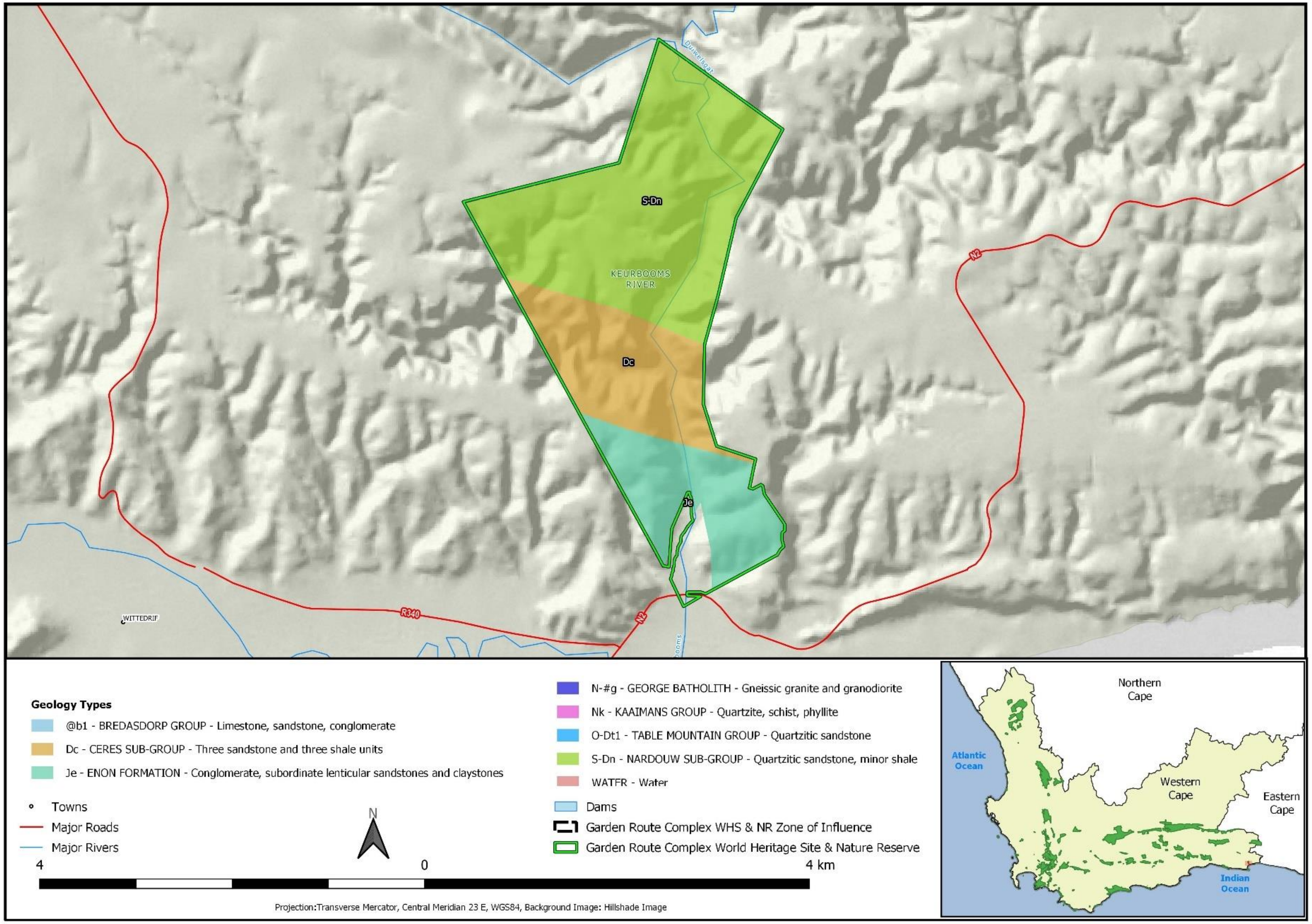
Map 2f: Topography of Annex Vlugt.



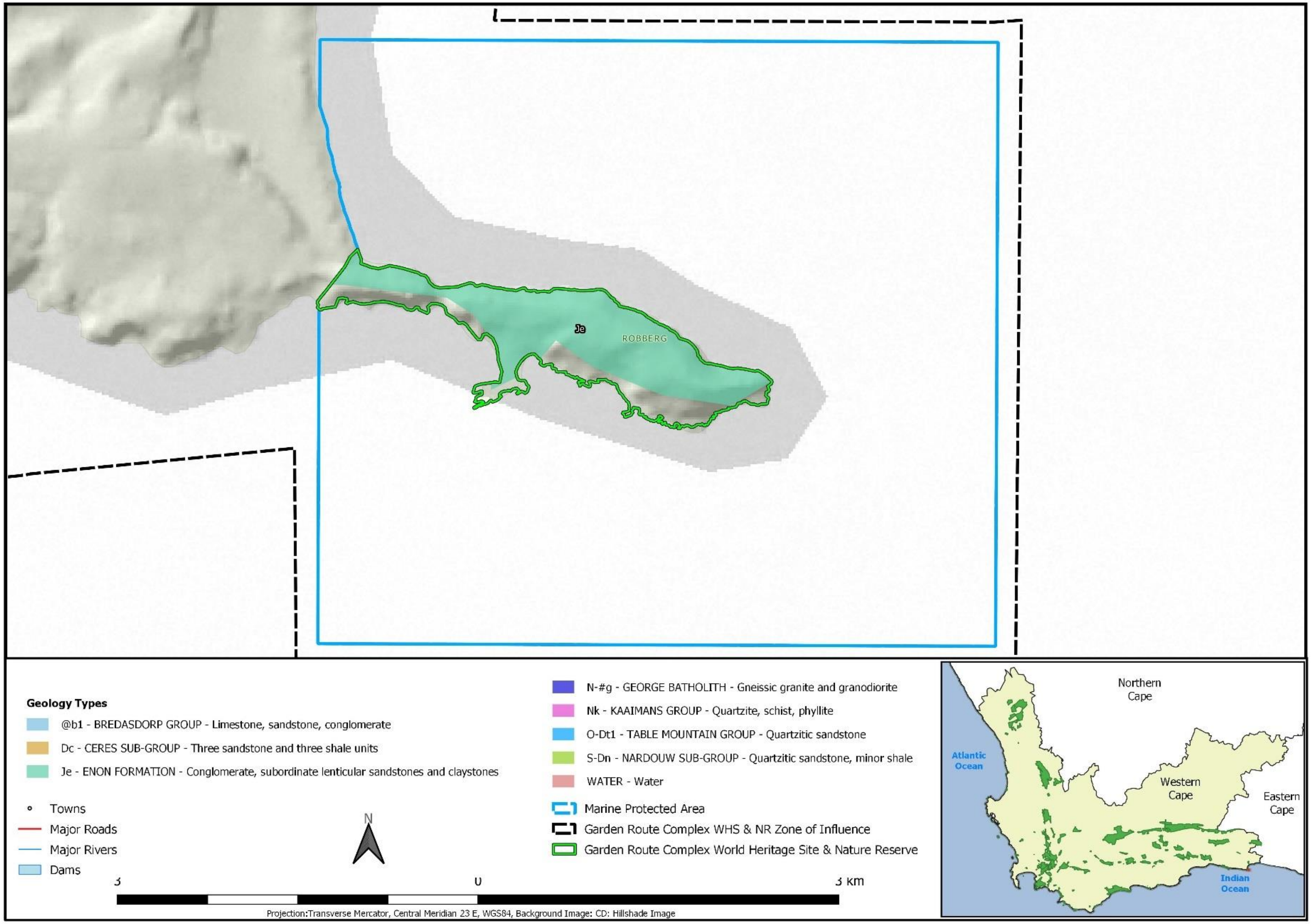
Map 3a: Geology of the Outeniqua Cluster.



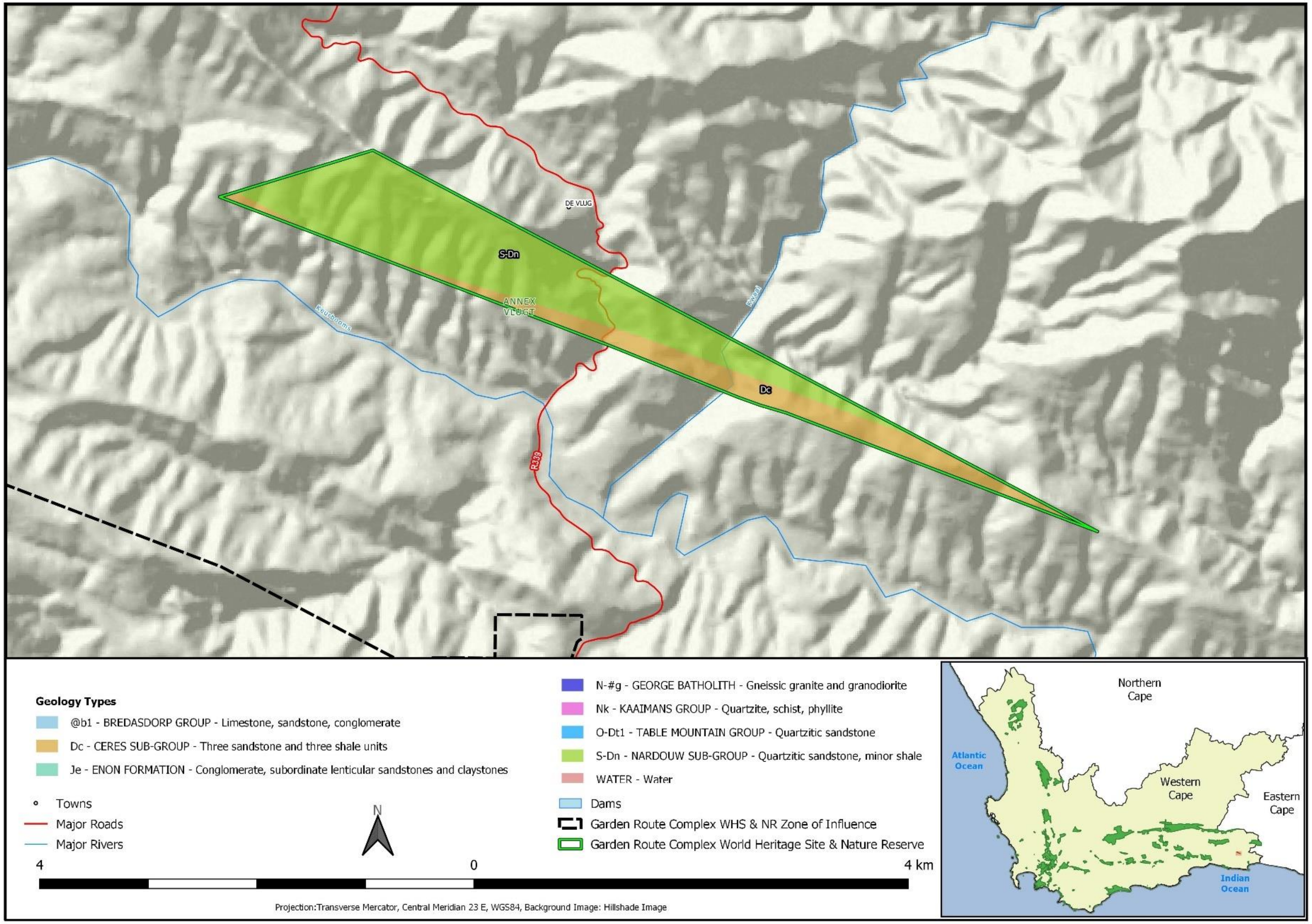
Map 3b: Geology of Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors.



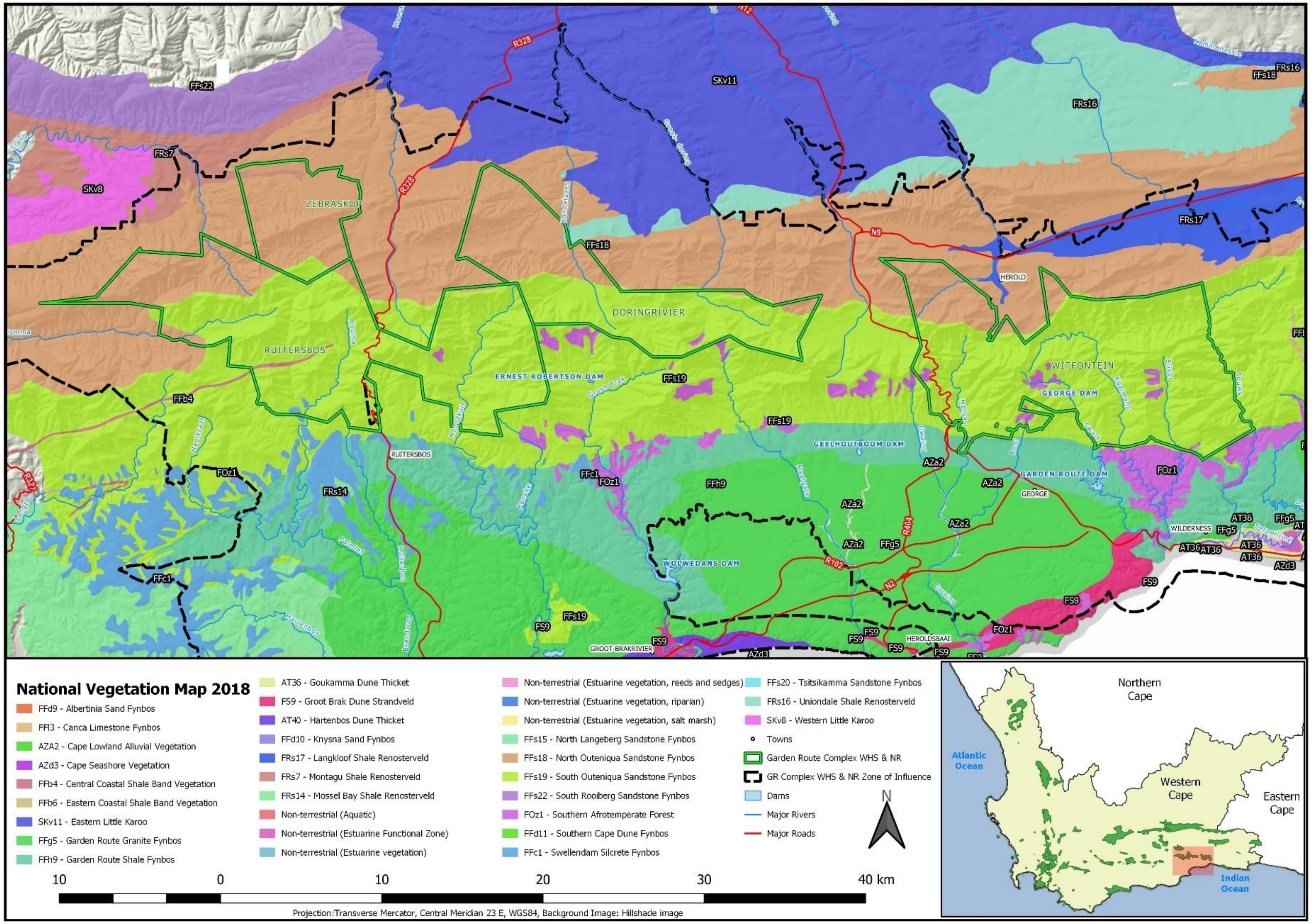
Map 3c: Geology of the Keurbooms River sector.



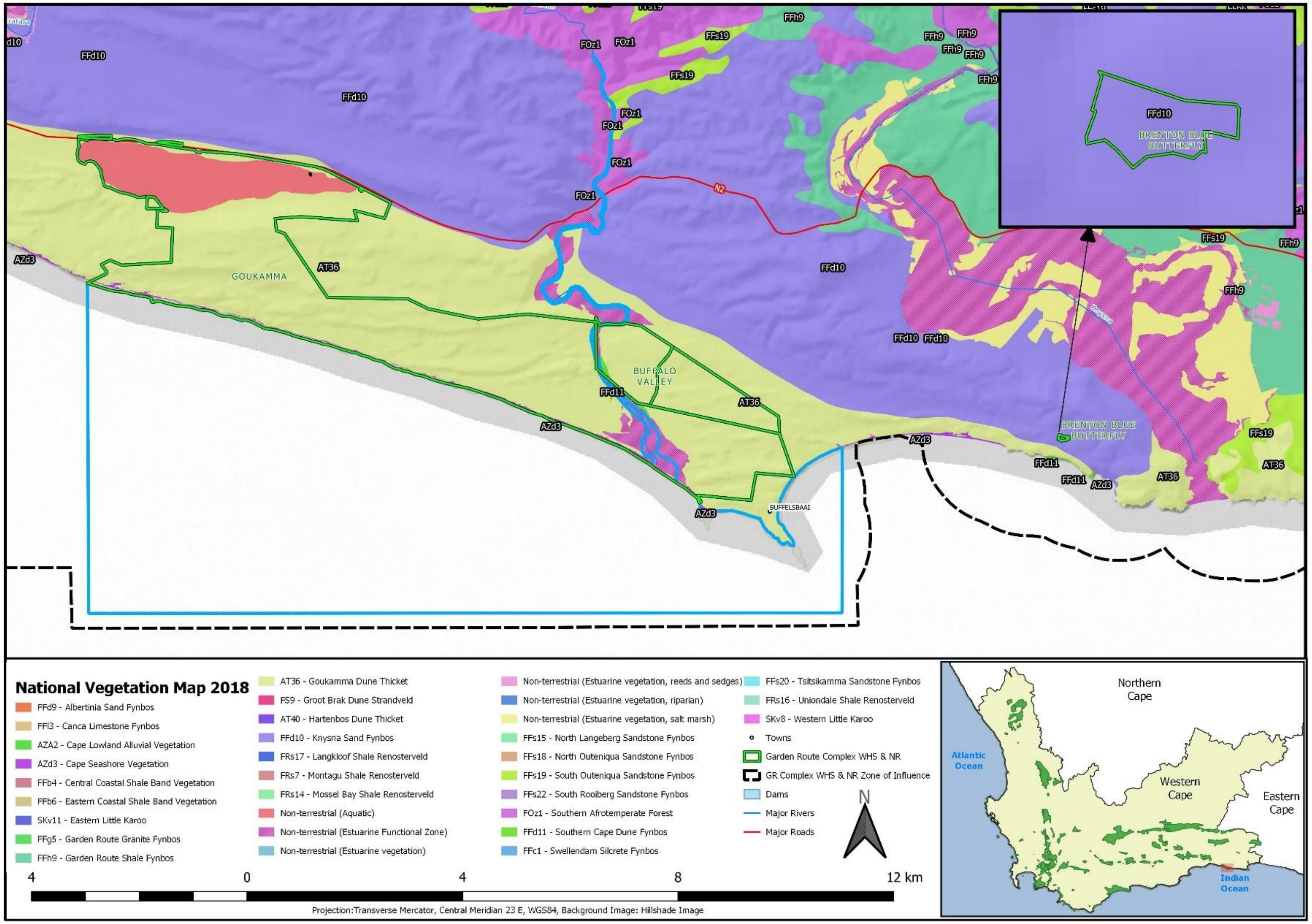
Map 3d: Geology of the Robberg sector.



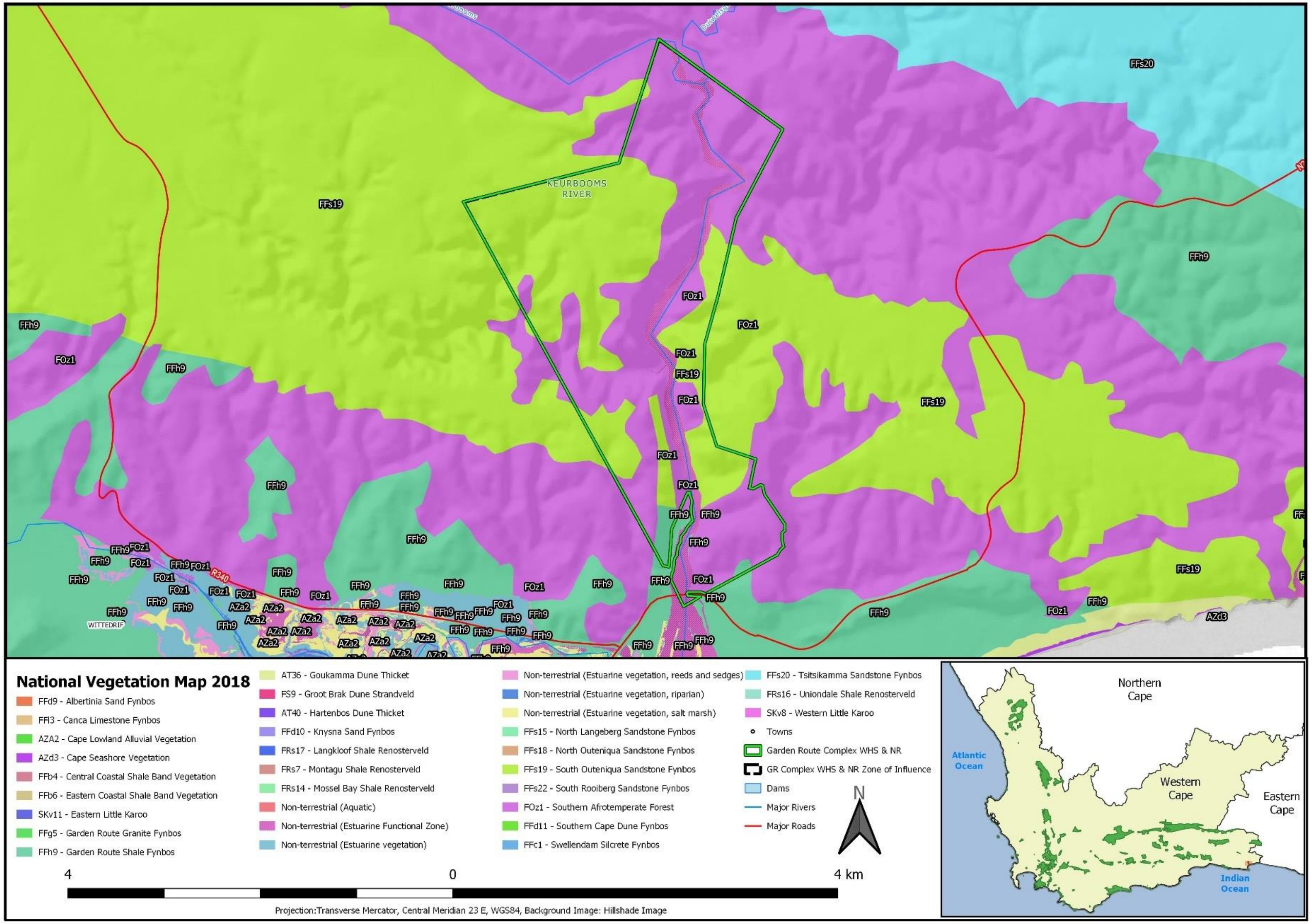
Map 3e: Geology of the Annex Vlugt sector.



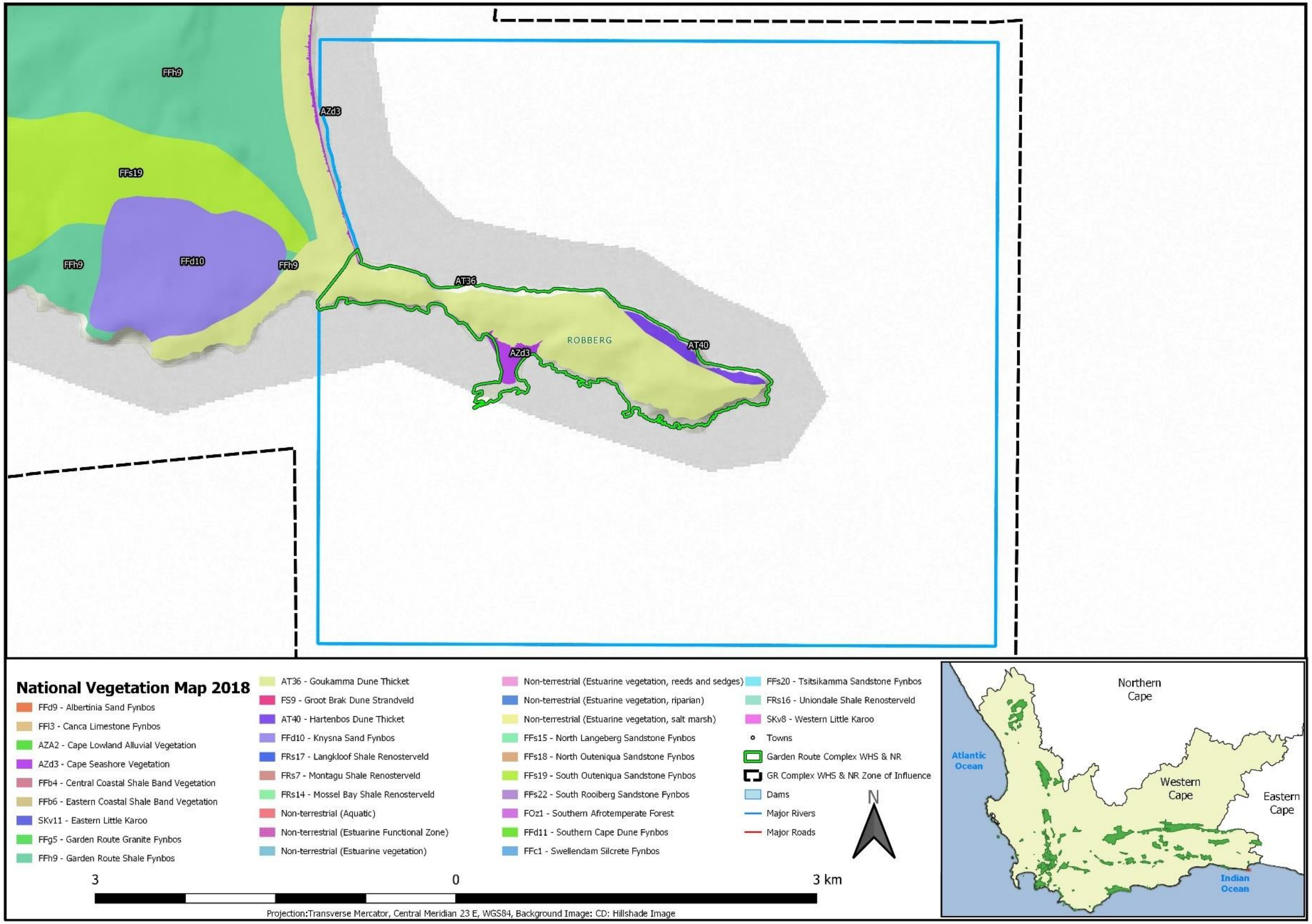
Map 4a: Vegetation of the Outeniqua Cluster based on the SA Vegetation Map (SANBI 2006-2018).



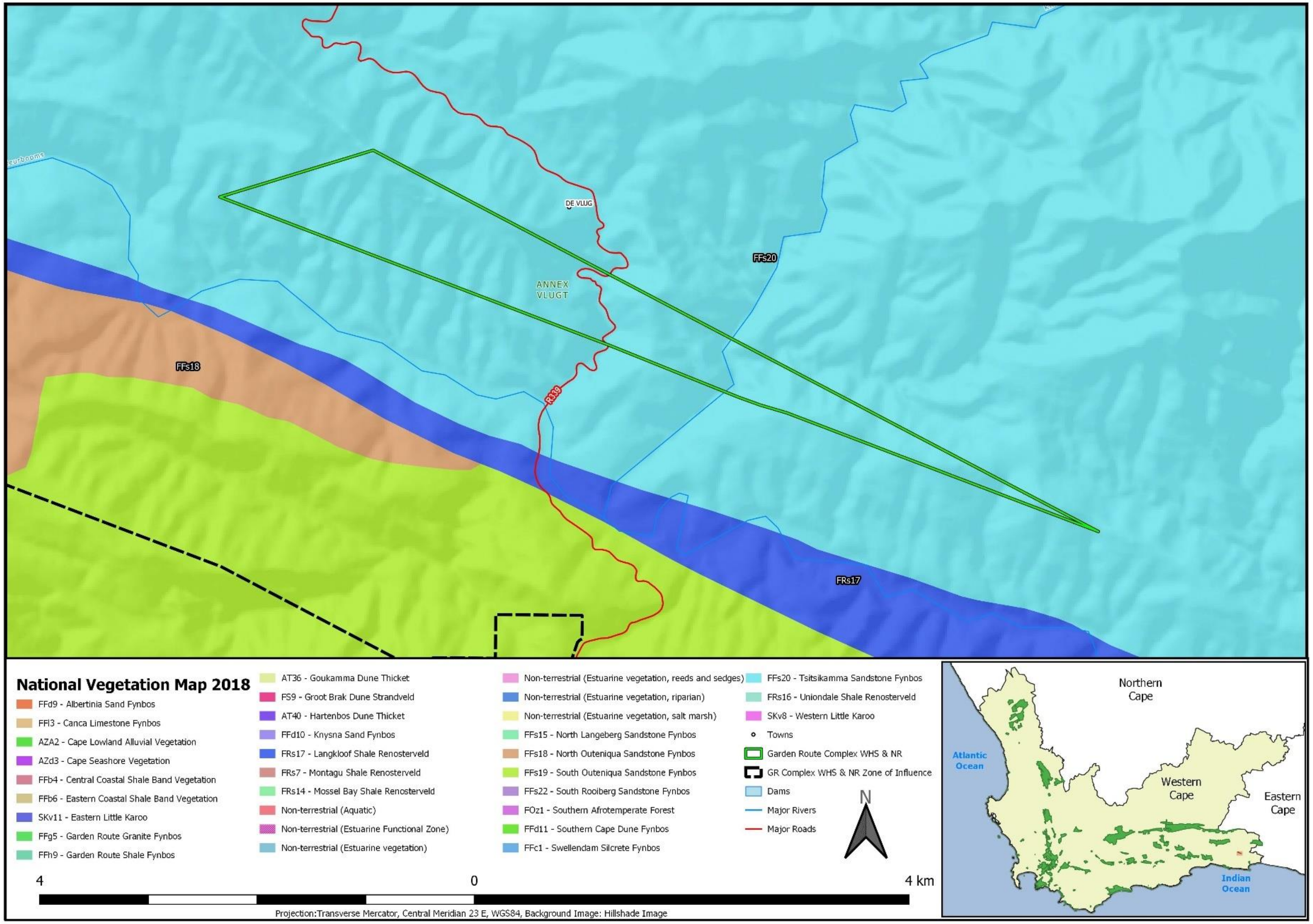
Map 4b: Vegetation of Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors based on SA Vegetation Map (SANBI 2006-2018).



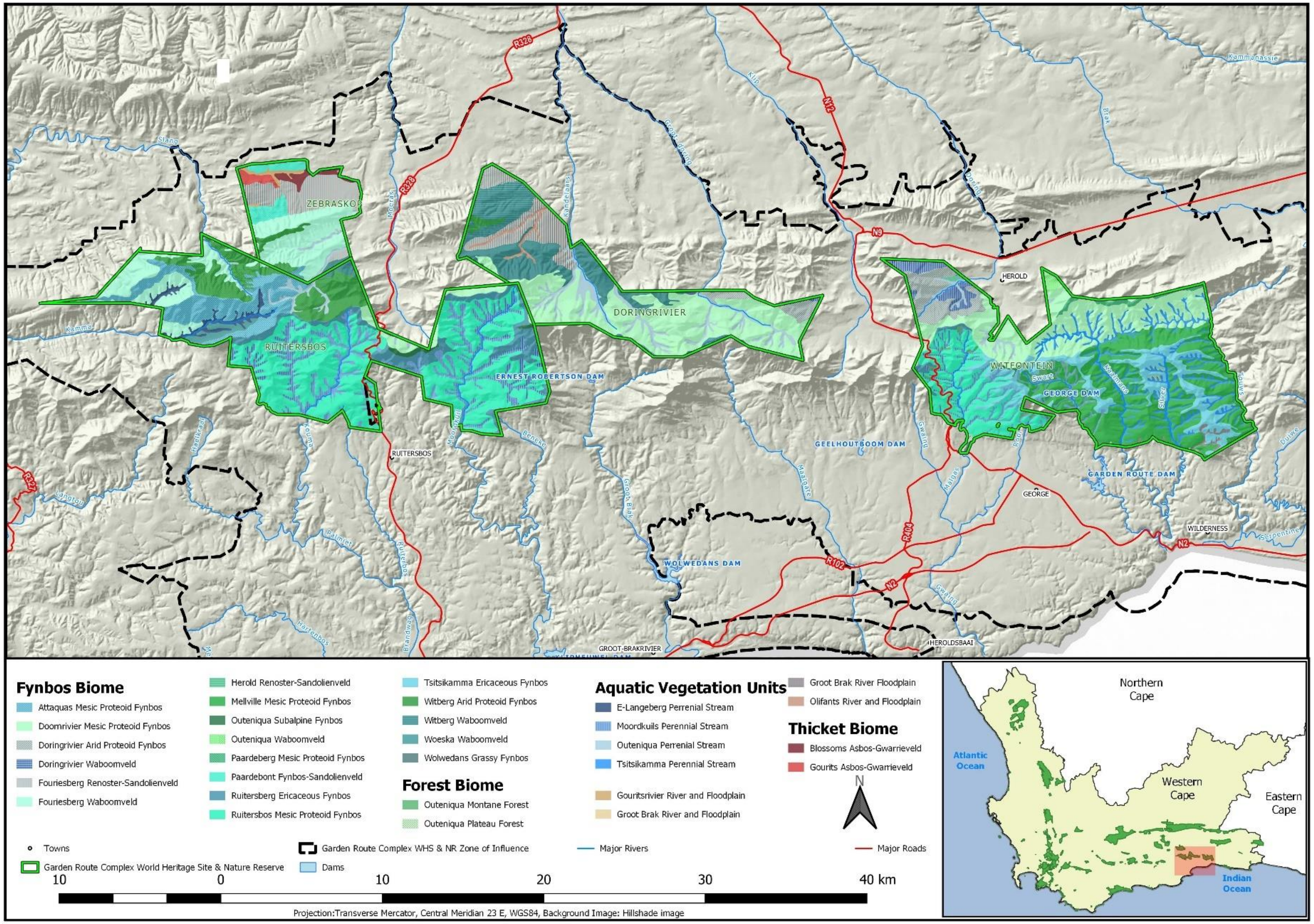
Map 4c: Vegetation of the Keurbooms River sector based on SA Vegetation Map (SANBI 2006-2018).



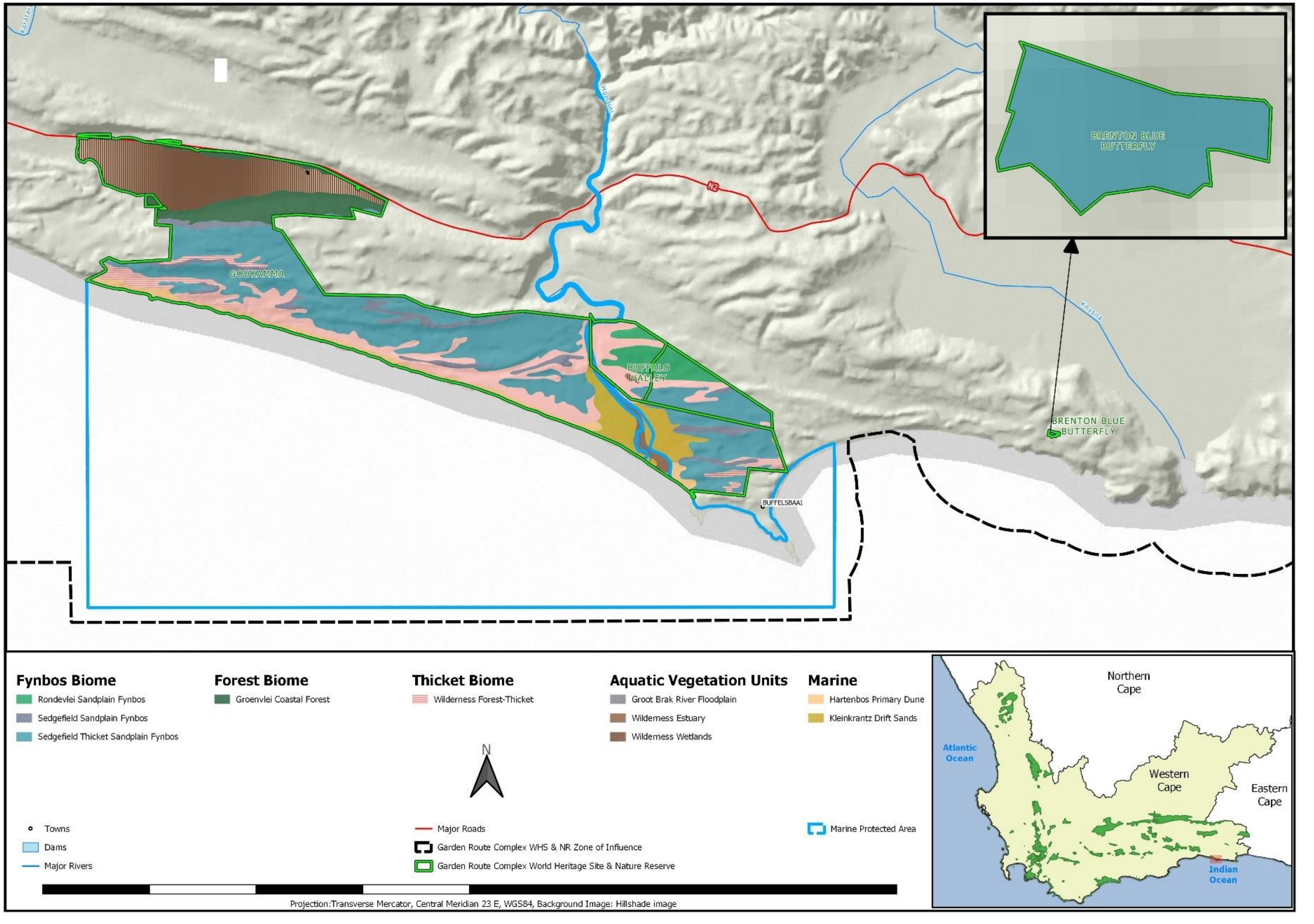
Map 4d: Vegetation of the Robberg sector based on the SA Vegetation Map (SANBI 2006-2018).



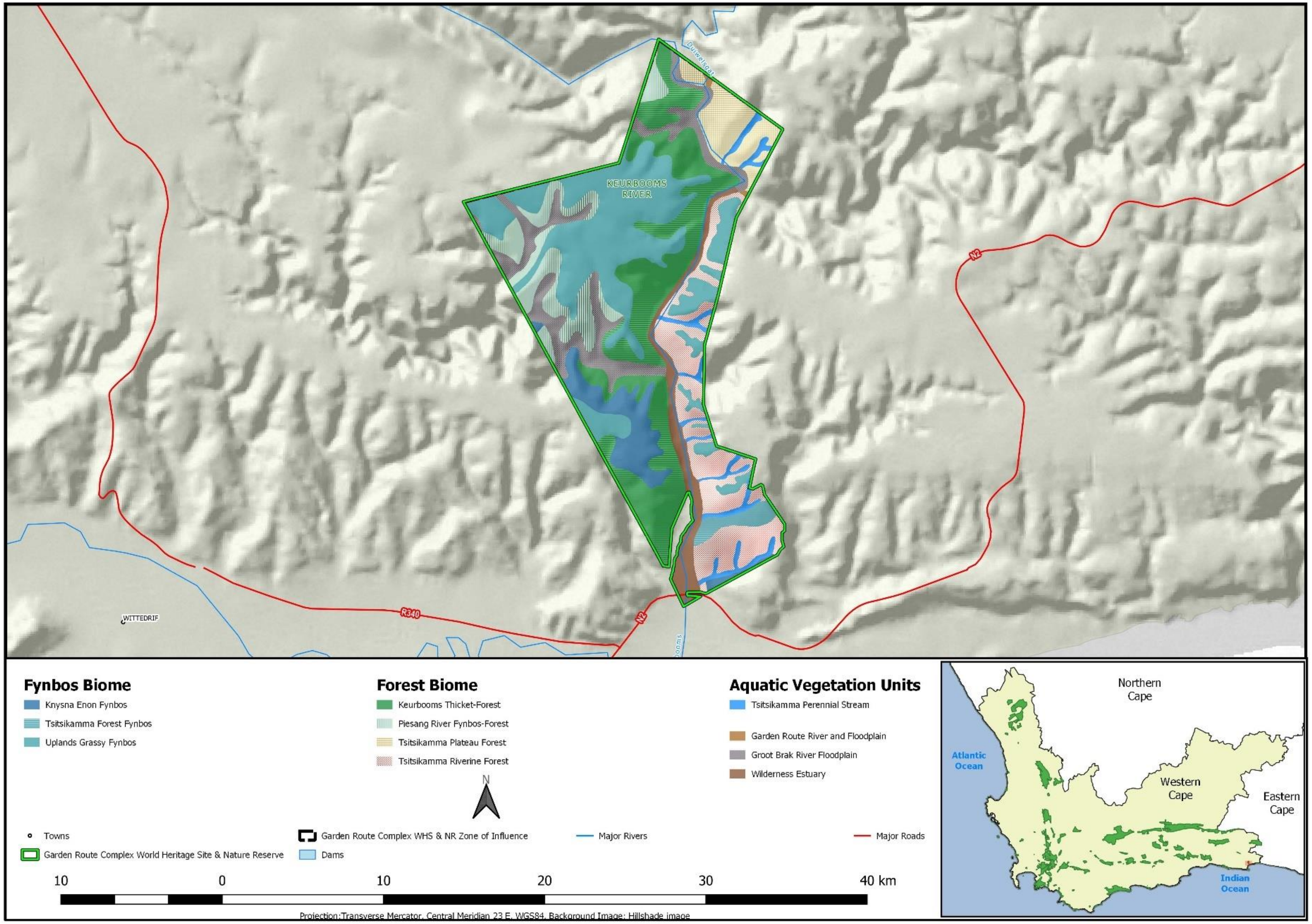
Map 4e: Vegetation of the Annex Vlugt sector based on the SA Vegetation Map (SANBI 2006-2018).



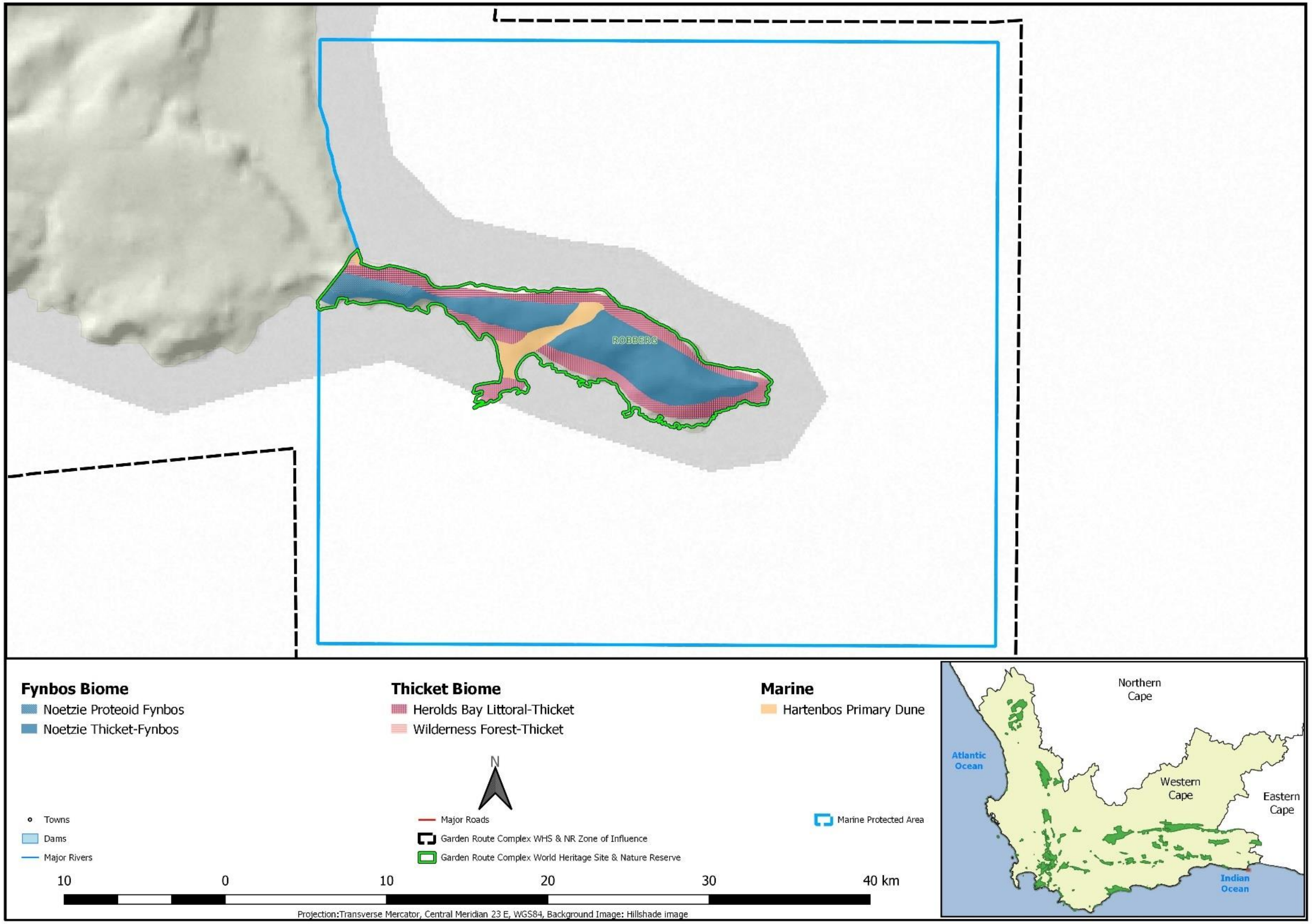
Map 5a: Fine-scale vegetation map of Outeniqua Cluster (Vlok et al. 2005, 2008; Vlok & De Villiers 2007).



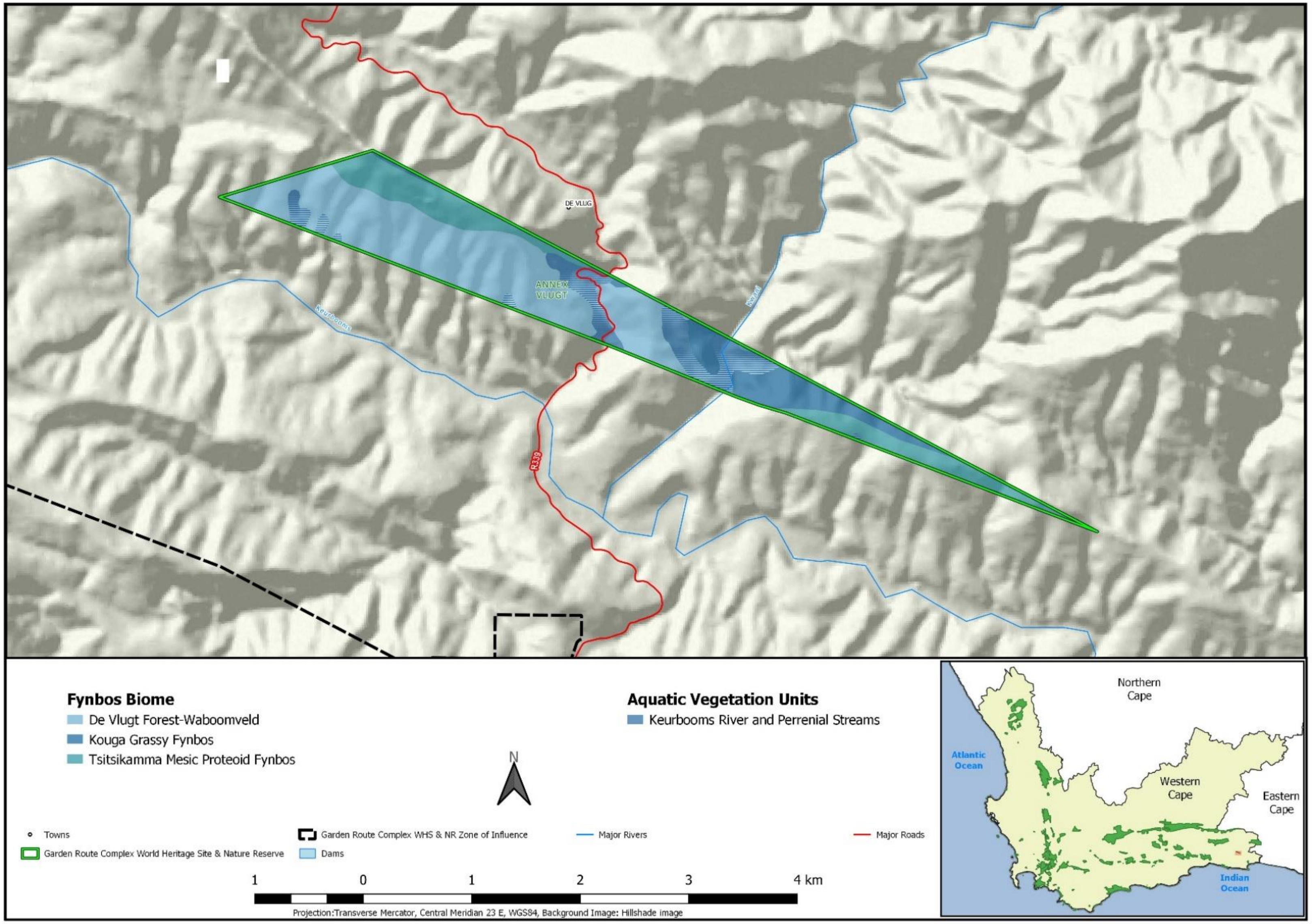
Map 5b: Fine-scale vegetation map of Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors (Vlok et al. 2008).



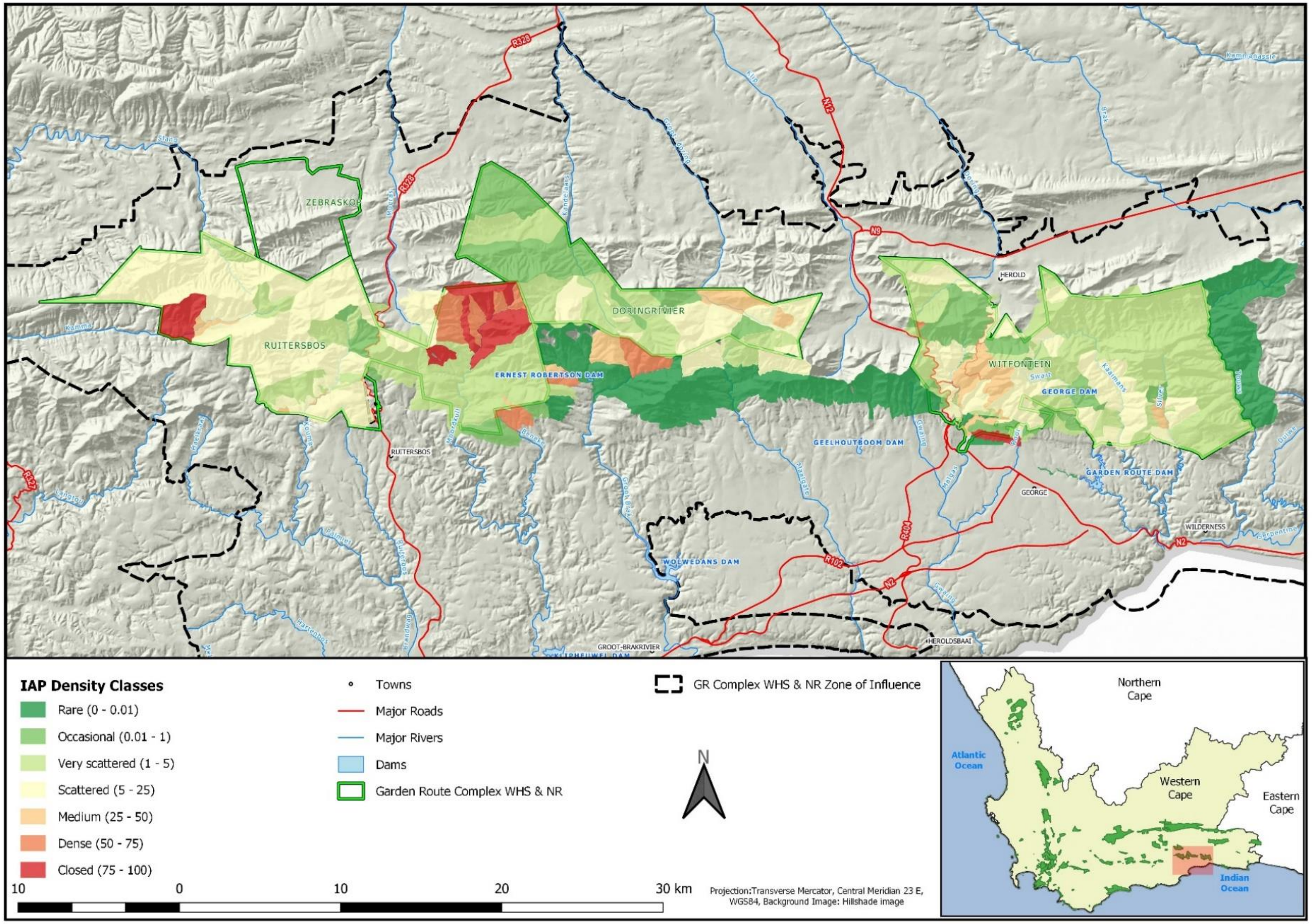
Map 5c: Fine-scale vegetation map of the Keurbooms River sector (Vlok et al. 2008).



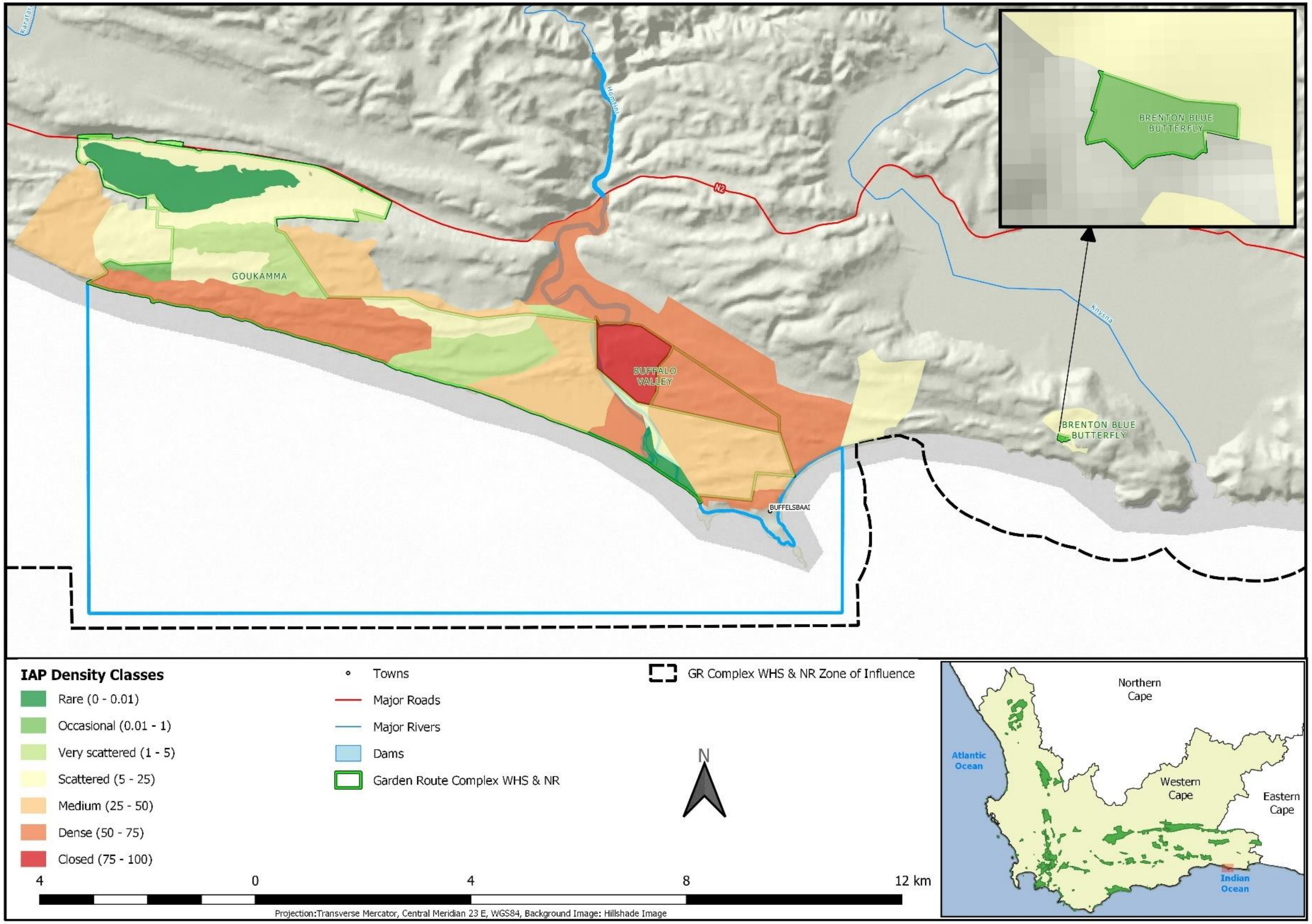
Map 5d: Fine-scale vegetation map of the Robberg sector (Vlok et al. 2008).



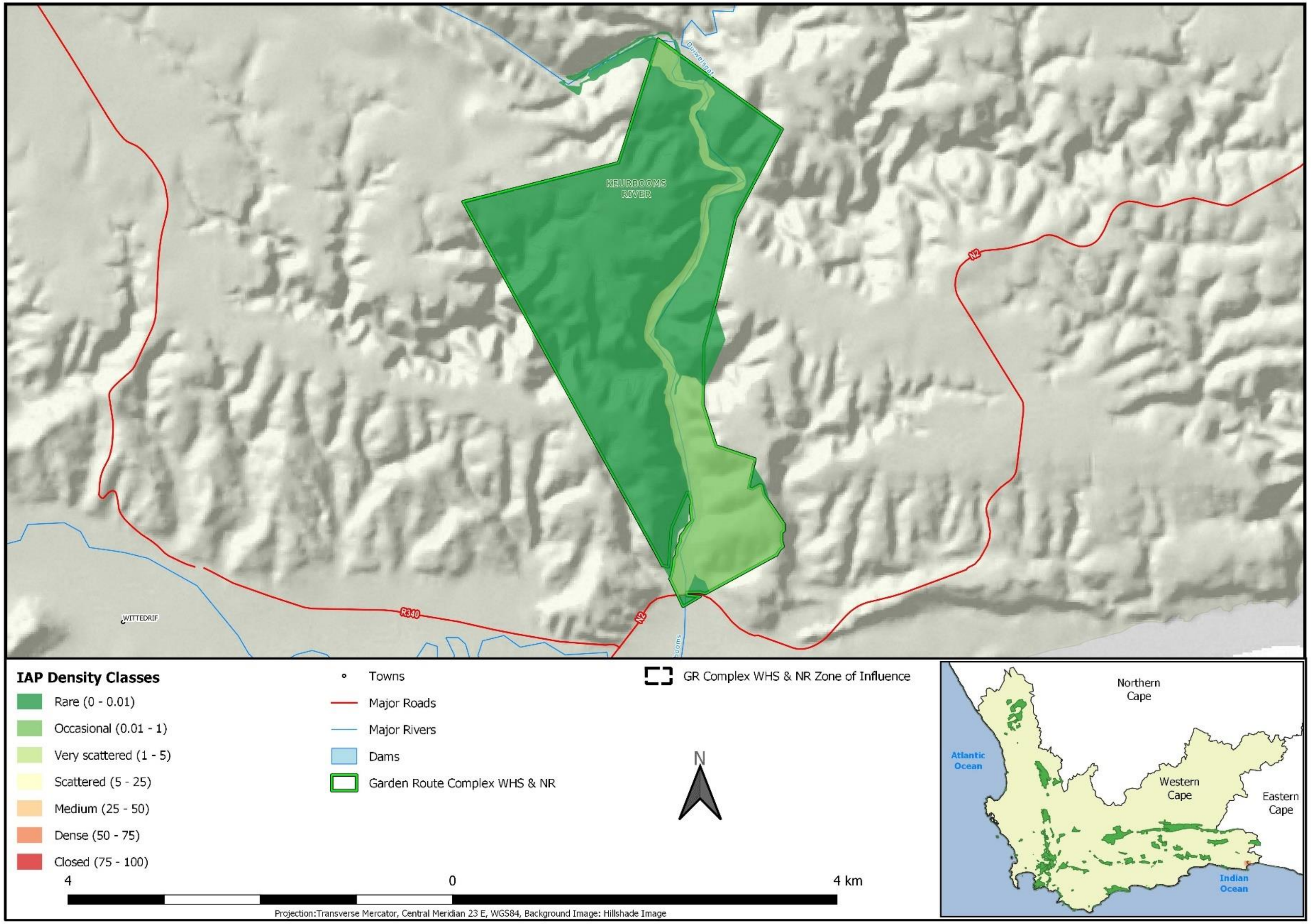
Map 5e: Fine-scale vegetation map of the Annex Vlugt sector (Vlok et al. 2008).



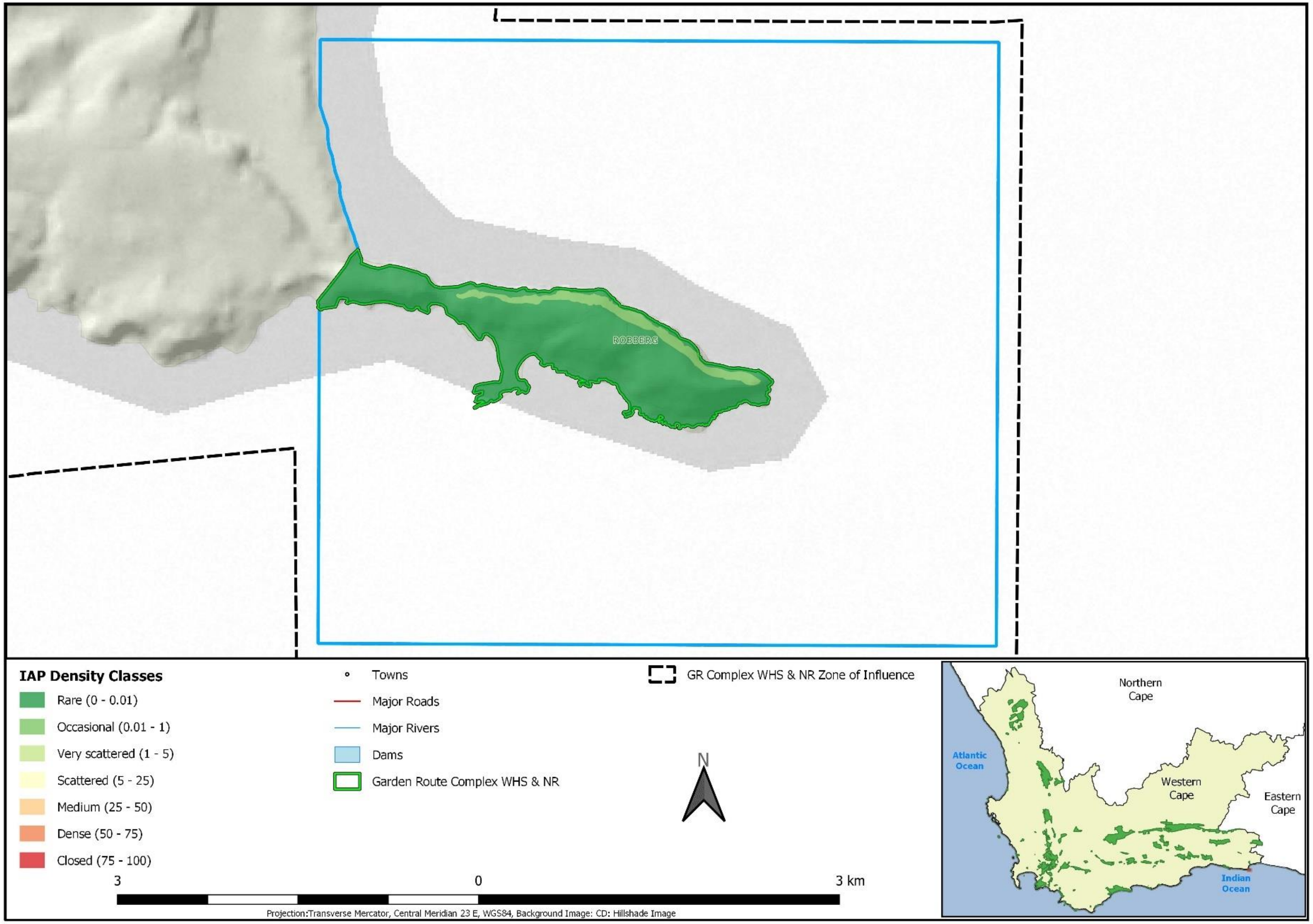
Map 6a: Invasive alien plant densities of Outeniqua Cluster.



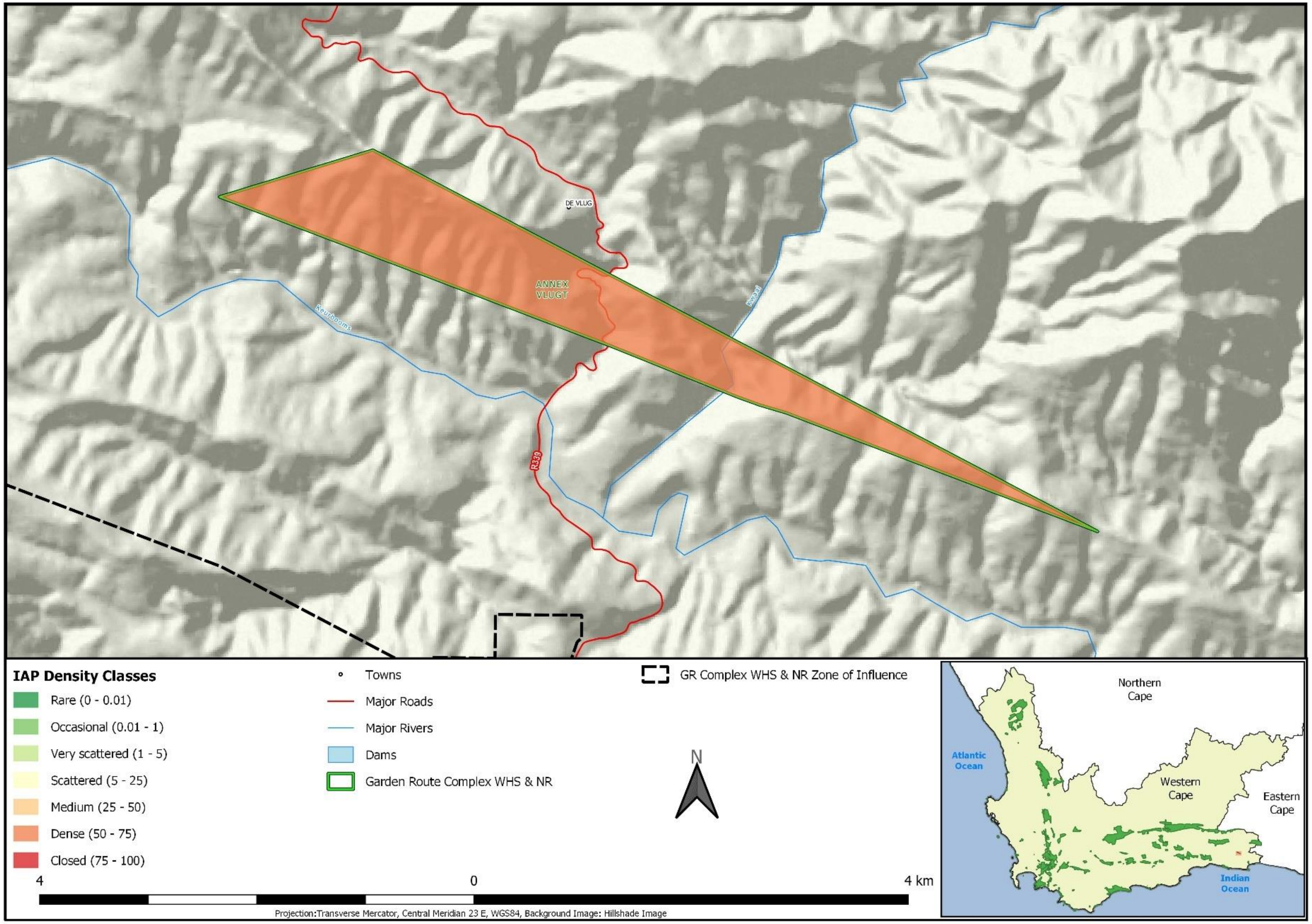
Map 6b: Invasive alien plant densities of the Goukamma, Buffalo Valley and Brenton Blue Butterfly (insert) sectors.



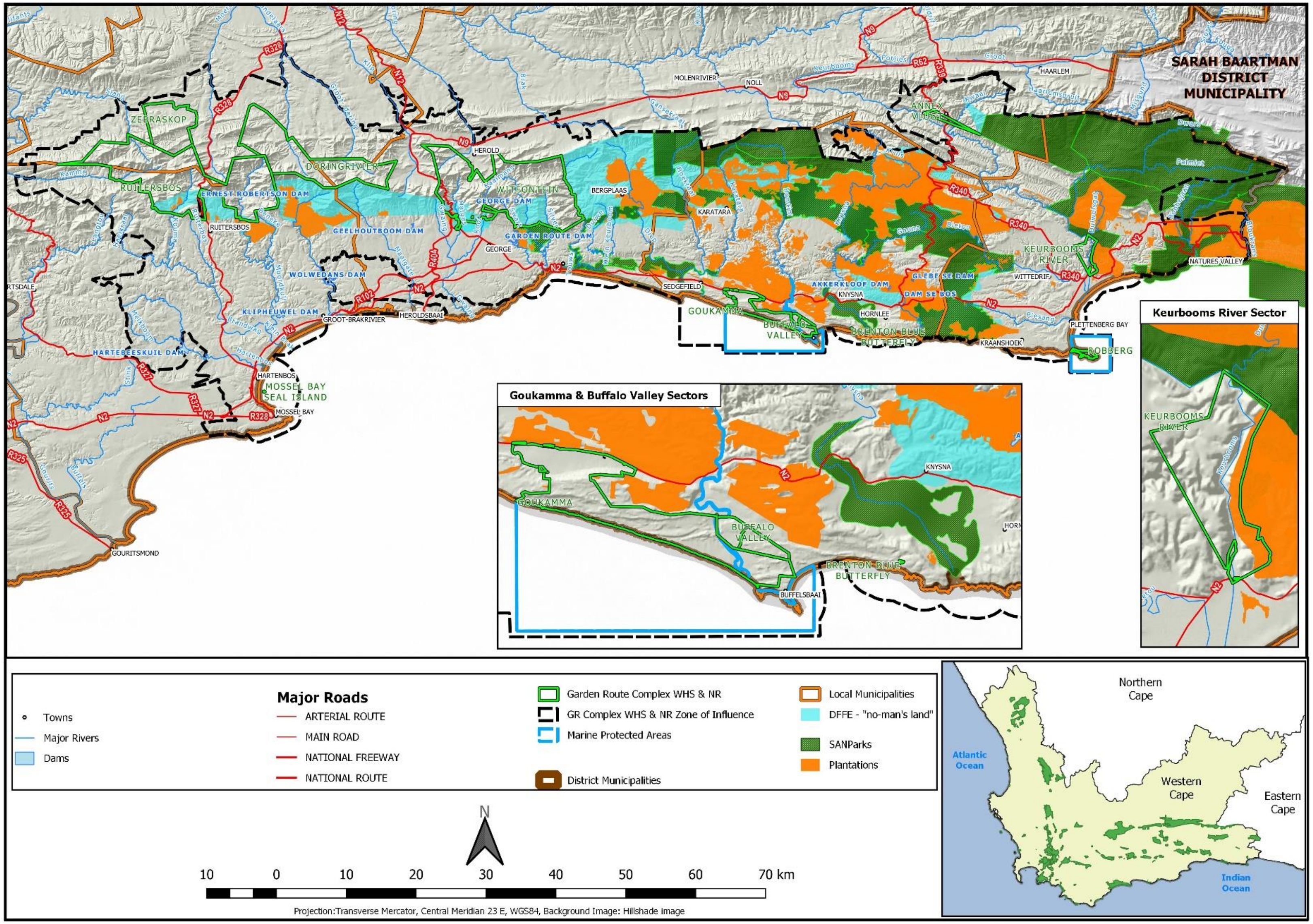
Map 6c: Invasive alien plant densities of the Keurbooms River sector.



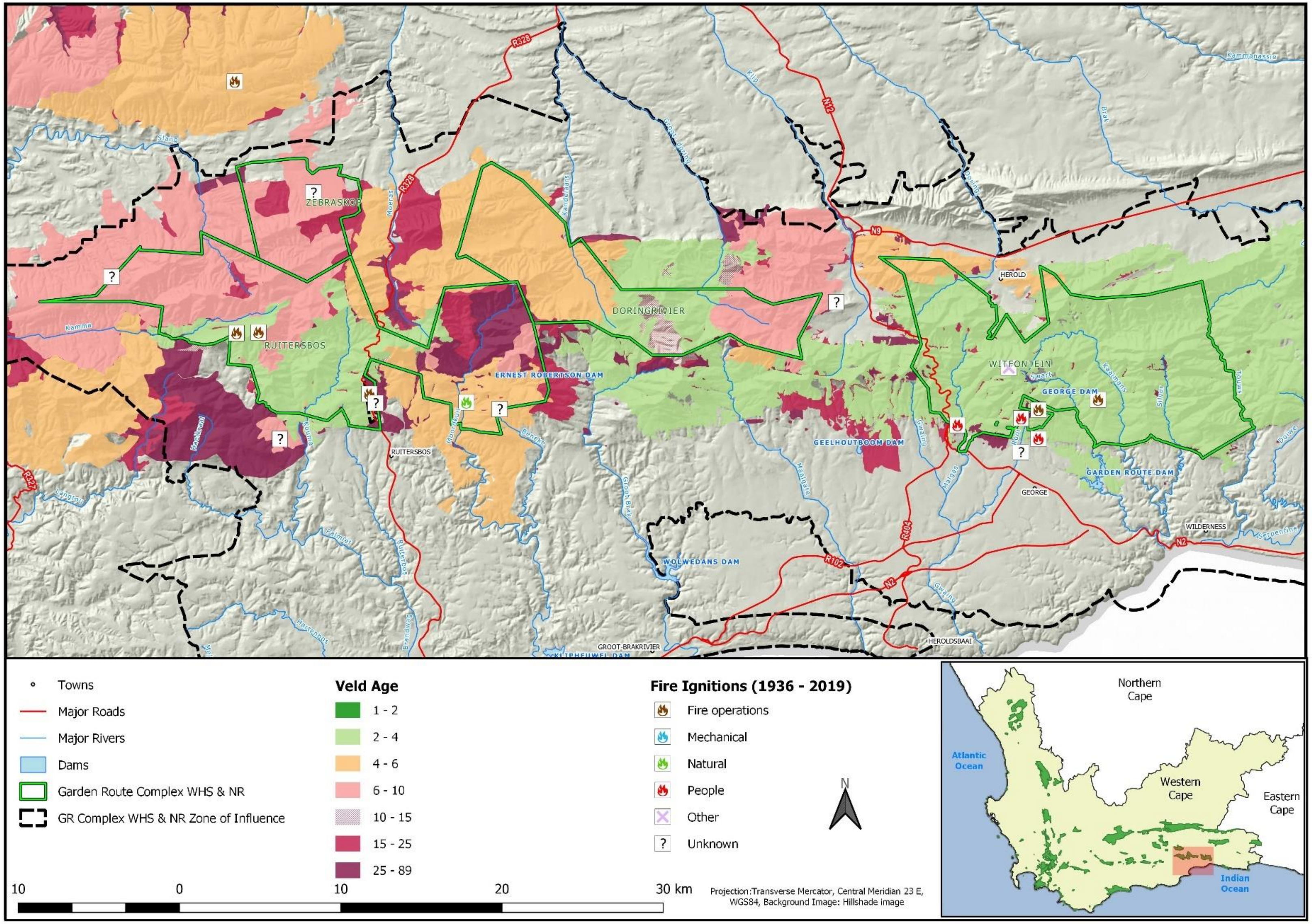
Map 6d: Invasive alien plant densities of the Robberg sector.



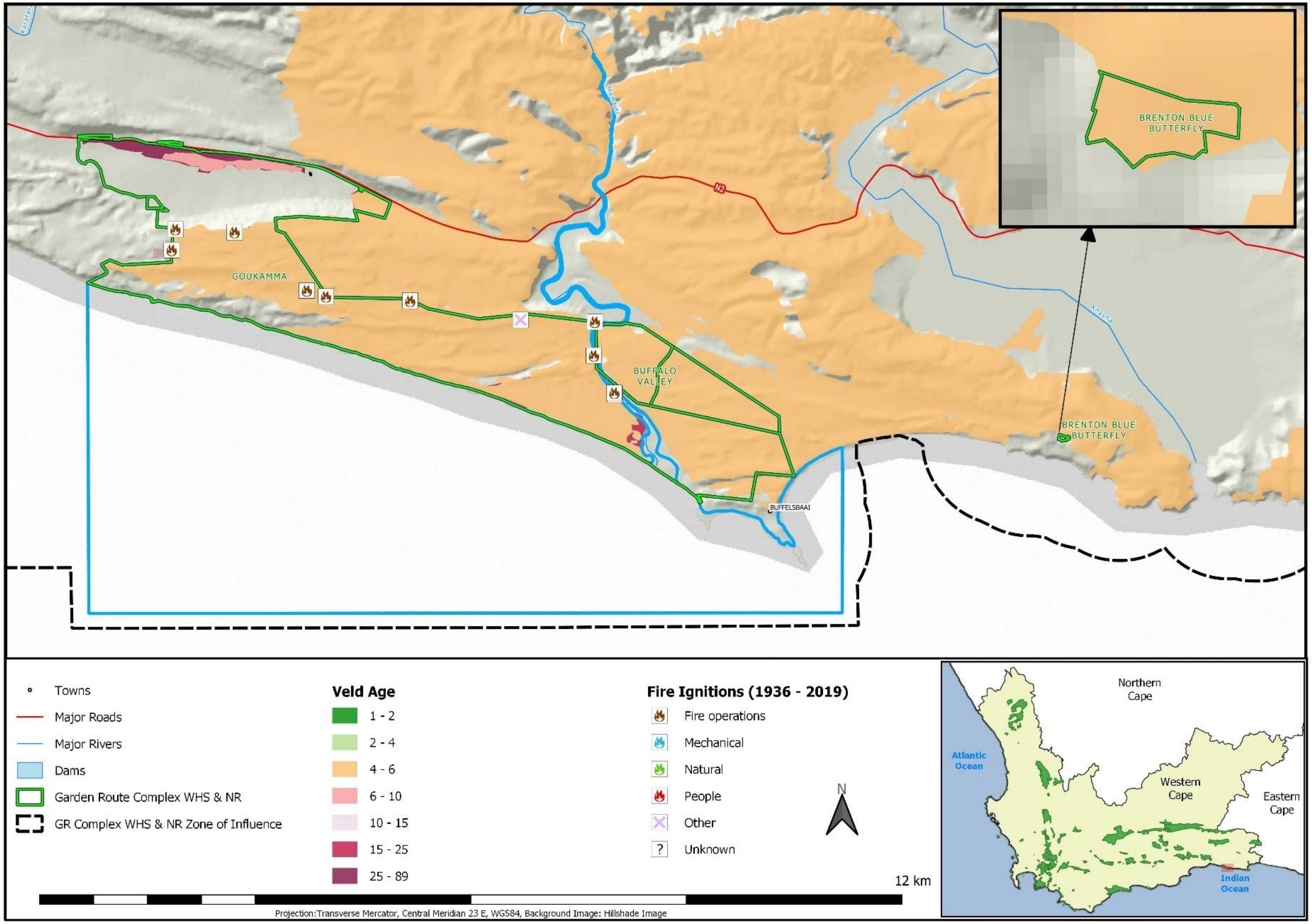
Map 6e: Invasive alien plant densities of the Annex Vlugt sector.



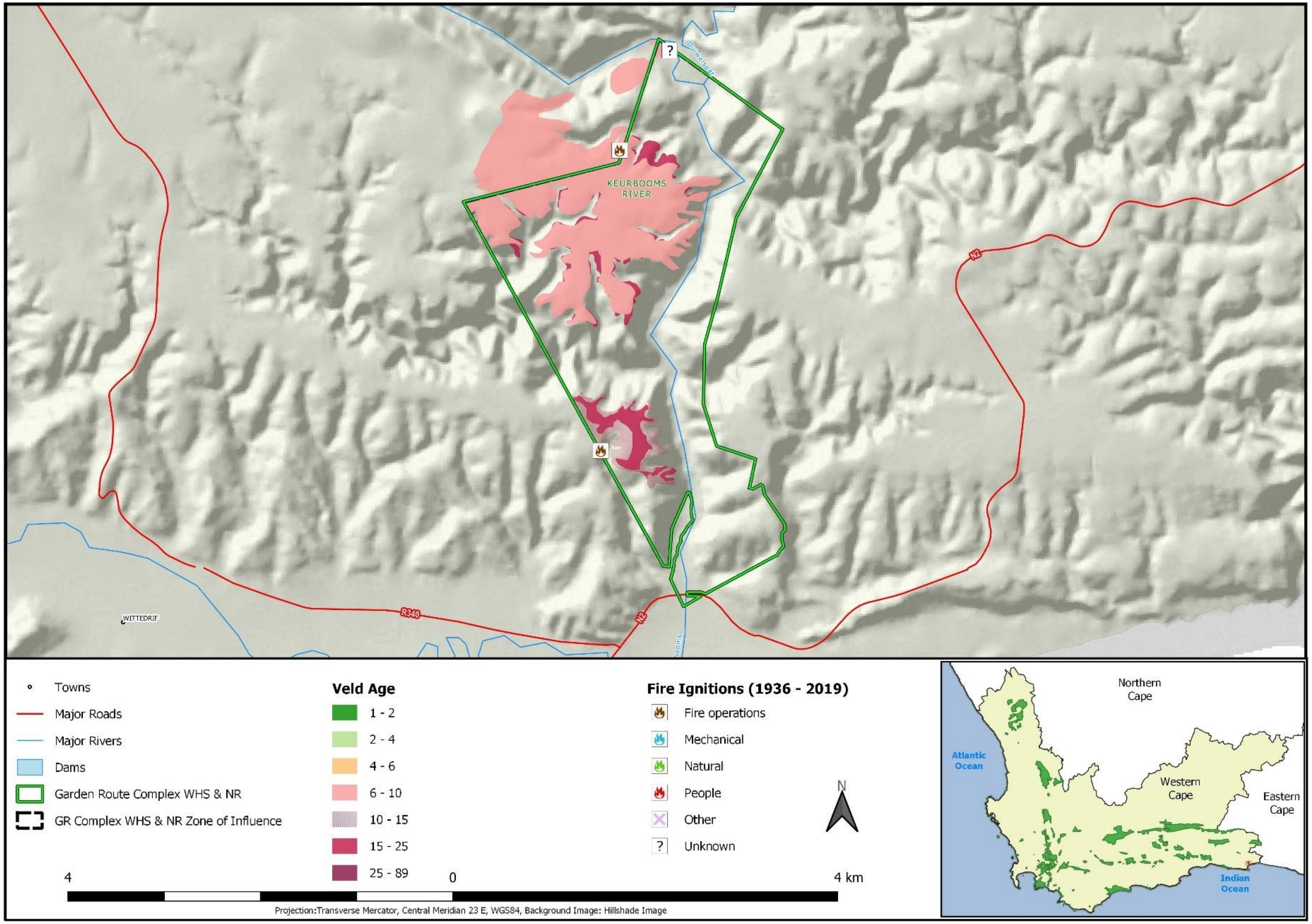
Map 7: Location of plantations and no-man's land in relation to the GRCWHS&NR and the Garden Route National Park.



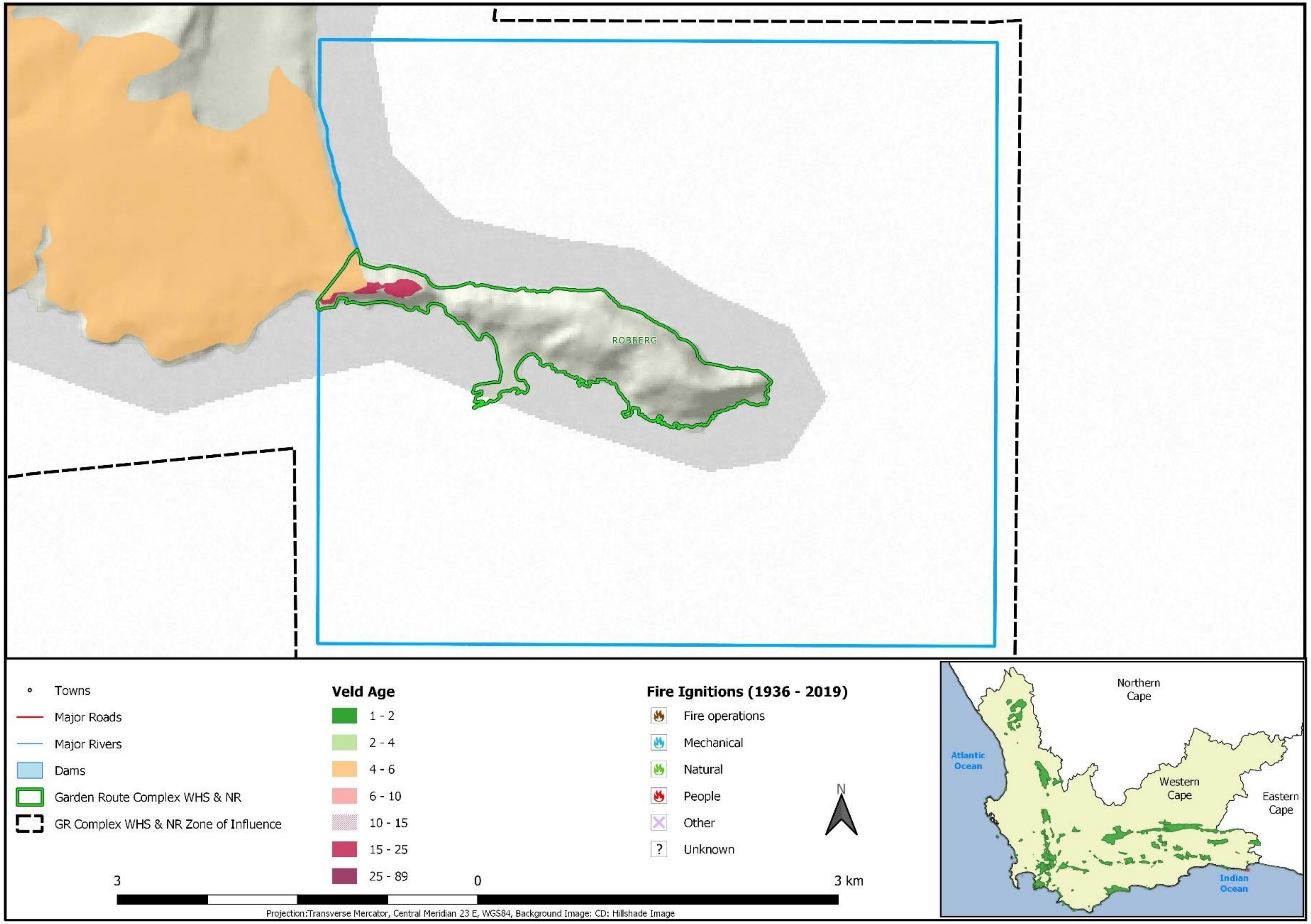
Map 8a: Current (2022) distribution of veld age classes and recorded sources of ignition on the Outeniqua Cluster.



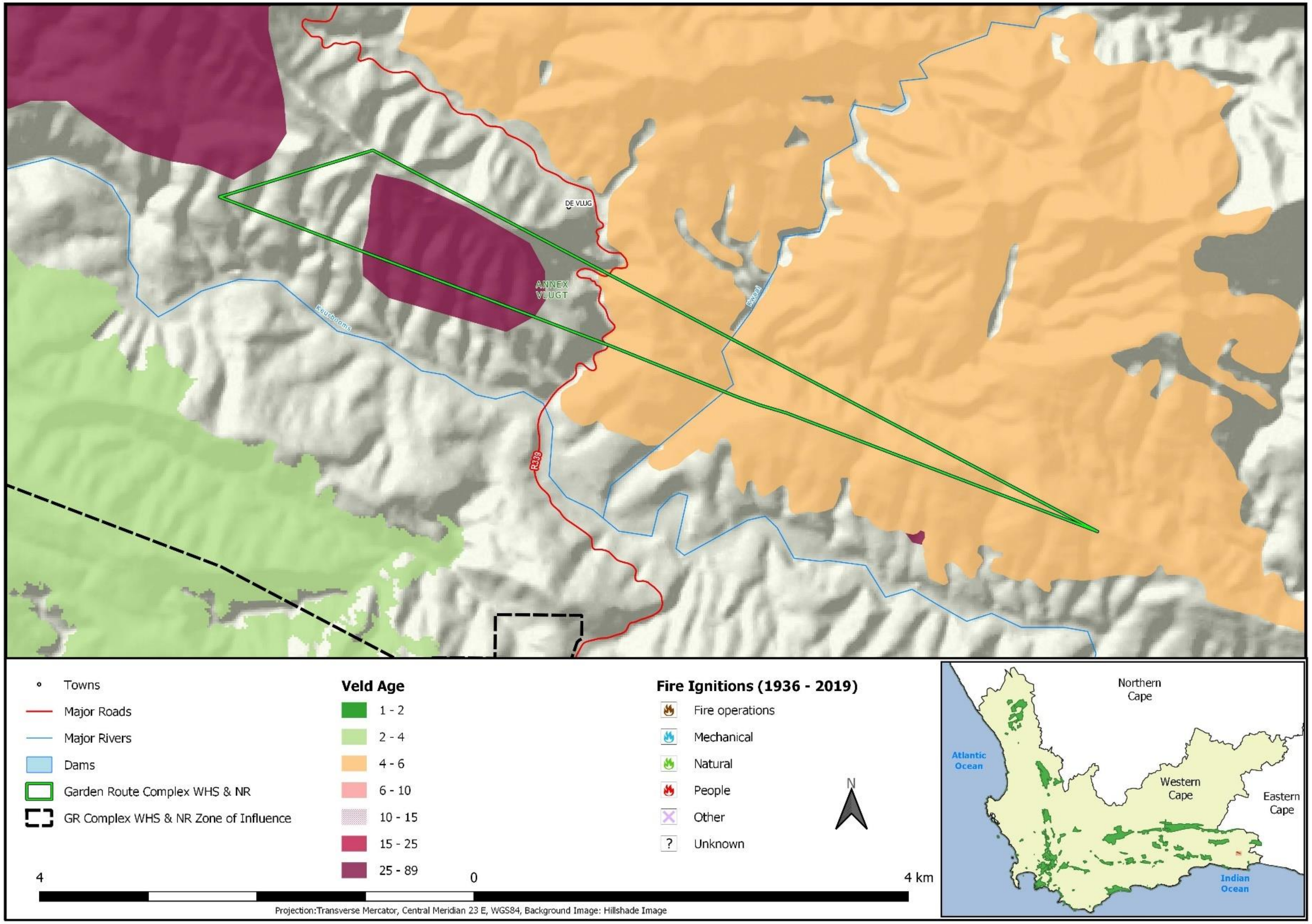
Map 8b: Current (2022) distribution of veld age classes and recorded sources of ignition on the Goukamma Cluster.



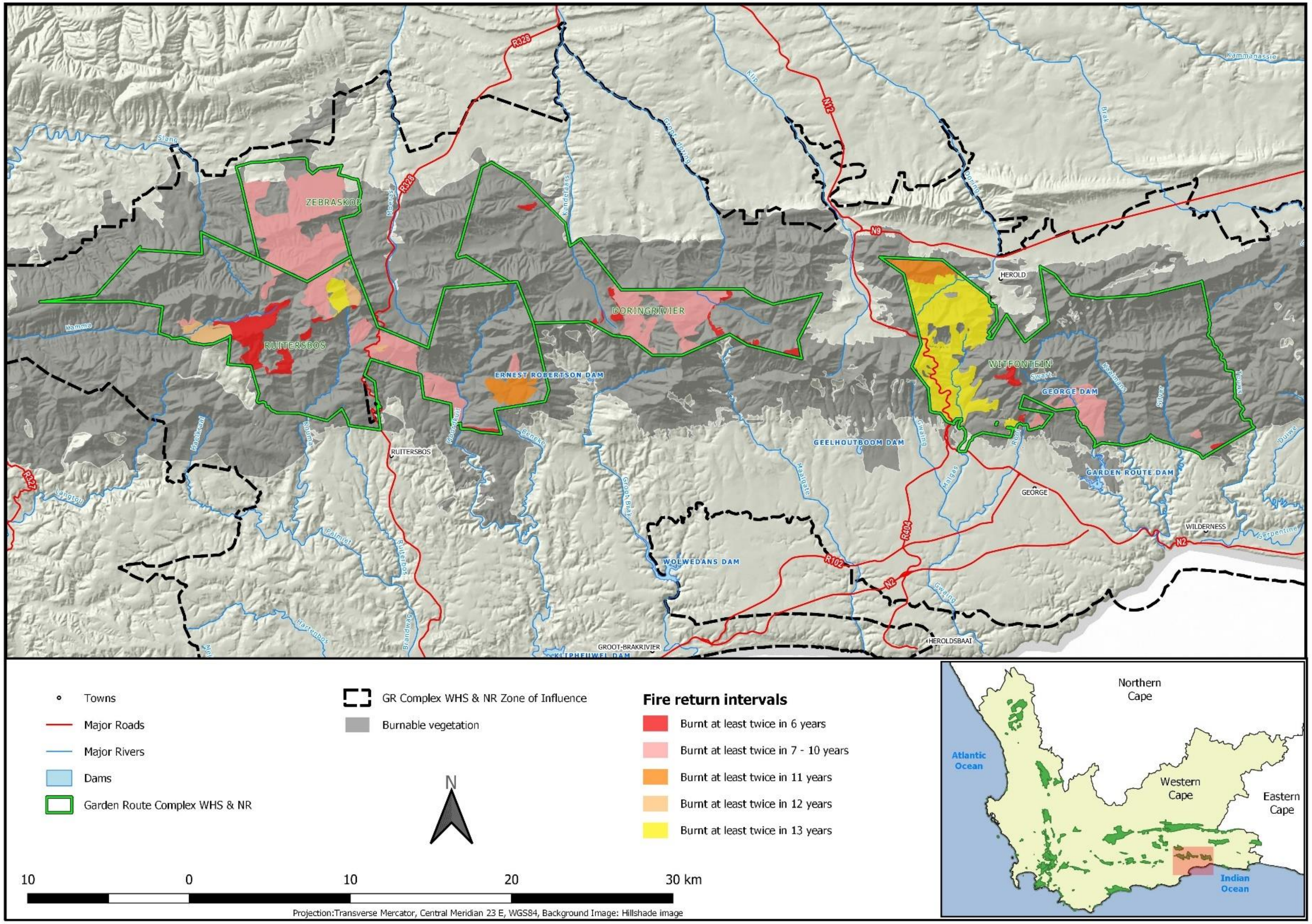
Map 8c: Current (2022) distribution of veld age classes and recorded sources of ignition on the Keurbooms River sector.



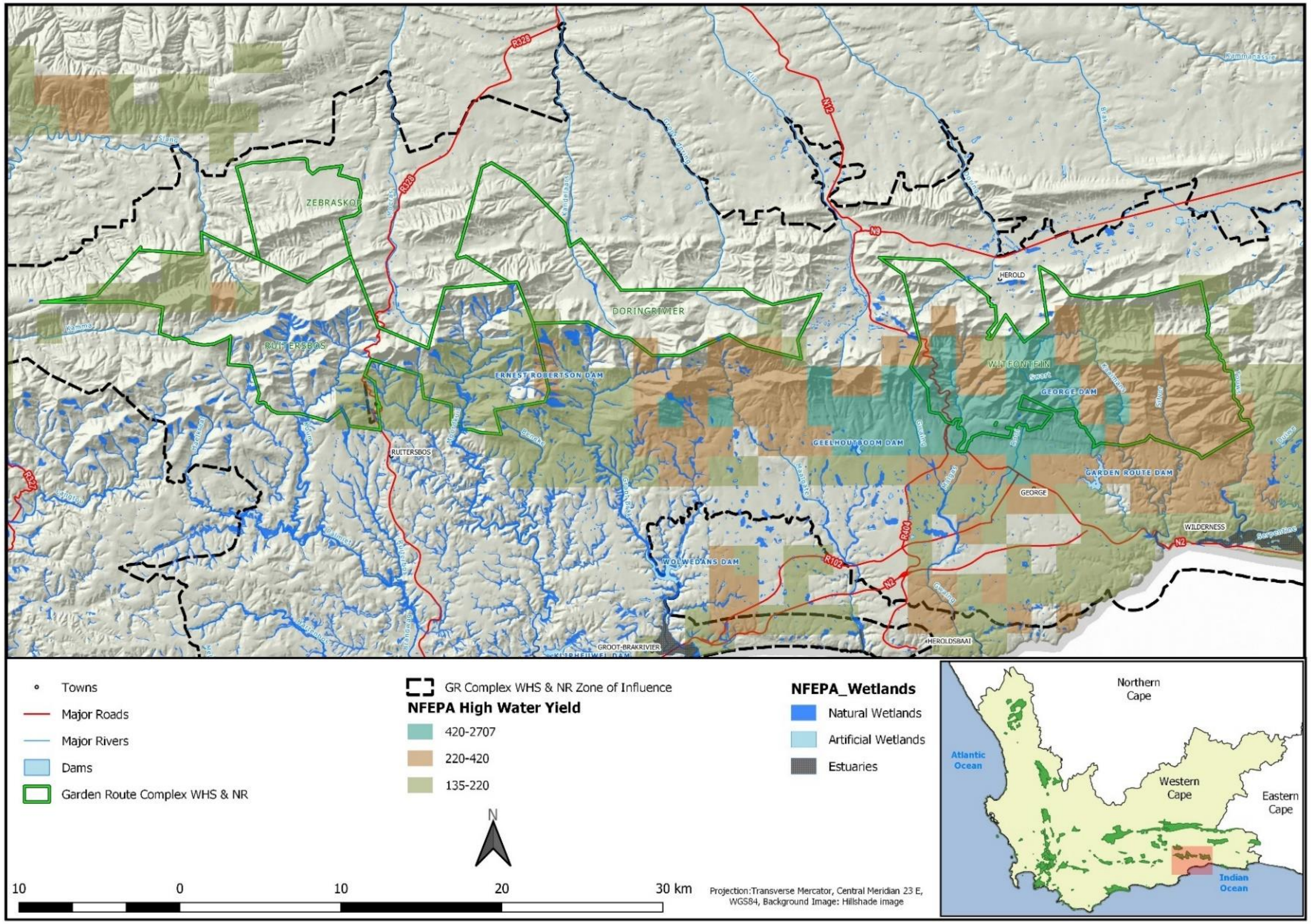
Map 8d: Current (2022) distribution of veld age classes and recorded sources of ignition on the Robberg sector.



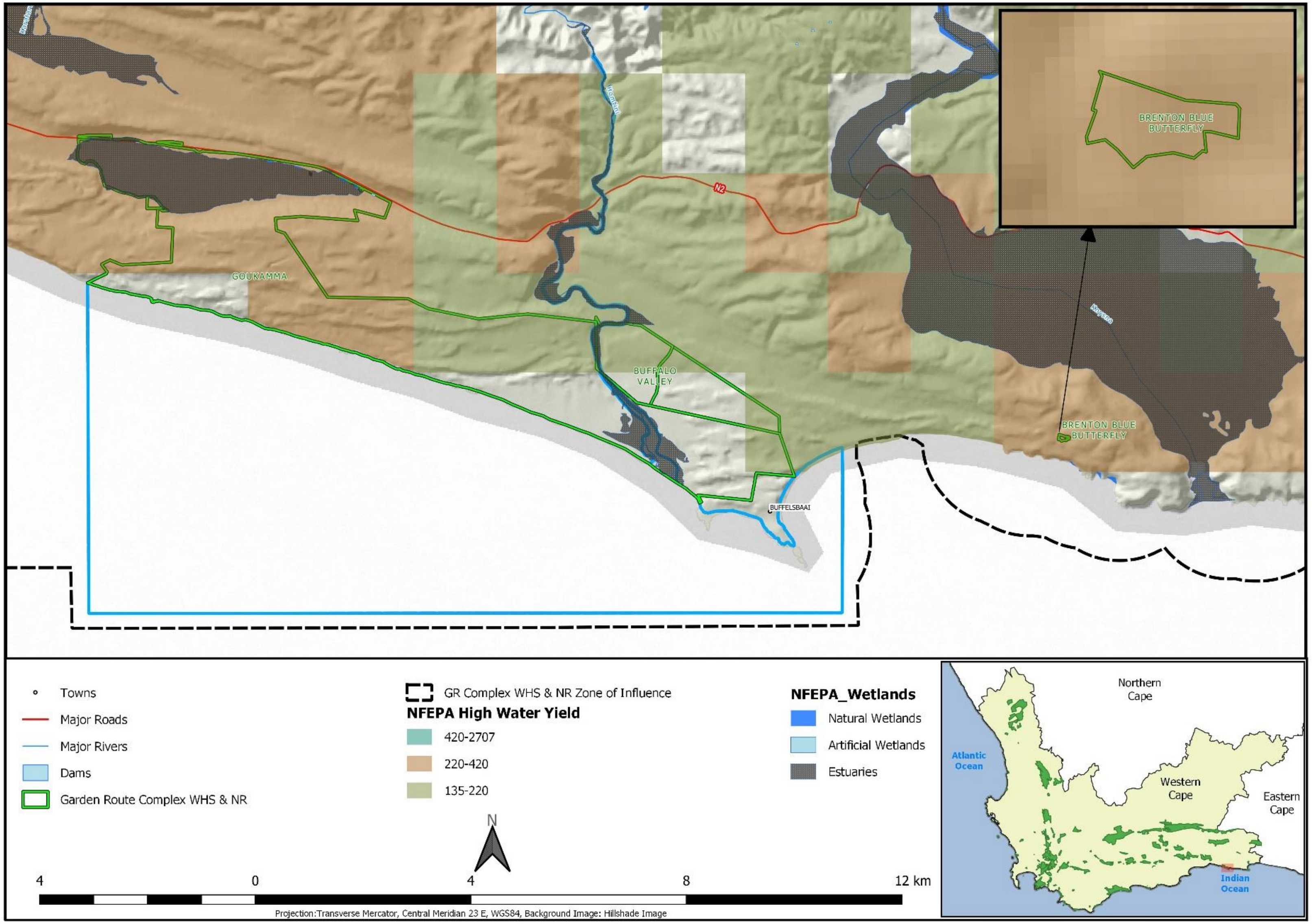
Map 8e: Current (2022) distribution of veld age classes and recorded sources of ignition on the Annex Vlugt sector.



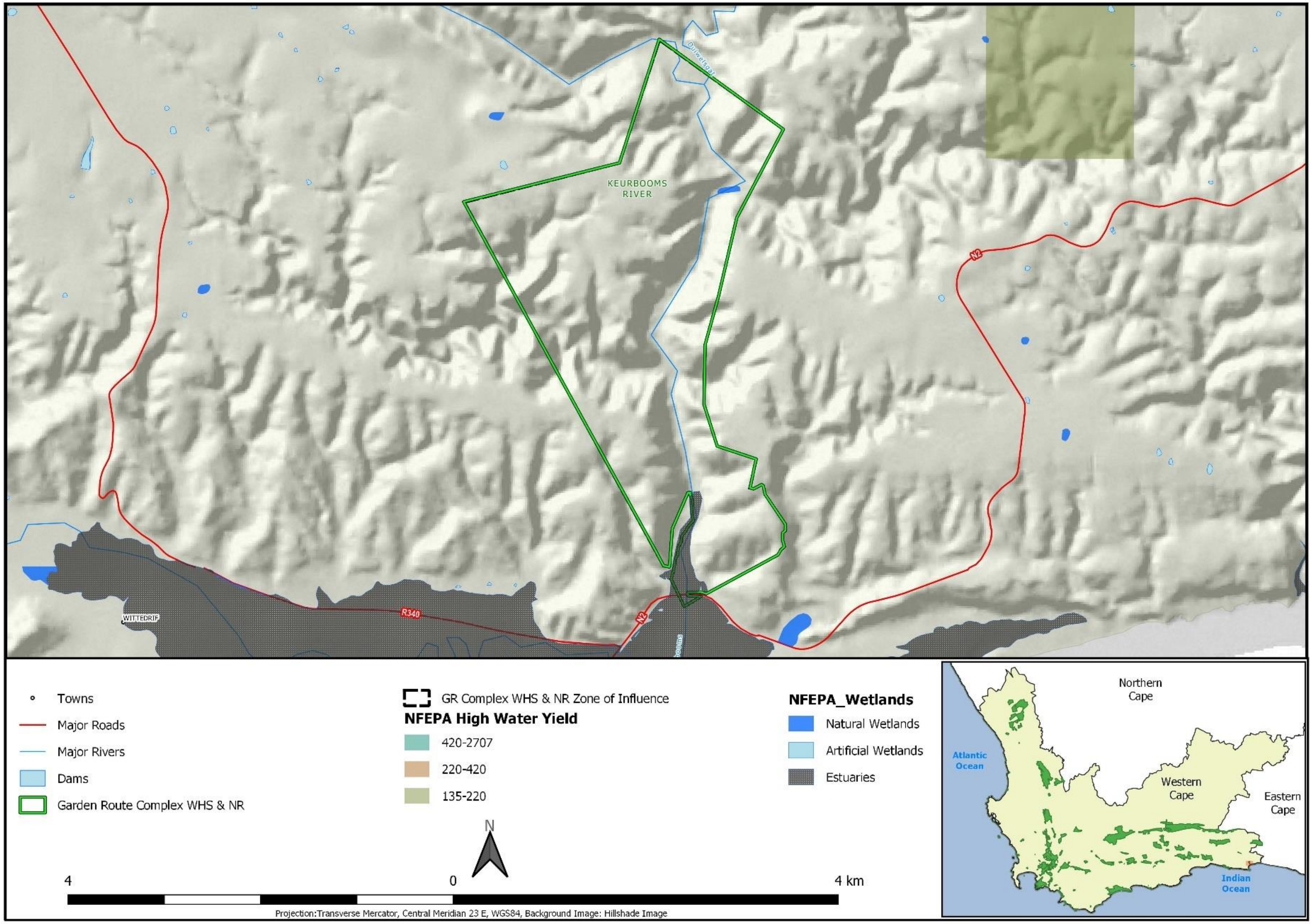
Map 9: Areas within the Outeniqua Cluster that have burnt at too short return intervals during the past 15 years.



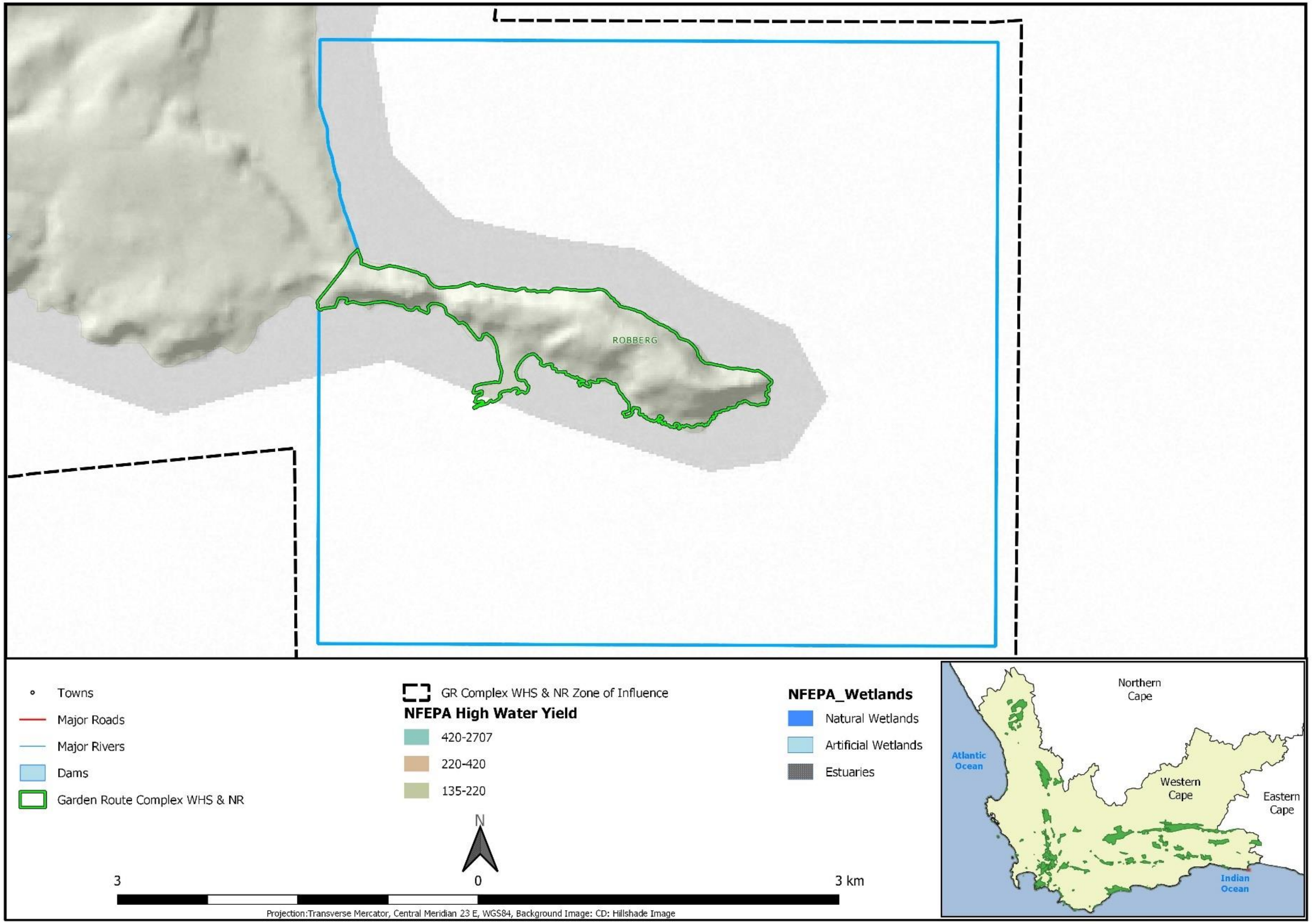
Map 10a: National Freshwater Ecosystem Priority and High Water Yield Areas of the Outeniqua Cluster.



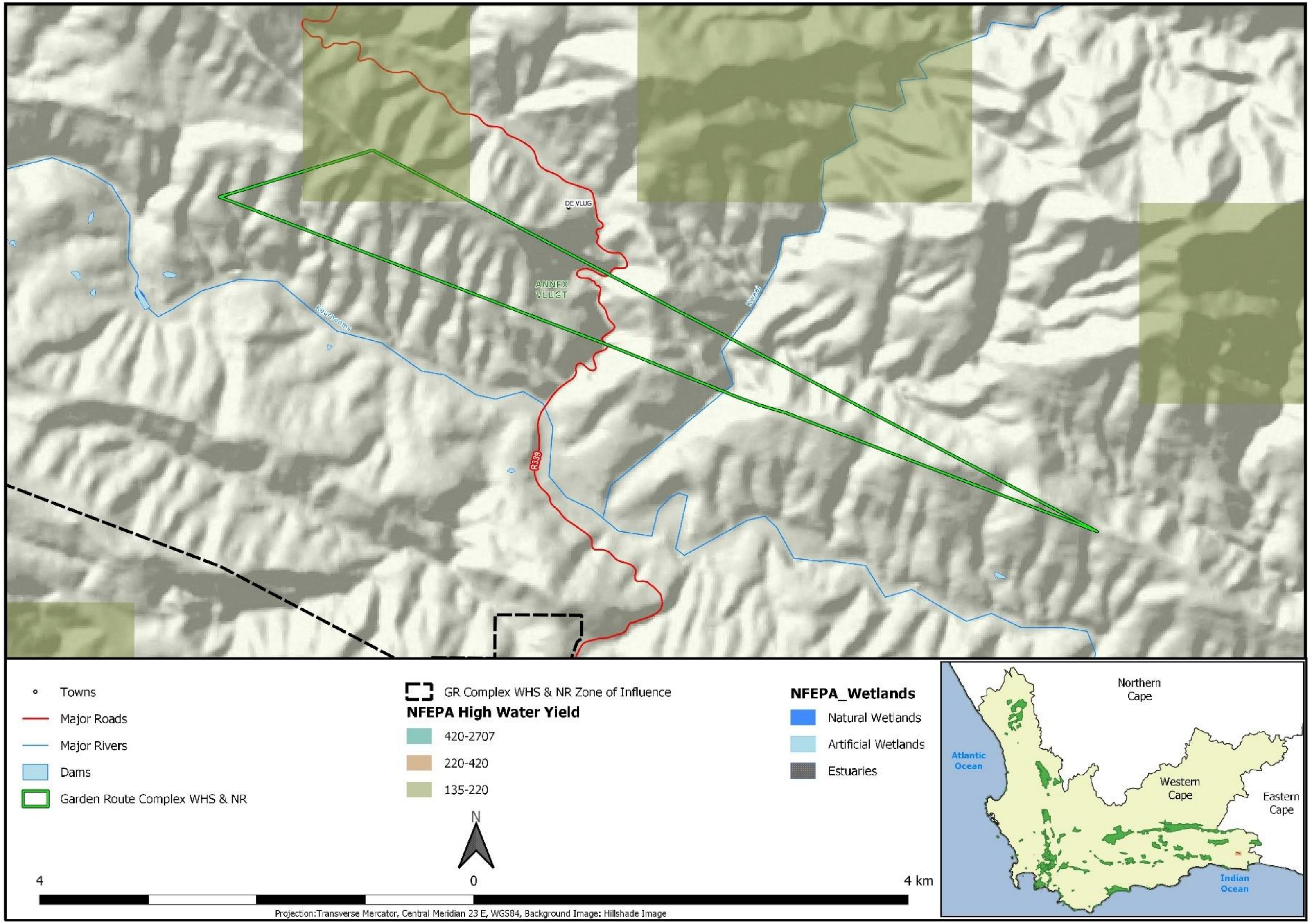
Map 10b: National Freshwater Ecosystem Priority and High Water Yield Areas of the Goukamma Cluster.



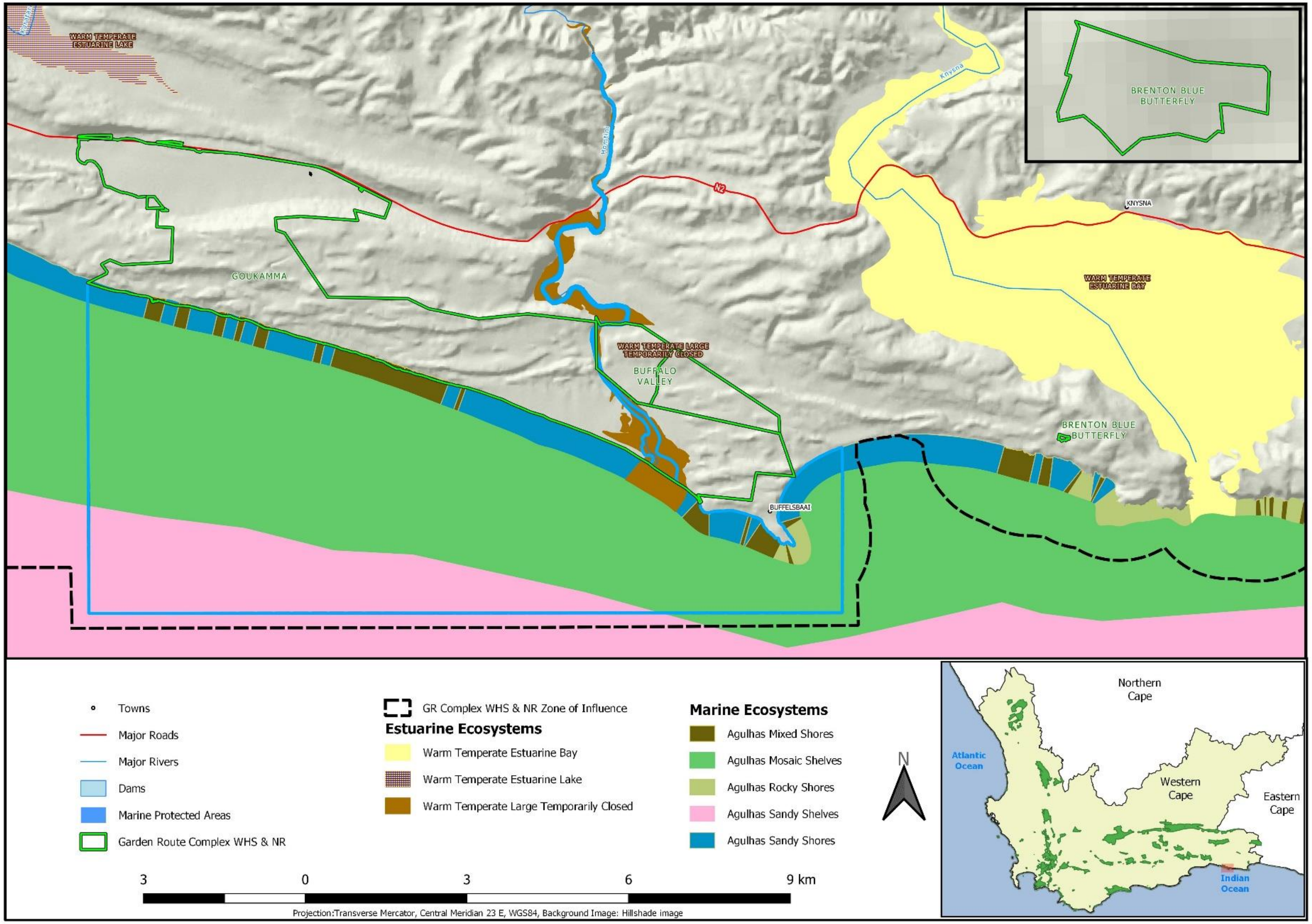
Map 10c: National Freshwater Ecosystem Priority and High Water Yield Areas of the Keurbooms River sector.



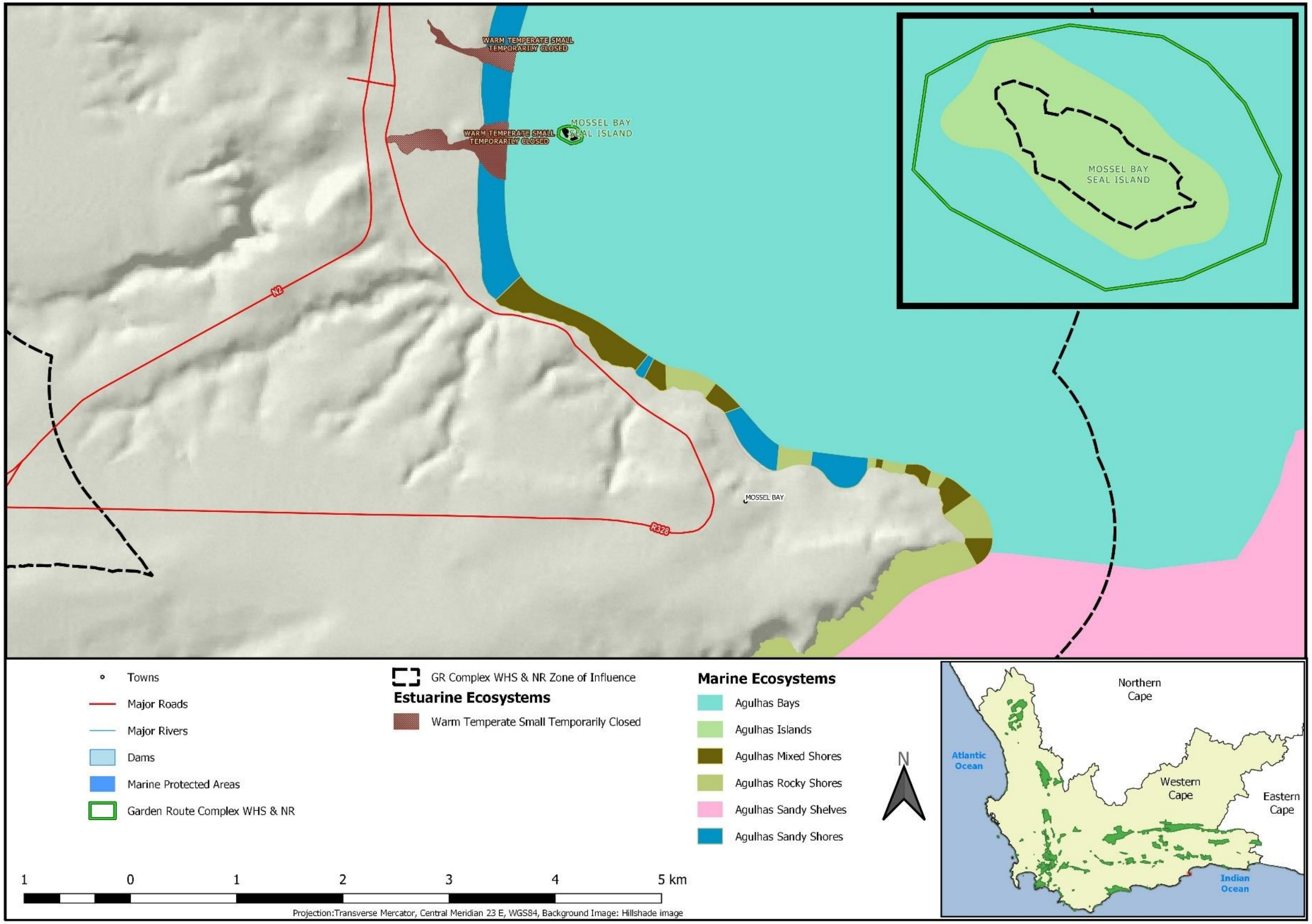
Map 10d: National Freshwater Ecosystem Priority and High Water Yield Areas of the Robberg sector.



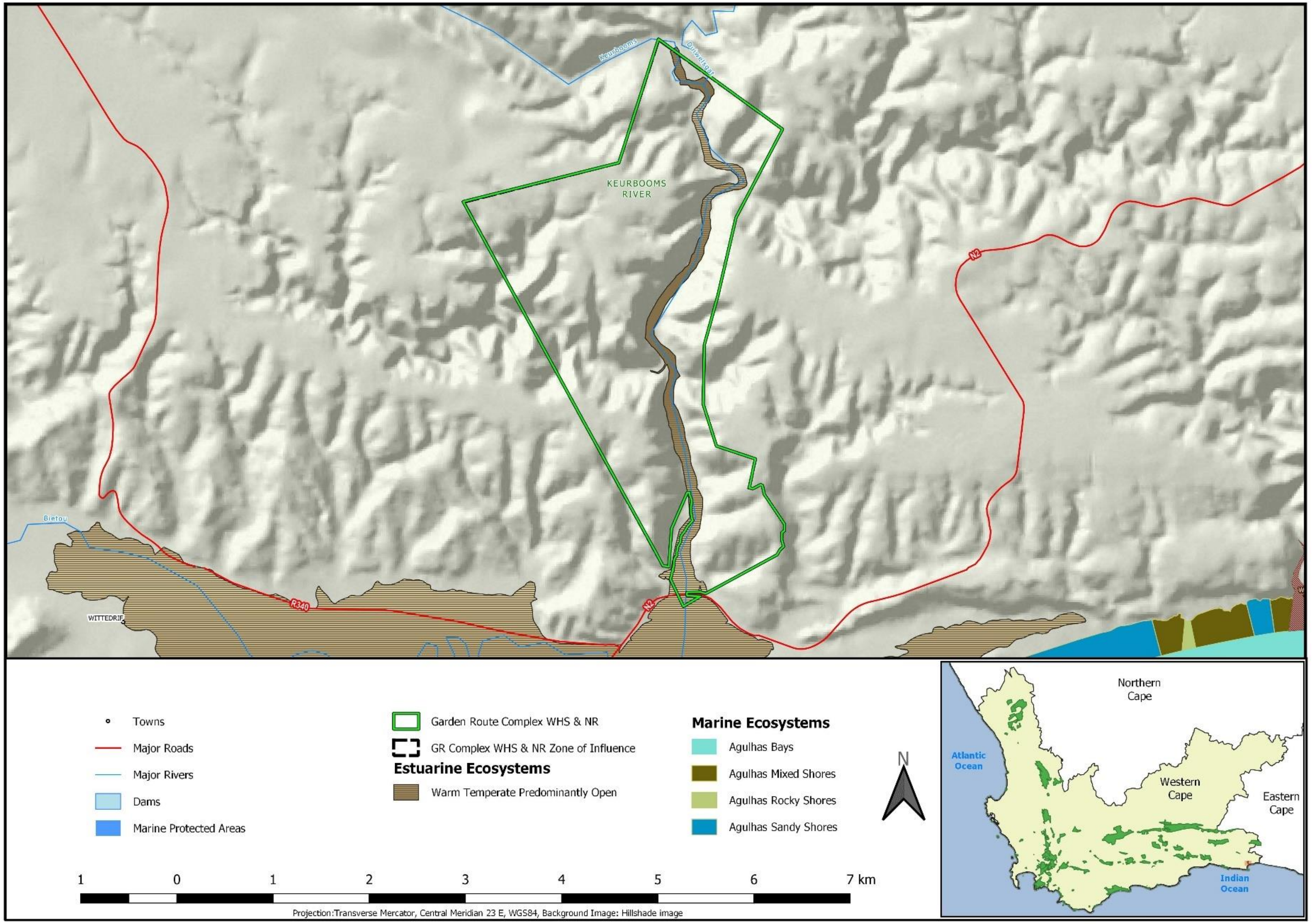
Map 10e: National Freshwater Ecosystem Priority and High Water Yield Areas of the Annex Vlugt sector.



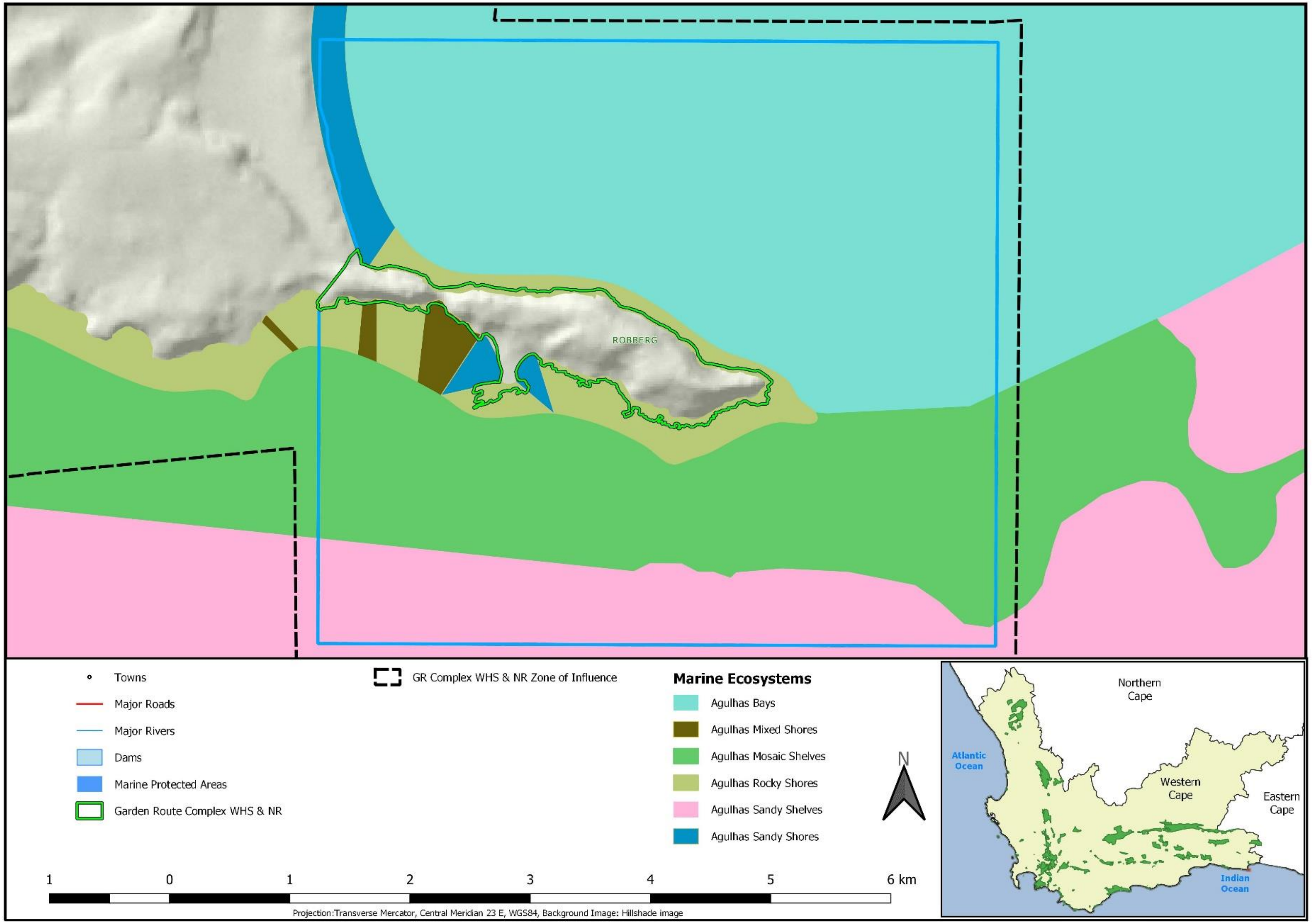
Map 11a: Marine and estuarine ecosystems of the Goukamma MPA.



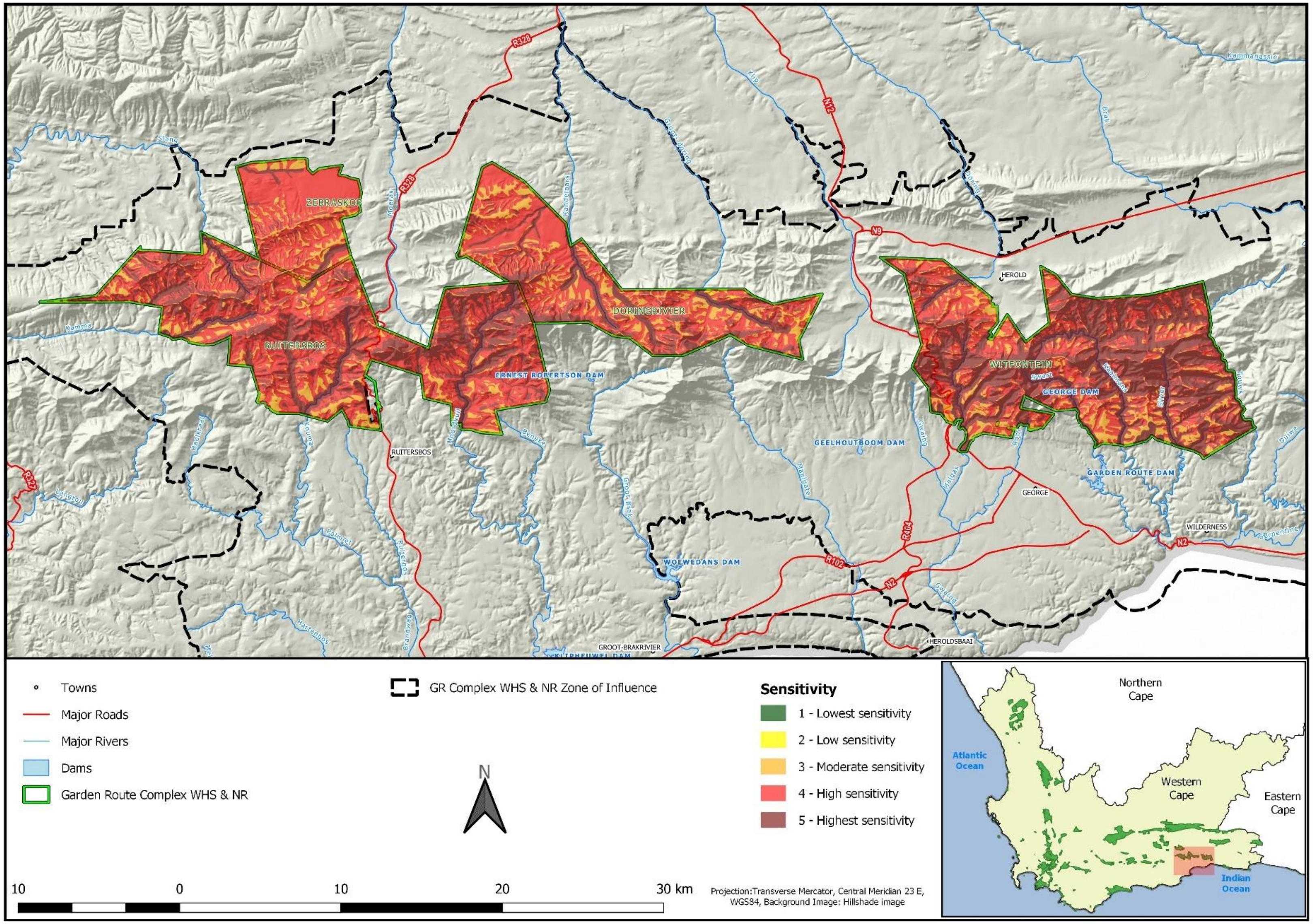
Map 11b: Marine ecosystems of Mossel Bay Seal Island.



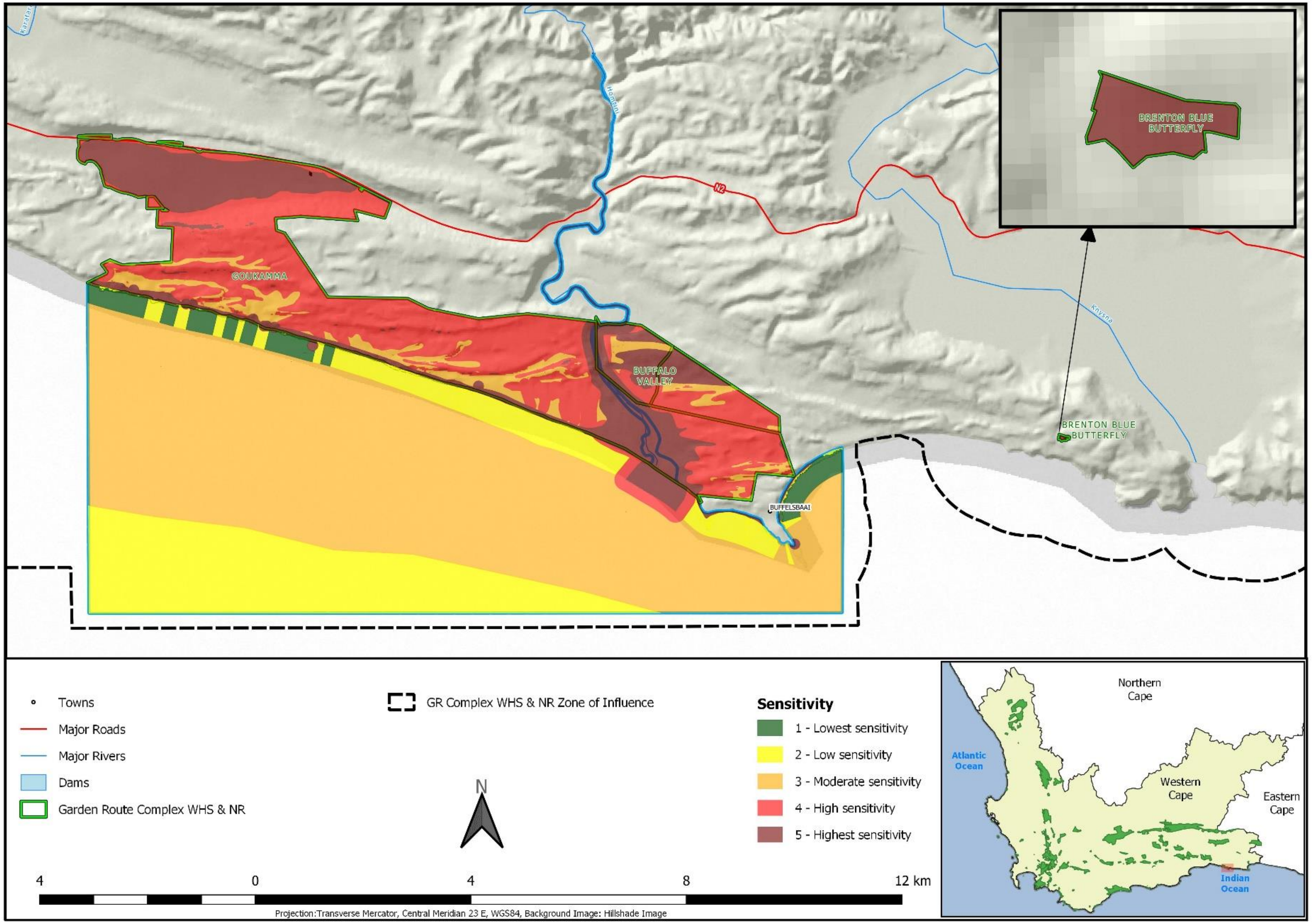
Map 11c: Marine and estuarine ecosystems of the Keurbooms River sector.



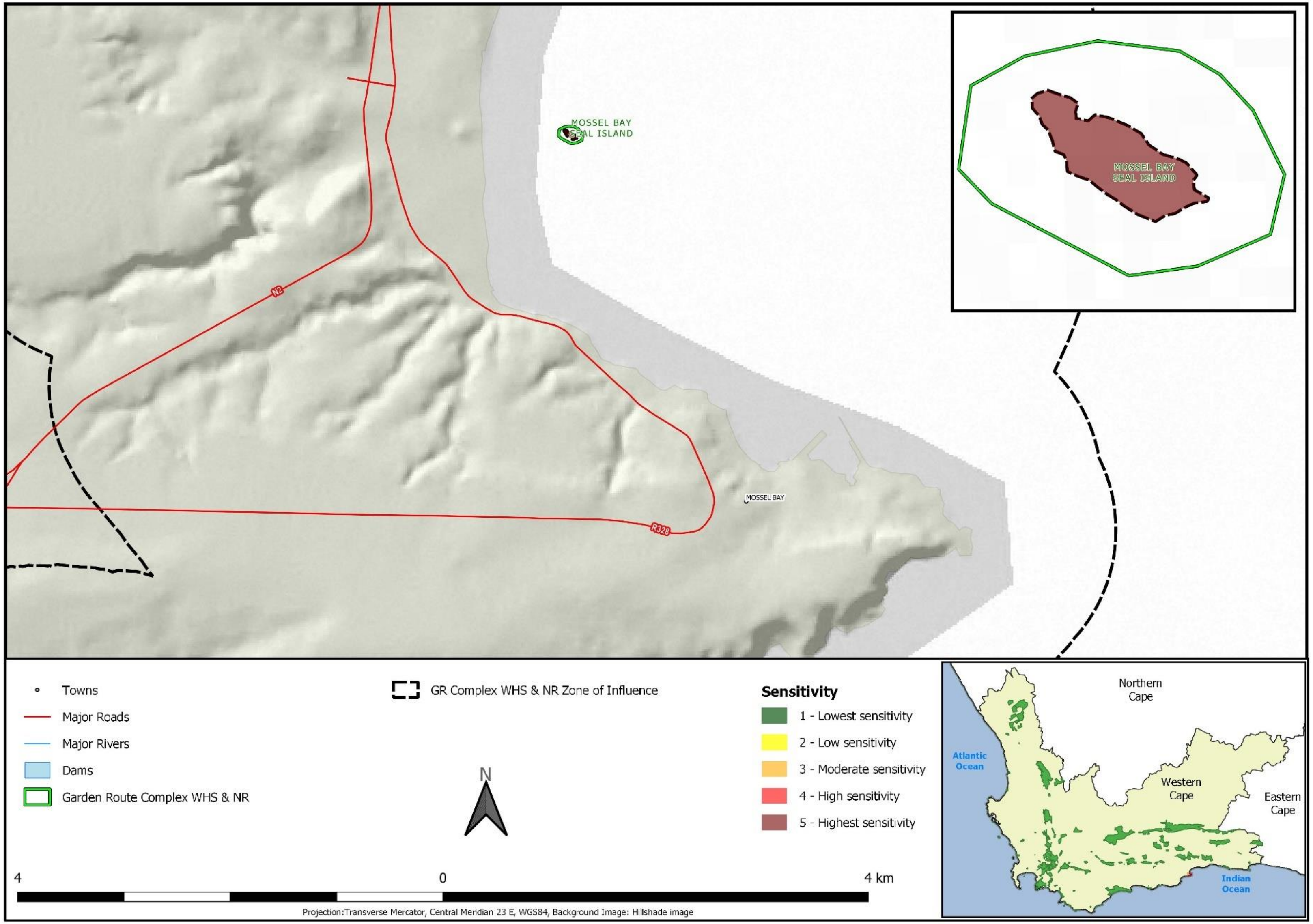
Map 11d: Marine ecosystems of the Robberg MPA.



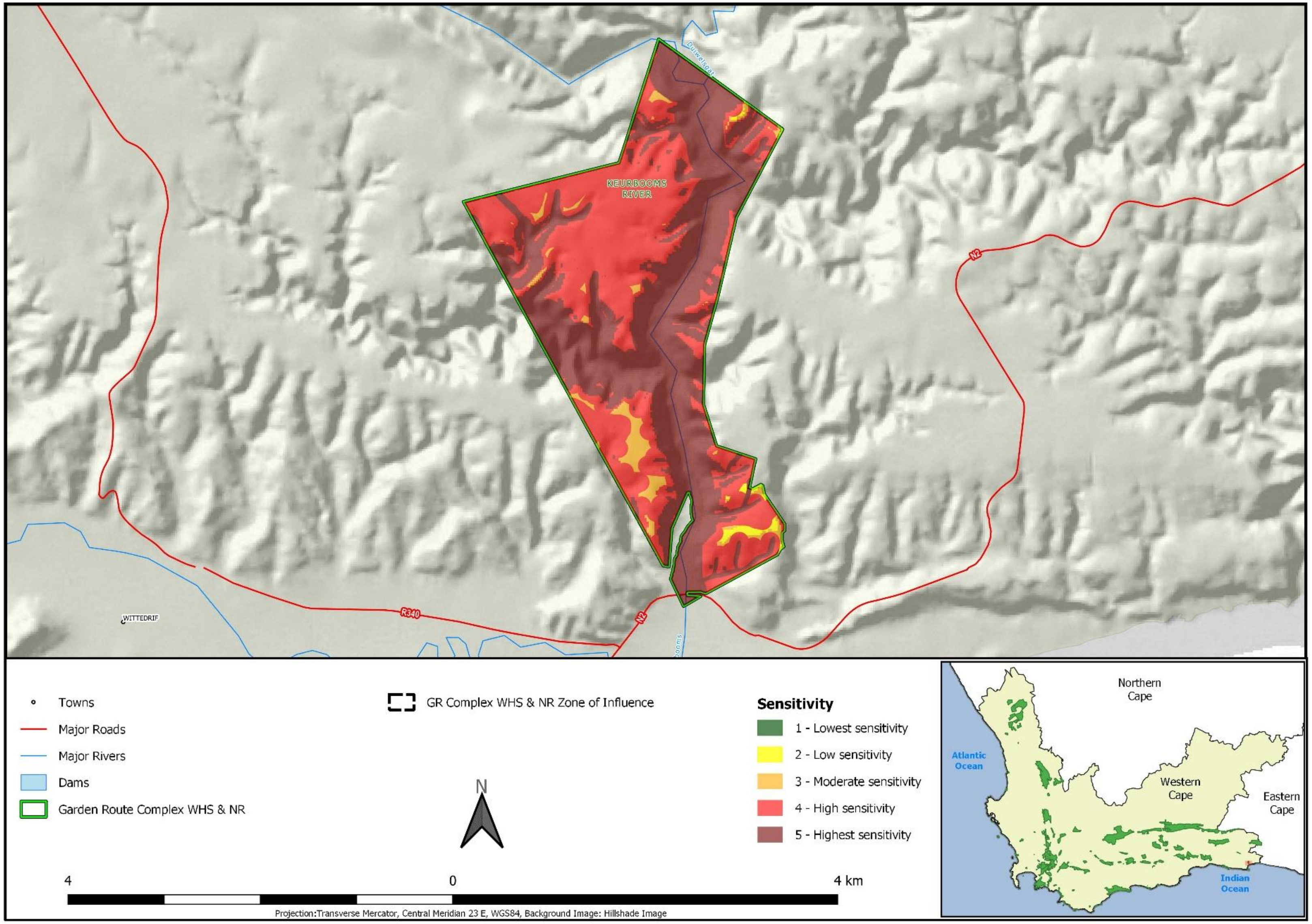
Map 12a: Sensitivity of the Outeniqua Cluster.



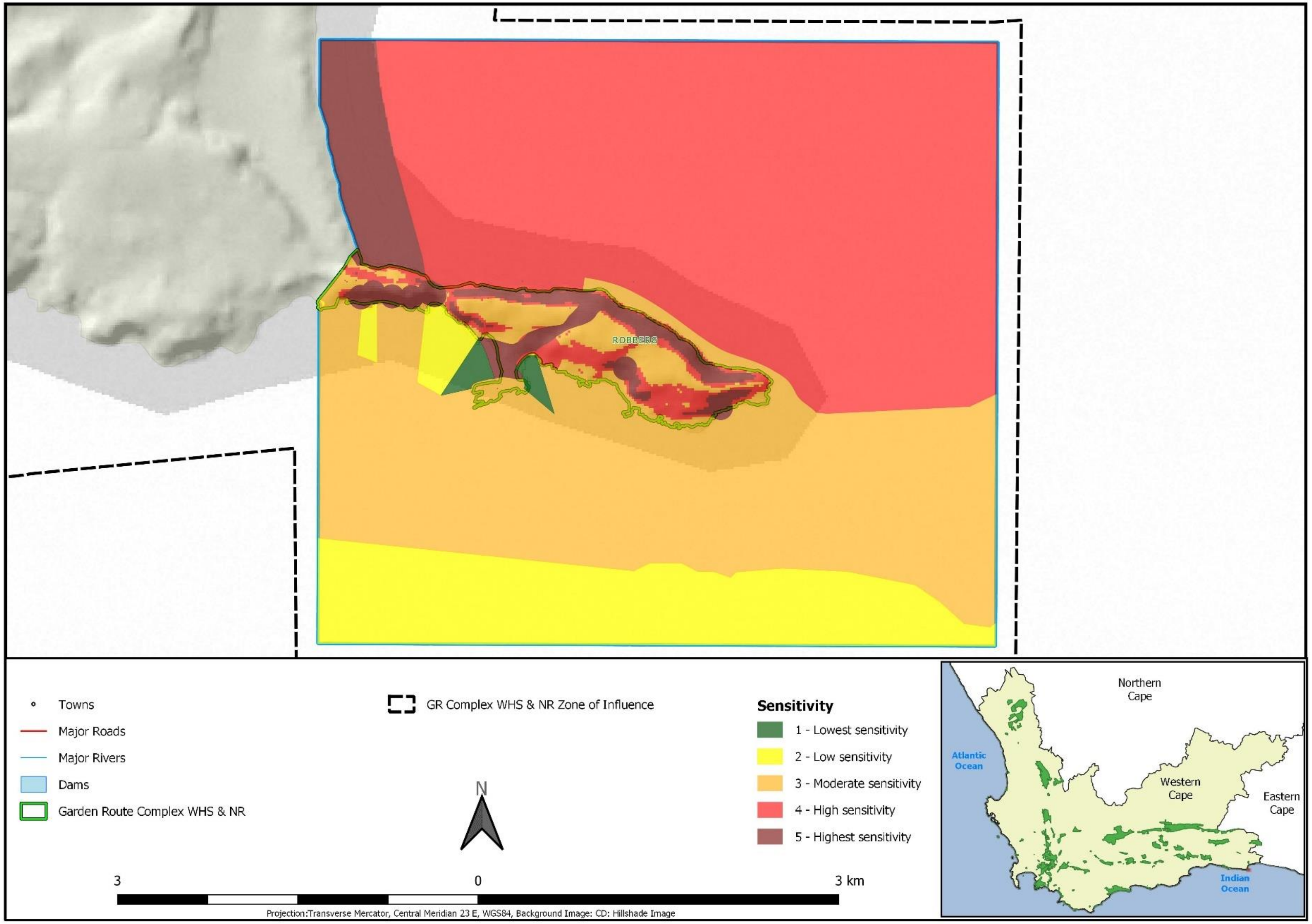
Map 12b: Sensitivity of the Goukamma Cluster.



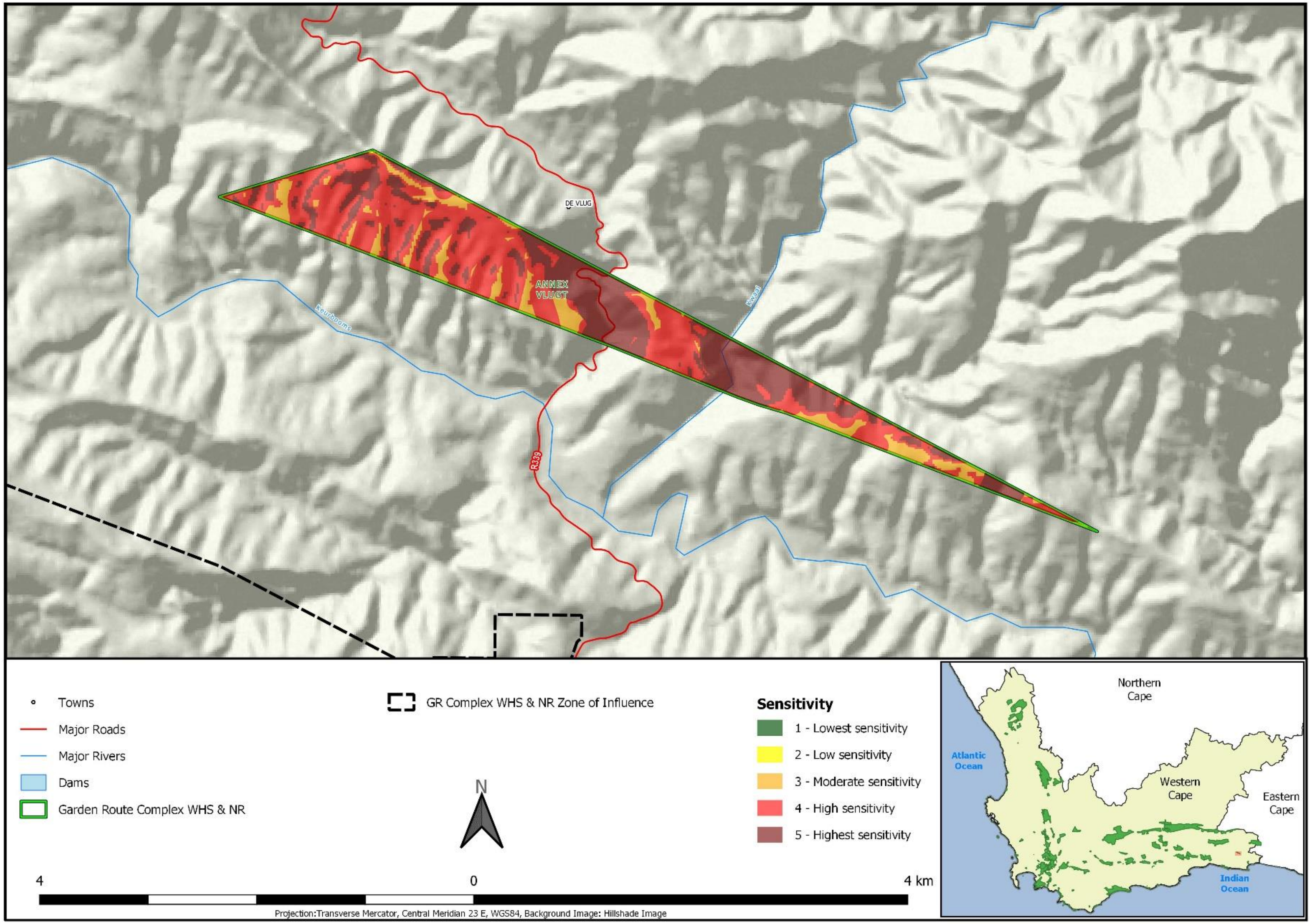
Map 12c: Sensitivity of the Mossel Bay Seal Island sector (Goukamma Cluster).



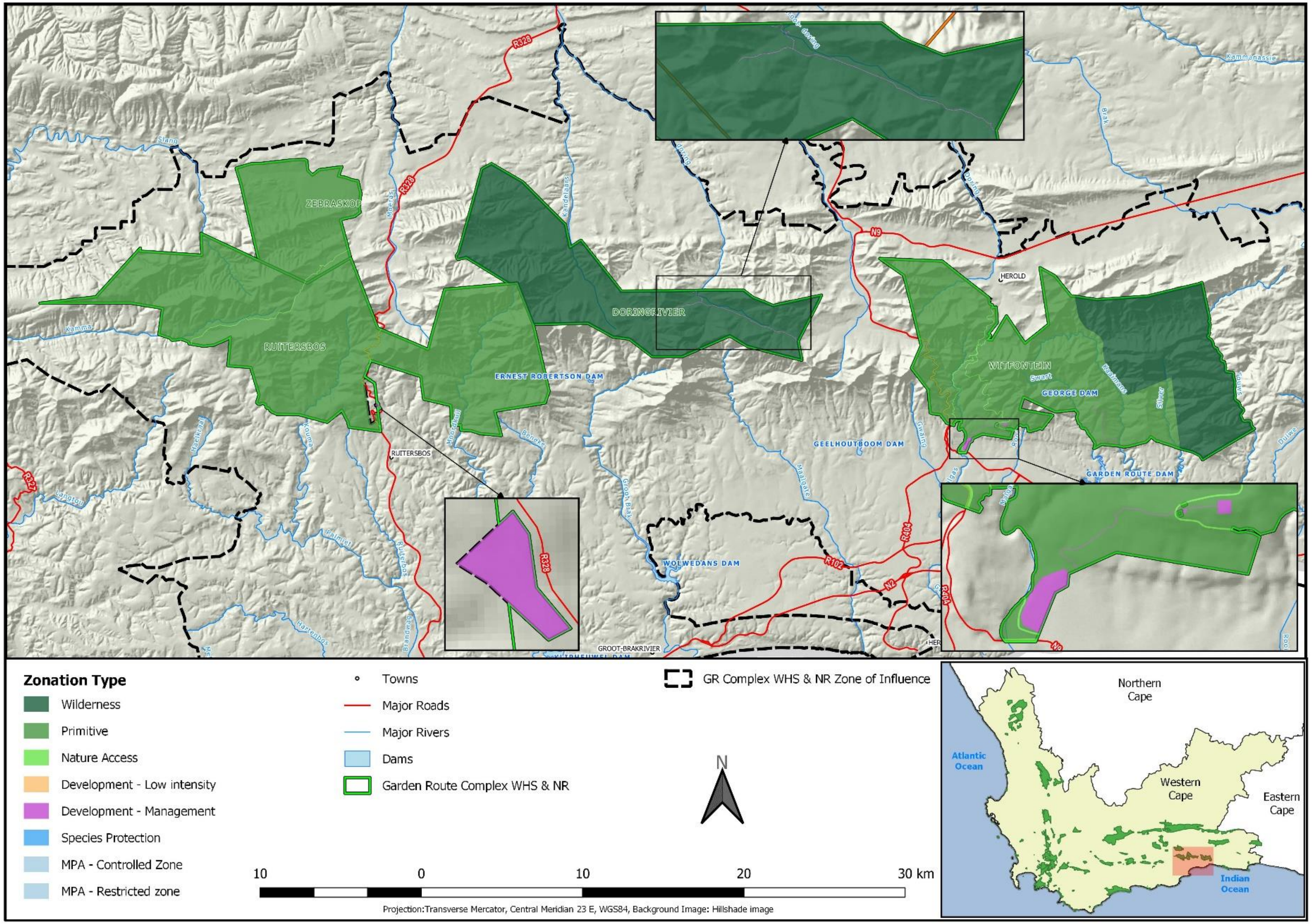
Map 12d: Sensitivity of the Keurbooms River sector.



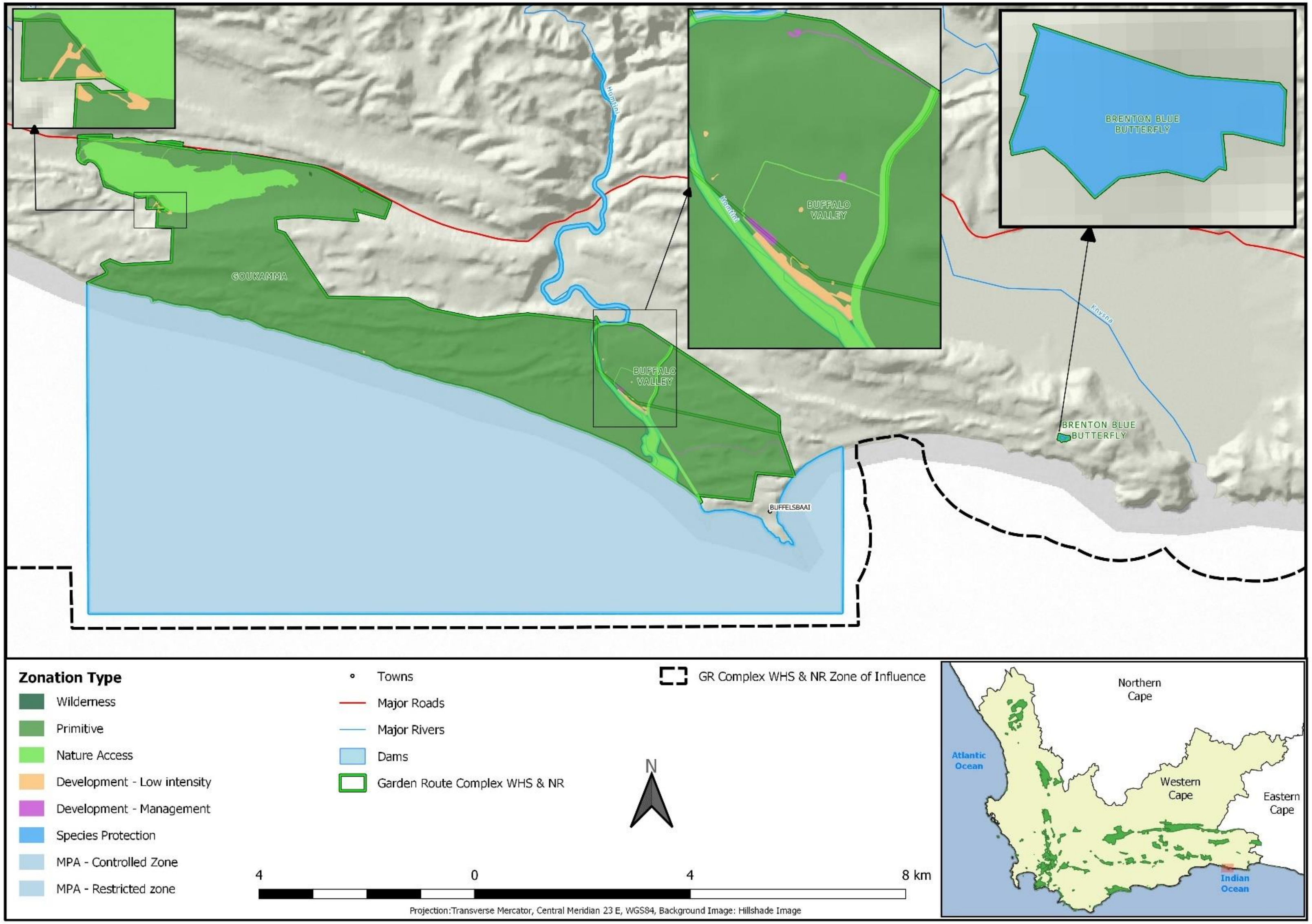
Map 12e: Sensitivity of the Robberg and Robberg MPA sectors.



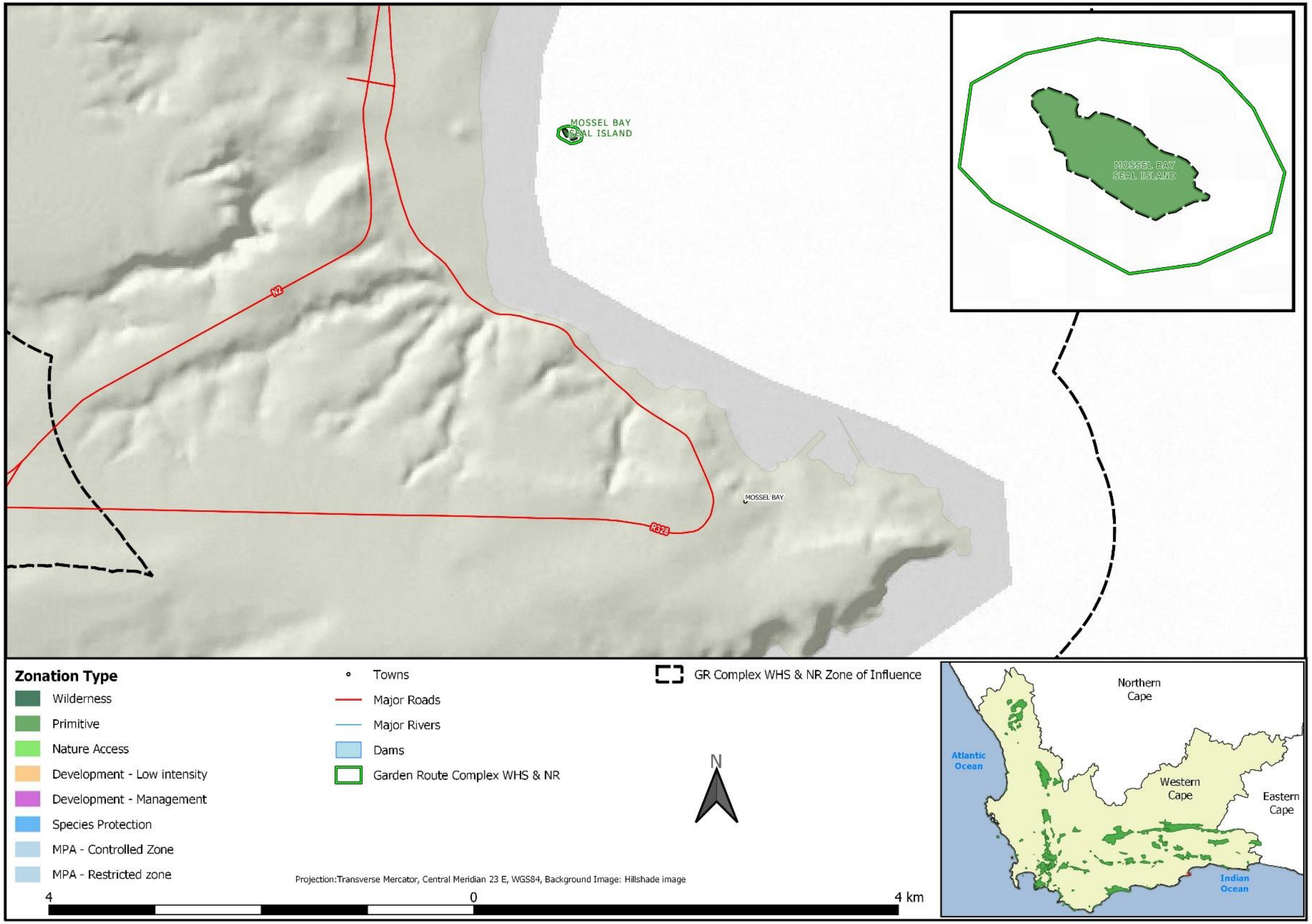
Map 12f: Sensitivity of the Annex Vlugt sector.



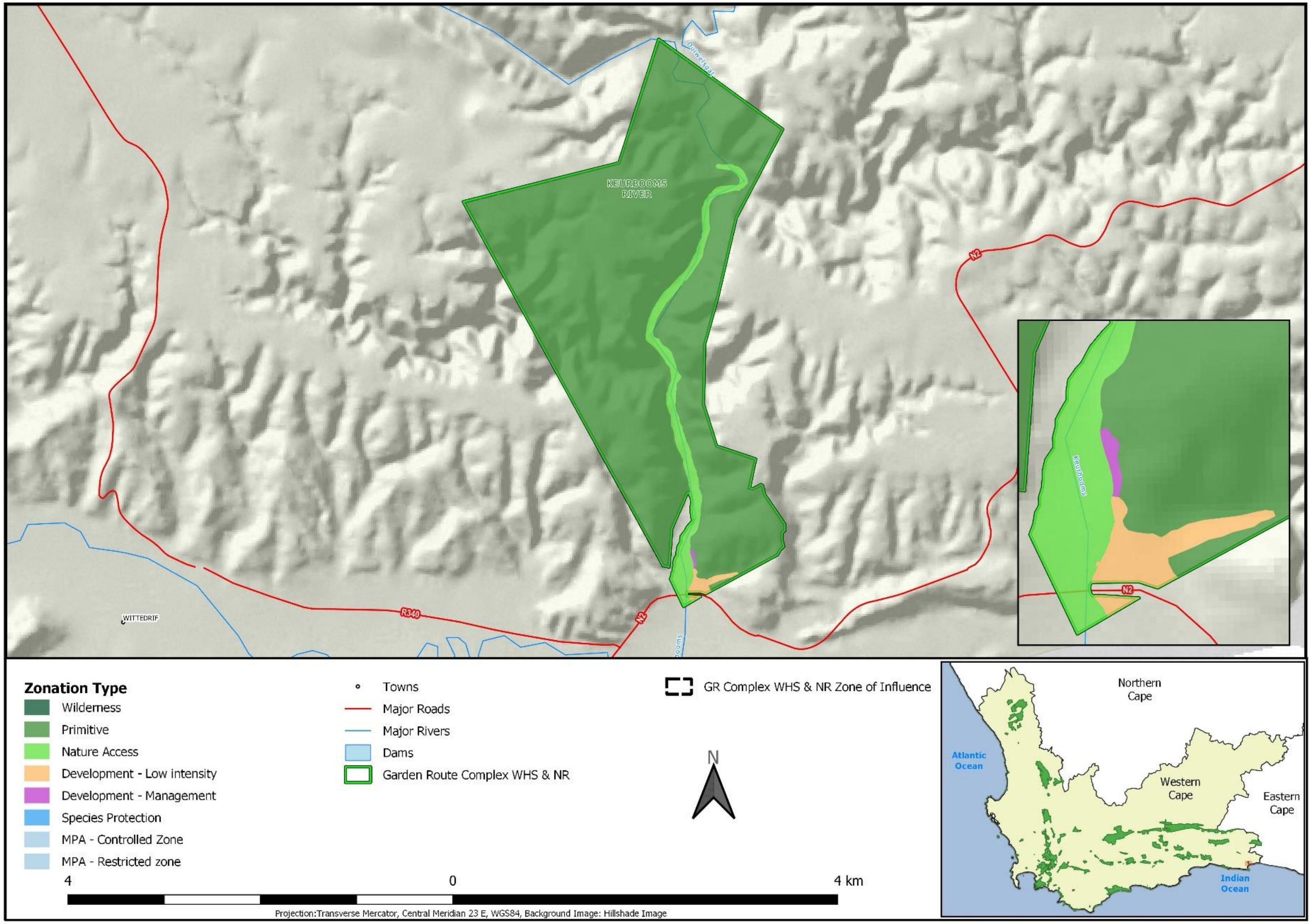
Map 13a: Zonation of the Outeniqua Cluster.



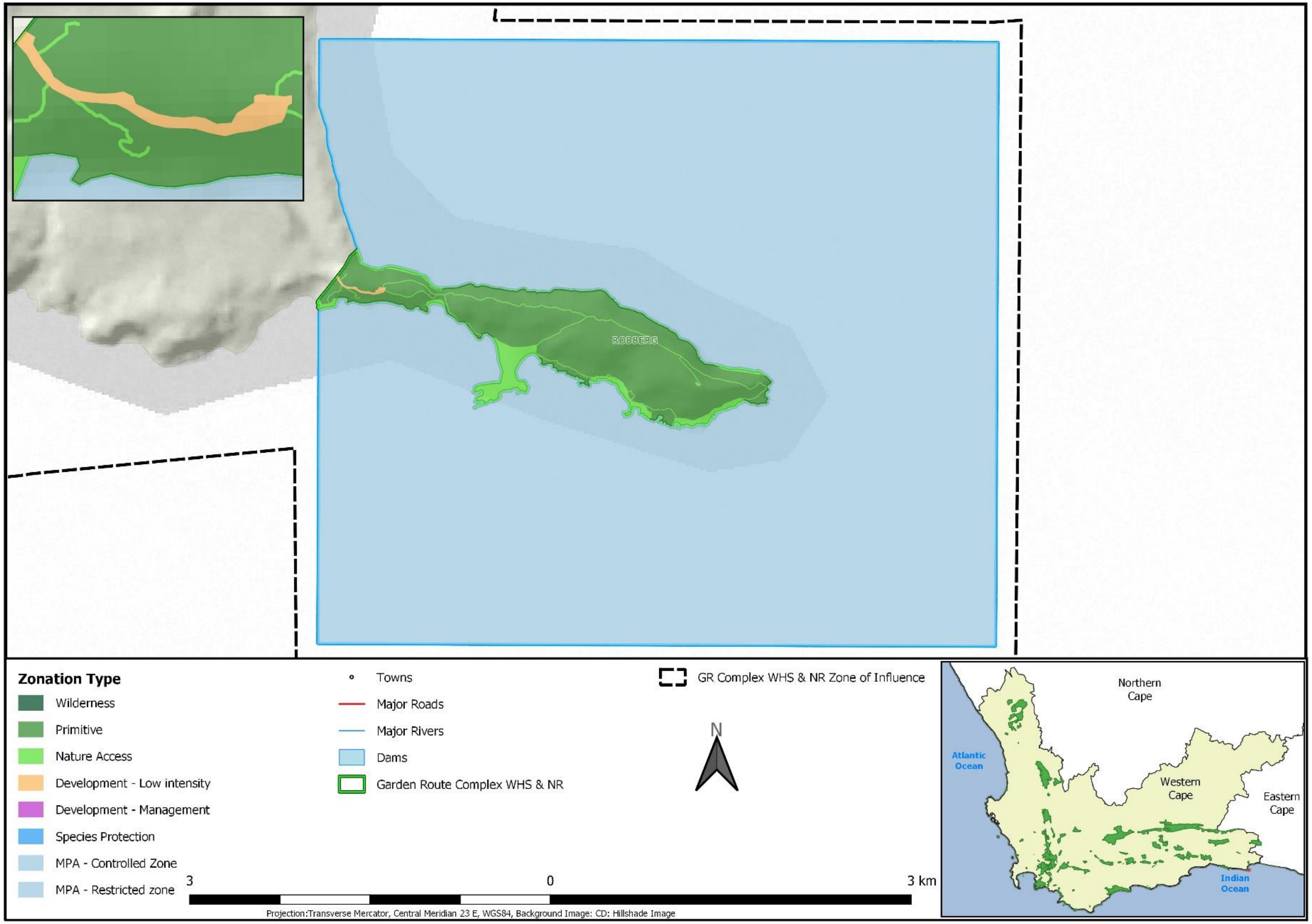
Map 13b: Zonation of the Goukamma Cluster.



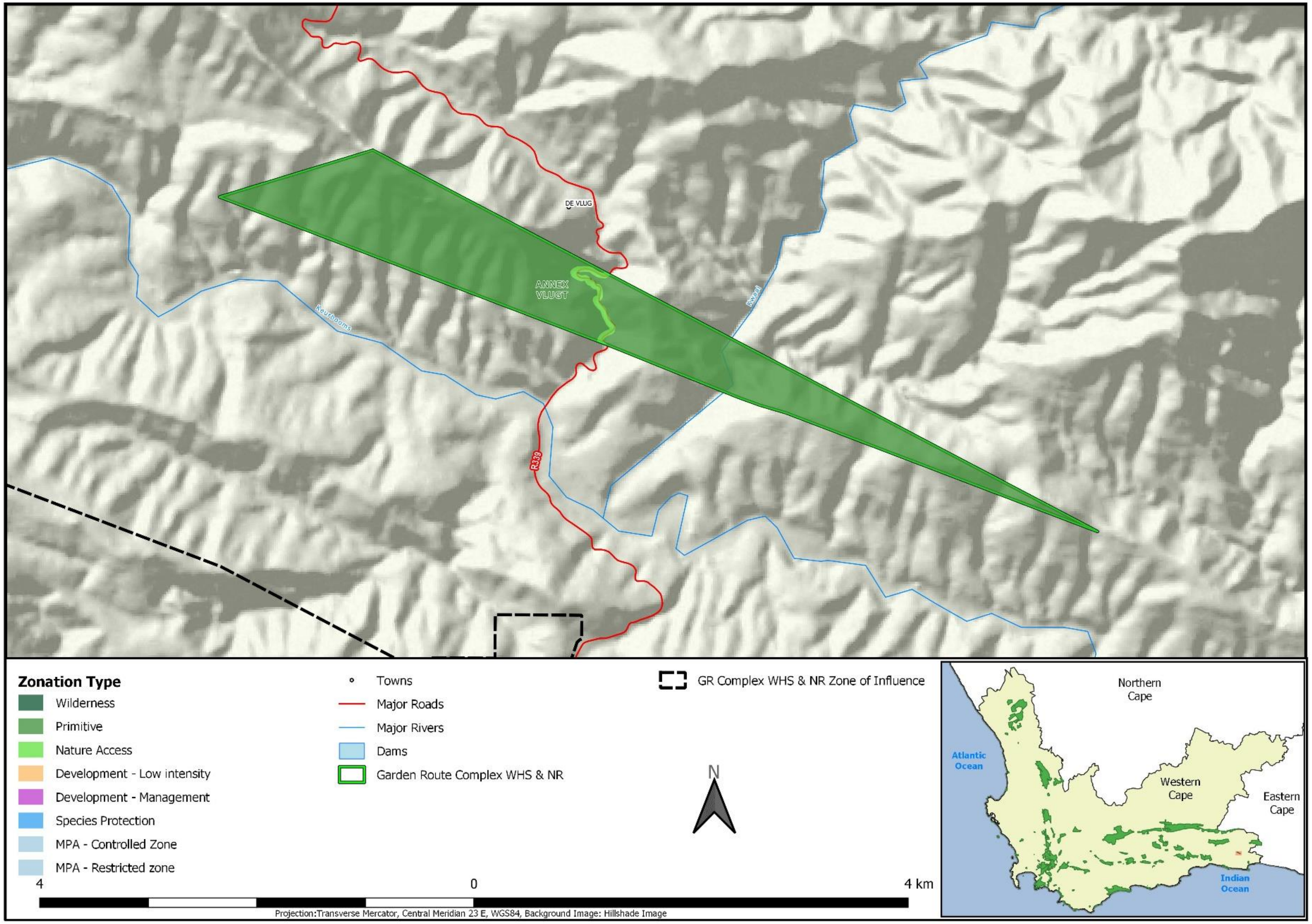
Map 13c: Zonation of the Mossel Bay Seal Island sector (Goukamma Cluster).



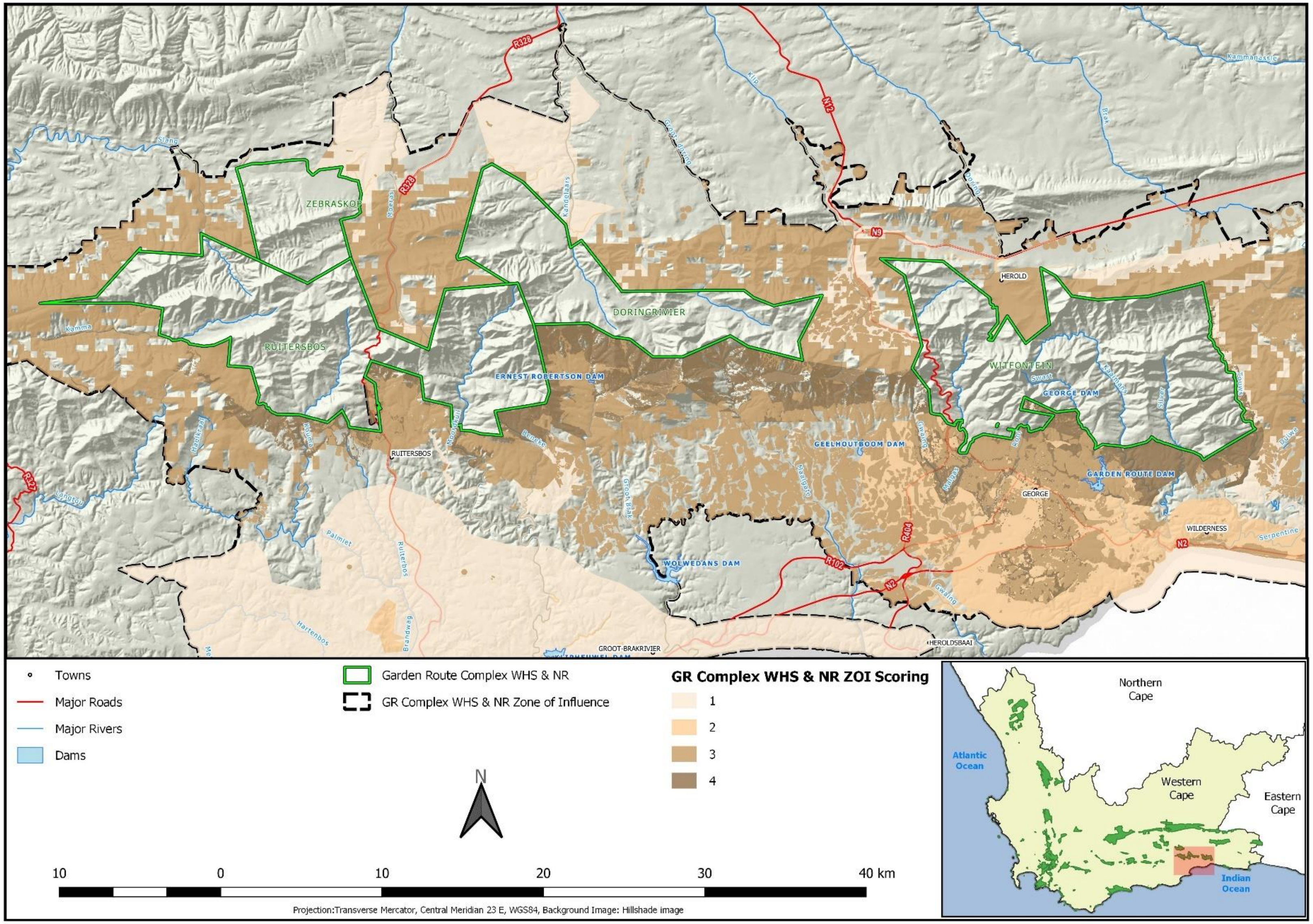
Map 13d: Zonation of the Keurbooms River sector.



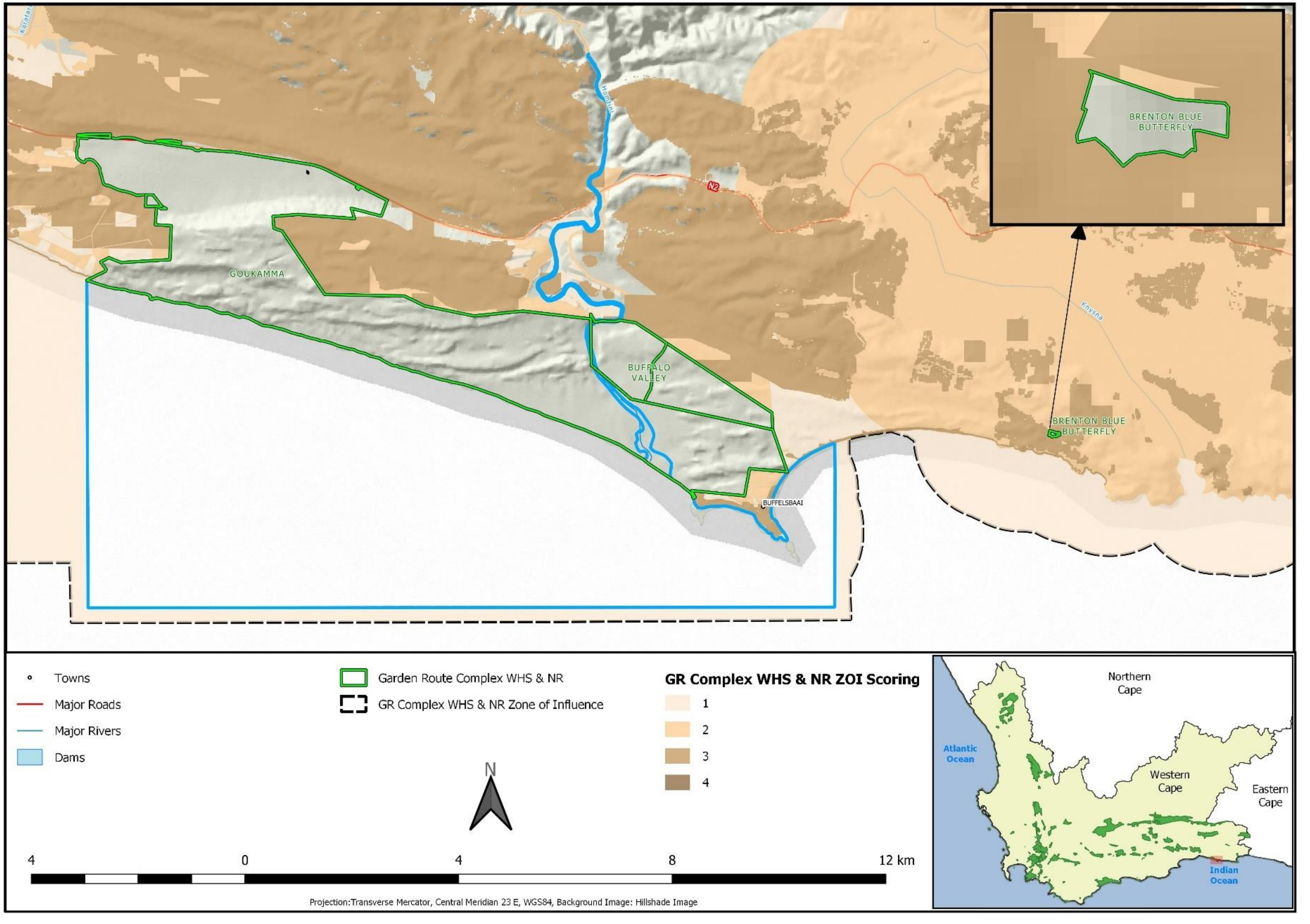
Map 13e: Zonation of the Robberg and Robberg MPA sectors.



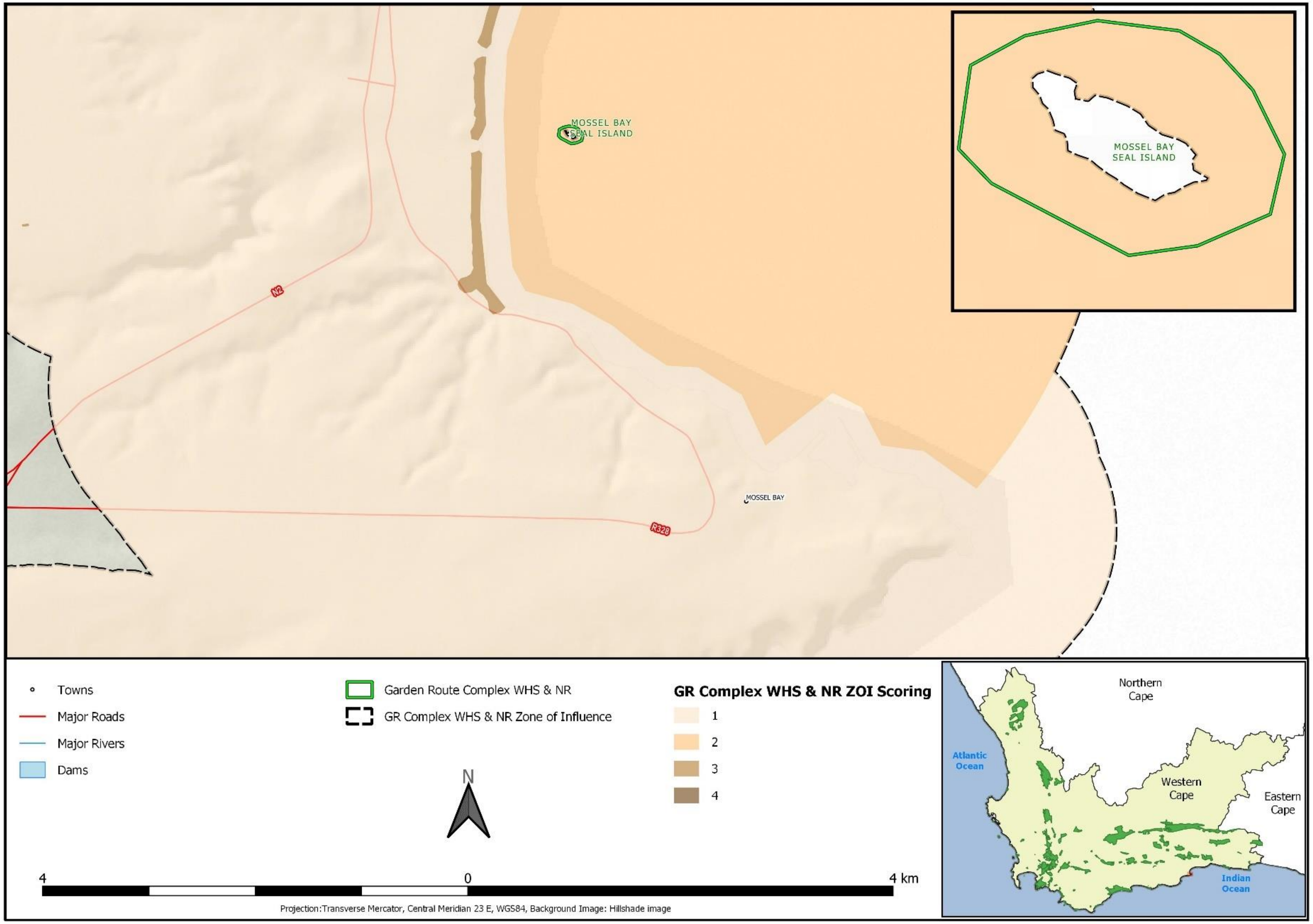
Map 13f: Zonation of the Annex Vlugt sector.



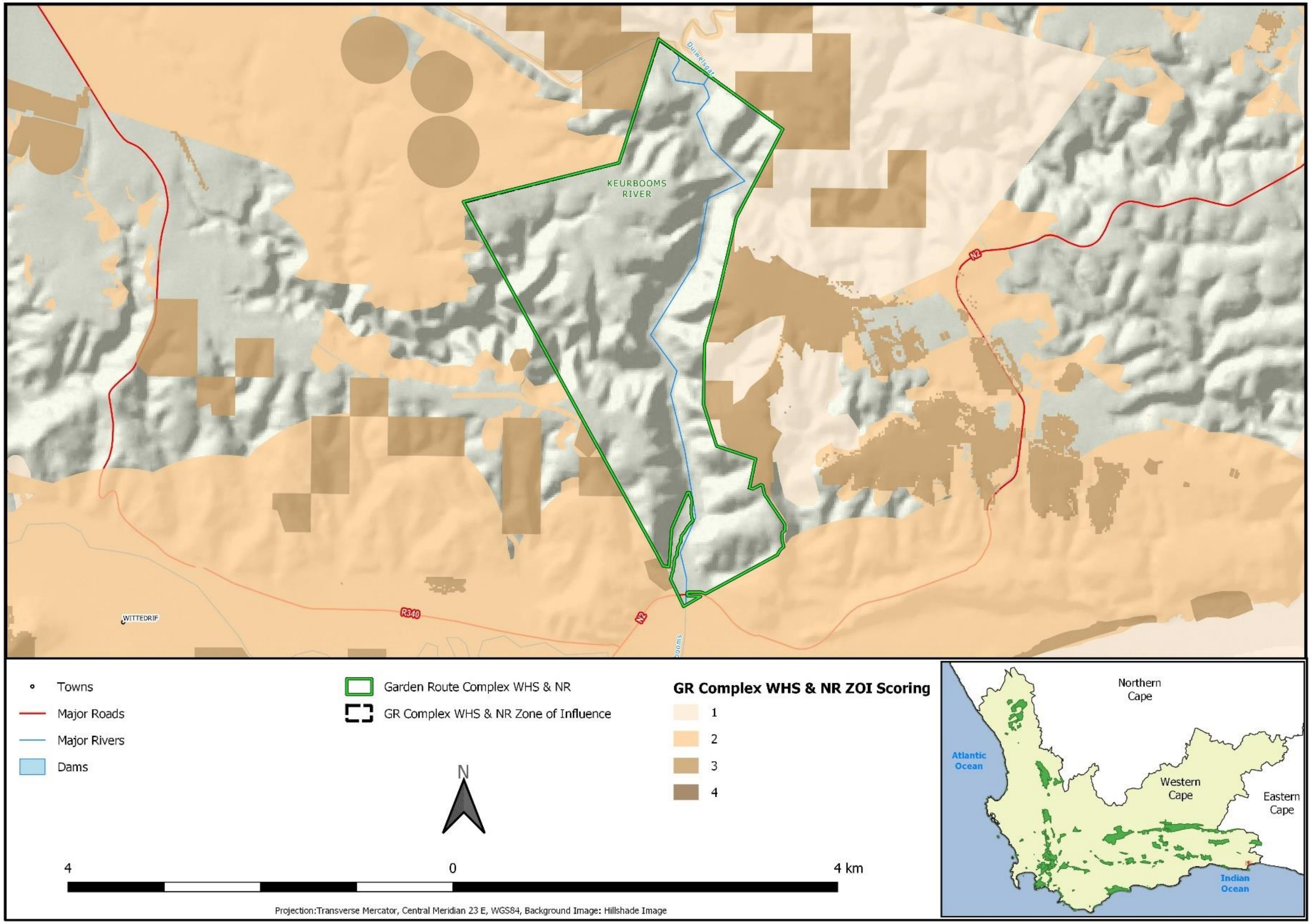
Map 14a: Zone of influence the Outeniqua Cluster.



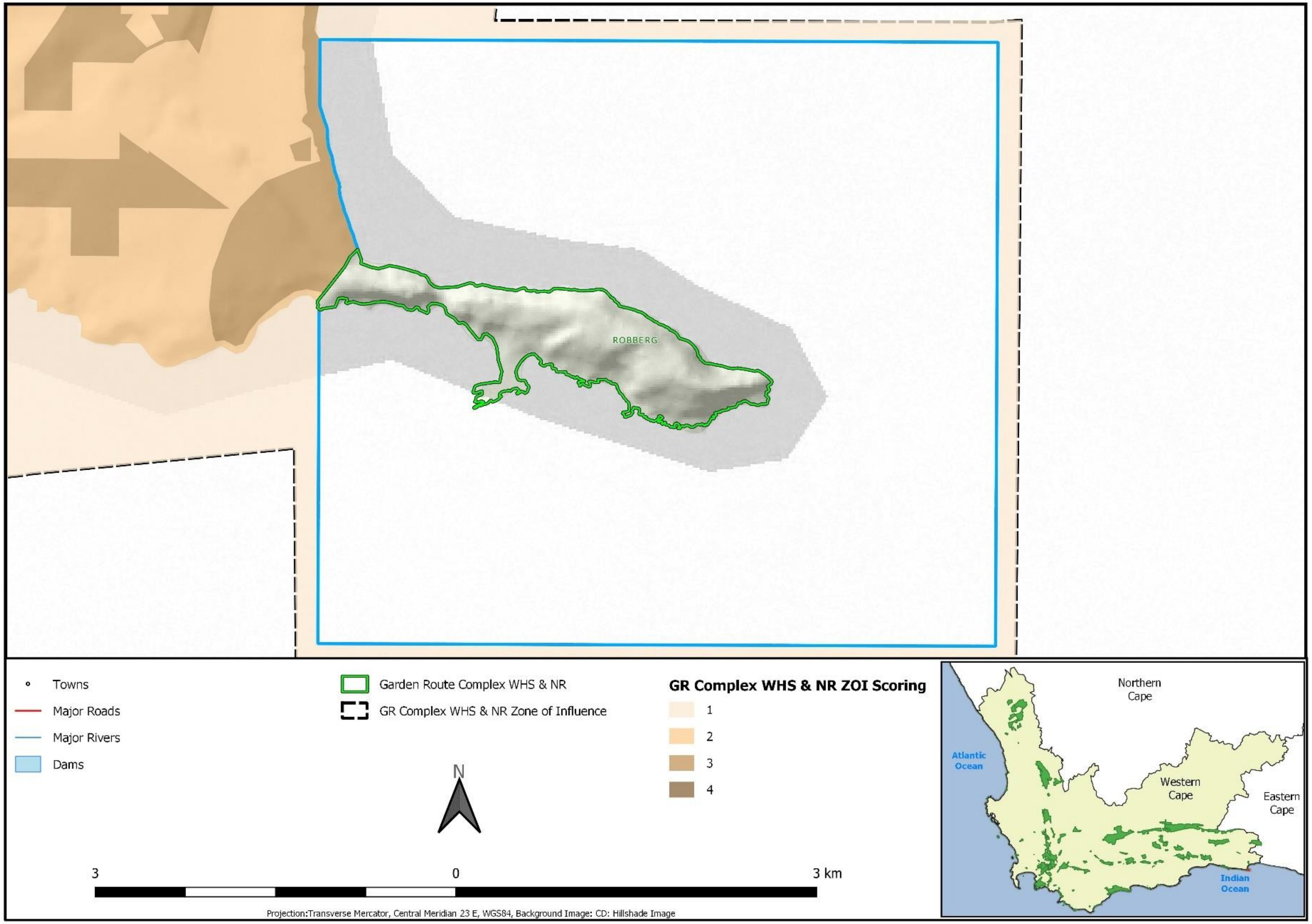
Map 14b: Zone of influence around the Goukamma Cluster.



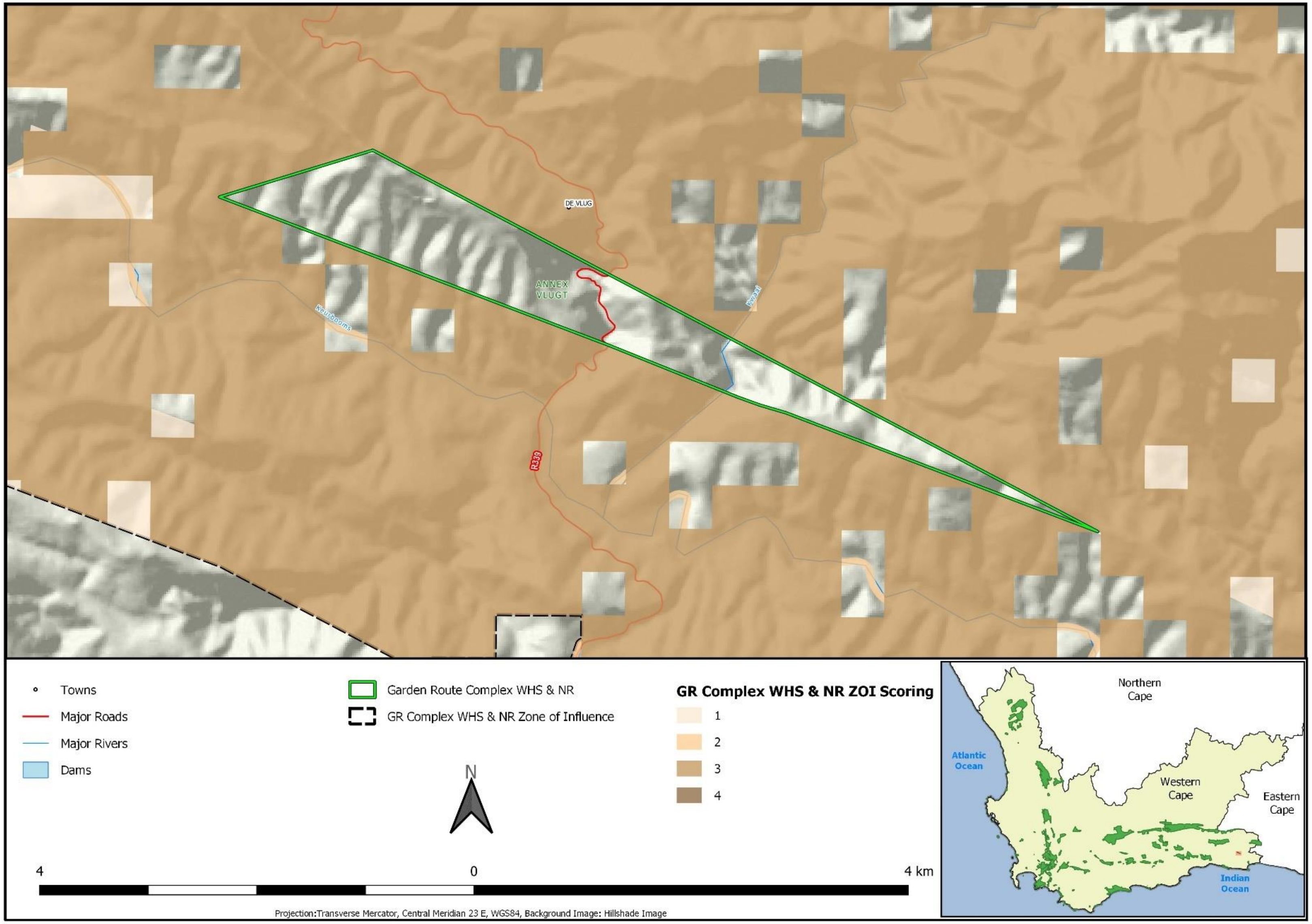
Map 14c: Zone of influence around the Mossel Bay Seal Island sector (Goukamma Cluster).



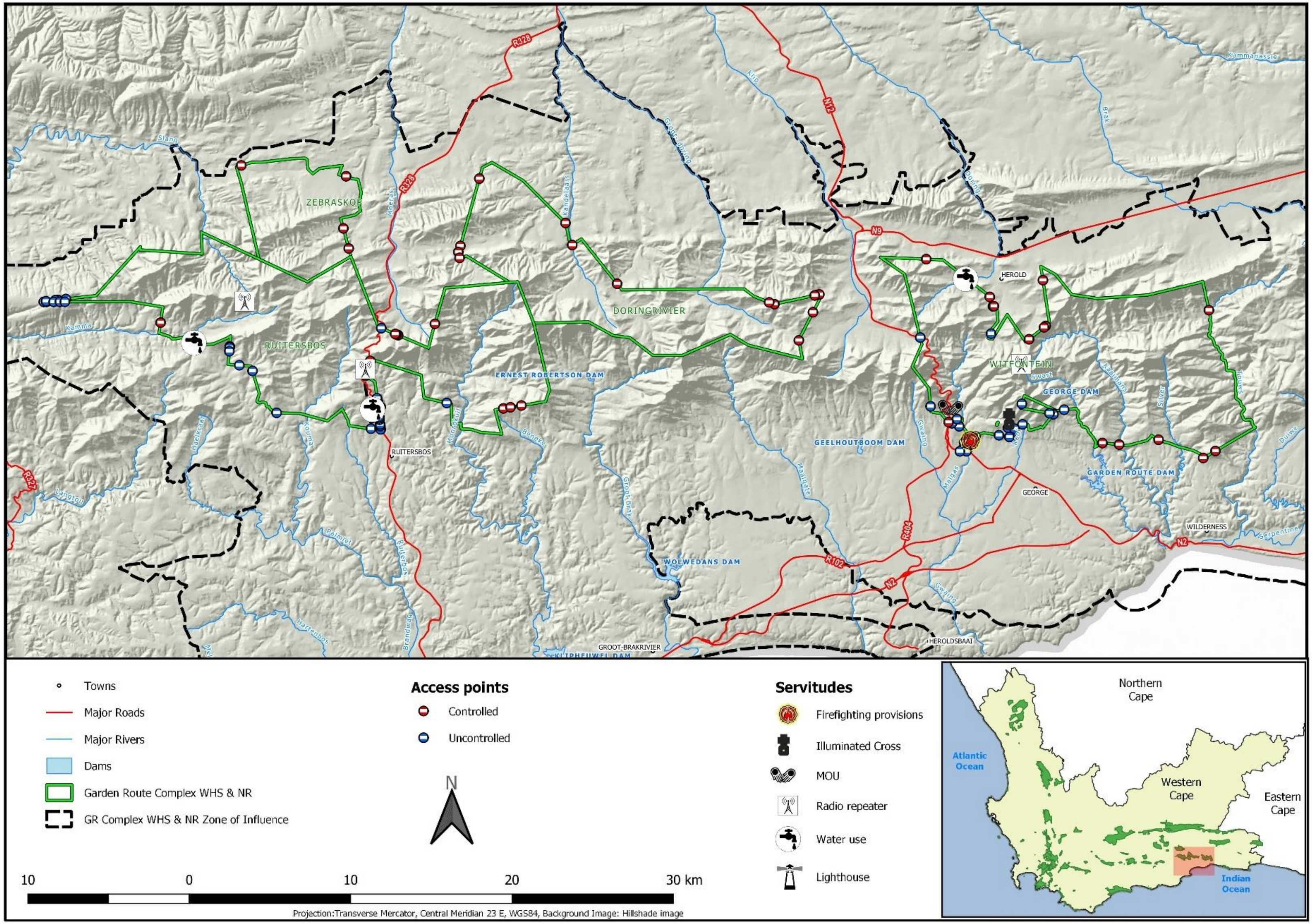
Map 14d: Zone of influence around the Keurbooms River sector.



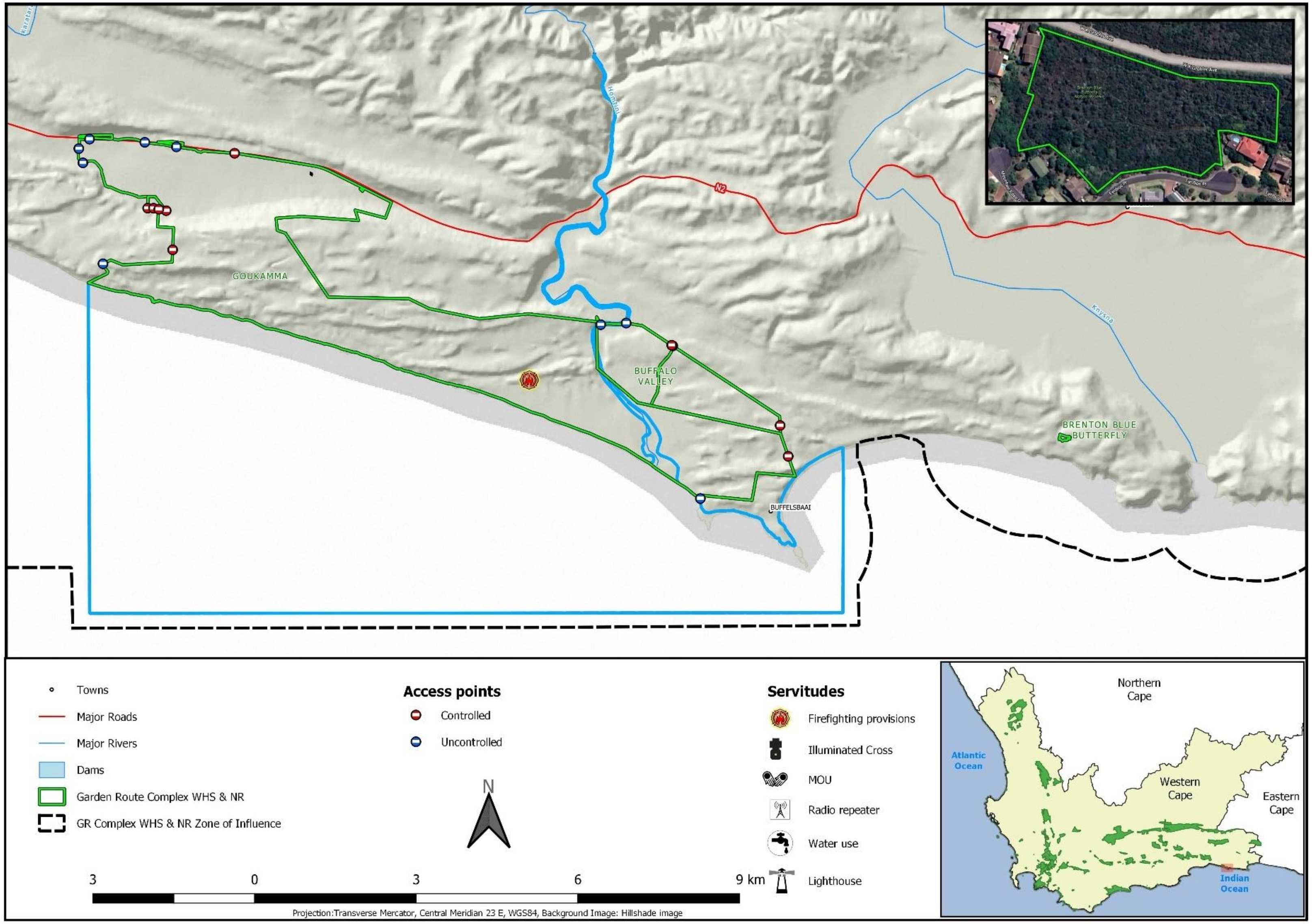
Map 14e: Zone of influence around the Robberg and Robberg MPA sectors.



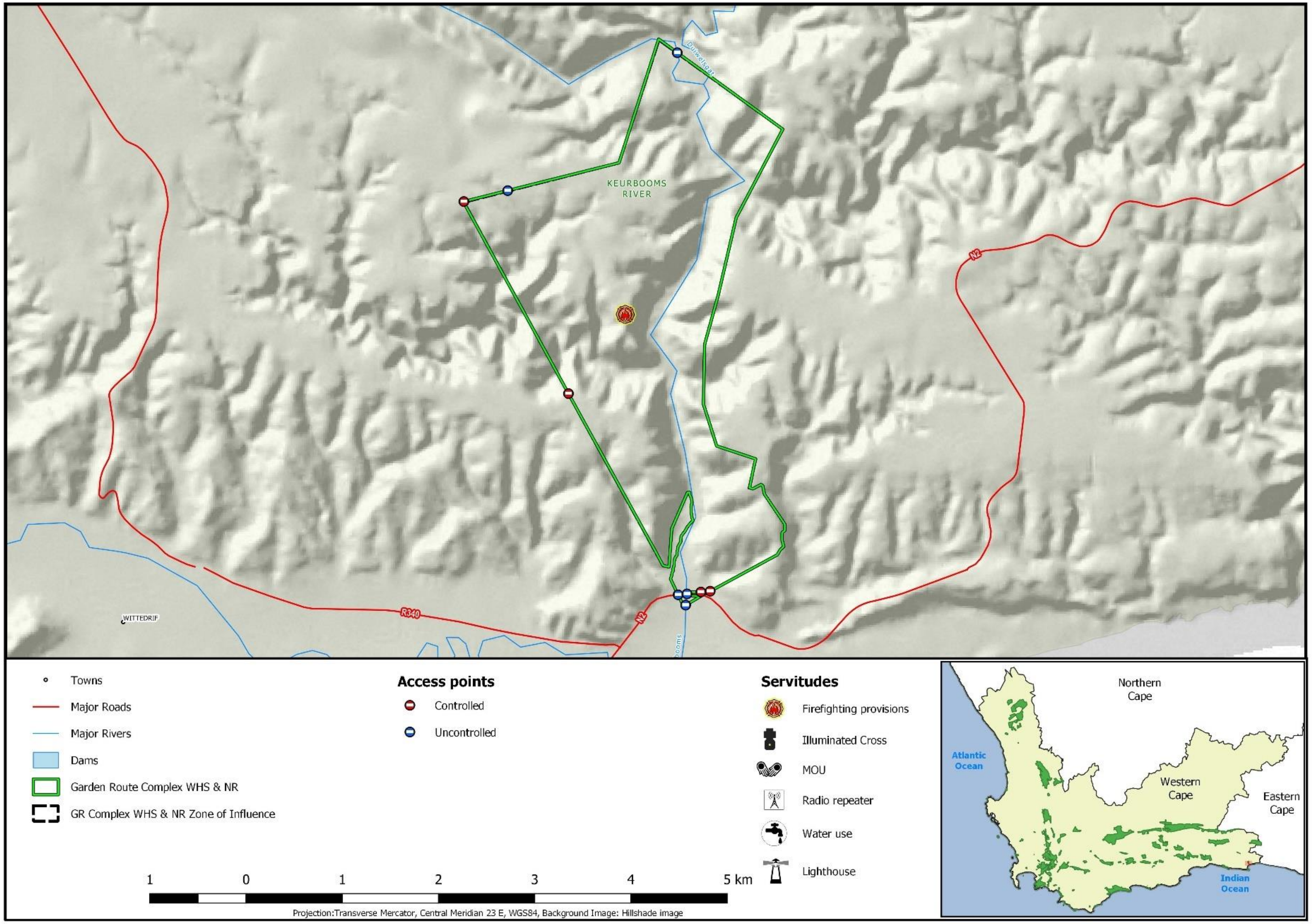
Map 14f: Zone of influence around the Annex Vlugt sector.



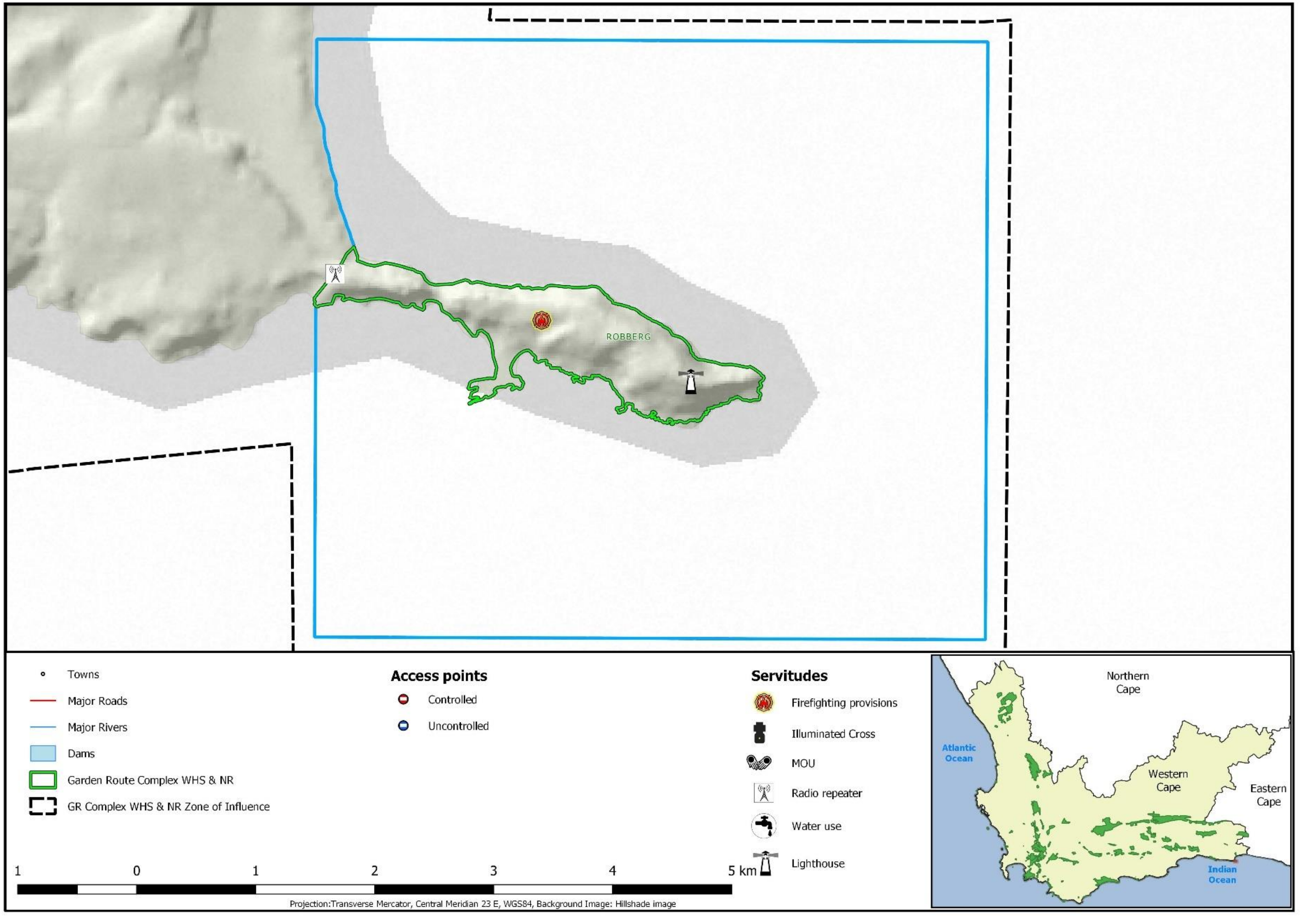
Map 15a: Access points to and servitudes on the Outeniqua Cluster.



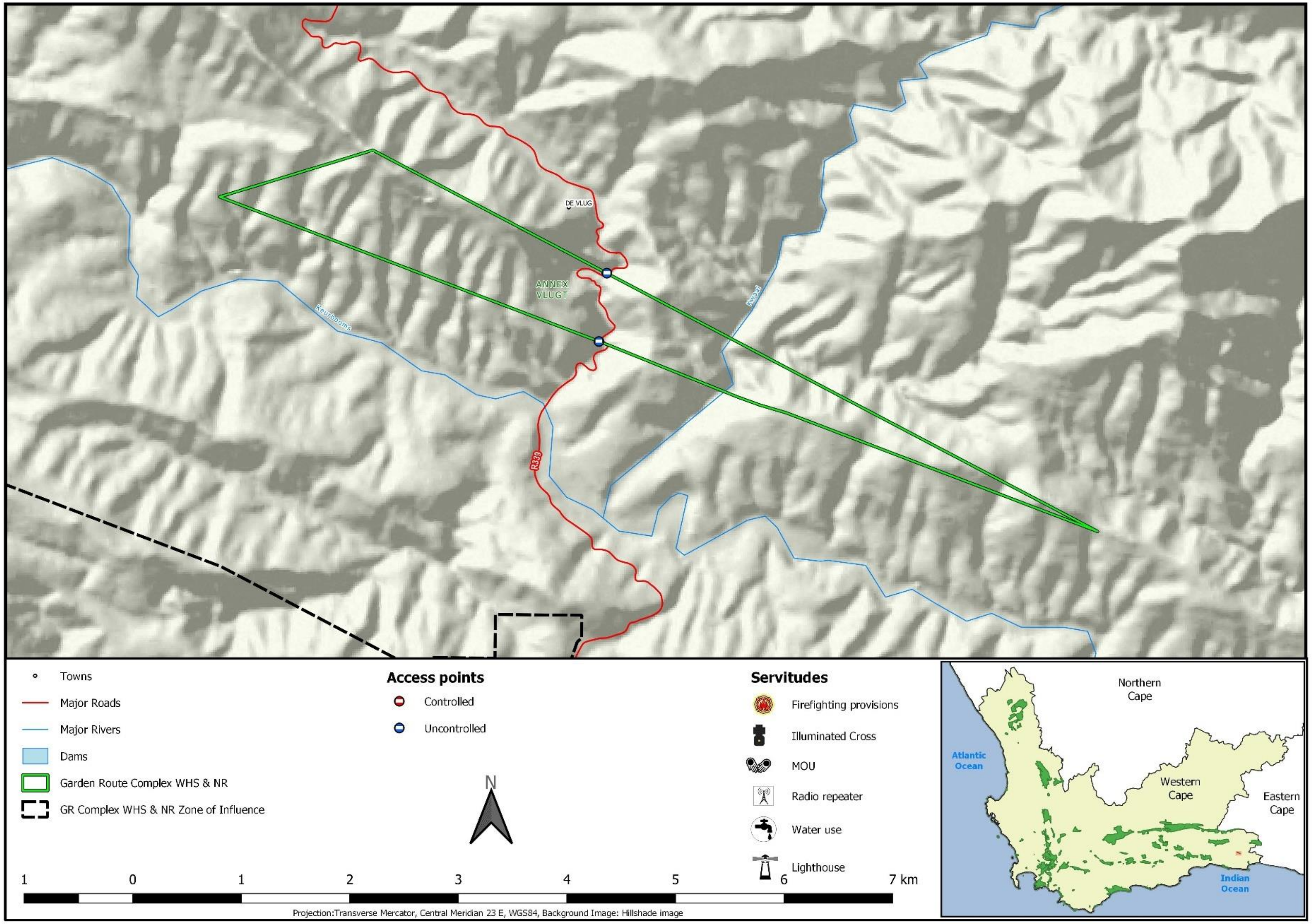
Map 15b: Access points to and servitudes on the Goukamma Cluster.



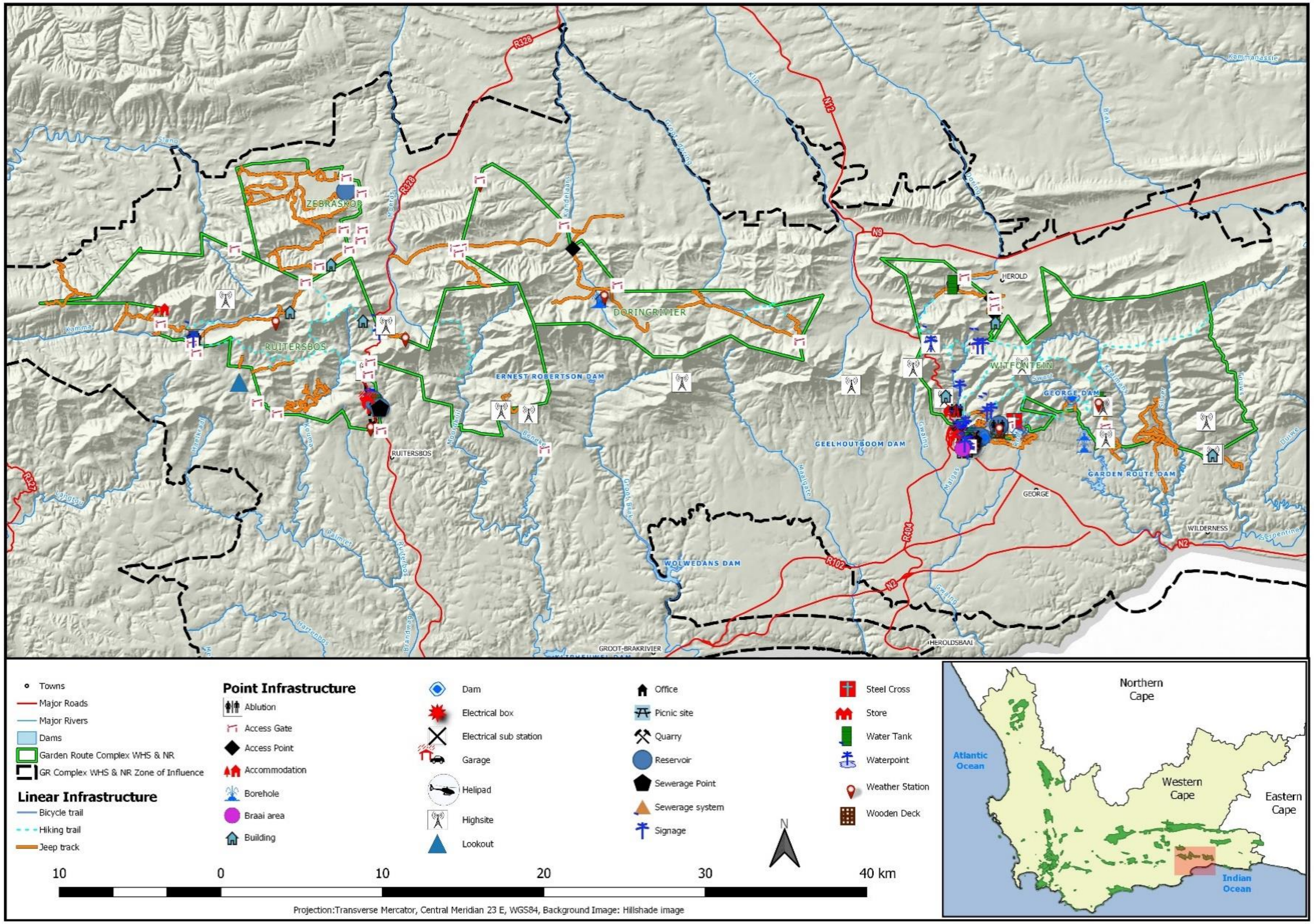
Map 15c: Access points to and servitudes on the Keurbooms River sector.



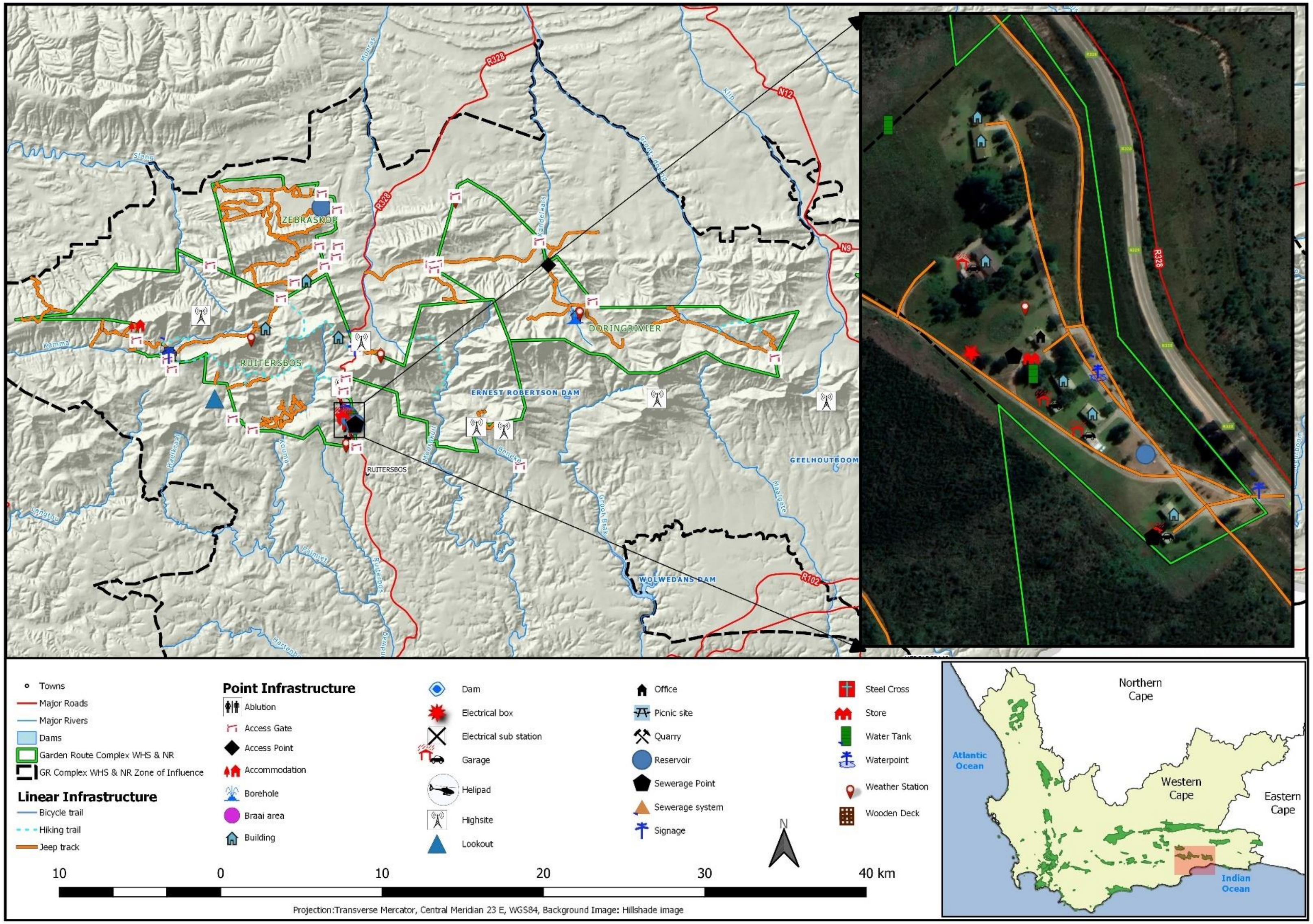
Map 15d: Access points to and servitudes on the Robberg and Robberg MPA sectors.



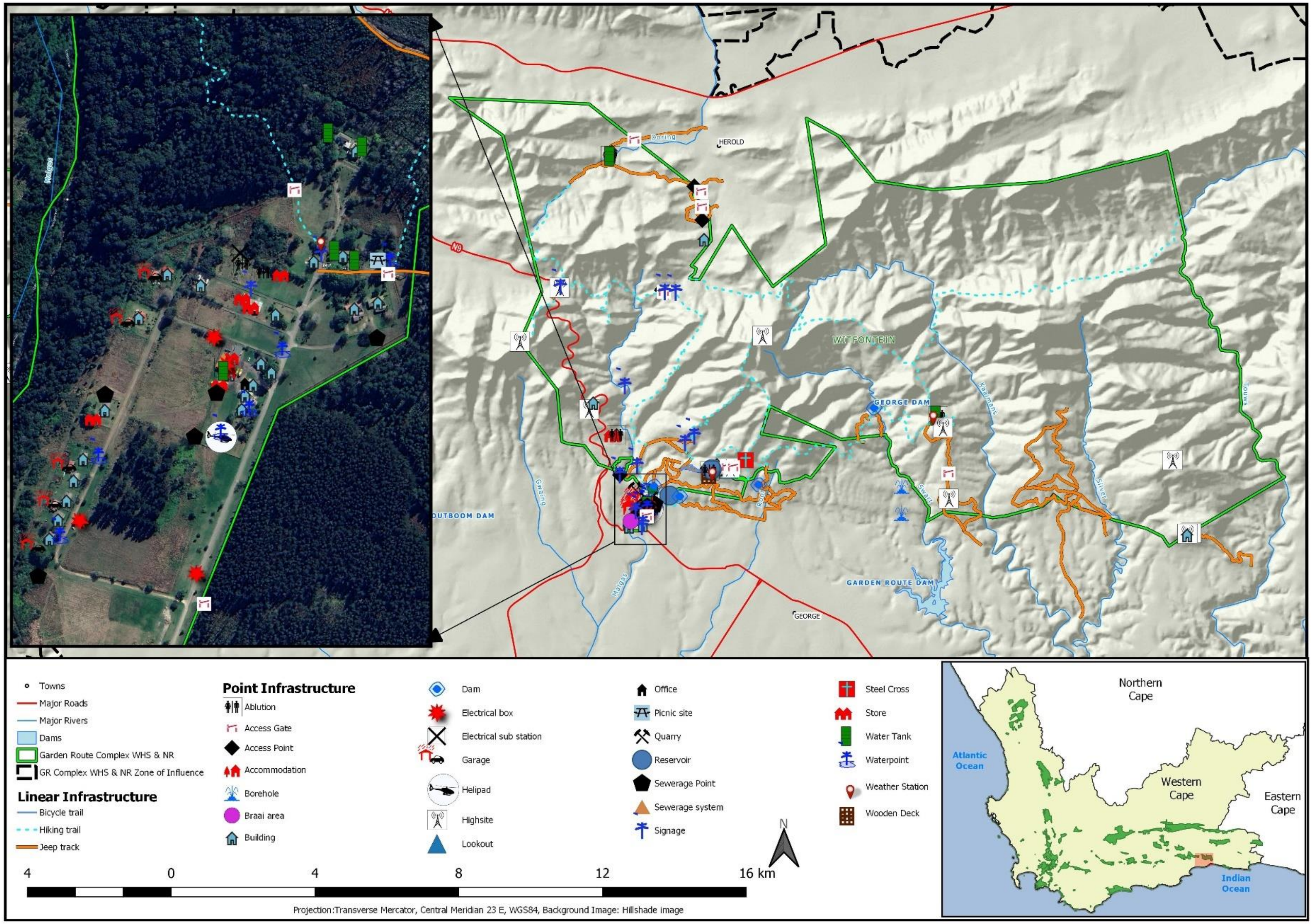
Map 15e: Access points to and servitudes on the Annex Vlugt sector.



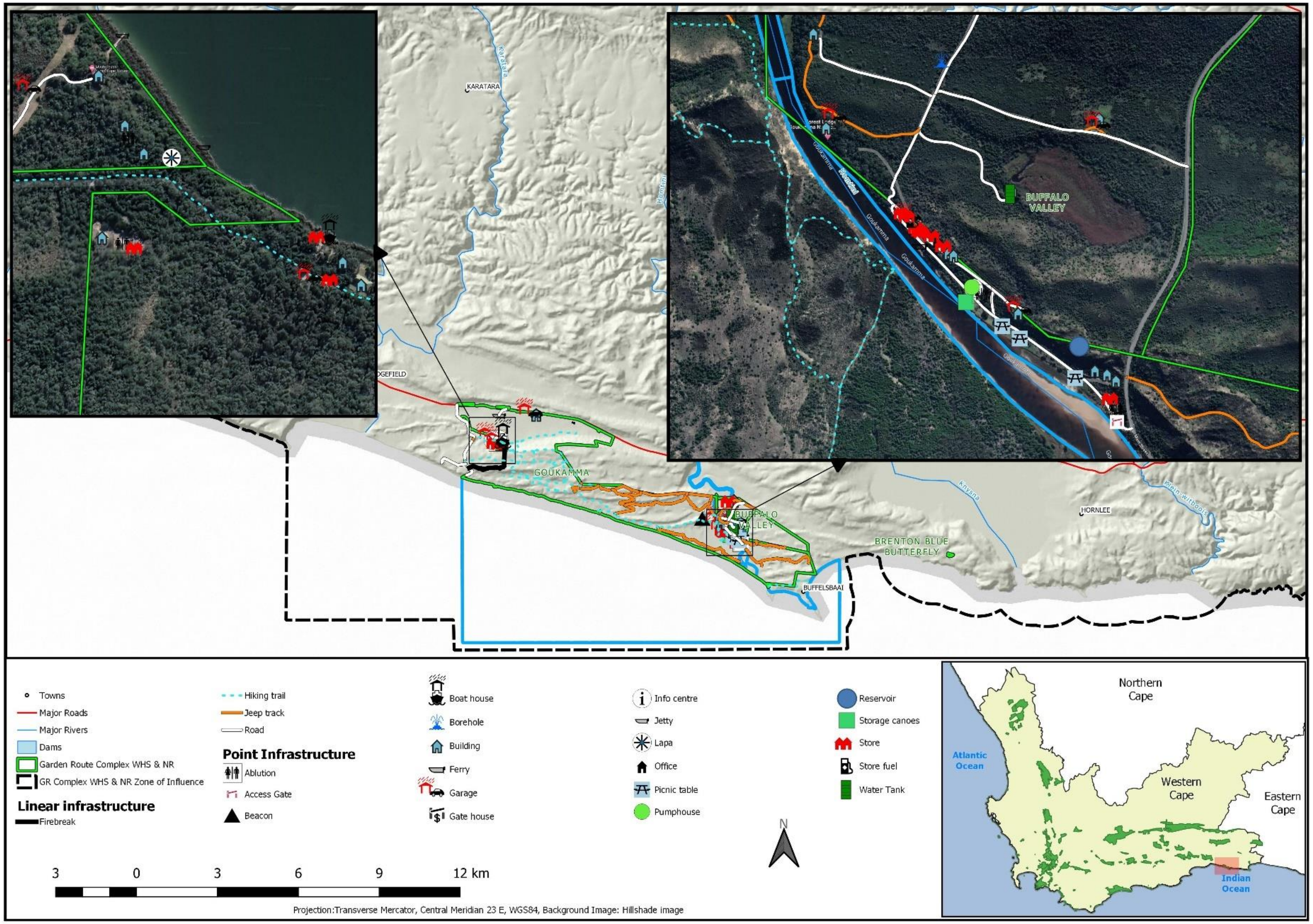
Map 16a: Infrastructure on the Outeniqua Cluster.



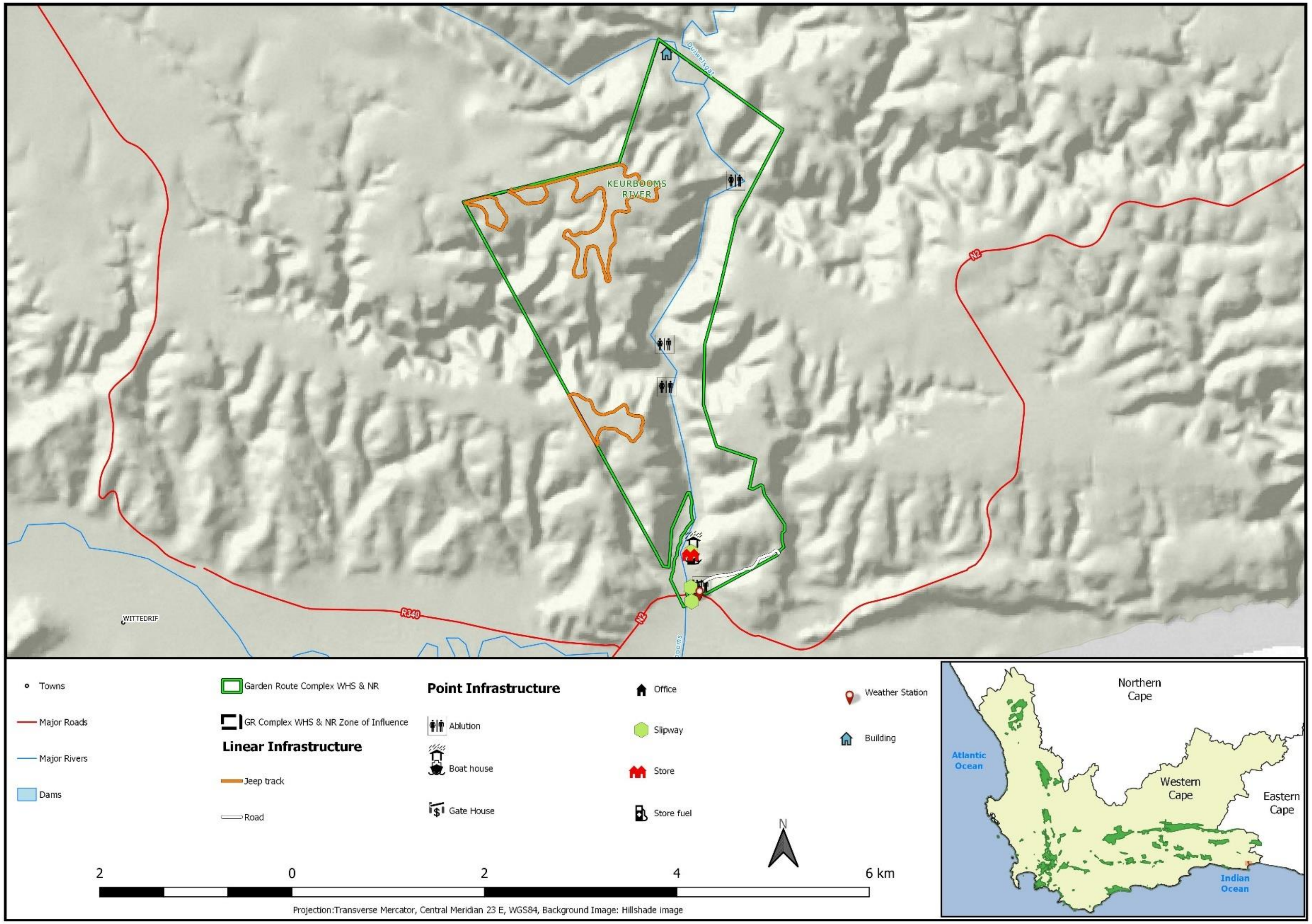
Map 16b: Infrastructure on the Ruitersbos sector of the Outeniqua Cluster.



Map 16c: Infrastructure on the Witfontein sector of the Outeniqua Cluster.

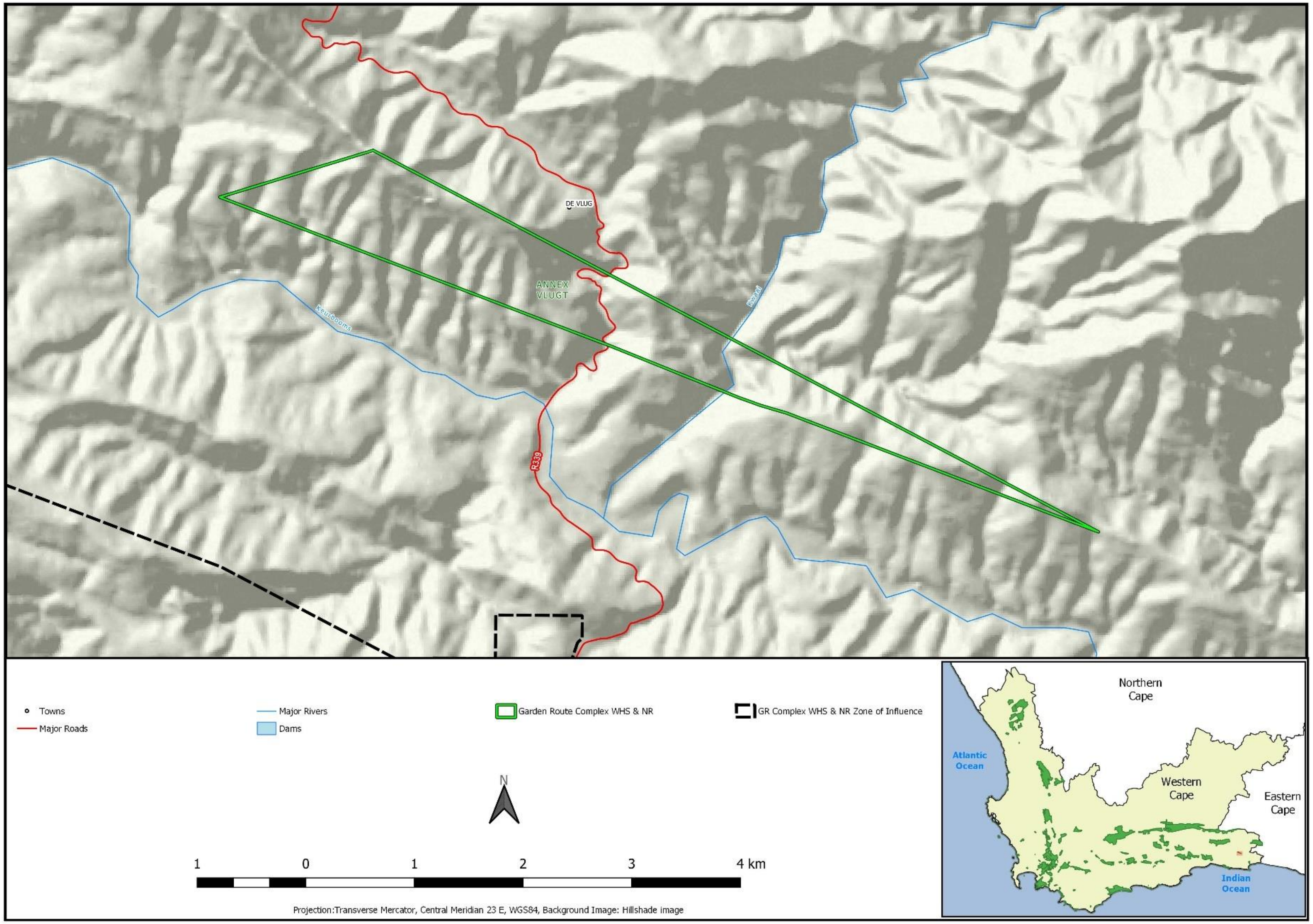


Map 16d: Infrastructure on the Goukamma Cluster.

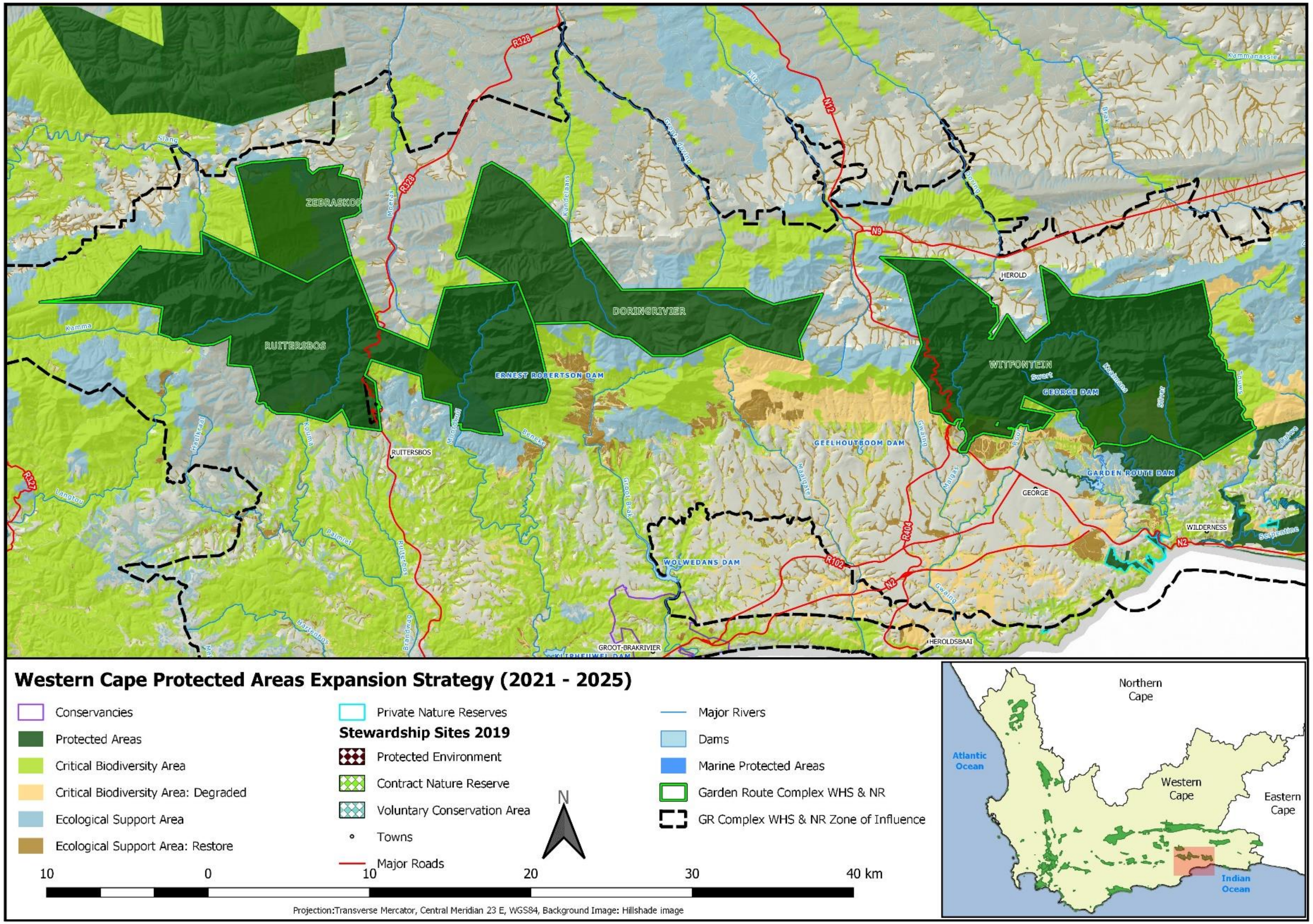


Map 16e: Infrastructure on the Keurbooms River sector.

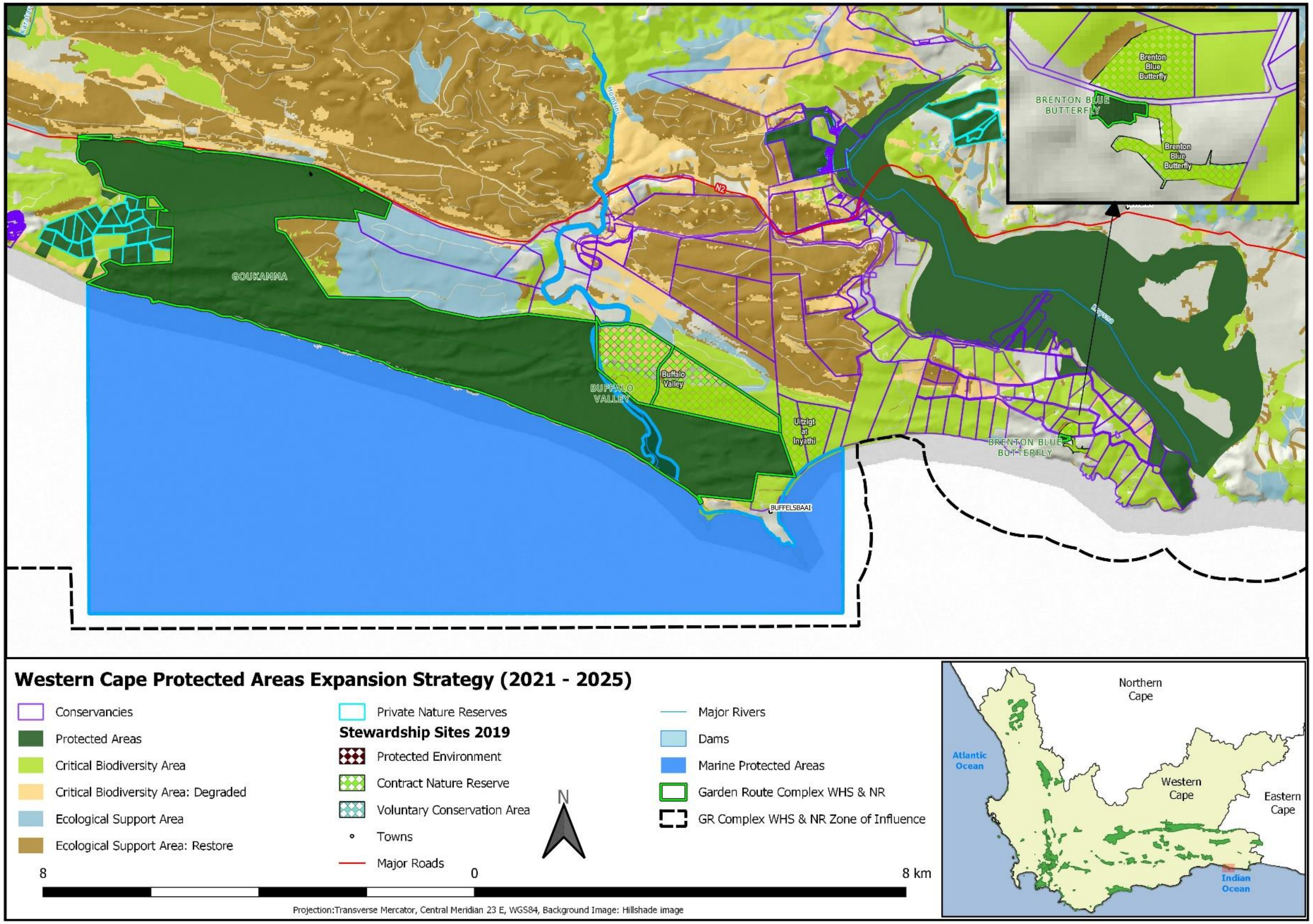
Map 16f: Infrastructure on the Robberg sector.



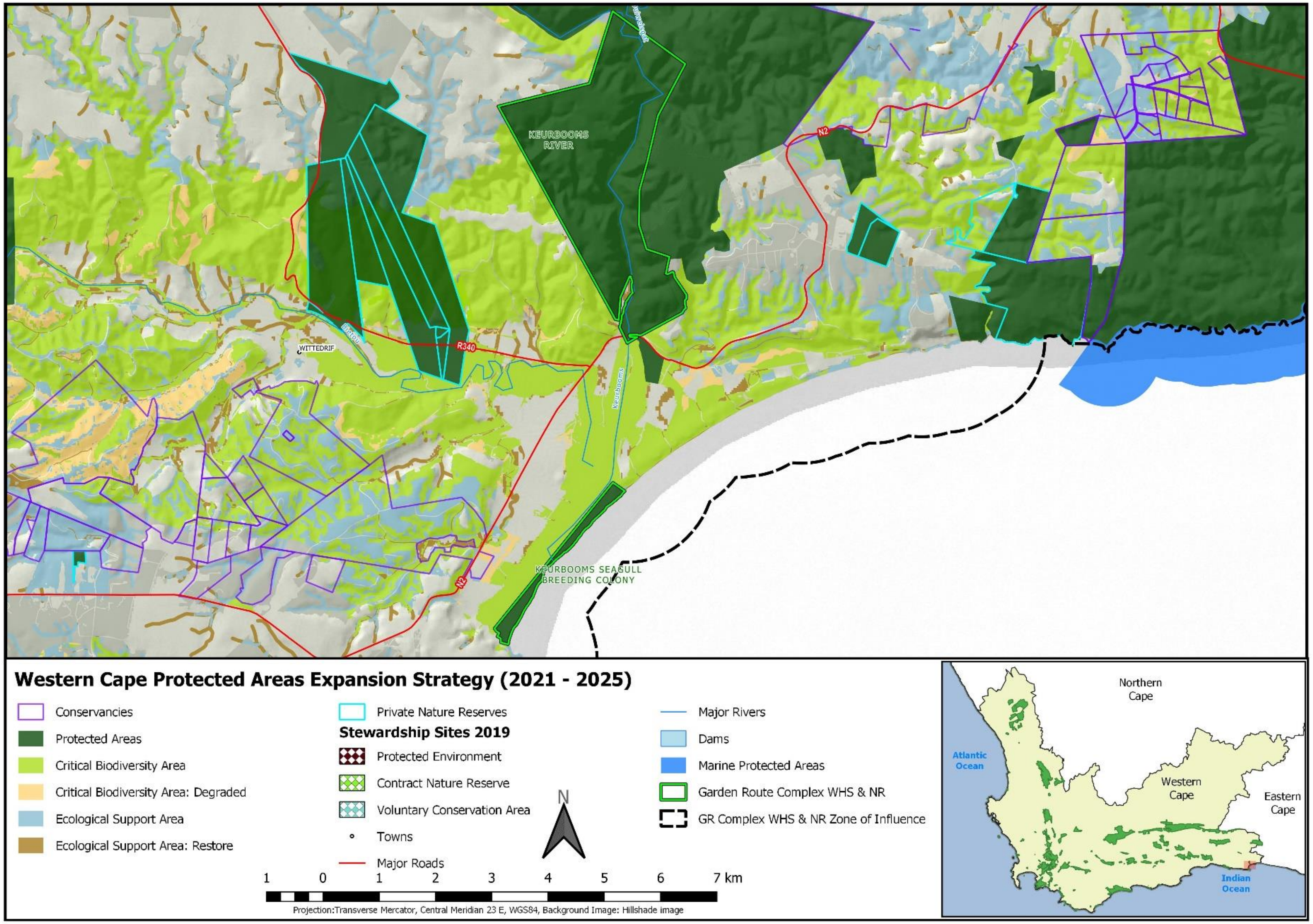
Map 16g: Infrastructure on the Annex Vlugt sector.



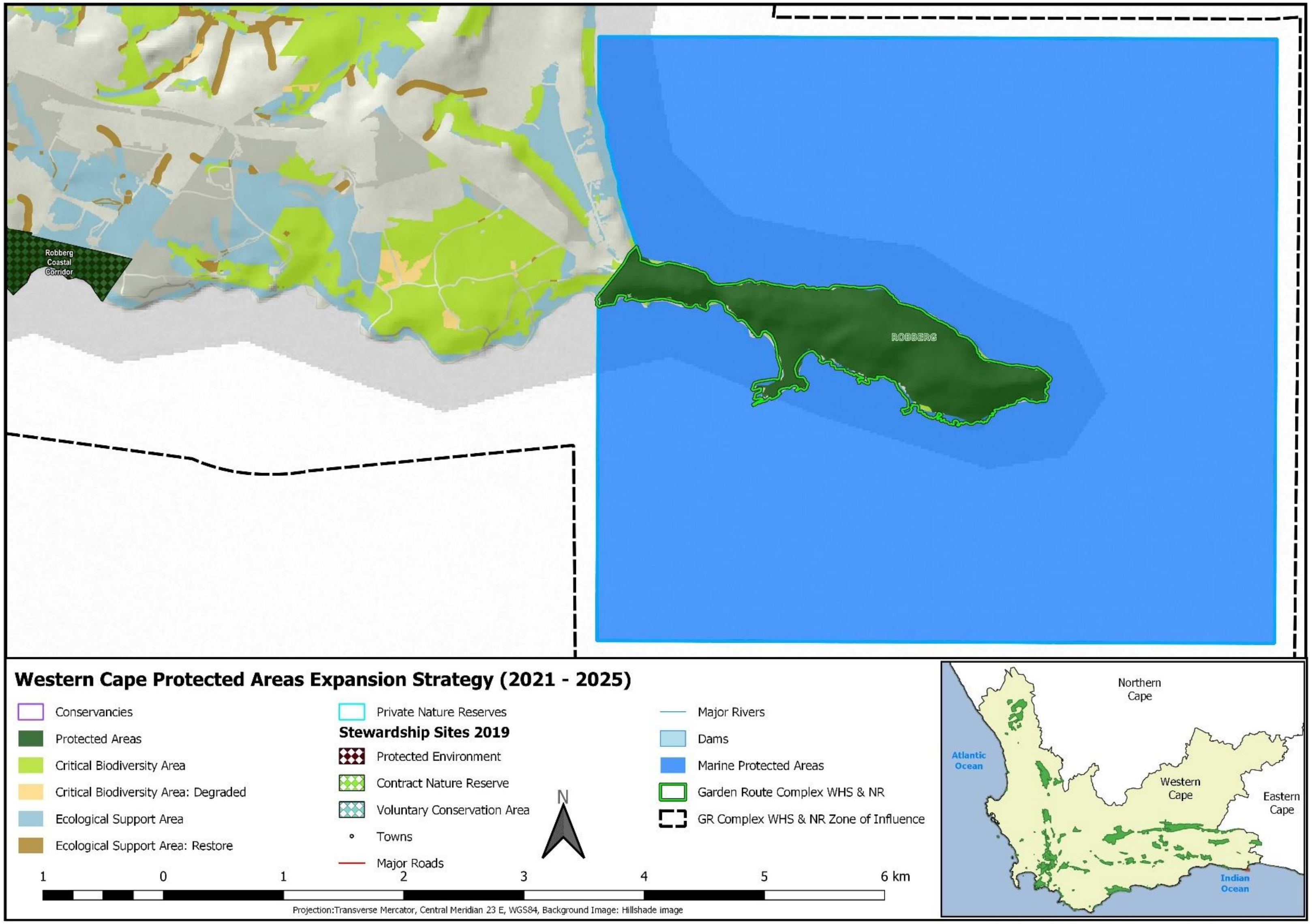
Map 17a: Expansion of the Outeniqua Cluster.



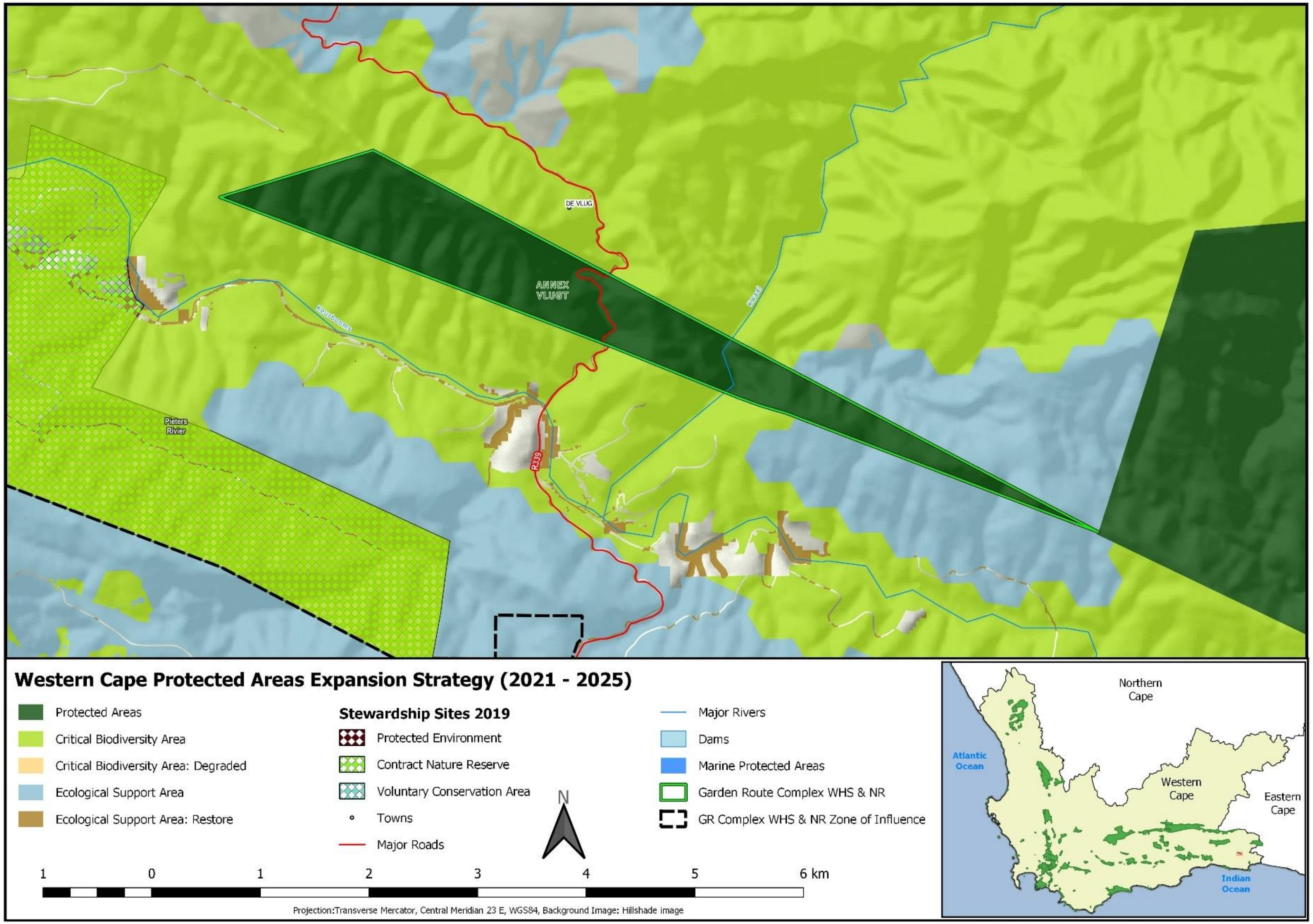
Map 17b: Expansion of the Goukamma Cluster.



Map 17c: Expansion of Keurbooms River sector.



Map 17d: Expansion of Robberg sector.



Map 17e: Expansion of Annex Vlugt sector.

APPENDIX 3: Stakeholder Engagement Report for the Garden Route Complex World Heritage Site and Nature Reserves.

GARDEN ROUTE COMPLEX WORLD HERITAGE SITE & NATURE RESERVES

PART OF THE CAPE FLORAL REGION PROTECTED AREAS WORLD HERITAGE SITE

Western Cape, South Africa

STAKEHOLDER ENGAGEMENT REPORT

COMPILED BY FOOTPRINT ENVIRONMENTAL SERVICES

DATE: MARCH 2023

CapeNature

FOOTPRINT Environmental Services