# Strategic Environmental Assessment for the proposed development of Green Hydrogen and the associated expansion of renewable energy generation and transmission infrastructure in the Namakwa Region

## Water Resources and Aquatic Ecosystems theme

27th November 2025

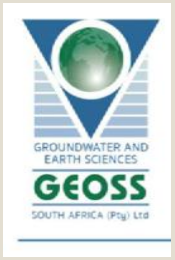

**Inputs by:**

Liz Day

Simon Lorentz

Zita Saal



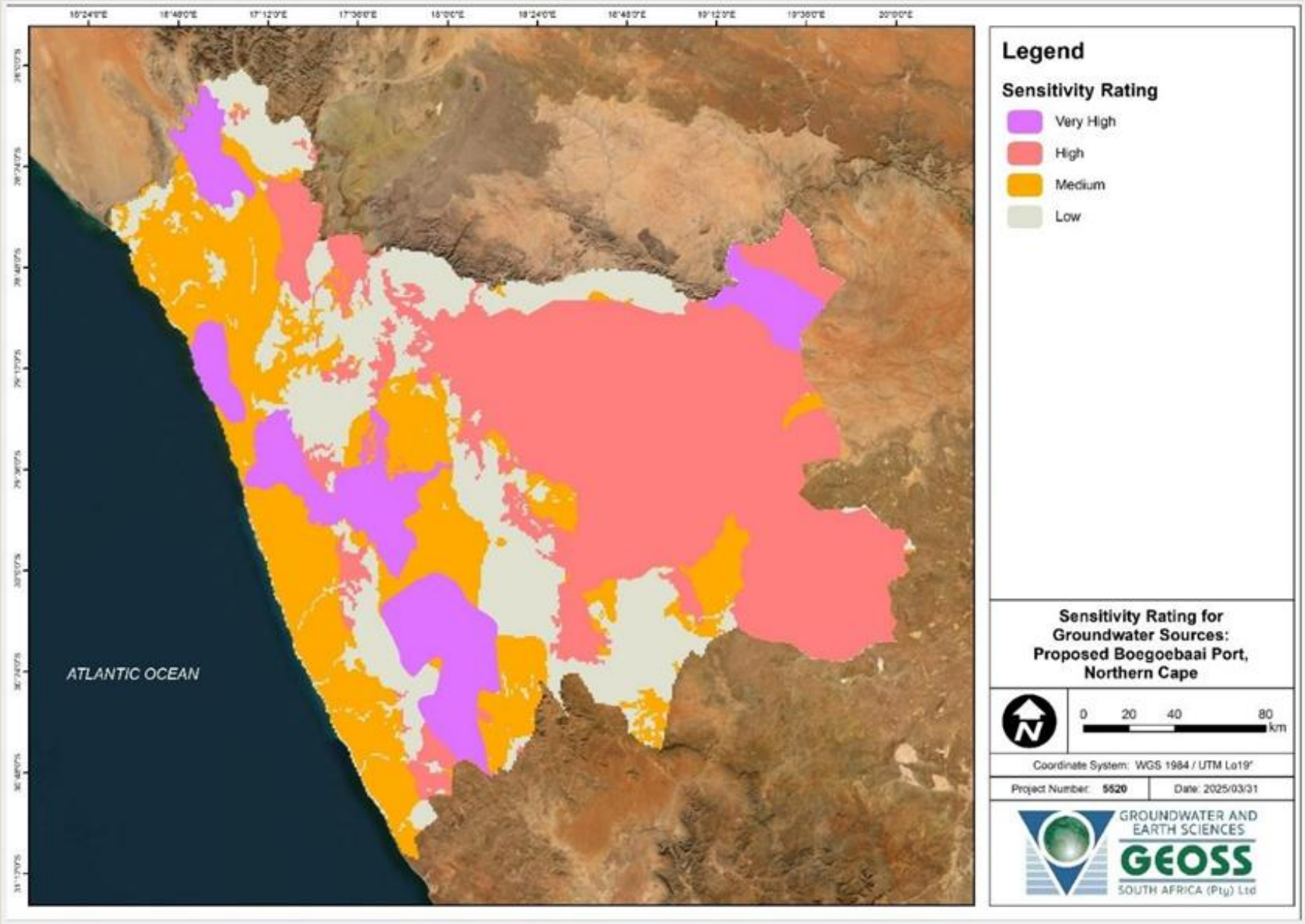
# Water Resources

- Groundwater
- Surface hydrology
- Aquatic ecosystems –
  - Inland
  - Estuarine

- **Sensitivities** mapped and rated separately
- **Activities** rated in terms of Risk

# Groundwater

- Sensitivity mapping considered:
  - Resource Units with high human dependence on groundwater
  - Strategic Water Source Areas (Very High Sensitivity : Port Nolloth, Kommagas and Kamiesberg SWSAs)
  - Threats posed by existing failing WWTWs and water treatment and distribution infrastructure
  - Water scarcity compared with current demand and management capacity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Project Number: 5520
Date: 2025/03/31
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# Groundwater risks and opportunities

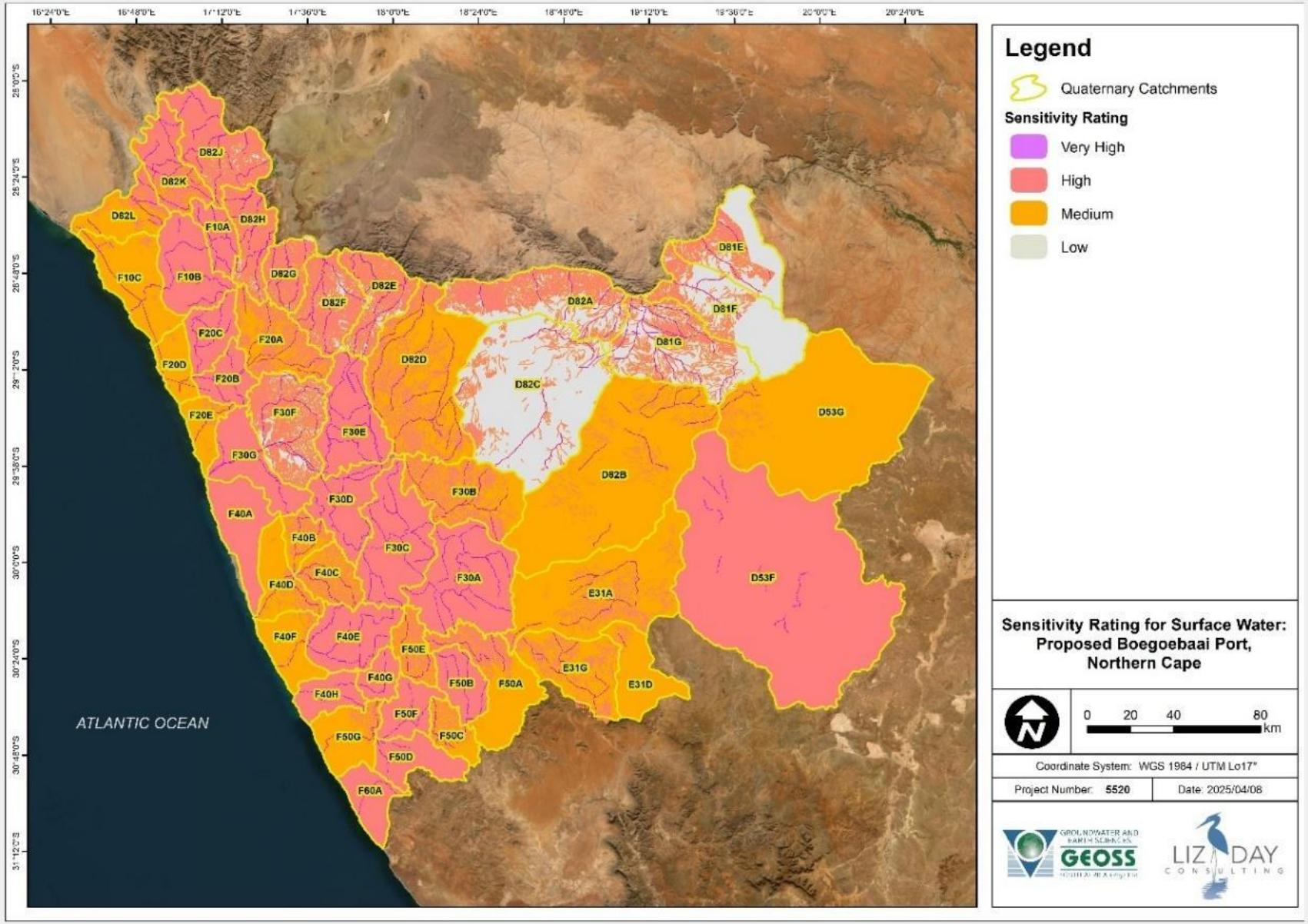
- **Risks**
  - Reduced recharge affecting groundwater availability and security
  - Reduced groundwater quality
  - Risks range from High to Very Low depending on sensitivity rating and Scenario
- **Opportunities**
  - Decreased pressure on resource if desalination becomes affordable (green H2 production scaled to produce additional fresh water)
  - Improved technical / management expertise for groundwater management

# Surface hydrology

- **Sensitivity** mapping considered:
  - Drainage networks (river systems)
  - The Orange River abstraction and reticulation network
  - Aridity levels, farm dam density

**Context**

- Arid to hyper-arid environment
- High surface water scarcity
- High level of demand on Orange River water resources
- Water scarcity likely to exacerbate with climate change.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Project Number: 5520
Date: 2025/04/08
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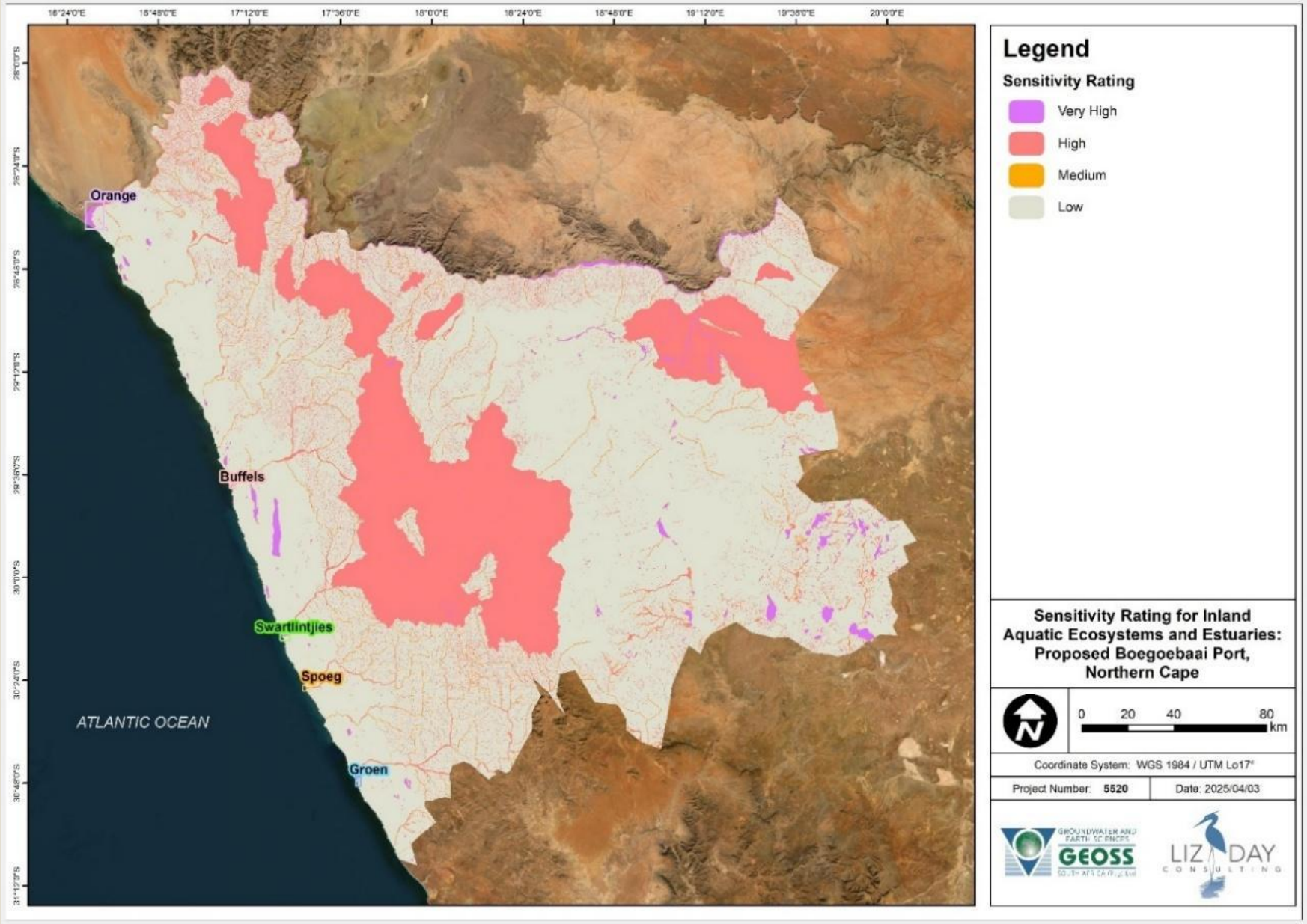
# Surface hydrology risks and opportunities

- **Risks**
- Increasing stresses on a limited water supply from the Orange River, for an increasing population;
- Increasing shortage of water to sustain life and livelihoods as areas become hyper-arid in future
- Risks rated Moderate to Very Low depending on sensitivity rating and Scenario
- **Opportunities**
  - Decreased pressure on resource if desalination is affordable
  - Improved technical / management expertise for more effective abstraction, storage and reticulation

# Aquatic ecosystems

- **Sensitivity** mapping considered:
  - The Orange River and its floodplain
  - Ephemeral rivers and drainage lines
  - Pans
  - Wetlands
  - Estuaries (including Orange River Ramsar wetland)

- **Context**
  - High biodiversity importance of some systems
  - Important ecosystem service provision in some areas
  - Thresholds of degradation already reached /exceeded in some areas
  - High sensitivity to
    - Changes in hydrology
    - Physical disturbance
    - Habitat fragmentation
    - Alien plant invasion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Coordinate System: WGS 1984 / UTM Lo17°
Project Number: 5520
Date: 2025/04/03
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# Aquatic ecosystem risks and opportunities

- **Risks**
  - Direct habitat degradation and biodiversity loss
  - Indirect biodiversity impacts from increased water availability – WWTW discharges; population growth (formal and informal)
  - Risks rated Moderate-to-High to Very Low depending on sensitivity rating and Scenario

- **Opportunities**
  - No biodiversity-associated opportunities

# General risk mitigation and management

- Avoidance of sensitive areas
- Improved training and other investment in management of WWTWs, water treatment and reticulation systems
- Investment in improved road design
- Rehabilitation of existing degraded ecosystems (e.g. Orange River Estuary)

# Strategic recommendations

- **Quantify** additional water volume (and quality) requirements and feasibility of excess fresh water production
- Ensure that recommended **EWR** for the lower Orange River and the Orange River Estuary can still be met
- Significant **investment** in training and infrastructure to allow improved management of groundwater resources, managed aquifer recharge, desalination, surface and groundwater abstraction and storage, water treatment, WWTWs and reticulation
- Avoidance of estuarine and inland aquatic ecosystems in any development context
- Implementation of non-flow related rehabilitation requirements for the Orange River Estuary
- Consider pro-active aquatic ecosystem offset banking.

# CONCLUSIONS

- Fresh water and its sustainable management are critical factors in any future development planning in this area
- The proposed development should only be considered if allowance is also made for large-scale desalination of seawater and/or groundwater to provide for the likely increase in direct and indirect water demand
- This could come at great ecological cost (footprint and changes in flow regime and water quality)
- A high degree of avoidance of aquatic ecosystems and groundwater recharge areas is required
- Solar and wind energy sources in the study area may be amply available, but the limited availability of water resources and the high sensitivity of aquatic ecosystems in this particular region is a major constraint.

# THE BOEGOEBAAI STRATEGIC ENVIRONMENTAL ASSESSMENT

## ECOLOGY, BIODIVERSITY AND CONSERVATION PLANNING: REGIONAL SENSITIVITY ASSESSMENT

**Philip Desmet**

Working Group Meeting 4
Date: Thursday, 27 November 2025
Time: 09:00 - 12:30

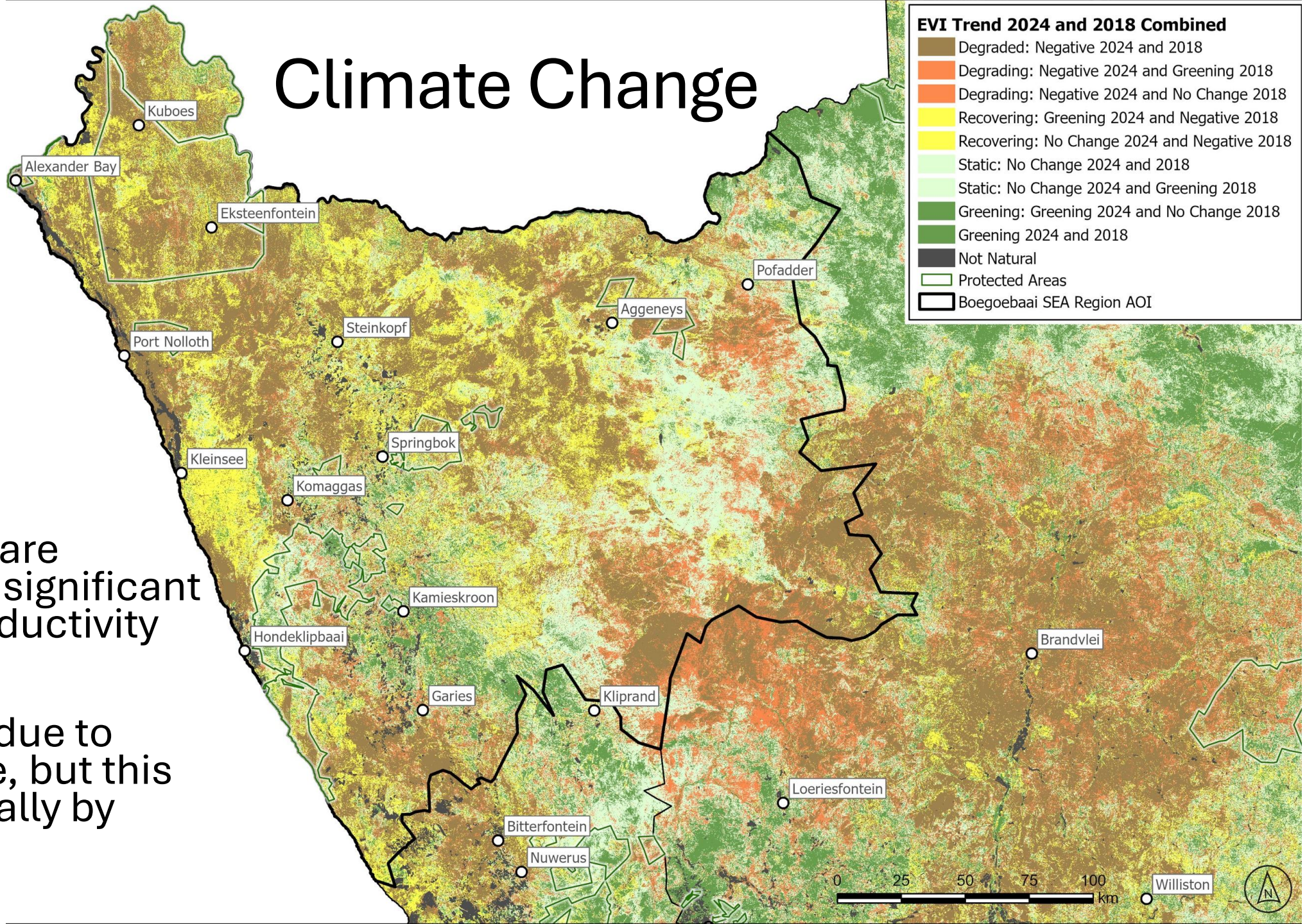
# Biodiversity Background

- Namaqualand is the most species diverse arid area in the world.
- No arid or desert area elsewhere on earth compares to Namaqualand in terms of the diversity and density of species.

# Current Threats to Biodiversity

| Activity | Description of Impact | Biodiversity Impact | Potential area of impact |
|---|---|---|---|
| **Livestock grazing** | Livestock eating natural vegetation | Loss of ecosystem function (reduction in plant cover and species diversity, increased soil erosion and runoff) | Widespread impacting the whole region |
| **Current mining** | Construction and operation of mine | Outright loss of habitat at mine site. Degradation of ecosystems in neighbourhood (dust and runoff) | Restricted to mine site and local neighbourhood |
| **Historic mining at Alexander Bay** | Legacy mining impacts continuing to self-propagate and expand area of impact. | Loss of habitat as a direct result of wind erosion and sand deposition | Neighbourhood to region |
| **Renewable energy - solar** | Construction of solar farms | Loss of habitat due to site clearing | Widespread |
| **Renewable energy - wind** | Operation of wind farms | Reduction in bird and bat populations due to turbine strikes | Widespread |
| **Aerial Linear infrastructure** | Operation of transmission lines | Reduction in bird populations due to collisions and electrocutions | Widespread |
| **Poaching of biodiversity** | Illegal collecting of plant and animal species from wild populations | Reduction in population sizes due to collecting | Widespread impacting all areas |

# Climate Change

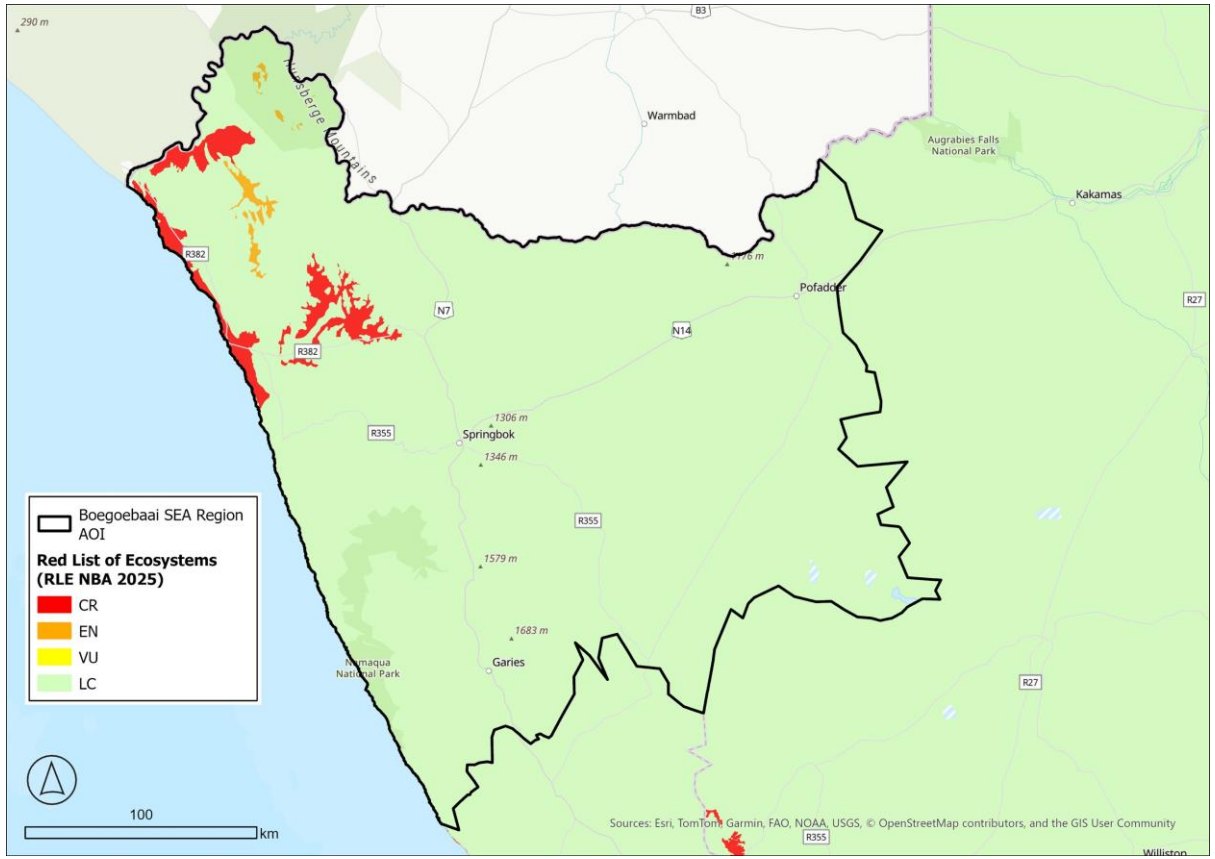



Ecosystems in Namaqualand are demonstrating significant declines in productivity

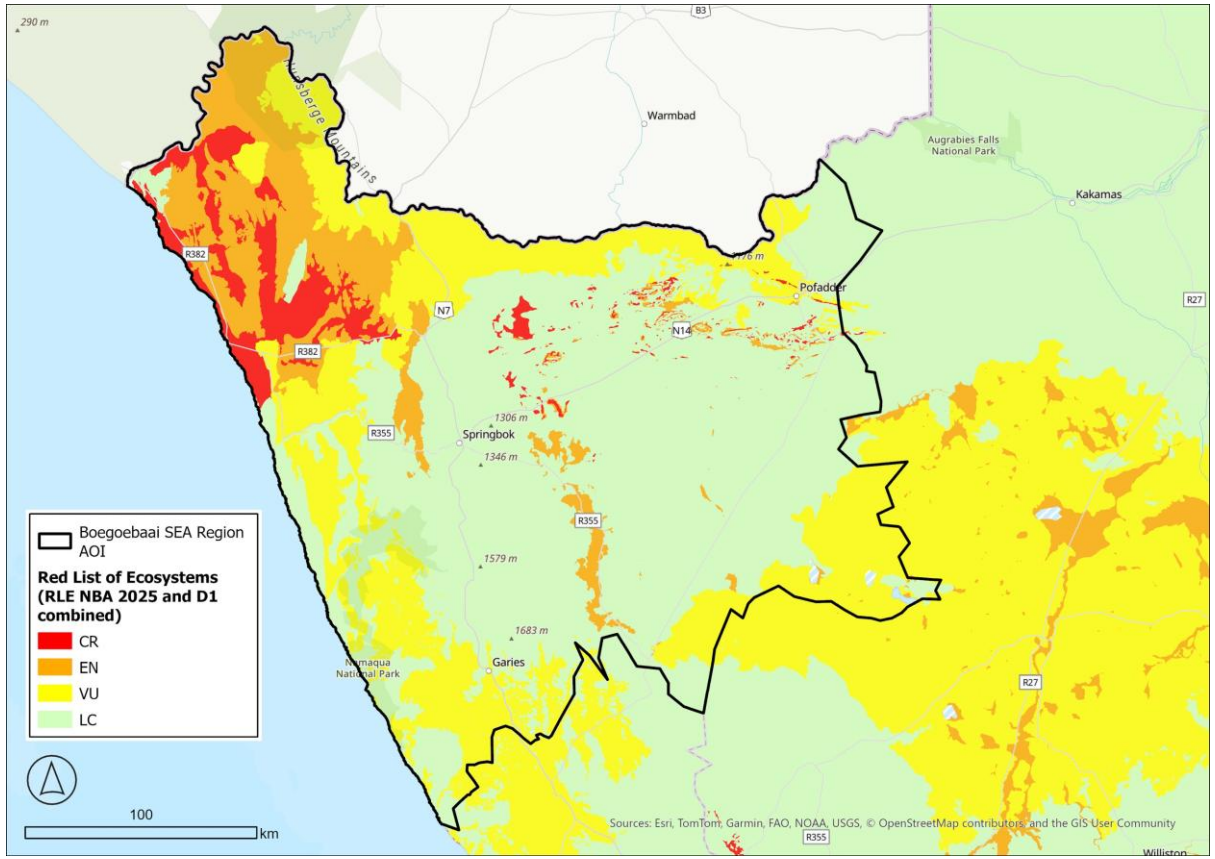
This change is due to climate change, but this is modified locally by land use

# Threatened Ecosystems (Ecosystem Status)

The Red List of Ecosystems (RLE) according to the NBA 2025




The combined NBA 2025 and D1 Red List of Ecosystems (RLE)



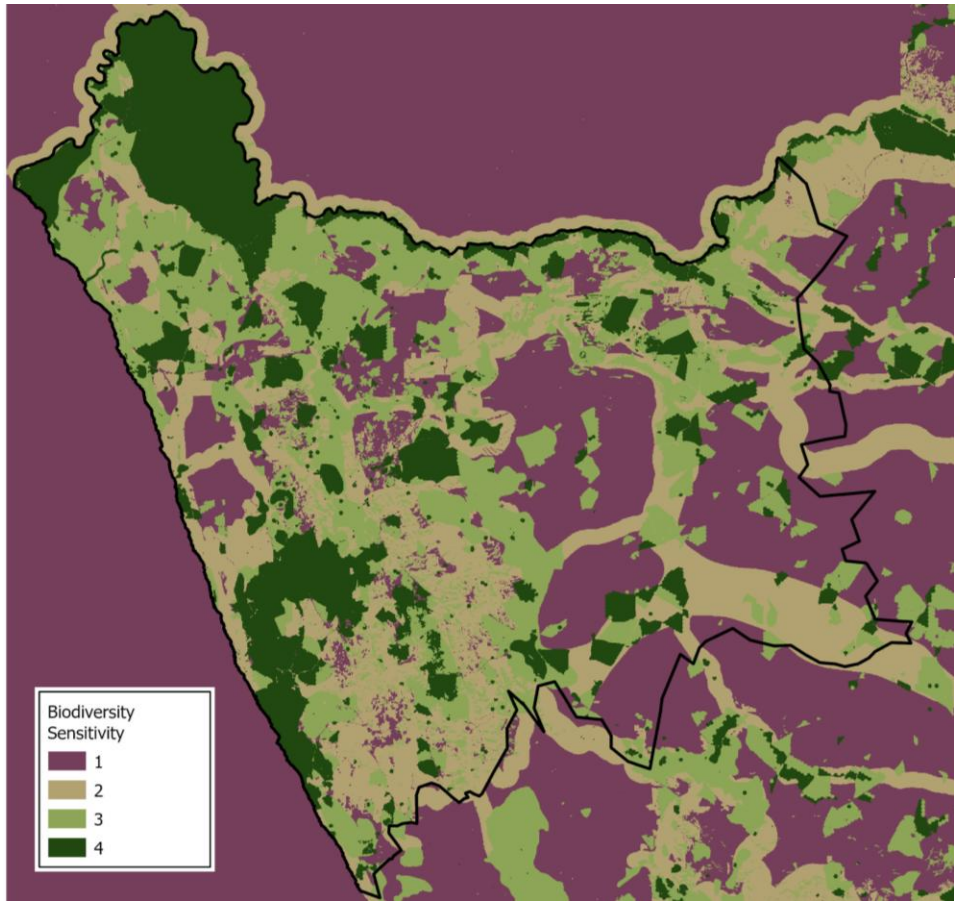
# Sensitivity Informants

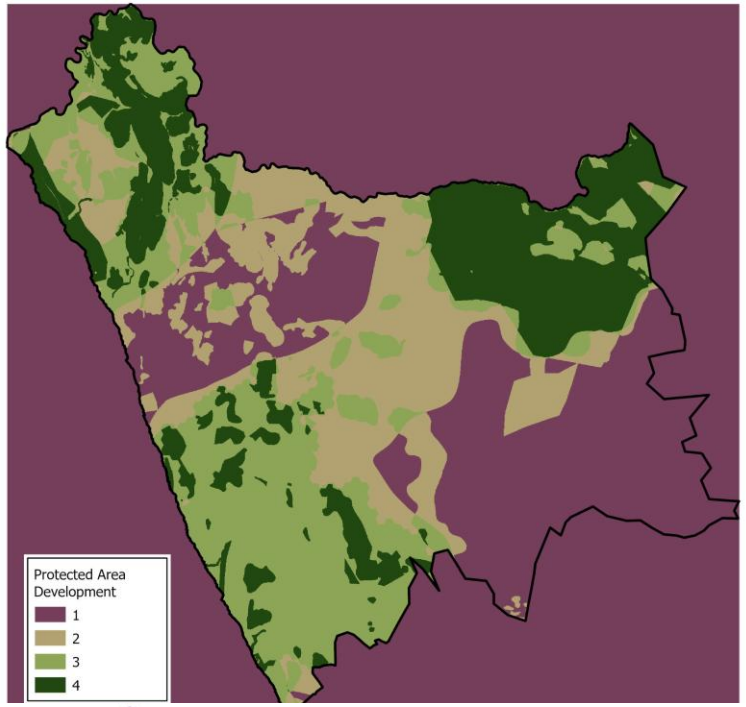
1. Biodiversity Spatial Planning Informants
    - Namakwa District Biodiversity Sector Plan 2009
    - Northern Cape Critical Biodiversity Areas 2024
    - Succulent Karoo Important Biodiversity Areas
    - Plants Species of Conservation Concern
    - Key Biodiversity Areas (KBAs)
2. Protected area development plans for SANParks, NC and LHSKT.

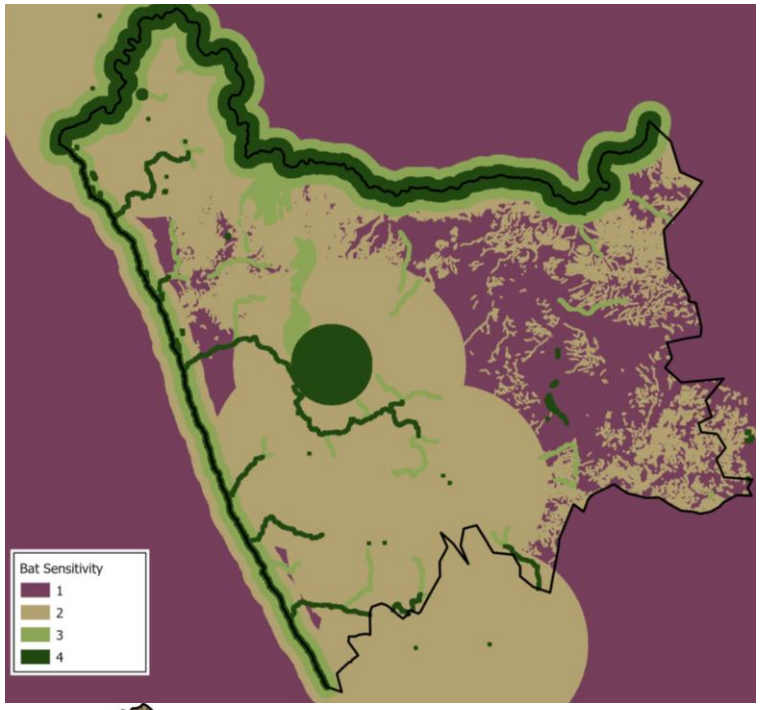
Sensitive areas for:

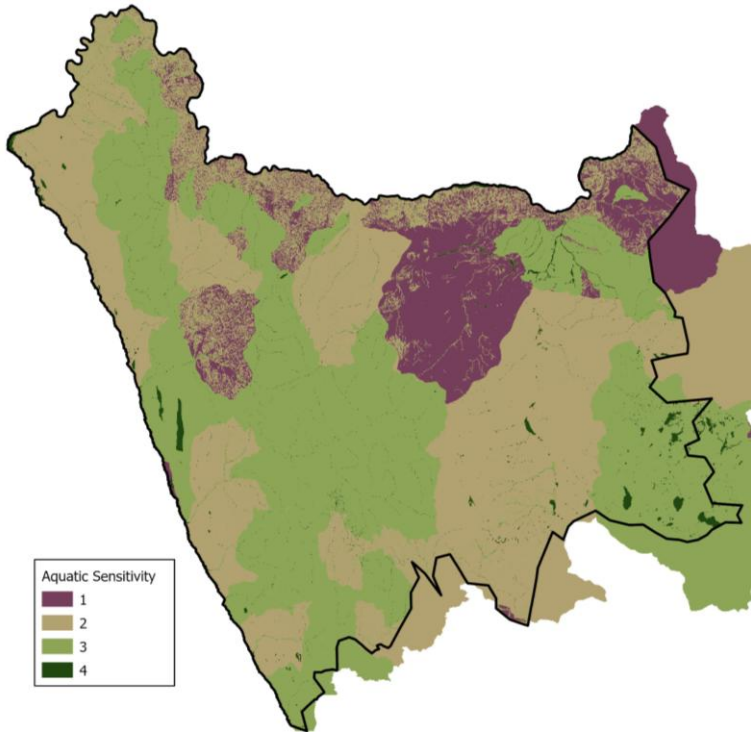
3. Birds
4. Bats
5. Aquatic (inland aquatic, estuary and surface water)

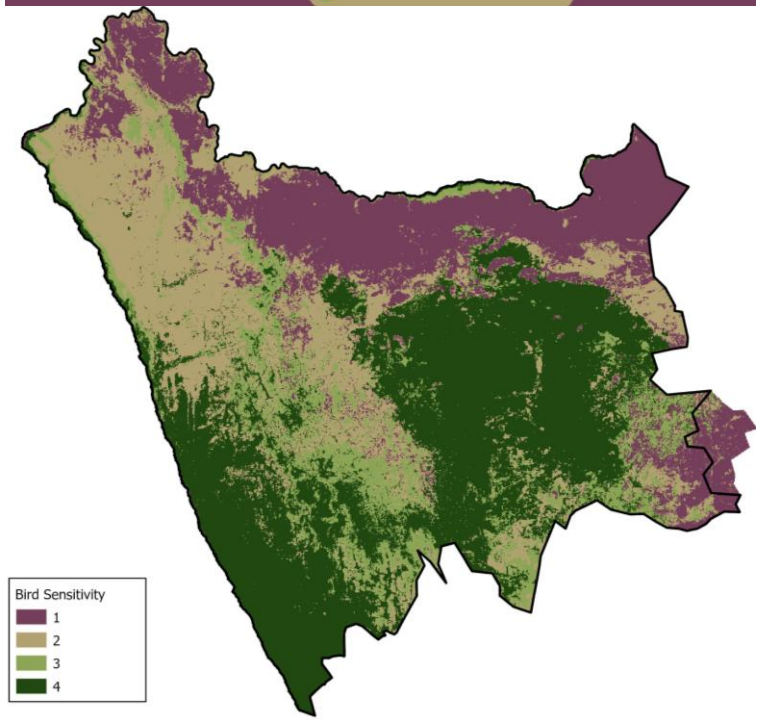
# Sensitivity Informants



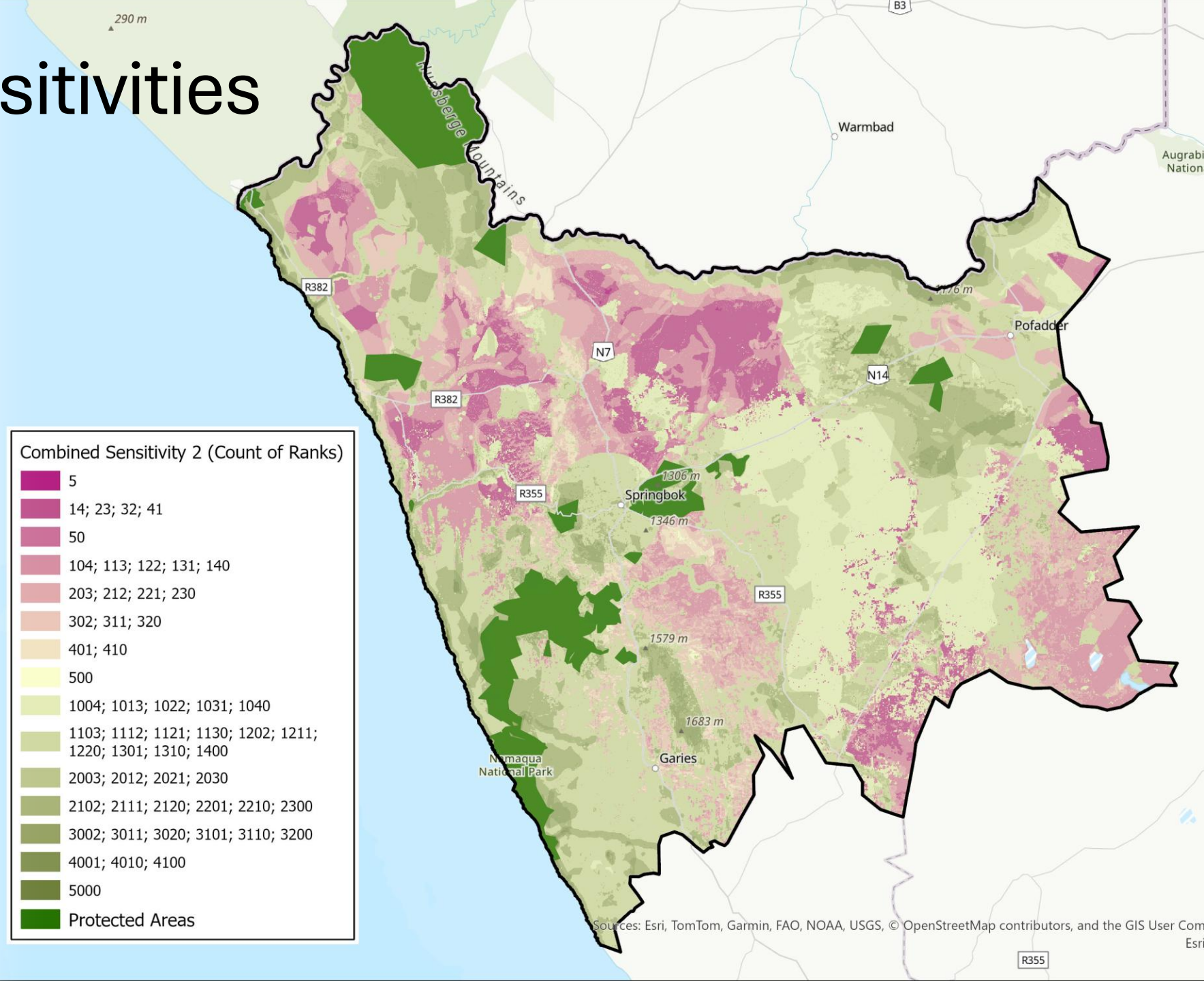



# Combined Sensitivities

**Category Code**

1 = Low
10 = Medium
100 = High
1000 = Very High

| Combined sensitivity category | % of region | Area (ha) |
|---|---|---|
| Low-Medium | 34% | 2 000 000 |
| Medium-High | 42% | 2 400 000 |
| High-Very High | 24% | 1 350 000 |



# Key data gaps

- ***Non-plant locality data*** and habitat information (e.g., critical habitats) such as for animals, reptiles or birds.
- Bird and bat ***ecological process spatial data*** such as the areas necessary to maintain migratory processes (breeding areas, flyways, migration routes).
- Landscape or regional ***ecological corridor network*** analysis and framework such as Vision 2040 corridor network. The consideration of landscape connectivity and linkages is not well considered in existing plans.

# Risks

**1. Biodiversity pattern impacts**

- The immediate and direct loss of biodiversity due to the loss of habitat or species populations during the construction phase
- Potential for species extinction in the short-term

**2. Ecological process impacts**

- The gradual and indirect loss of biodiversity due to the loss, disruption or degradation of ecological processes necessary for supporting species populations
- Potential for species extinction in the long-term

# Risk Mitigation

Biodiversity pattern impacts:

- **Avoid** development in sensitive landscapes (categories 2-4).
- Where avoidance is not possible then safeguard regional biodiversity using biodiversity **offsets** to increase the extent of impacted ecosystems within formal protected areas.

Ecological process impacts:

- **Avoid** development in sensitive landscapes (categories 2-4).
- Development type, site, ecosystem or species-specific **mitigation measures** to reduce disturbance, prevent creation of impermeable barriers to movement and eliminate incidental death of individuals.
- Where avoidance is not possible then safeguard regional biodiversity using biodiversity **offsets** specifically for ecological processes to increase the extent of impacted ecosystems within formal protected areas or OECMs.

# Opportunities

- Deal with the Alexkor mining legacy
- Economic development can help communities reduce dependency on livestock farming
- GH2 can support development of the biodiversity economy:
  - Integrated planning
  - Infrastructure investment
  - PA development
  - Skills development

# Strategic Management Actions


1. Plan GH2 to support / compliment the biodiversity economy
2. Develop a detailed spatial framework for Vision 2040 (ecological corridors)
3. **Protect sense of place**

# Bat Specialist Assessment

# for the

# Strategic Environmental Assessment

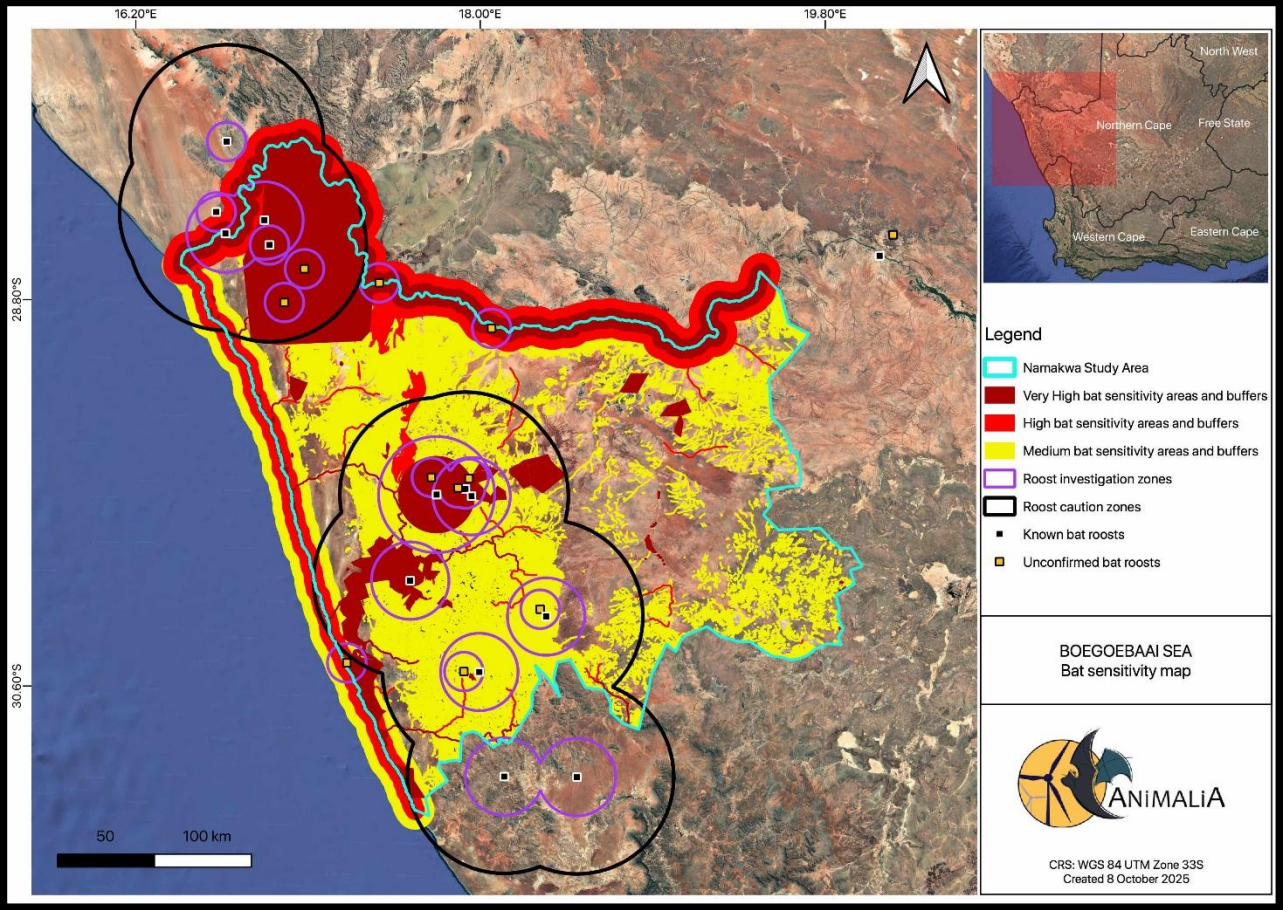
# of the

# Proposed Boegoebaai Port, SEZ and Namakwa Region

Werner Marais & Rebecca Welch

Animalia Consultants (Pty) Ltd

# Bat Sensitivity Analysis




| SENSITIVITY TIER | KEY FEATURES |
|---|---|
| Very High | Open water, perennial rivers, wetlands, coastlines, protected areas, bat roosts |
| High | Limestone geology, potential caves (* roosting sites) |
| Medium | Non-perennial watercourses |
| Low | Areas without these critical features; limited roosting and foraging potential |

Plus: Roost Investigation Zones and Roost Caution Zones

- Identified around known bat roosts.
- These indicate areas where bats may be particularly active, and where field verification becomes critical

# Bat Site Sensitivity Overview

| SENSITIVITY CATEGORIES | IMPORTANCE | DEVELOPMENT SUITABILITY |
|---|---|---|
| Very High | Critical habitats, high bat activity, species of conservation concern.<br>• provide water, moisture & abundant fruit & insect resources<br>• Support colonies of SCCs | • Generally unsuitable for development; high risks to bat populations. |
| High | | |
| Medium | Moderate or uncertain bat activity, may host Near Threatened or Rare species. | • Development possible with detailed assessment & strict mitigation. |
| Low | Limited bat activity. | • Comparatively more suitable; still requires verification of local sensitivities. |

# Description of Impacts Across the Development Scenarios

Three major negative impacts on bats:

1. Reduced fecundity: Disturbance of roosts.
2. Disruption of ecological processes: Loss and fragmentation of foraging habitat .
3. Increased mortality: Bat collision & barotrauma from turbines.

**= population decline = increased risk of extinction**

The assessment of impacts across three scenarios:

- Risk increases with both project scale and habitat sensitivity.
  - Very High and High sensitivity areas present the greatest risk, risks remain high to Very High even after mitigation.
  - Medium sensitivity areas present moderate risk levels- reduced with effective mitigation.
  - Low sensitivity areas present minimal risk.
- Risk levels vary between by scenarios, but all potential risks can be reduced through effective mitigation and management measures.

Congress Avenue bridge – Austin, Texas

# Strategic Management Recommendations

- **National Policy:**
  - Share operational mortality data
  - Conduct national-scale SEA spatial risk analysis.
- **Regional Planning:**
  - **A**void Very High sensitivity areas
  - Research on ecological processes e.g. migratory routes of cave dwelling bats.
  - Future EIA Studies:
    - Preconstruction monitoring for ≥12 months.
    - Include fruit bats and non-echolocating species.
    - Focus on Near Threatened *Cistugo seabrae* (Angolan Hairy Bat).
    - Field verification of roosts in Investigation & Caution zones.
- **Enhancing Positive and Reducing Negative Impacts**:
  - Keep natural areas natural, keep wild areas wild
  - Avoid Very High sensitivity areas.
  - Ongoing data collection.


Questions or suggestions?

# STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED BOEGOEBAAI PORT, SPECIAL ECONOMIC ZONE (SEZ) AND THE NAMAKWA REGION

## WORK PACKAGE 2 – NAMAKWA REGION

## AVIFAUNAL SPECIALIST ASSESSMENT

**Working Group Meeting**

**27 November 2025**

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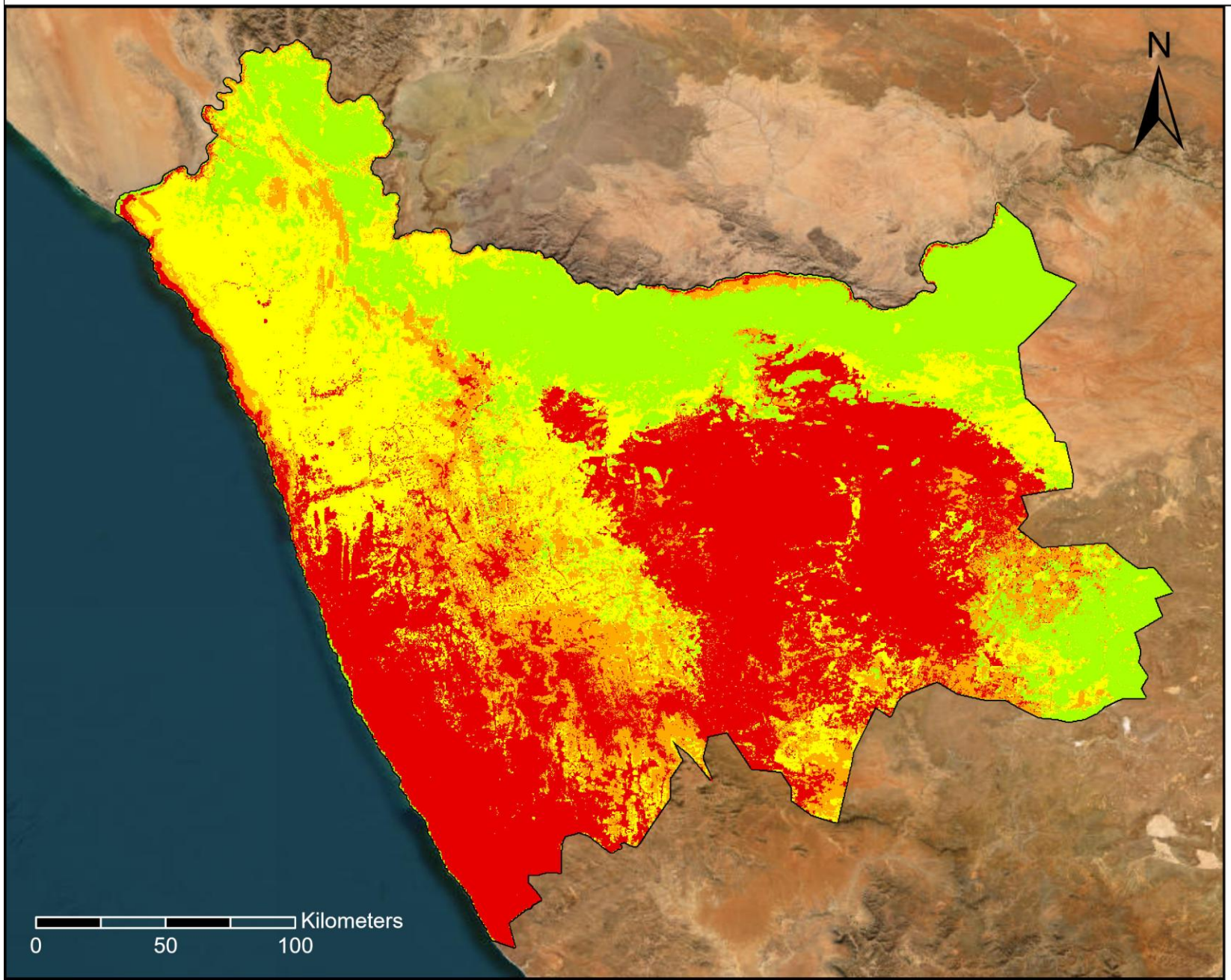
# Composite Avifaunal Sensitivity Map of the Namakwa Region




**Legend**

Composite Avifaunal Sensitivity Map

Rating

- Low
- Medium
- High
- Very High

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# Key Potential Impacts to Avifauna

- **Displacement due to Disturbance**
  - Noise, lighting, and human activity during construction and operation
- **Habitat Loss / Fragmentation / Transformation**
  - Port, SEZ, renewable energy and linear infrastructure footprints
- **Collisions**
  - Wind turbines, powerlines, masts, and other tall structures
- **Electrocutions**
  - Transmission and distribution infrastructure, particularly affecting large raptors and vultures

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# Risk & Opportunities Assessment

Key findings concluded from our Avifaunal Risk Assessment are:

- **Without mitigation**, both $GH_2$ development scenarios present **High to Very High** risks to priority avifaunal species, especially in areas of **Very High Sensitivity**.
- **Scenario 2 ("Big $GH_2$")** carries the greatest cumulative risk, with potentially severe to extreme consequences for Endangered and Critically Endangered bird species.
- **With implementation of best-practice mitigation**, risks can be reduced to **Moderate–High**, but residual impacts remain considerable in sensitive habitats.
- Even the baseline scenario reflects ongoing pressures as a result of climate change, mining, agriculture, and existing renewable energy expansion.

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# Key recommended Strategic Management Actions

1. *Spatial Planning & Sensitivity Controls*

2. *Technology-Specific Standards*

3. *Monitoring & Adaptive Management*

4. *Governance & Data Management*

5. *Incentives & Financing*

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# Key recommended Strategic Management Actions

*1. Spatial Planning & Sensitivity Controls*

- Embed avifaunal sensitivity mapping into planning tools (such as EMFs, SDFs, IDPs), designate no-go zones for critical habitats, apply science-based buffers, align infrastructure to avoid very high and high-risk areas, and cap cumulative development in sensitive landscapes.

*2. Technology-Specific Standards*

- Adopt bird-safe design and operational mitigation measures to ensure minimising collision, electrocution, and disturbance risks through appropriate siting, engineering, and seasonal restrictions.

*3. Monitoring & Adaptive Management*

- Use standardised pre- and post-construction monitoring protocols, set Thresholds of Potential Concern (TPCs), link results to Potential Biological Removal (PBR) rates and Population Viability Analysis (PVA), and trigger adaptive measures when thresholds are exceeded.

*4. Governance & Data Management*

- Mandate avifaunal standards and independent oversight in approvals, require cumulative impact reviews, ensure open data sharing, and establish a regional technical forum for coordinated decision-making.

*5. Incentives & Financing*

- Fast-track low-risk, high-standard projects and fund biodiversity actions such as retrofitting hazardous infrastructure and securing key buffer habitats through a dedicated conservation fund.

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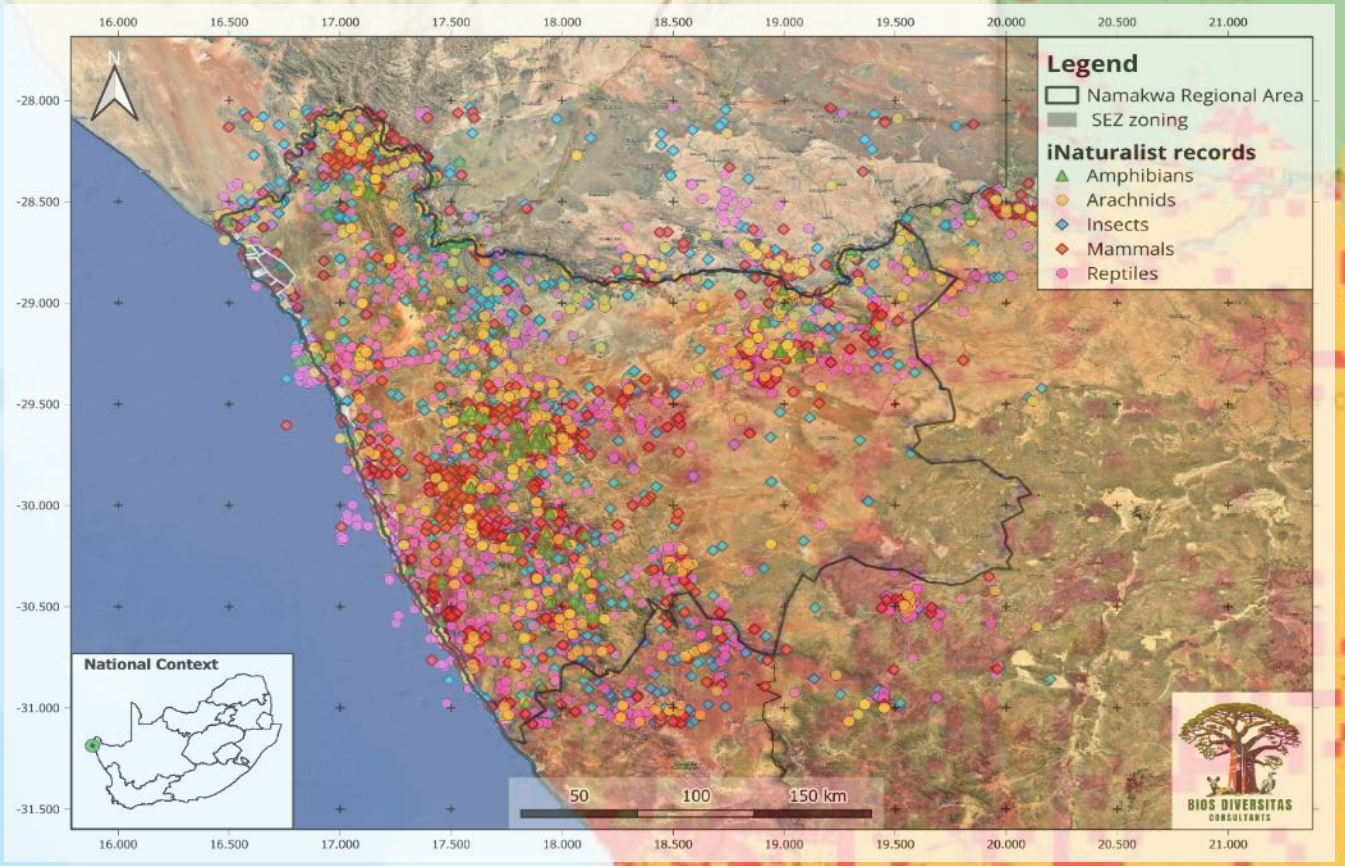
# Strategic Environmental Assessment (SEA) Proposed Namakwa Region Fauna Desktop Assessment (WP2)

Corné Niemandt

27 November 2025

## Ecological context – Namakwa Region

- The Namakwa / Succulent Karoo system supports highly specialised small mammals, reptiles, amphibians and invertebrates, many with restricted ranges and low ability to move across transformed landscapes.
- Critical Biodiversity Areas (CBAs), threatened ecosystems along the coastline and ecological corridors are important to keep ground-dwelling and fossorial species connected (e.g. small antelope, rodents, shrews, burrowing skinks, geckos, scorpions, termites, beetles, pollinating insects).




Karas

Cape

SOUTH

Legend:
Very High
High
Medium
Low

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri Thailand, NGCC, (c) OpenStreetMap contributors, and the GIS User Community

90 180 360 Kilometers

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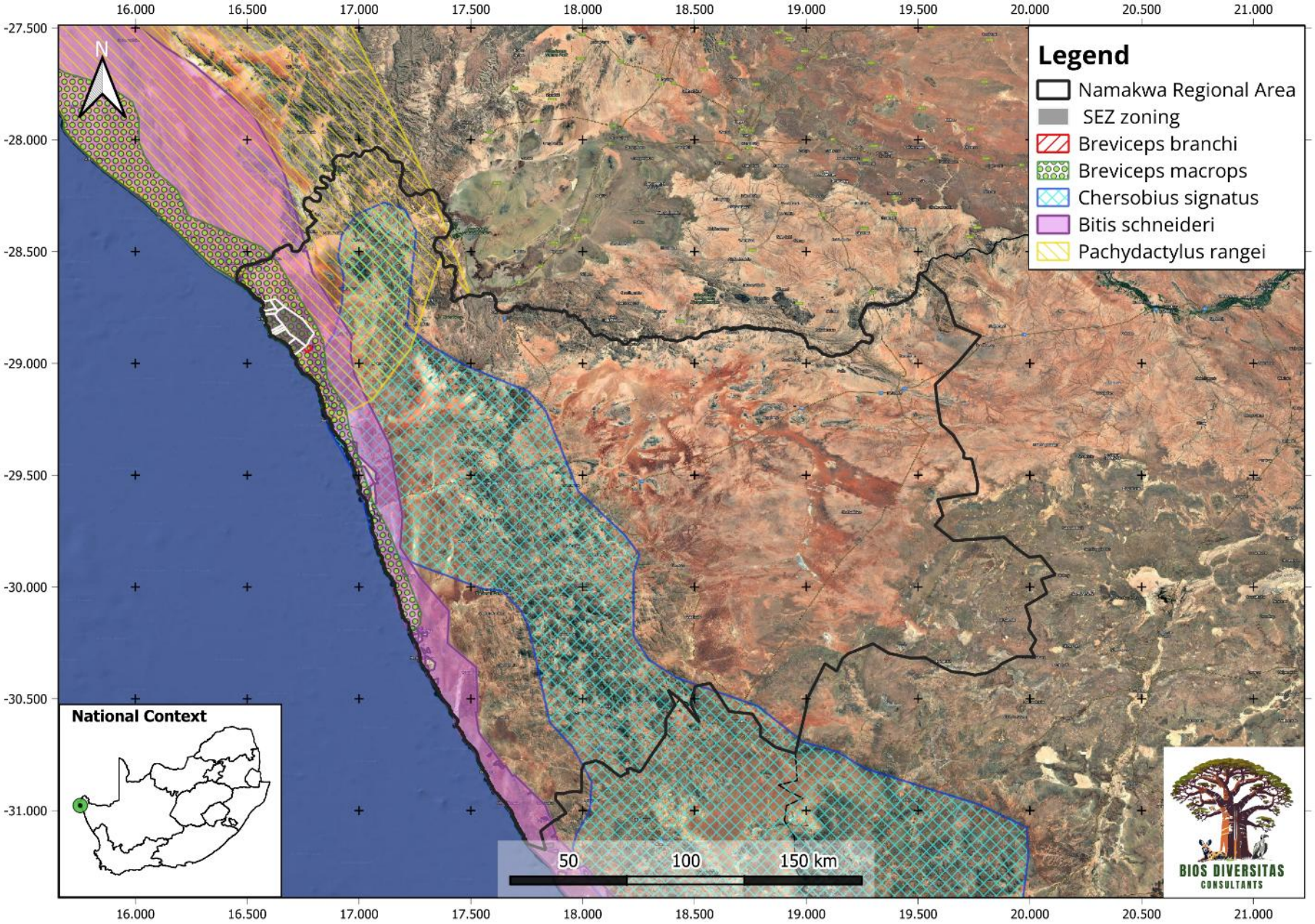
| Scientific Name | Common Name | Red List Status | Likelihood |
|---|---|---|---|
| *Chersobius signatus* | Speckled Cape Tortoise | EN (R, G) | Moderate to Low |
| *Psammobates tentorius trimeni* | Western Tent Tortoise | EN (R, G) | Moderate |
| *Pachydactylus rangei* | Namib web-footed gecko | CR (R) | High |
| *Bitis schneideri* | Namaqua Dwarf Adder | NT (R) | High |
| *Dermochelys coriacea* | Leatherback Sea Turtle | CR (R); VU (G) | Moderate |
| *Cryptochloris wintoni* | De Winton's Golden Mole | CR (R) | High |
| *Eremitalpa granti granti* | Grant's Golden Mole | VU (R) | High |
| *Hyaena (Parahyaena) brunnea* | Brown Hyaena | NT (R) | High |
| *Panthera pardus pardus* | African Leopard | VU (G) | Moderate |
| *Bathyergus janetta* | *Namaqua* Dune Mole-rat | Uplisted to Endangered | High |
| *Breviceps macrops* | Desert Rain Frog | VU (R, G) | High |
| *Breviceps branchi* | Branch's Rain Frog | DD (R, G) | High |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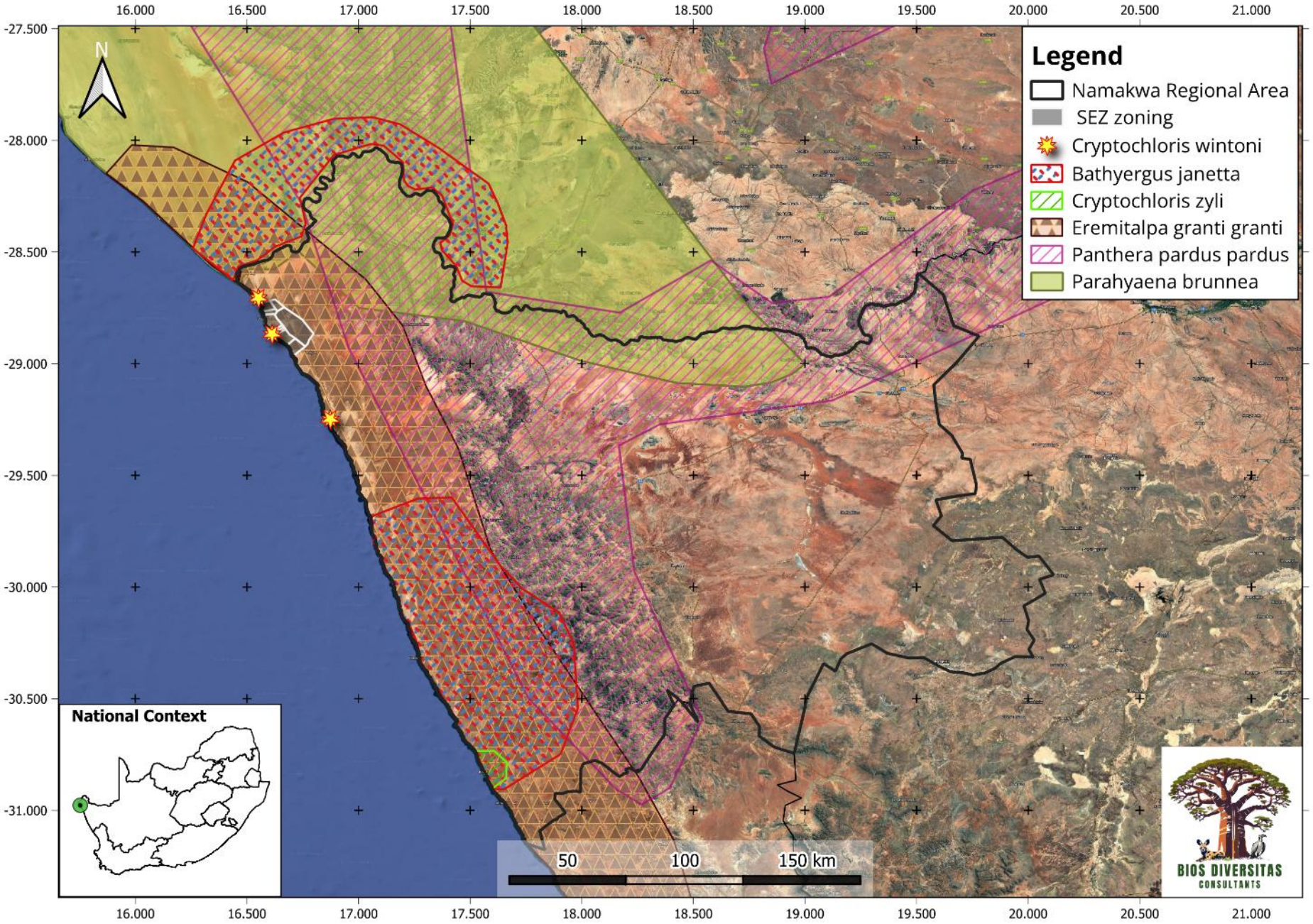
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N
Legend
Namakwa Regional Area
SEZ zoning
Cryptochloris wintoni
Bathyergus janetta
Cryptochloris zyli
Eremitalpa granti granti
Panthera pardus pardus
Parahyaena brunnea
National Context
50
100
150 km
BIOS DIVERSITAS
CONSULTANTS

# Wind energy facilities – key impacts

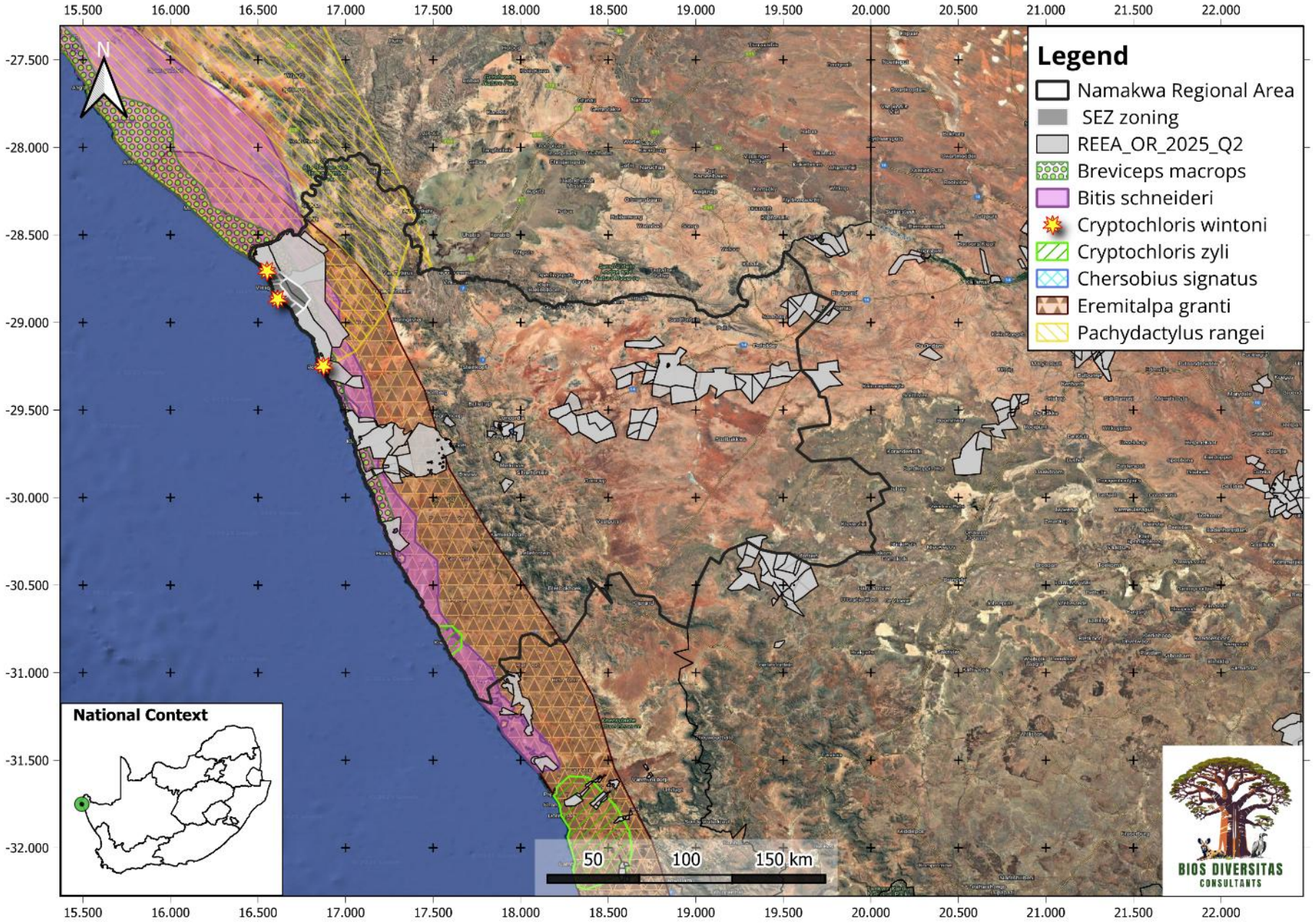
- **Habitat loss and fragmentation**
  - Infrastructure break up continuous habitats, especially dune systems.
  - Fragmentation isolate small mammal, reptile and invertebrate populations, affecting gene flow and recolonisation after droughts.
- **Disturbance and behavioural change**
  - Construction and maintenance traffic increase noise, vibration and human presence,
  - Displace medium and small mammals from breeding or foraging areas.
  - Soil compaction and disturbance reduce burrow density and quality.
- **Indirect impacts**
  - Increased road networks can lead to higher roadkill rates.
  - Increased poaching and illegal collection of high-value reptiles and mammals.

# Solar PV/CSP facilities – key impacts

- **Large-scale habitat transformation**
  - Requires clearing or heavy modification of entire footprints, often fenced.
  - Affects microhabitats critical for reptiles, amphibians and invertebrates (rock piles, termitaria, shallow pans, ephemeral drainage lines).
- **Barriers to movement**
  - Perimeter fencing and dense infrastructure create hard barriers and movement filters for fauna, fragmenting home ranges and seasonal movement paths.
  - Loss of permeability can be critical for wide-ranging species and for dispersal of ground-active invertebrates.
- **Microclimate and substrate changes**
  - Shading, altered run-off and soil disturbance change the thermal and moisture regimes at ground level.
  - Under-panel management (e.g. gravel vs partial vegetation cover) strongly influences whether habitat value is retained.

## Comparative view for Namakwa (for $GH_2$ planning)

- **Wind**
  - Smaller direct footprint, but disproportionate fragmentation via roads and powerlines.
  - Impacts through landscape connectivity, disturbance and roadkill, affecting mammals, reptiles, amphibians and invertebrates over a broad area.
- **Solar**
  - Much larger contiguous footprint with high-intensity habitat transformation inside the site.
  - Strong, localised impacts on ground-dwelling and burrowing fauna, with long-term loss of microhabitats.
  - Impacts through roadkill, fences, disturbance and potential heat island effect.


Legend
Namakwa Regional Area
SEZ zoning
REEA_OR_2025_Q2
Breviceps macrops
Bitis schneideri
Cryptochloris wintoni
Cryptochloris zyli
Chersobius signatus
Eremitalpa granti
Pachydactylus rangei
National Context
50
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150 km
BIOS DIVERSITAS
CONSULTANTS
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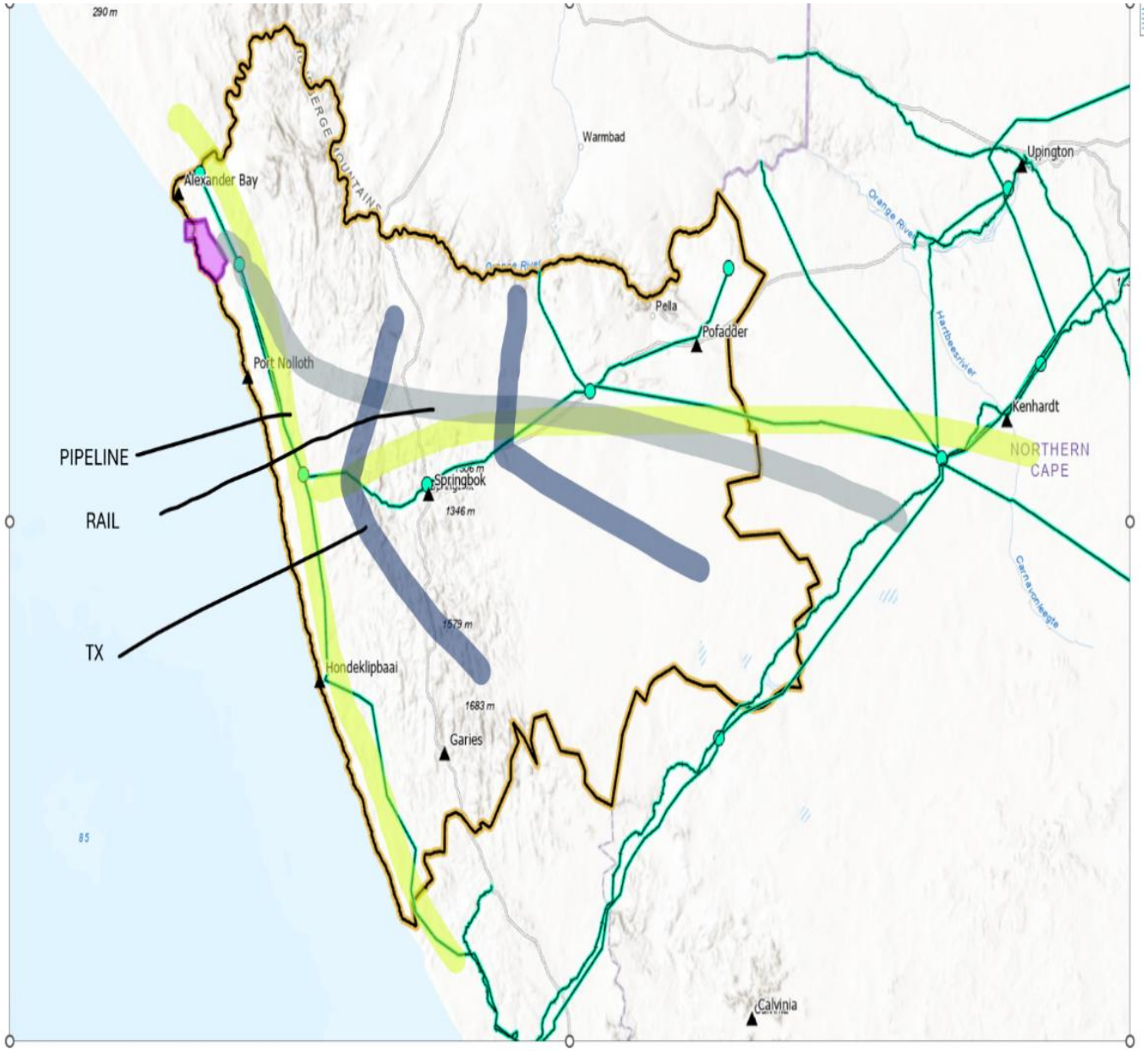
-32.000


290 m
Warmbad
Alexander Bay
Upington
Orange River
Pella
Pofadder
Port Nolloth
Kenhardt
NORTHERN CAPE
PIPELINE
RAIL
TX
Springbok
1346 m
1679 m
Hondeklipbaai
1683 m
Garies
Calvinia

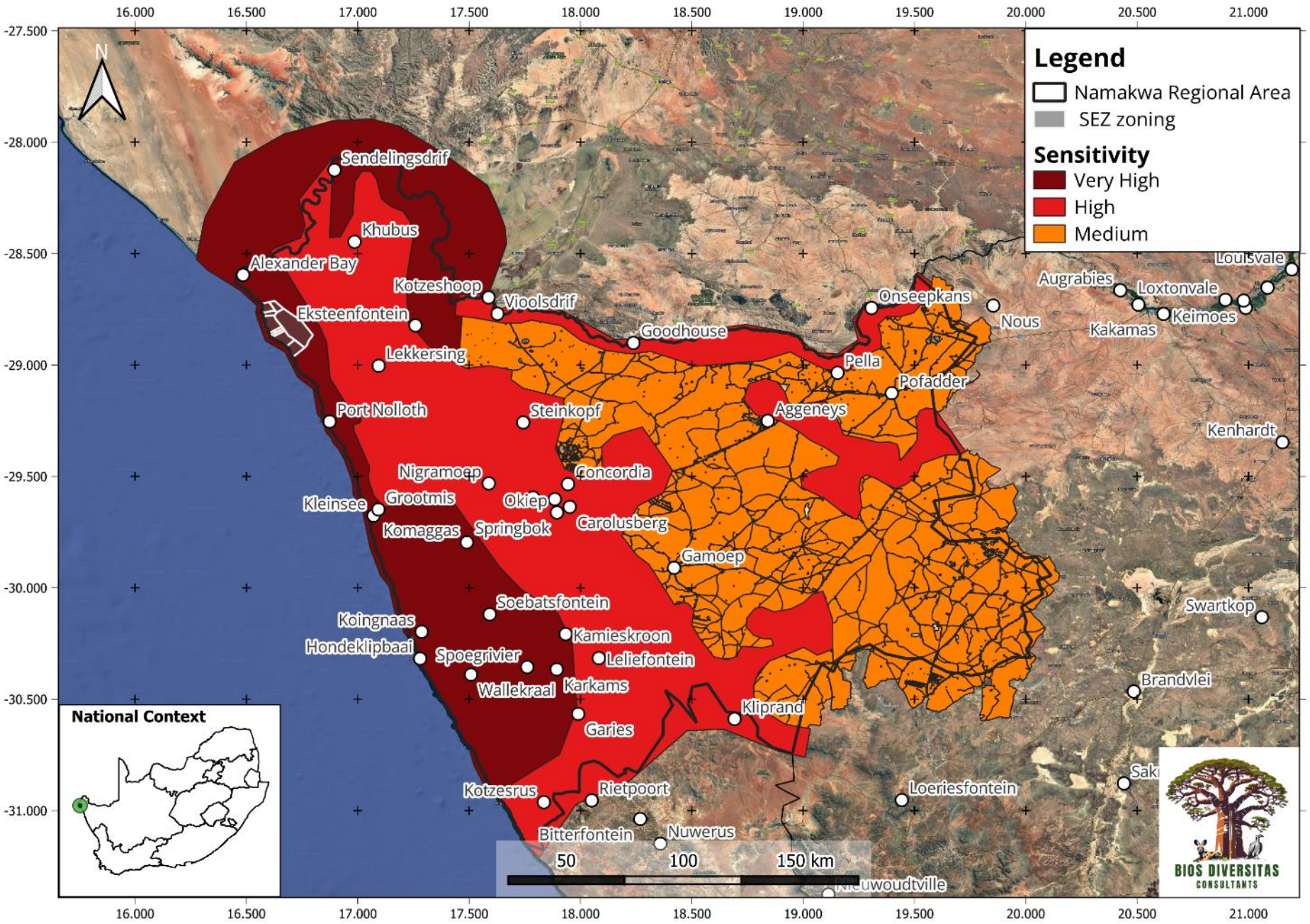
# Impacts of pipelines, railways and roads in sensitive systems on animal SCC

## Why linear infrastructure is high-risk in sensitive systems

- In CBAs, ecological corridors, wetlands, riparian zones and dune systems, many SCC are already under pressure from habitat loss, small population size and low dispersal ability.
- Create long edges and barriers that disproportionately affect wide-ranging mammals, low-mobility reptiles and amphibians, and narrow-range invertebrates.

## Key impact pathways on animal SCC

- Habitat loss and degradation (construction footprint)
- Fragmentation, barriers and disrupted connectivity
- Direct mortality
- Hydrological and geomorphic changes
- Edge effects, disturbance and invasive species


Legend
Namakwa Regional Area
SEZ zoning
Sensitivity
Very High
High
Medium
National Context
N
16.000
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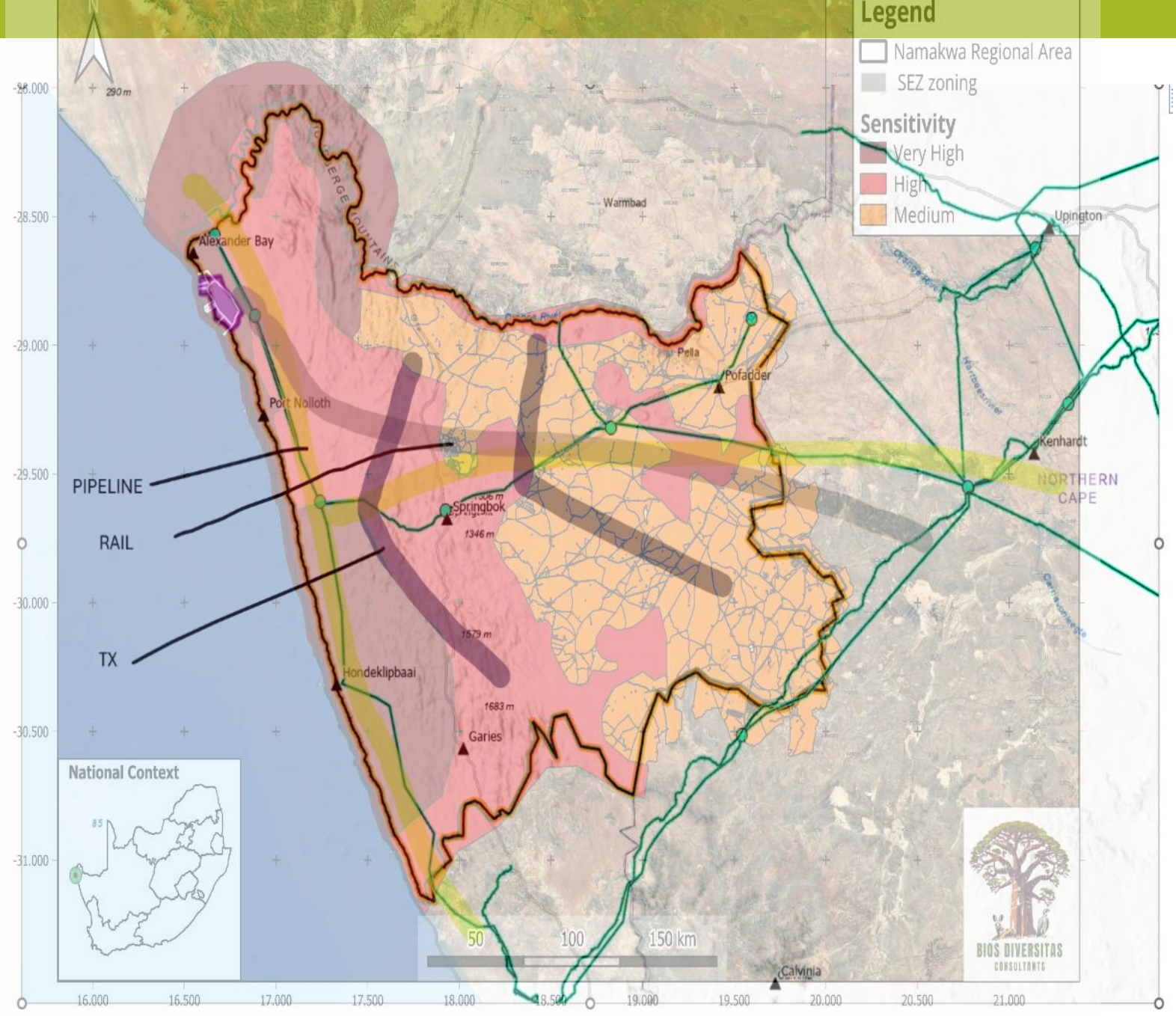
-30.000
-30.500
-31.000
Sendelingsdrif
Khubus
Alexander Bay
Kotzeshoop
Vioolsdrif
Eksteenfontein
Goodhouse
Lekkersing
Port Nolloth
Steinkopf
Nigramoep
Concordia
Kleinsee
Grootmis
Okiep
Komaggas
Springbok
Carolusberg
Gamoep
Soebatsfontein
Koingnaas
Kamieskroon
Hondeklipbaai
Spoegrivier
Leliefontein
Wallekraal
Karkams
Garies
Kliprand
Kotzesrus
Rietpoort
Bitterfontein
Nuwerus
Onseepkans
Nous
Pella
Pofadder
Aggeneys
Augrabies
Loxtonvale
Keimoes
Kakamas
Louisvale
Kenhardt
Swartkop
Brandvlei
Loeriesfontein
50
100
150 km
BIOS DIVERSITAS
CONSULTANTS


Legend
Namakwa Regional Area
SEZ zoning
Sensitivity
Very High
High
Medium
Alexander Bay
Port Nolloth
Warmbad
Springbok
Pella
Pofadder
Upington
Kenhardt
Hondeklipbaai
Garies
Calvinia
NORTHERN CAPE
PIPELINE
RAIL
TX
National Context
50
100
150 km
BIOS DIVERSITAS
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## $GH_2$ take-home messages

- **Avoid** intact CBAs, threatened ecosystems, and key corridors for both technologies; these areas are essential for ground-dwelling mammals, reptiles, amphibians and invertebrates.
- Use wind in areas where some linear fragmentation is acceptable, and rigorously manage road layout, access control and speed to limit disturbance and roadkill.
- Use solar preferentially on **already-degraded or low-sensitivity land**, design permeable fencing and internal corridors, and retain/restore microhabitats to support reptiles, amphibians and invertebrate diversity.

## Planning & mitigation messages for $GH_2$ / sensitive systems

- **Avoidance first**: Route outside CBAs, wetlands, riparian buffers, dunes and key movement corridors for SCC wherever technically feasible.
- **Minimise new linear features**:
  - Re-use and upgrade existing corridors rather than creating new ones.
  - Bundle pipelines, roads and (where unavoidable) rail within a single, narrow corridor rather than multiple parallel alignments.
- **Maintain connectivity**:
  - Design and locate culverts, underpasses and at-grade crossings in line with known movement routes of priority mammals and amphibians.
  - Use permeable fencing or targeted fencing gaps in SCC movement hotspots.
- **Reduce mortality and disturbance**:
  - Speed limits, traffic management, and night-driving controls in sensitive sections.
  - Temporary trench escape ramps and daily inspections for pipelines during construction.
- **Protect microhabitats**:
  - Micro-align to retain rocky outcrops, pans, termitaria and vegetated drainage lines that are key SCC refugia.
- **Monitor SCC**:
  - Implement a pre- and post-construction monitoring programme to detect unforeseen impacts and adjust management.

## Opportunities

- Strategic landscape planning can *improve* connectivity
- Rehabilitation and restoration at scale
- Long-term stewardship and conservation finance
- Improved management of existing pressures
- Data, monitoring and knowledge generation
- Design innovation for “fauna-friendly” infrastructure
- Socio-ecological co-benefits that indirectly help fauna


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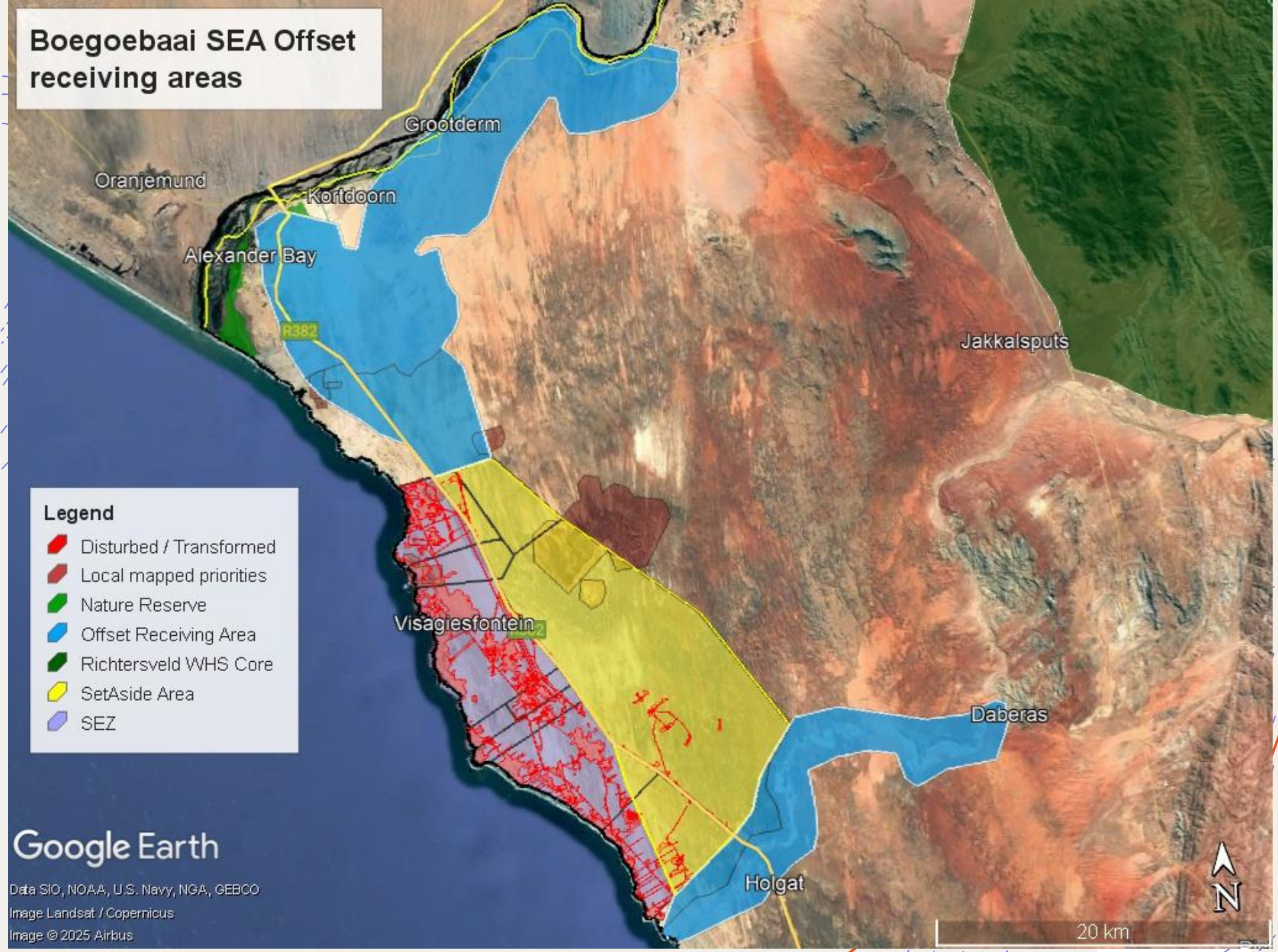
# BB GH2 SEZ SEA

## WP2 Biodiversity Offset framework for regional developments

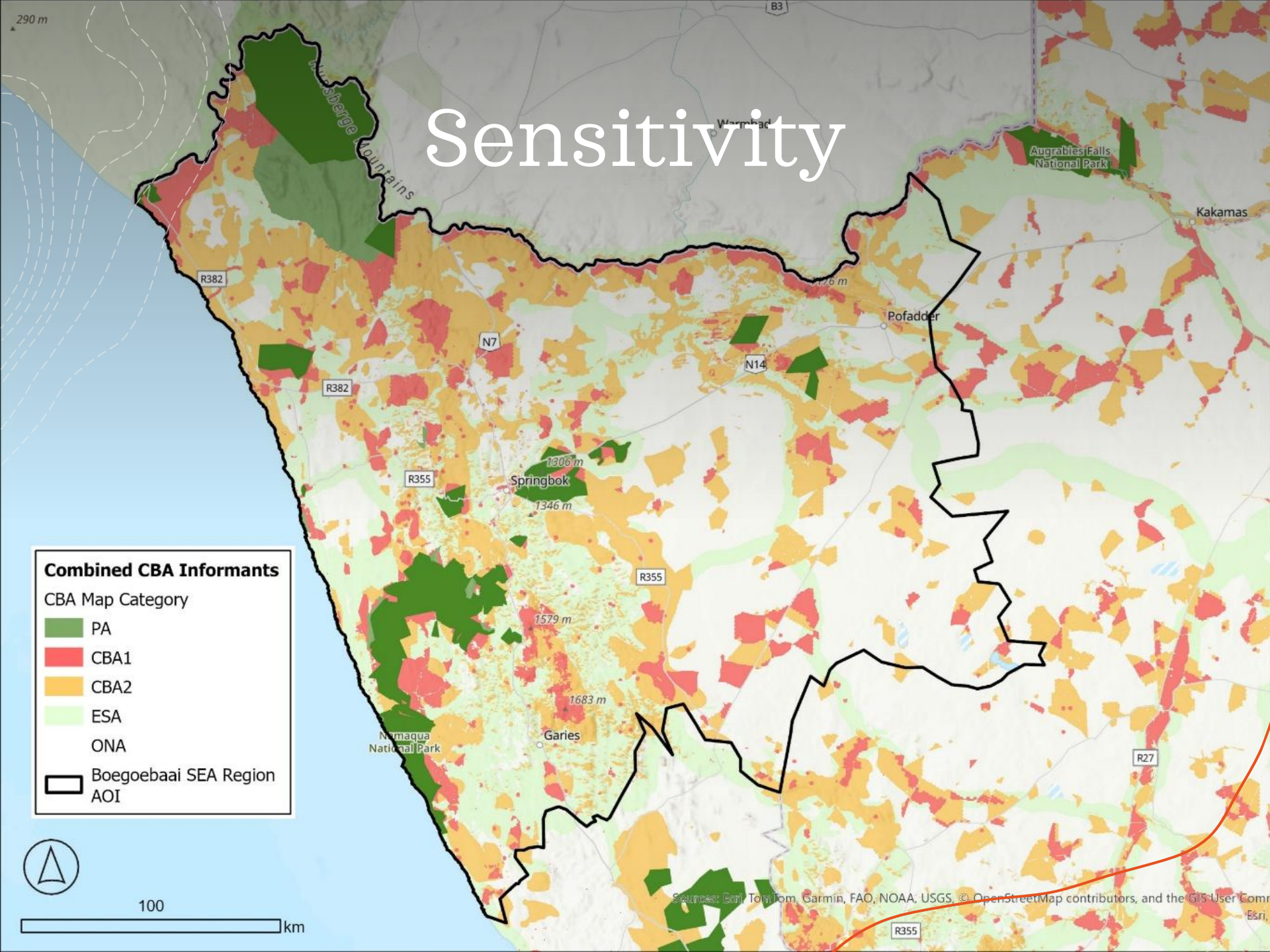
Mark@ecological.co.za


Boegoebaai SEA Offset receiving areas
Grootderm
Oranjemund
Kortdoorn
Alexander Bay
R382
Jakkalsputs
Visagiesfontein
Daberas
Holgat
Legend
Disturbed / Transformed
Local mapped priorities
Nature Reserve
Offset Receiving Area
Richtersveld WHS Core
SetAside Area
SEZ
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Image © 2025 Airbus
N
20 km

# Starting point & assumptions

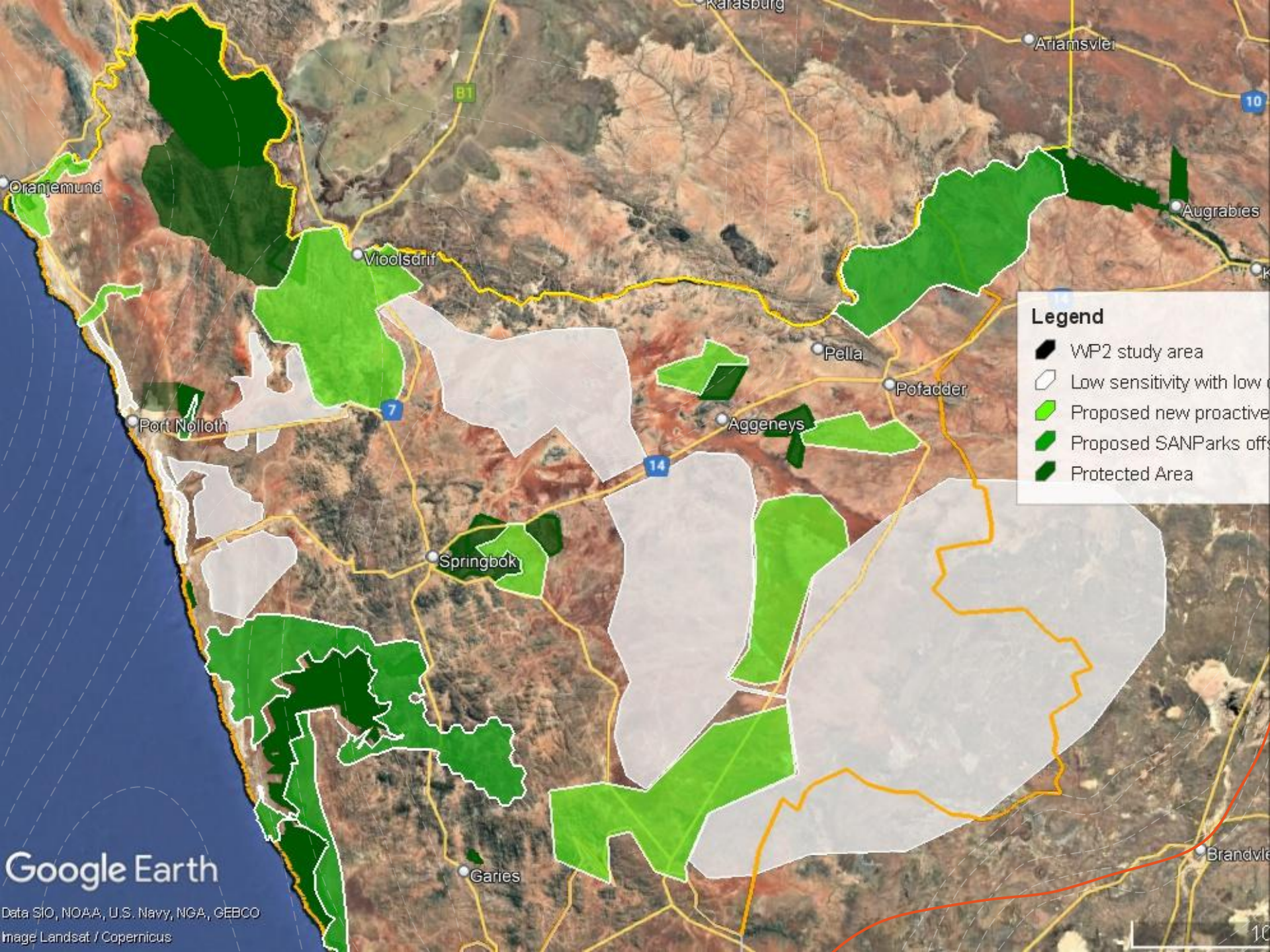
+ Only terrestrial ecosystems,
+ Generalist birds catered for by veg type offsets
+ Density of sensitive features (71% of WP2 area)
+ Existing EAs for RE projects insufficient, and need renewal
+ Impacts at >100 000 ha scale significant
+ Political will exists to resolve land, legacy issues to locate WEF along coast
+ Standard EMPr constraints possible – e.g. pole mount PV
+ 80% fixed, 20% flexible infrastructure need offsets
+ Offset framework realistic on institutional limits to establish & manage sites
+ GH2 Eligibility criteria favour cautious, well-mitigated impacts

# Sensitivity



# Implications …

- 80% fixed infrastructure on 16000 ha @10:1
- 20% flexible PV & WEF on 128 000 ha @ 2:1
- New, unplanned grid expansion + impacts
- Big GH2 Scenario = **183 000 ha** of offset sites
- Equivalent to creating a new Richtersveld and Namaqua Park combined…
- Small GH2 scenario = 40 000 ha
- 1m ha offset receiving sites identified
- Many impacts potentially > threshold (marine, birds, listed Ecosys) require ecological compensation **IF** authorised

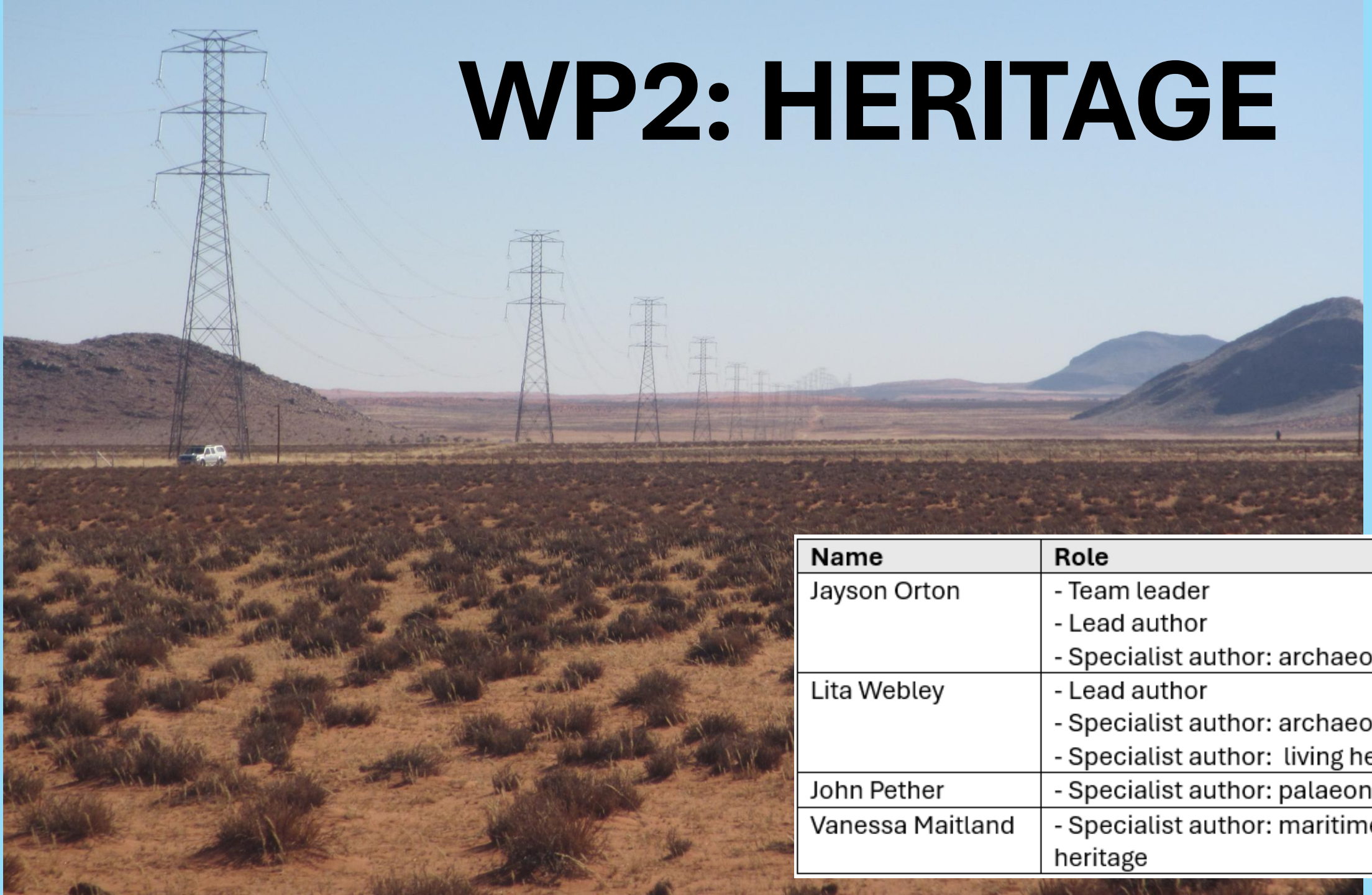

Karasburg
Ariamsvlei
B1
10
Oranjemund
Augrabies
Vioolsdrif
Pella
Pofadder
Port Nolloth
7
Aggeneys
14
Springbok
Garies
Brandvle
Legend
WP2 study area
Low sensitivity with low
Proposed new proactive
Proposed SANParks offs
Protected Area
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

| WP1 Local Feature/Priority* | Area (ha) | WP2 Regional Feature** | Area (ha) |
|---|---|---|---|
| Pagvlei-Grootderm-Brandkaros | 19 600 | NPAES surrounding Namaqua NP | 300 000 |
| Rooibank heuweltjies | 14 000 | NPAES Vioolsdrif-Steinkopf- | 200 000 |
| Swartbank heuweltjies | 3 500 | NPAES focus area Augrabies - Pella | 195 000 |
| Farm 1 (natural portion) NW of Kleinduin Section Richtersveld NP | 10 000 | NPAES focus area Vyftienmylseberg Kleinduin/ Richtersveld NP | 3 600 |
| Visagiefontein & Kop | 3 300 | Consolidate Goegap – Kangnas | 28 000 |
| Holgat river & catchment | 7 400 | Gamsberg Reserve Extended | 54 000 |
| | | Kliprand – Koa Valley | 200 000 |
| Total | ≈ 60 000 | Total | ≈ 990 000 |

# Conclusions

- Generic EMPr required for PV & WEF, e.g. no clearing
- Many ecosystems impacts are offsetable IF proactive, and done with landowners and authorities.
- May need to involve reduced grazing,
- Effective offsets should be proactive, in scheme, delivered by SEZ proponents & **NOT** at EIA stage
- Some impacts need Ecological Compensation – complex, risky, challengeable. Lender and market rules…
- Social compensation for lost livelihoods unclear
- Offset cost must be incorporated into economic viability calculus

# WP2: HERITAGE



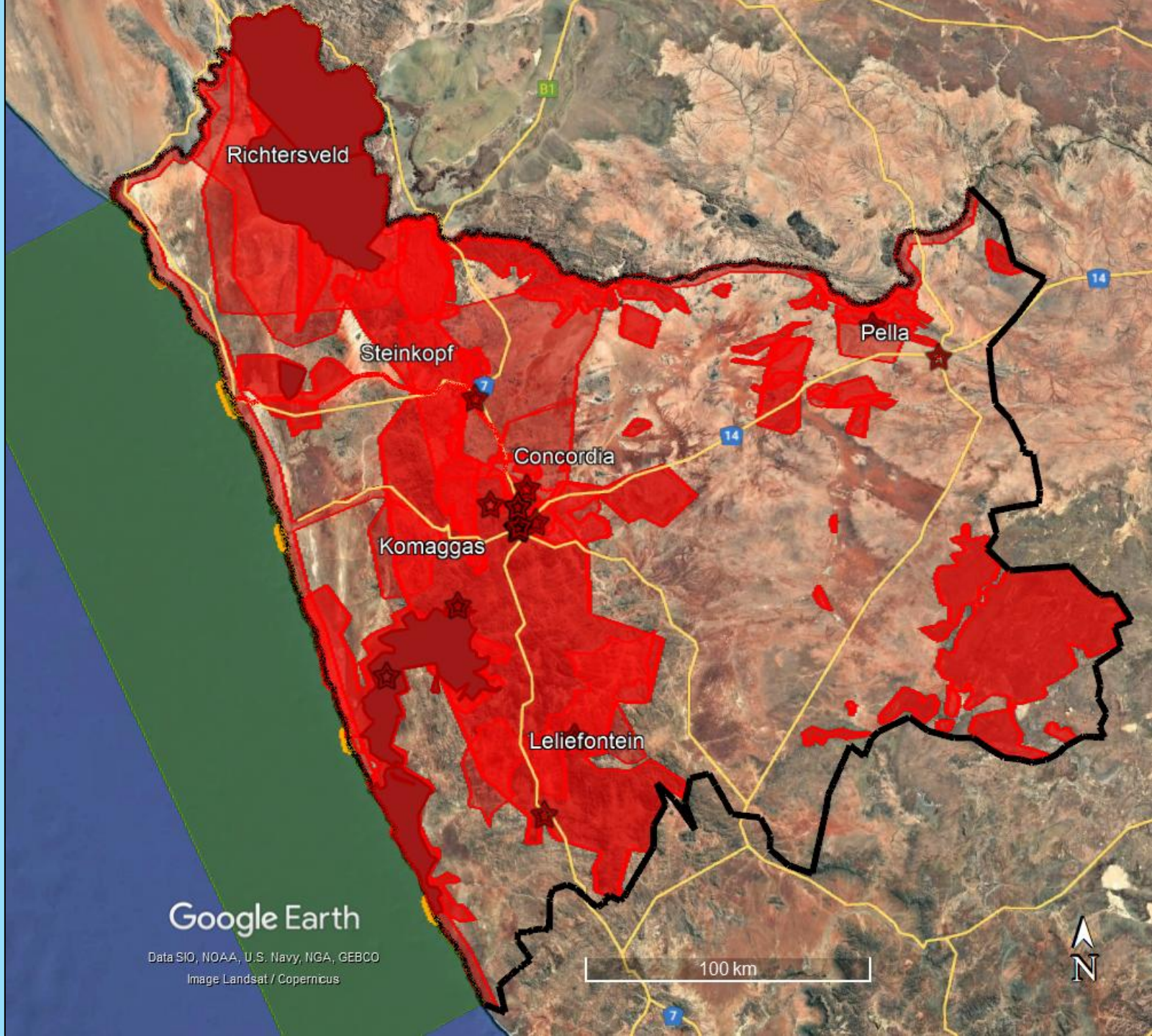
| Name | Role |
|---|---|
| Jayson Orton | - Team leader<br>- Lead author<br>- Specialist author: archaeology |
| Lita Webley | - Lead author<br>- Specialist author: archaeology<br>- Specialist author: living heritage |
| John Pether | - Specialist author: palaeontology |
| Vanessa Maitland | - Specialist author: maritime heritage |

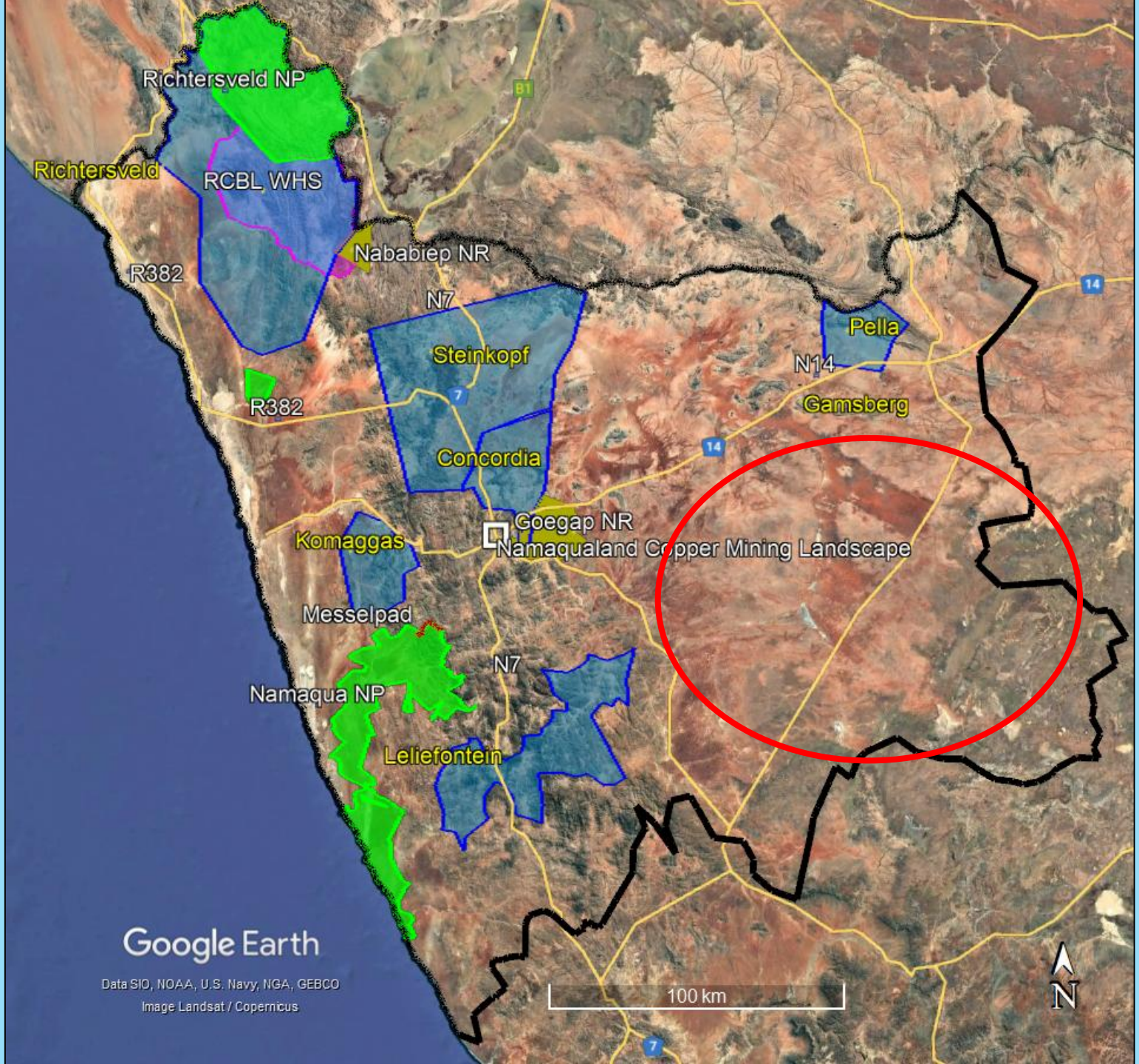
# SENSITIVITY OF RECEIVING ENVIRONMENT (combined heritage themes)

[Excludes visual]

Terrestrial: Only Very high and High sensitivity shown; the rest is largely low

Maritime: Only Medium and Low sensitivity occur






Least sensitive area overall (high for palaeontology only)

# PALAEONTOLOGY



V HIGH
HIGH
MOD
LOW
NOT SENS.
CLEAR = unclassified

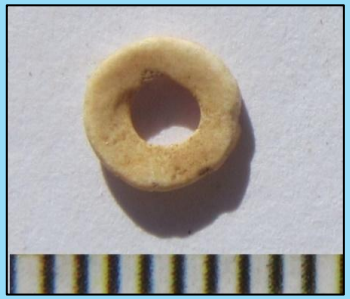
SAHRIS PALAEONTOLOGICAL SENSITIVITY MAP

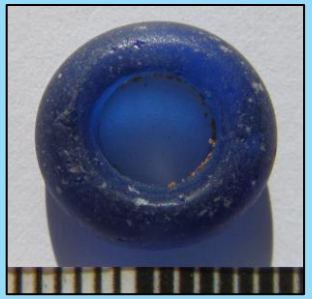
Renewable Energy Generation & Transport Infrastructure
STRATEGIC ENVIRONMENTAL ASSESSMENT - WP2 - NAMAKWA REGION

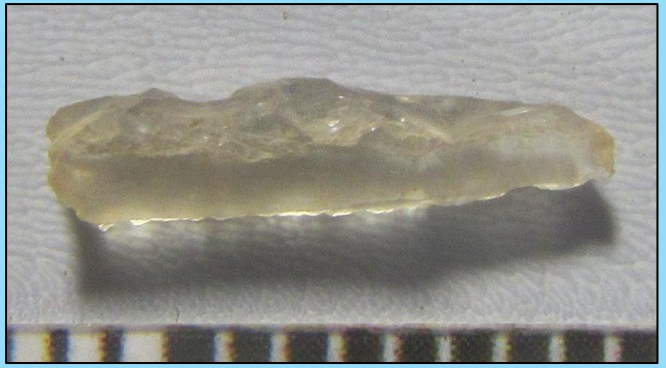
# GEOLOGICAL HERITAGE

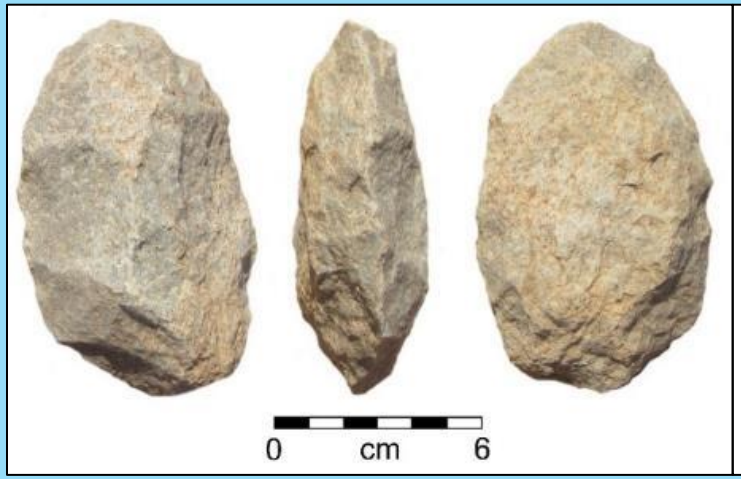
Orbicular granite

# ARCHAEOLOGY



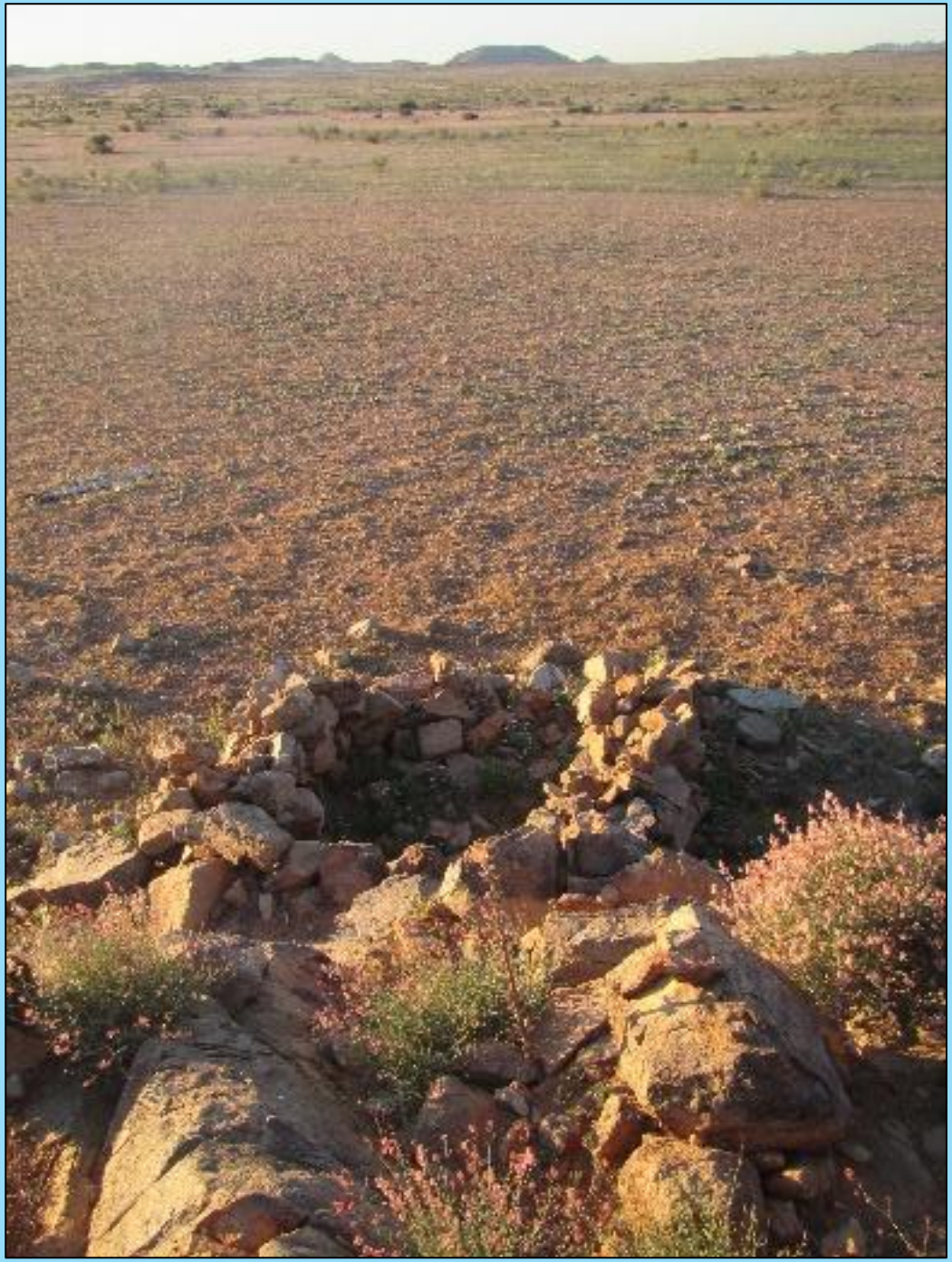


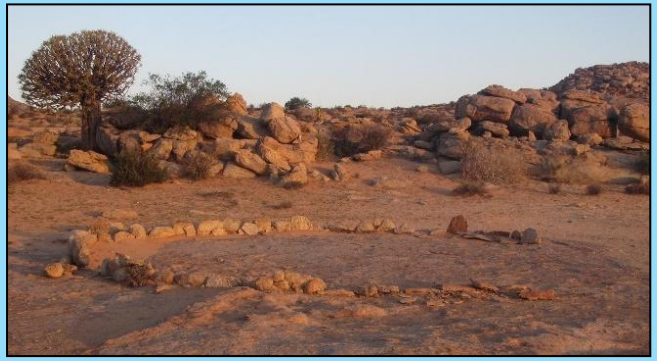




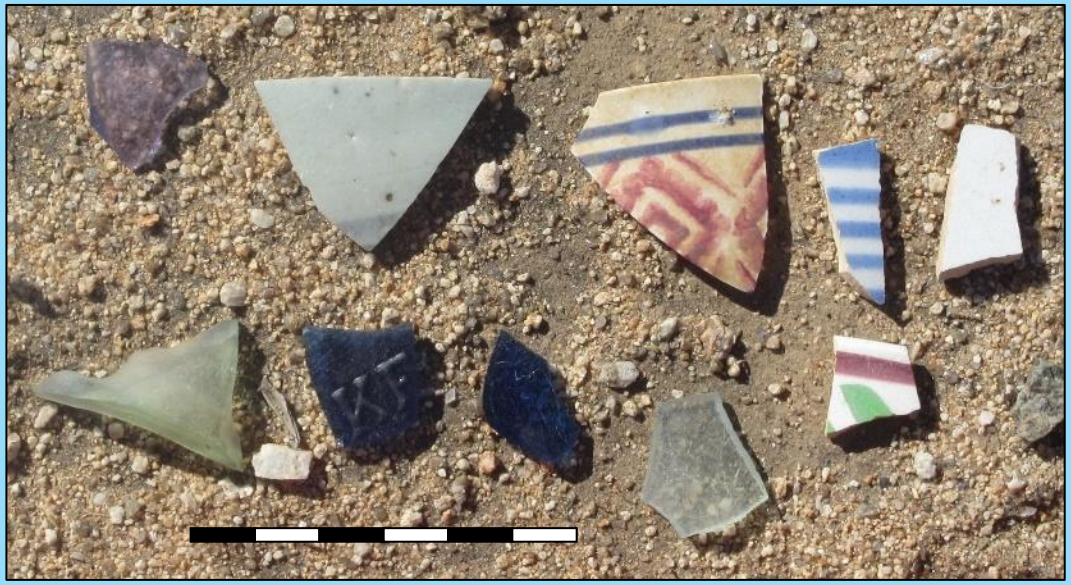
ATLAS
educational
"The bookshop where you save!"


1879
G.W.MEYER
EAU



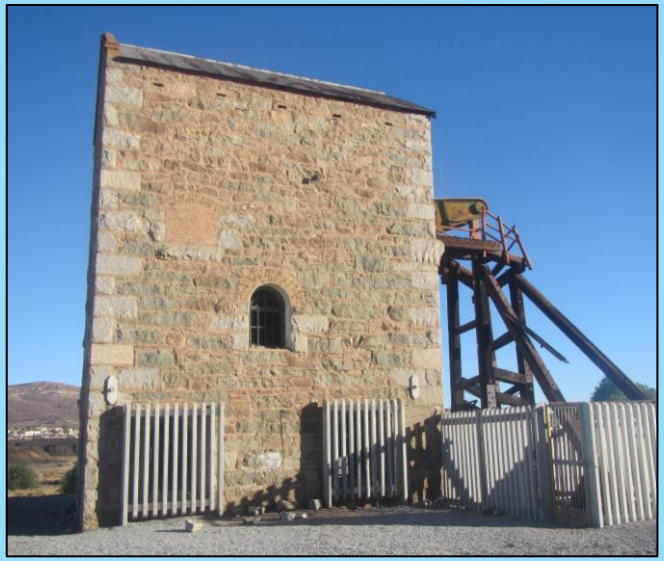


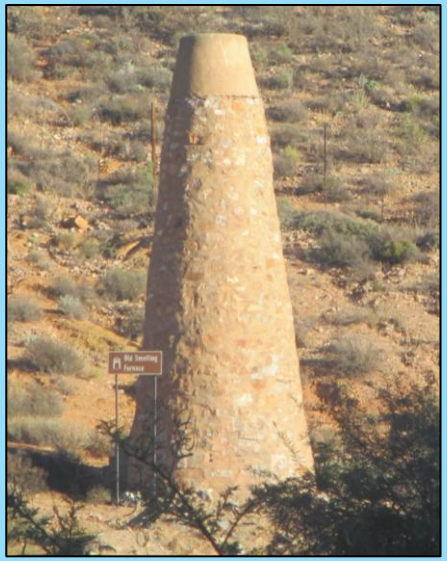

1 2 3 4 5 6 7 8

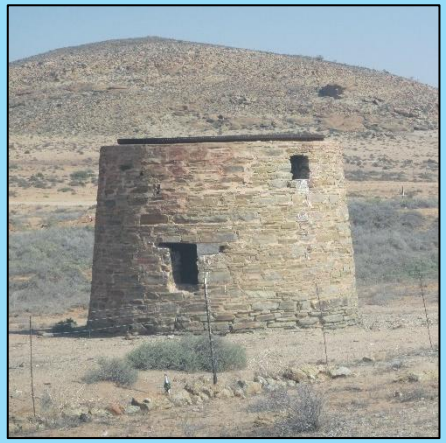


# BUILDINGS

# MINING

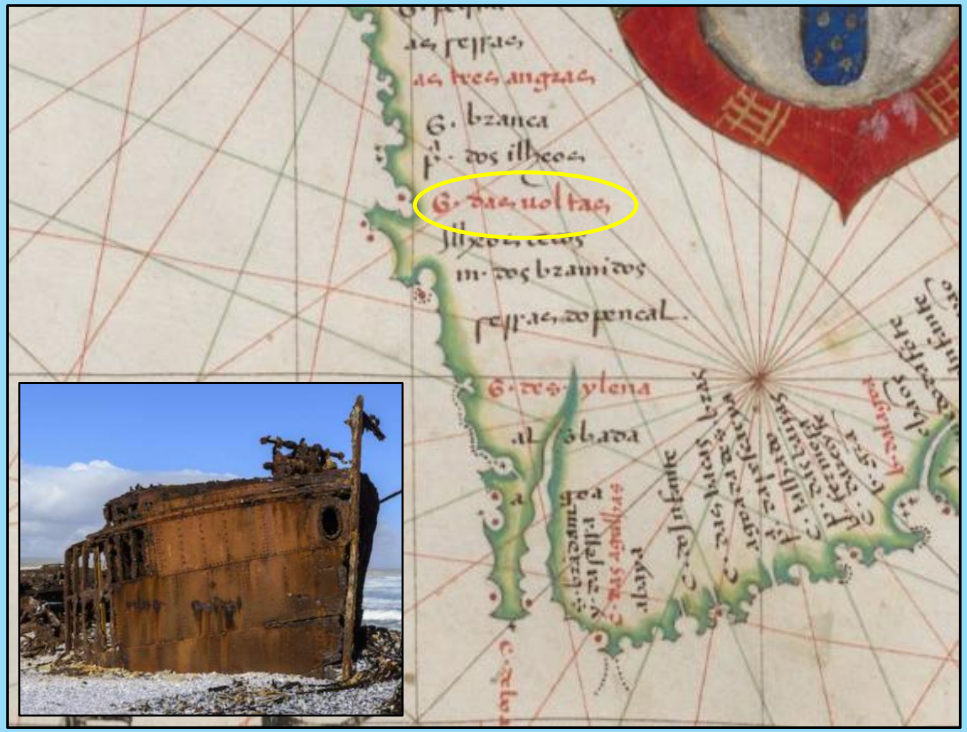




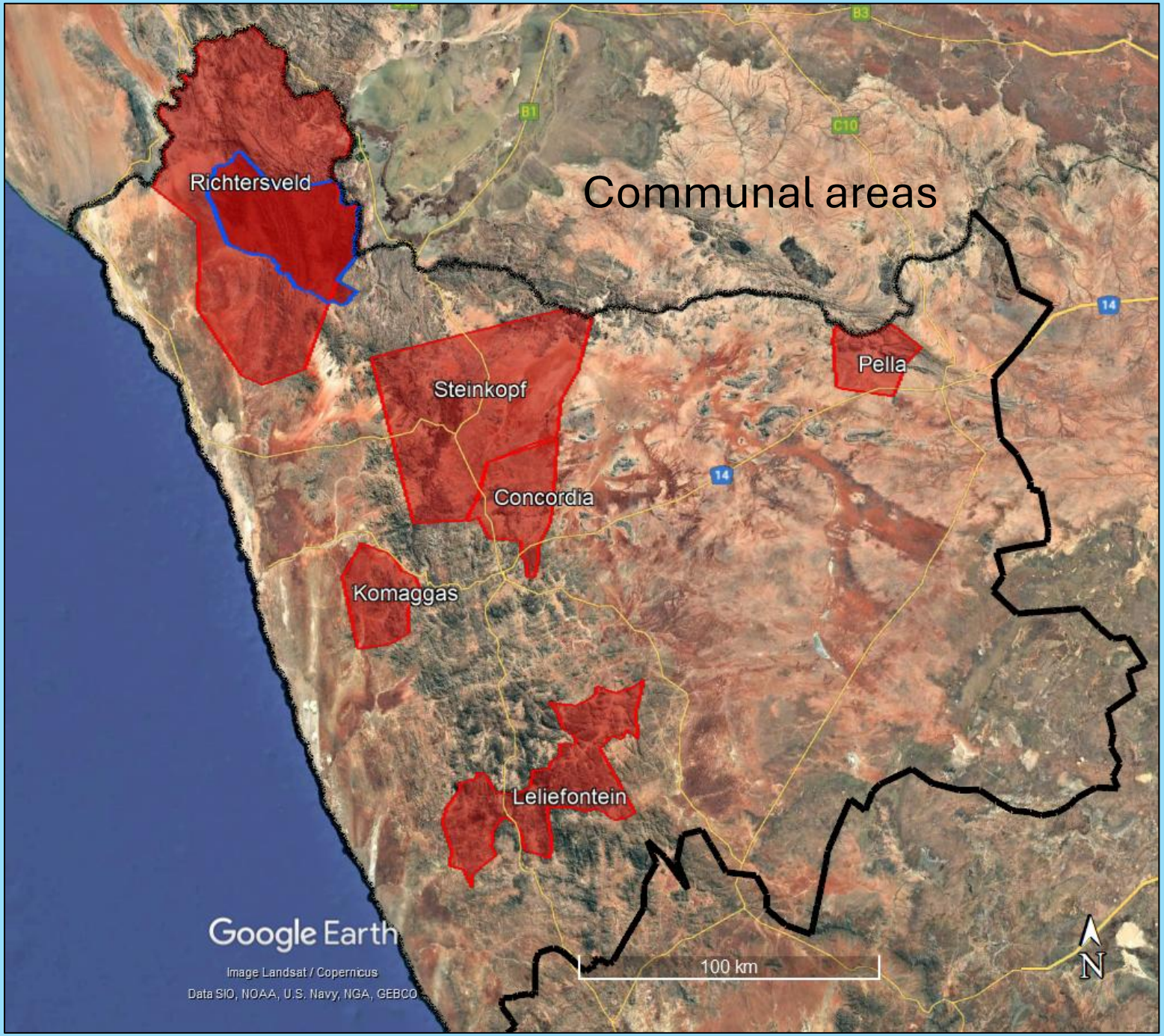


# GRAVES

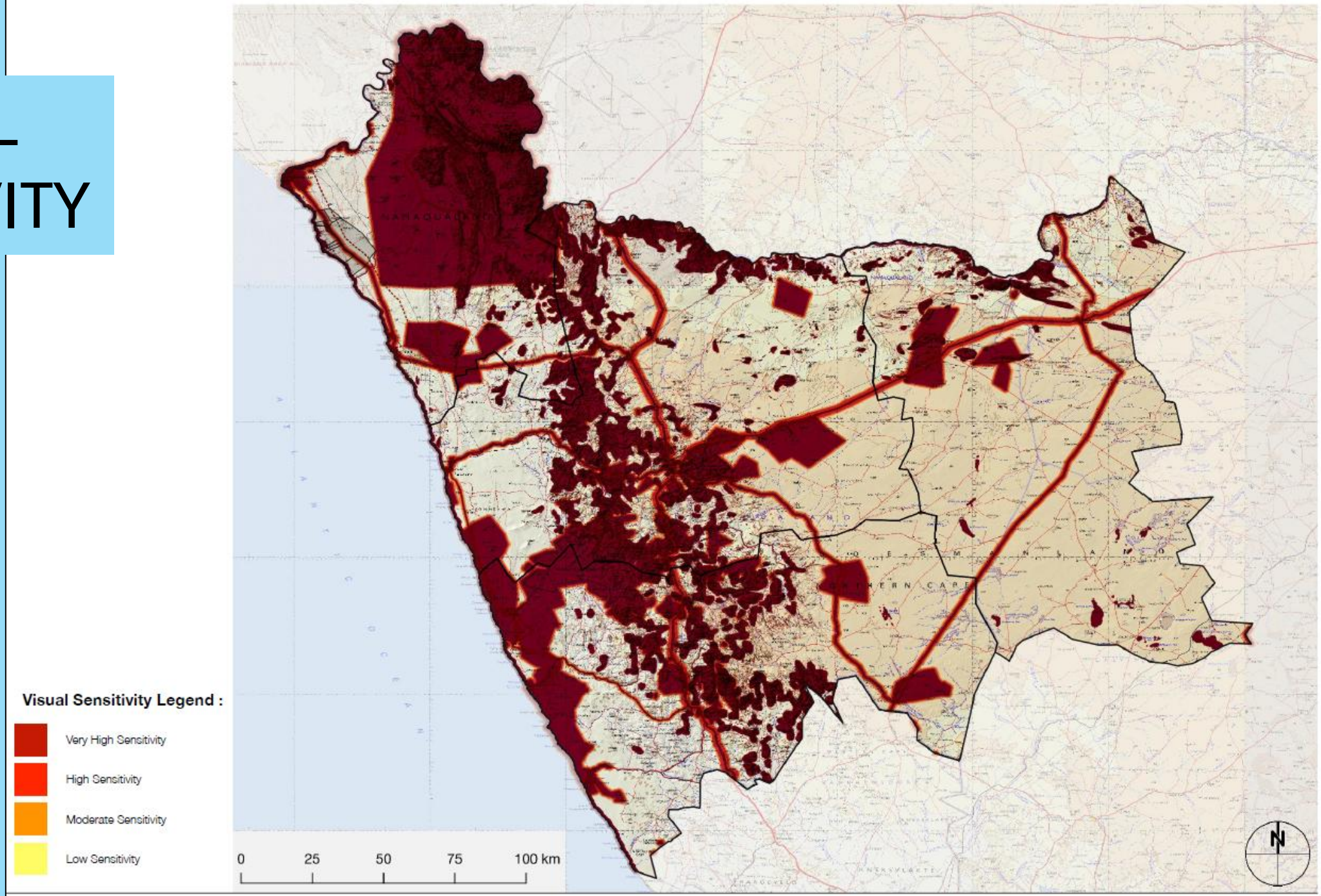
# MARITIME ARCHAEOLOGY



# LIVING HERITAGE



# VISUAL SENSITIVITY




**Namakwa :** Visual Sensitivity

*base map : CD NGI 1:500K Topographic Series 2714 Alexander Bay, 2718 Upington, 2916 Springbok*

# CULTURAL LANDSCAPES

NB: tourism value of landscapes

# RISK AND OPPORTUNITY ASSESSMENT

| Aspect | Risk (with management) | Opportunity (with management) |
|---|---|---|
| Palaeontology | Generally moderate (loss of fossils) | Generally low (gain in scientific knowledge) |
| Archaeology | Low to high (loss of archaeological sites) | Generally low (gain in scientific knowledge) |
| Maritime | Generally very low (loss of wrecks) | Generally very low (gain in scientific knowledge) |
| Graves | Moderate to high (loss of graves) | Moderate to high (identification and protection of graves) |
| Built environment | Very low to moderate (loss of historical structures and features) | Moderate to very high (conservation and restoration of historical structures and features) |
| Living heritage | Low to moderate (loss of land associated with living heritage) | Moderate to high (long term protection of land associated with living heritage) |
| Cultural landscape | Very low to high (visual intrusion into iconic/sensitive viewscapes) | Moderate to high (rehabilitation of existing impacts and avoidance/protection of iconic/sensitive viewscapes) |

# STRATEGIC MANAGEMENT ACTIONS

Project-specific evaluation during EIAs for all aspects of heritage.

PALAEONTOLOGY
- No areas requiring avoidance

ARCHAEOLOGY
- Mitigation & monitoring

MARITIME HERITAGE
- Possible magnetometer surveys

GRAVES
- Chance finds procedure

HISTORICAL & BUILT HERITAGE
- Restoration & adaptive reuse
- Buffering

LIVING HERITAGE
- Negotiate with herder/local communities

CULTURAL LANDSCAPES
- Buffering scenic routes
- Protecting iconic landscapes and views
- Consult SANParks, UNESCO, SAHRA and local tourism operators
- Avoid copper landscape
- Avoid parks, reserves and WHS

# STRATEGIC ENVIRONMENTAL ASSESSENT

FOR THE PROPOSED BOEGOEBAAI PORT, SPECIAL ECONOMIC ZONE AND BROADER NAMAKWA REGION

**November 2025**

## Work Package 2: Impacts on Integrated Spatial and Infrastructure Planning.


J. Maritz
Elsona van Huyssteen
Jabulani Jele
Nonjabulo Malinga
Michelle Audouin



science, technology & innovation
Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR
Touching lives through innovation
80th anniversary

# Report prepared

**Strategic Environmental Assessment - for the Boegoebaai Port, Special economic Zone and Namakwa Region**

**BOEGOEBAAI: IMPACTS ON INTEGRATED SPATIAL AND INFRASTRUCTURE PLANNING**

J. Maritz
Jabulani Jele
Nonjabulo Malinga
Elsona van Huyssteen
Michelle Audouin

Date: Aug 2025

Version 12



## Contents



### LIST OF TABLES



Report (reviewed) submitted Aug 2025.

# Approach:

Main Methodology

**Study components:**

1. Desktop & Literature research
2. Spatial information – GIS base
3. Engagements (limited)
4. Analysis

Reporting

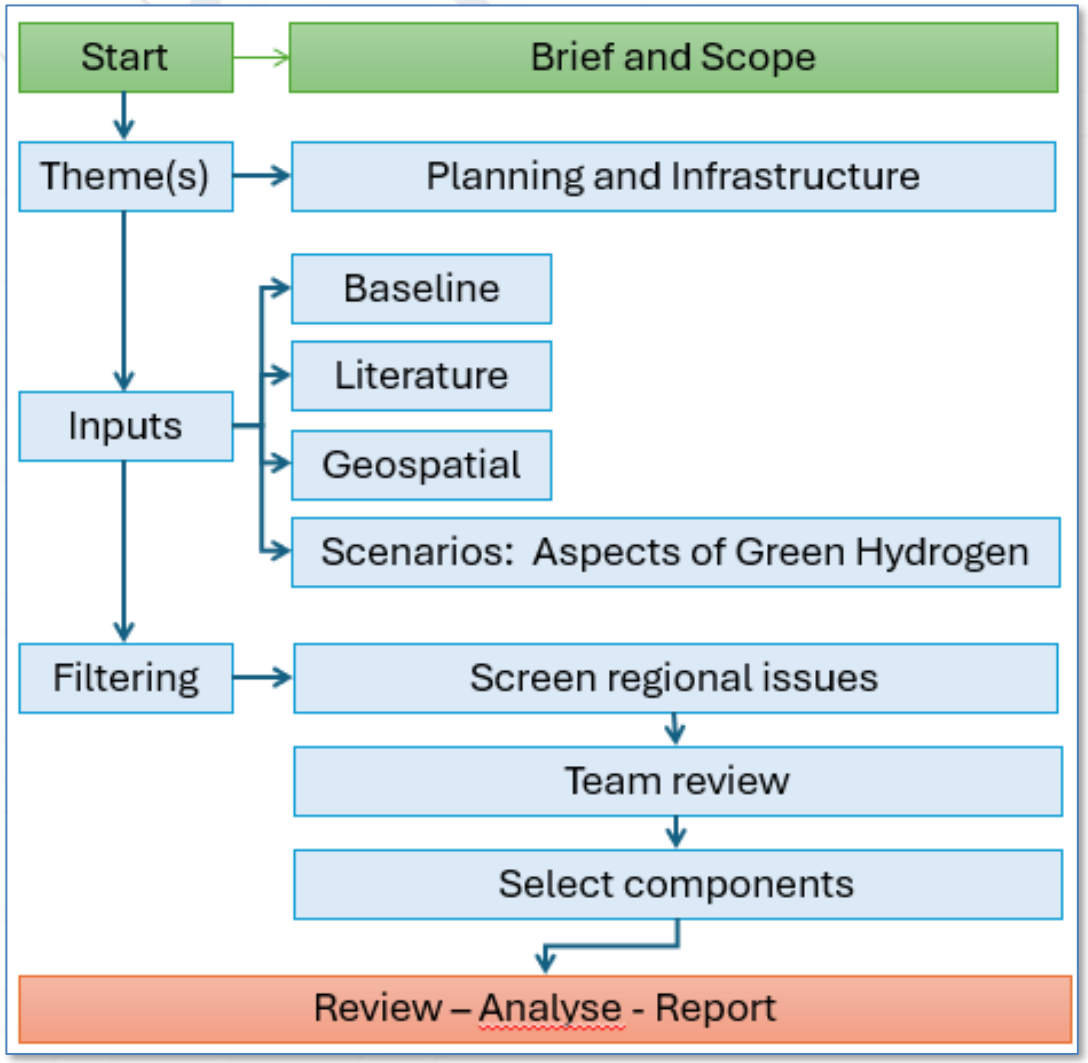
5. Reporting
6. Review of report
   (2 technical & 1 document reviewer)
7. Adjusted Report

**Spatial extent = Regional:**

1. Local municipalities (4x)
2. District municipality (1)
3. Consider issues beyond this extent


**Focus:**
Impacts on Integrated Spatial and Infrastructure Planning.

# Identify key impact themes:




- Planning issues and major infrastructure aspects informed components
- Timelines also affected some infrastructure (not all relevant from start)
- Scale also informed regional projects to be considered.

# Potential impacts and possible management

- Identified **three main** impact (themes)
- Describe **anticipated impacts** from proposed development across  a small and large GH2 growth path

1. **Spatial and Development Planning, land use management and governance**
2. **Settlement development and service delivery implications**
3. **Construction of large economic infrastructure projects**

→ **Generally described**

→ **Baseline (Status Quo)**

→ **Small GH2 Scenario**

→ **Big GH2 Scenario**

# Impact theme 1:
# Municipal Development planning and management

- **Baseline:** Existing planning demand is low. Current mechanisms such as the District Municipal Tribunal are sufficient for limited applications.

- **Small Green Hydrogen:** A sharp increase in land-use applications is expected, particularly in Richtersveld. Without new capacity, institutions will be unable to manage high volumes, and delays may arise from complex land ownership and CPA-related issues.
  - Risk severity: severe without mitigation.

- **Large Green Hydrogen:** Regional infrastructure projects (green energy, pipelines, new rail) will sustain high pressure across several municipalities. The risks remain severe if not addressed.
  - Risk severity: severe without mitigation; moderate with mitigation.

Nama Khoi and Kamiesberg **lack key management roles** such as Technical Managers and Project Management Unit (PMU).

Some municipalities - lack of essential planning staff, dedicated units, and geographic information system (GIS) personnel

# Impact theme 2:
# Settlement Infrastructure Development and Management

- **Baseline:** Limited growth is occurring, with incremental pressures in Pofadder, Aggeneys, and Springbok. Infrastructure conditions remain largely unchanged elsewhere.

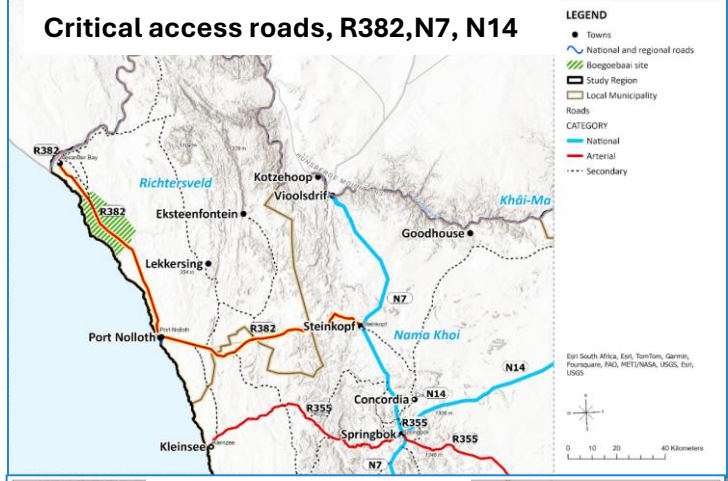
- **Small Green Hydrogen:** Settlement pressure will increase sharply, particularly in Port Nolloth and Alexander Bay, driven by construction workers, in-migration, and port- and SEZ-related activities. Social services and bulk infrastructure (water, sanitation, electricity) will be under significant strain.
  - Risk severity: severe without mitigation; moderate with mitigation.
- **Large Green Hydrogen:** Sustained demand across multiple towns, with Richtersveld and secondary towns facing high growth. Without intervention:  service breakdowns, informal settlement growth, and inequality risks rise.
  - Risk severity: severe without mitigation; moderate with mitigation.

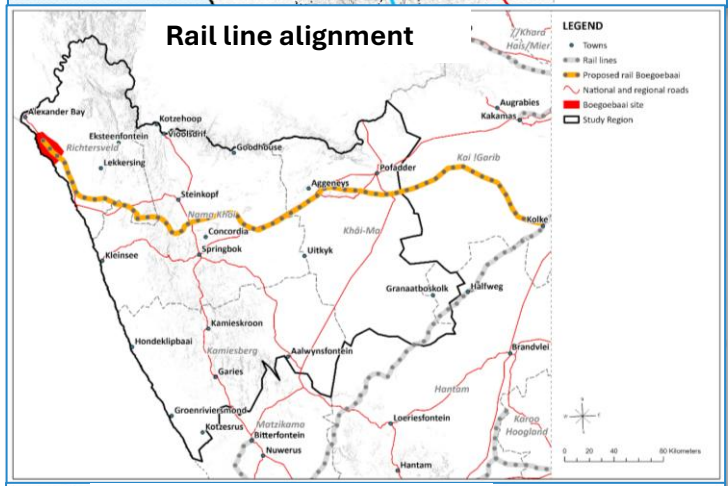
Alexandar Bay – maintenance and infrastructure challenges

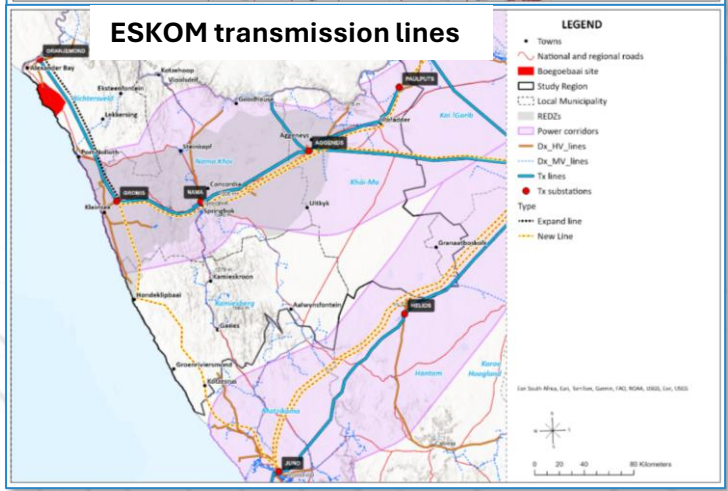

Gravel road access to small towns difficult

# Impact Theme 3: Construction of Economic Infrastructure

- **Baseline:** Roads (R382, N7, N14) currently experience low traffic volumes and routine maintenance.
  No pipelines or rail infrastructure are present, with only minor Eskom upgrades underway. No development a port/SEZ.
- **Small Green Hydrogen:** Multiple simultaneous projects (port, SEZ, pipelines, transmission, renewable energy) will create severe pressure on transport, land, and resource systems.
  Key risks include deterioration of the R382 from heavy vehicle traffic, high demand for construction materials and water, and accommodation of large construction workforces.
  - Risk severity: high to severe.
- **Large Green Hydrogen:** Risks escalate with additional rail and pipeline development.
  Land acquisition, servitude processes, and environmental impacts will be complex.
  Heavy traffic will further strain regional roads.
  - Risk severity: severe without mitigation; moderate with mitigation.



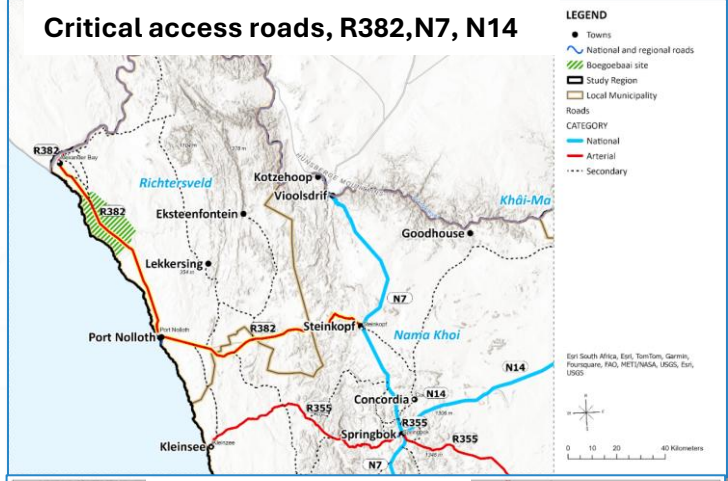



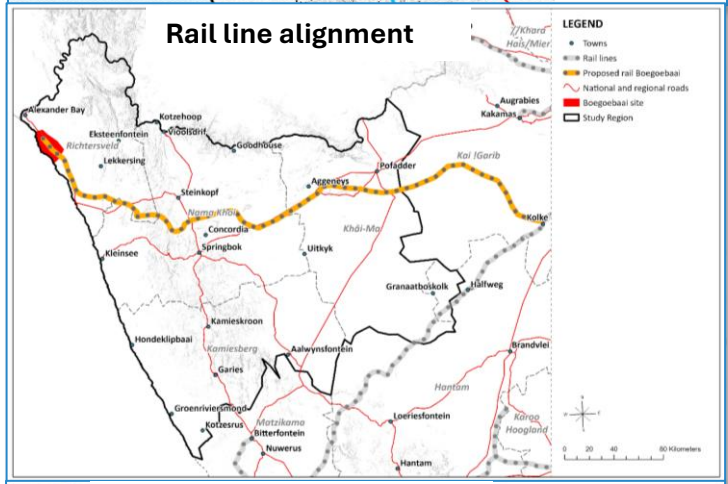



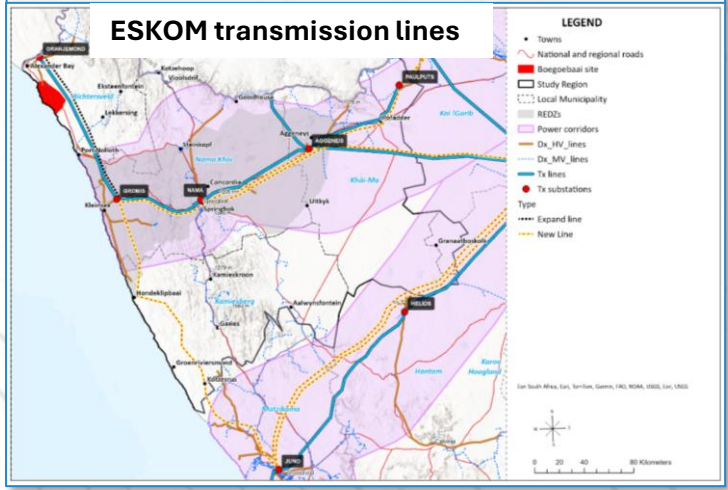
# Impact Theme 3:
# Construction of Economic Infrastructure

**List of projects under this theme:**

1. Port and SEZ
2. Road corridor (focus on the R382)
3. Pipeline corridor
4. Rail line
5. Transmission corridors
6. Green energy projects/corridors/sites



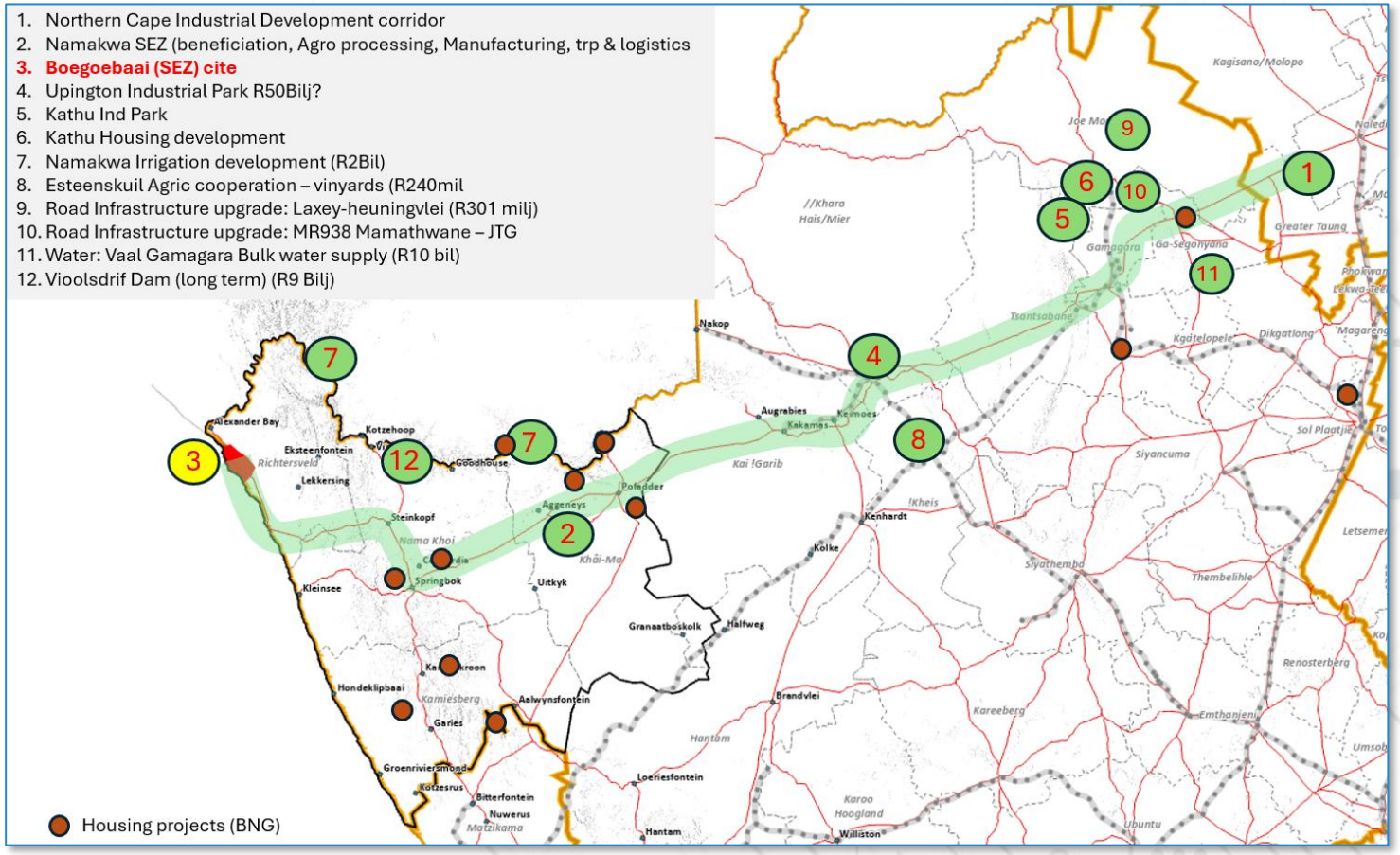



# Regional Development Opportunities

- **NCape OTP (2024)** lists all regional anchor projects, that can be significant and influence regional resources, skills demand & impact nearby settlements

- **NCape Industrial Corridor is a driver** and along has several projects
- Most significant **likely to affect the region** is
  - Vioolsdrift dam,
  - Namakwa Irrigation and
  - Namakwa SEZ



# Consider project timelines

- SEZ project involves multiple large infrastructure components – each requiring dedicated design, construction and operational phases
- Simultaneous projects putting pressure on settlement, roads,
- Project interdependencies – GE tied to GH2 production, R382 a critical shared infrastructure

*Table 4: Timeline for various critical infrastructure items.*

| Timeline | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | Up to 2050 | Notes: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Port Landside*[3] | Design | | Tender | Construction | | | *Operation* | | | | | | | | Richtersveld focus |
| External Road*[4] | Design | | Tender | Construction | | | *Operation* | | | | | | | | Richtersveld focus |
| Future Rail*[5] | Pre-planning and Planning | | | Design | | | Tender | Construction | | | | *Operation* | | | Wide regional impact |
| Future Pipeline Phase 1[6][7] | Pre-planning and Planning | Design | Tender | Construction | | | Operation | | | | | | | | Scenario 1 - Regional impact |
| Future Pipeline Phase 2 | | | | | | | Planning | Design | Tender | Construction | | | *Operation* | | Scenario 2 - Regional impact |
| Green Energy (S) Direct[8] | Pre-Planning | Planning | Design | Tender | Construction | | Operation | | | | | | | | Richtersveld focus |
| Green Energy (W) Direct[9][10] | Pre-Planning | Planning | Design | Tender | Construction | | Operation | | | | | | | | |
| Green Energy (Wheel)[11] | Pre-Planning | Planning | Design | Tender | Construction | | **Ongoing as separate projects in the region. Linked to Bidding cycle** | | | | | | | | Wide regional impact |
| Electrolizer[12][13] | Pre-Planning | Planning | Design | Tender | Construction | | *Operation* | | | | | *Planning -expansion* | | *Expand Electrolyzer* | Richtersveld focus |
| Desalination[14] | Pre Planning | Planning | Design | Tender | Construction | | *Operation* | | | | | *Planning -expansion* | | *Expand desalination* | Richtersveld focus |

1st Ship at Berth

# Risk Assessment

*Table 15: Risk associated with a negative impact.*

| Negative impact | Scenario | Spatial receiving environment / receptor | Without management | | | With management | | |
|---|---|---|---|---|---|---|---|---|
| | | | Consequence (-) | Likelihood | Risk | Consequence (-) | Likelihood | Risk |
| 1. Development Planning Pressure | S0: BASELINE | **Richtersveld** (Primary Receiver) | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY LIKELY | VERY LOW |
| | S1: SMALL GH2 | | DRASTIC | DEFINITE | VERY HIGH | MODERATE | DEFINITE | MODERATE |
| | S2: BIG GH2 | | SIGNIFICANT | DEFINITE | HIGH | MODERATE | DEFINITE | MODERATE |
| | S0: BASELINE | **Kamiesberg, Nama Khoi, Khai Ma** (Rest Of Region) | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | SIGNIFICANT | MORE LIKELY | HIGH | MODERATE | MORE LIKELY | MODERATE |
| | S2: BIG GH2 | | SIGNIFICANT | MORE LIKELY | HIGH | MODERATE | MORE LIKELY | MODERATE |
| | S0: BASELINE | **District, Province and National** (Incl. Agencies: NCEDA, COGSTA) | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | DRASTIC | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | SIGNIFICANT | DEFINITE | HIGH | MODERATE | DEFINITE | MODERATE |

| Negative impact | Scenario | Spatial receiving environment / receptor | Without management | | | With management | | |
|---|---|---|---|---|---|---|---|---|
| | | | Consequence (-) | Likelihood | Risk | Consequence (-) | Likelihood | Risk |
| 2. Settlement Infrastructure Development & Management | S0: BASELINE | **Richtersveld** (Alexander Bay And Port Nolloth) | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | EXTREME | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | EXTREME | VERY LIKELY | VERY HIGH | MODERATE | DEFINITE | HIGH |
| | S0: BASELINE | **Nama Khai** (Steinkopf and Springbok Settlement Cluster) | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | SIGNIFICANT | MORE LIKELY | HIGH | MODERATE | MORE LIKELY | MODERATE |
| | S2: BIG GH2 | | SIGNIFICANT | MORE LIKELY | HIGH | MODERATE | MORE LIKELY | MODERATE |
| | S0: BASELINE | **Khai Ma** (Poffadder And Aggeneys) | SIGNIFICANT | LIKELY | HIGH | MODERATE | LIKELY | MODERATE |
| | S1: SMALL GH2 | | SIGNIFICANT | LIKELY | HIGH | SLIGHT | LIKELY | MODERATE |
| | S2: BIG GH2 | | MODERATE | LIKELY | MODERATE | MODERATE | LIKELY | MODERATE |
| | S0: BASELINE | **Rest Of Settlements** | SLIGHT | LIKELY | VERY LOW | SLIGHT | LIKELY | VERY LOW |
| | S1: SMALL GH2 | | MODERATE | LIKELY | MODERATE | SLIGHT | LIKELY | LOW |
| | S2: BIG GH2 | | MODERATE | LIKELY | MODERATE | SLIGHT | LIKELY | LOW |

# Risk Assessment

| Negative impact | Scenario | Spatial receiving environment / receptor | Without management | | | With management | | |
|---|---|---|---|---|---|---|---|---|
| | | | Consequence (-) | Likelihood | Risk | Consequence (-) | Likelihood | Risk |
| 3. Construction of Economic Infrastructure Projects | S0: BASELINE | 1. Port & SEZ | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | EXTREME | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | DRASTIC | DEFINITE | VERY HIGH | MODERATE | DEFINITE | MODERATE |
| | S0: BASELINE | 2. Road Corridor (focus on R382) | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | EXTREME | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | SIGNIFICANT | LIKELY | LOW | MODERATE | UNLIKELY | LOW |
| | S0: BASELINE | 3. Pipeline Corridors | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | EXTREME | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | EXTREME | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S0: BASELINE | 4. Rail Corridor | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S2: BIG GH2 | | EXTREME | DEFINITE | VERY HIGH | SIGNIFICANT | DEFINITE | HIGH |
| | S0: BASELINE | 5. Transmission Corridors | SLIGHT | VERY LIKELY | VERY LOW | SLIGHT | LIKELY | VERY LOW |
| | S1: SMALL GH2 | | DRASTIC | DEFINITE | VERY HIGH | MODERATE | DEFINITE | MODERATE |
| | S2: BIG GH2 | | DRASTIC | DEFINITE | VERY HIGH | MODERATE | DEFINITE | MODERATE |
| | S0: BASELINE | 6. Green Energy Projects/ Corridors/Sites | MODERATE | LIKELY | MODERATE | SLIGHT | LIKELY | LOW |
| | S1: SMALL GH2 | | EXTREME | DEFINITE | VERY HIGH | SUBSTANTIAL | DEFINITE | HIGH |
| | S2: BIG GH2 | | DRASTIC | DEFINITE | VERY HIGH | MODERATE | DEFINITE | MODERATE |

# Positive Impact

*Table 16: Opportunity associated with a positive impact.*

| Positive impact | Scenario | Spatial receiving environment / receptor | Without management | | | With management | | |
|---|---|---|---|---|---|---|---|---|
| | | | Consequence (+) | Likelihood | Opportunity | Consequence (+) | Likelihood | Opportunity |
| 4. Settlement Infrastructure Development | S0: BASELINE | Port Nolloth and Alexander Bay | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | MODERATE | DEFINITE | MODERATE | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | MODERATE | DEFINITE | MODERATE | SIGNIFICANT | DEFINITE | HIGH |
| | S0: BASELINE | Steinkopf and Springbok cluster | SLIGHT | VERY UNLIKELY | VERY LOW | SLIGHT | VERY UNLIKELY | VERY LOW |
| | S1: SMALL GH2 | | MODERATE | DEFINITE | MODERATE | SIGNIFICANT | DEFINITE | HIGH |
| | S2: BIG GH2 | | MODERATE | DEFINITE | MODERATE | SIGNIFICANT | DEFINITE | HIGH |
| | S0: BASELINE | Pofadder and Aggeneys | MODERATE | MORE LIKELY | MODERATE | SIGNIFICANT | MORE LIKELY | MODERATE |
| | S1: SMALL GH2 | | MODERATE | MORE LIKELY | MODERATE | SIGNIFICANT | MORE LIKELY | MODERATE |
| | S2: BIG GH2 | | MODERATE | MORE LIKELY | MODERATE | SIGNIFICANT | MORE LIKELY | MODERATE |
| | S0: BASELINE | Rest of Settlements | SLIGHT | LIKELY | VERY LOW | SLIGHT | LIKELY | VERY LOW |
| | S1: SMALL GH2 | | SLIGHT | LIKELY | VERY LOW | SLIGHT | LIKELY | VERY LOW |
| | S2: BIG GH2 | | SLIGHT | LIKELY | VERY LOW | SLIGHT | LIKELY | VERY LOW |

# Mitigation recommendations - actions:

| Impact Theme: | Measures: |
|---|---|
| **1. Development planning and regulatory capacity** | 1. Establish a strengthened **planning support mechanism at district/provincial level** to manage high volumes of land-use applications<br>2. Build municipal planning capacity, including dedicated planners based in the region, to ensure effective processing and compliance, and<br>3. Develop clear, coordinated processes for securing servitudes and addressing communal land ownership disputes. |
| **2. Settlement Infrastructure Development and Management** | 1. Prioritise bulk service upgrades (water, sanitation, electricity) in Port Nolloth and Alexander Bay<br>2. Strengthen municipal financial viability and planning to manage settlement growth<br>3. Focus housing and service delivery in nodal areas to reduce informality and concentrate resources, and<br>4. Align social infrastructure investments (schools, clinics, waste facilities) with the settlement growth patterns. |

# Mitigation recommendations - actions:

| Impact theme: | Measures: |
|---|---|
| **3. Construction of Economic Infrastructure** | 1. Shorten maintenance cycles on the R382 and secure sustainable budgets for upkeep<br>2. Implement systematic monitoring of road conditions to enable timely intervention<br>3. Coordinate land acquisition and servitude processes across agencies (rail, pipelines, transmission)<br>4. Develop guidelines for construction camps in collaboration with municipalities to avoid overburdening local services, and<br>5. Monitor and plan for water demand associated with construction, including possible borehole use |

# Conclude

- Successful implementation of the Boegoebaai Port and SEZ development will require substantial **enhancements in municipal planning capacity**.
- The most acute pressures expected:
  1. Land-use planning capacity,
  2. Settlement services (particularly water and sanitation), and
  3. Transport/economic  infrastructure.

- With targeted mitigation, risks can be reduced to moderate, provided institutional, financial, and infrastructure measures are sequenced in advance of peak development phases.
- The scenarios highlight the importance of **early planning, coordinated land access, and investment in bulk services** as preconditions for enabling the Port and SEZ to drive sustainable regional development.

# Thank you

## STRATEGIC ENVIRONMENTAL ASSESSENT

FOR THE PROPOSED BOEGOEBAAI PORT, SPECIAL ECONOMIC ZONE AND BROADER NAMAKWA REGION

Work Package 2: Impacts on Integrated Spatial and Infrastructure Planning.

**November 2025**

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# Socio-economic and institutional chapter

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26 Nov 2025

# 4 different types of complexity

- The Port, the GH2 and the SEZ (different types of interventions)
- The time period – short, medium and long term
- Different spatial size (BB/Port Nolloth; Springbok; wider Namaqualand
- Types of impacts – direct, indirect, interventionist and unintended consequences

Four sectors: Macro-economics, Agriculture, Tourism, Institutional issues

# Goals of the study

1. Assess social sensitivity of local and regional receiving environments – tourism, agriculture, mining, macro-economics, institutions, social cohesion

2. Differential impacts on different subregions, e.g. urban/rural, distance from the projects

3. Identify strategic constraints, opportunities, options

4. Provide an integrated decision-making framework and suite of tools – different consultative approaches

# Macro-economic implications (generally pro-growth)

- Economic agglomeration near Boegoebaai and SEZ corridor
- Increase in property values
- Job creation and training in various sectors – *"wean dependence of agriculture"? Complex impacts*.
- CSI programme
- Business service diversification and multipliers – direct, indirect and induced effect
- Crucial importance of *multi-sectoral* port – mining, agriculture and commercial
- Boom effects (construction phases) and smaller "bust" effects after specific construction impacts
- Strong impacts on Port Nolloth and Springbok

# Expected Macro-impacts: GH2

- Local communities can benefit from GH2, e.g. as part of CSI
- Need GH2 distribution system (e.g. transport of fuel cells) – may benefit agriculture in the region
- May encourage relocation of firms to Boegoebaai area
- Need extensive training at post-school level
- Can promote local preferential procurement
- Desalination at GH2 plant may provide fresh water to communities
- Need disaster management skills
- Important regional partnership with Govt, private sector, universities etc

# Likely macro-economic impacts of SEZ

- Connect mining hubs – Aggeneys, Sishen, Postmasburg with Boegoebaai – agglomeration
- Robust regional institutional institutions
- Potentially massive negative impacts of **trucking** system – may destroy tourism in the northern Namaqualand; urgent need for mining ore transport by rail

# Social impacts

- Expected rapid in-migration of workers and work-seekers
- Negative social impacts – e.g. teenage pregnancies and crime
- Need massive expansion of health services to locals and workers in Port Nolloth area
- Food and housing prices will increase – exacerbate inequality
- Exacerbate social tensions and will need institutional development and intervention
- Increase housing backlog

# Tourism

- Already rapid tourism development and growth
- May be challenged and damaged by industrialisation and heavy road trucking
- Need strong focus on maintaining pristine, natural and heritage areas
- Need regional and urban planning to protect tourism
- Must upgrade Springbok airport to provide SCHEDULED commercial flights and car rental – will benefit both Boegoebaai and tourism

# Agriculture

- Not much increase in agricultural demand and production
- Intensive crop agriculture along Orange River can benefit from the harbour
- Potential tension of the project with extensive small-scale pastoral farming in Richtersveld – *trade-off of production vs purchase or rental income paid by project*
- Farmers may benefit from improved roads – if ore transport is done by rail –this will also prevent pollution and ore dust (e.g. EU requirements)

# Mining

- Stimulus to Vedanta Zinc mine near Aggeneys – intensify need for the harbour – and RAIL transport
- Copper prices likely to increase – more economic opportunity and can benefit from harbour and transport

# Institutional issues

- District Municipalities crucial facilitators – need increased technical and financial capacity – Namakwa DM fairly well established
- Local municipalities have variable capacity – Springbok LM improving rapidly
- Massive new challenges for municipalities – urban planning, infrastructure, housing, social facilities
- Tax bases will grow but need to be managed
- **Will need strong integrated regional planning organisation to co-ordinate all the sectors. Danger of institutional gaps between national, provincial and municipal, and SOEs.**

# Public participation and consultation

- Extremely contested due to historical factors – land claim, diamond mine closures, poor private sector and governmental responses
- Different professional facilitation approaches to consultation need to be assessed BEFORE government launches a PROPER consultation process

  = Problem-driven Iterative approach – joint discovery

  = Green Hydrogen Community Participation toolkit

  = achieving Free, Prior and Informed Consent (FPIC) – from mining sector
- Confusion between the SEA process and the future participation process
- Need a pre-negation scoping by a reputable and generally acceptable facilitator!

END

# RISKS (negative impacts) can be mitigated

1. Population shifts – in-migration
2. Pressure on municipal services – housing, water etc
3. Pressure on health services
4. Boomtown impacts (e.g. prostitution, family disintegration, etc)
5. Tourism (creation of industrial landscape)
6. Export agriculture
7. Municipal capacity – technical services
8. Municipal capacity – political engagement
9. Pressure on existing roads

# OPPORTUNITIES

- Job creation
- Skills development
- Regional broadband roll-out
- Expanded regional airport in Springbok

# CONCLUSION

Boegoebaai will create an industrial landscape.

With costs and benefits;

And with risks which can largely be mitigated,

But still *an industrial landscape!*

Deeply normative!

END