Work Package 1:

Strategic Environmental Assessment for the proposed Boegoebaai Port and Special Economic Zone

August 2025

SUMMARY FOR POLICYMAKERS

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List of acronyms and abbreviations

CBA	Critical Biodiversity Area
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ESA	Ecological Support Area
FPIC	Free, Prior and Informed Consent
GH_2	Green Hydrogen
Ha	Hectares
IFC	International Finance Corporation
KBA	Key Biodiversity Area
NBA	National Biodiversity Assessment
NCEDA	Northern Cape Economic Development, Trade and Investment Promotion Agency
NHRA	National Heritage Resources Act
NPAES	National Protected Area Expansion Strategy
PA	Protected Area
RCPA	Richtersveld Communal Property Association
SANBI	South African National Biodiversity Institute
SANEDI	South African National Energy Development Institute
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SPM	Summary for Policymakers
TNPA	Transnet National Ports Authority
PtX	Power-to-X

1. THE ORIGIN, SCOPE, PURPOSE AND METHODS OF THIS ASSESSMENT

Green hydrogen (GH_2), and its derivative Power-to-X (PtX) products, such as green ammonia and green methanol, could decarbonise the South African energy economy, generate new revenues, create jobs and skills, and facilitate a Just Energy Transition[1].

As part of South Africa's ambition to reduce its reliance on fossil fuels and become a player in the emerging GH_2 market, a substantial programme of greenfield infrastructure and development has been proposed in the Northern Cape consisting of three main components:

1. A new breakwater port[2] and port precinct 1 km north-west of the landmark called the Buchu or Boegoeberg Twins (hereinafter referred to as "Boegoebaai").

2. A mixed-use Special Economic Zone[3] (SEZ) located adjacent to the proposed Boegoebaai port.

3. A network of regional renewable energy generation facilities (wind and solar PV), electrical grid infrastructure, roads, pipelines and other GH_2 support infrastructure.

Box SPM 1: What is Green Hydrogen (GH_2) and Power-to-X (PtX) products?

GH_2 is a form of hydrogen fuel produced by splitting water into hydrogen and oxygen using renewable energy sources like solar or wind power. Unlike grey or blue hydrogen, it generates no greenhouse gas emissions during production. PtX is a broader concept that encompasses various technologies and processes (including GH_2) to convert electrical power, from renewable sources, into different forms of energy carriers, chemicals, or materials. This conversion enables the storage, transportation and use of hydrogen (Power-to-Hydrogen), synthetic fuels (Power-to-Liquid), and even chemicals (Power-to- Chemicals), broadening the scope of renewable energy applications, particularly crucial for industries and sectors where green electrification is challenging, such as heavy- duty transport, maritime shipping, and aviation ('hard-to-abate' sectors).

There are many different philosophical positions on what it means for something to be "green". "Green", as it is applied in the context of hydrogen production, is predominantly used in the narrow, reductionist sense, where the sole metric of greenhouse gas emissions is considered, meaning that a product is "green" when its upstream production inputs have been supplied exclusively by renewable energy with minimal, or no carbon emissions. The concept of "green" hydrogen thus excludes broader ecological and social aspects such as, for example, biodiversity conservation and equitable social beneficiation, making it a relatively weak concept from a sustainability perspective. In other words, "green" hydrogen is not necessarily "sustainable" hydrogen. For something to be "green", does not make it intrinsically good, sustainable or socially desirable, although obviously is can be good, sustainable and socially desirable, depending on the context, and how well projects are designed, constructed and operated.

[1] The Just Energy Transition is a South African policy framework for managing the shift from a high-carbon to a low-carbon, economy in a manner that advances socially equality and inclusivity (Presidential Climate Commission Report, 2022).
[2] A breakwater port is a type of harbor protected by an artificial offshore structure built to shield the port from the force of waves, currents, and storm surges
[3] Special Economic Zones (SEZs) are "geographically designated areas of a country set aside for specifically targeted economic activities, supported through special arrangements (that may include laws) and systems that are often different from those that apply in the rest of the country" (the DTIC, 2017).

A new greenfield port development and SEZ, plus the regional supporting GH_2 infrastructure, at the scales envisaged, will have many direct and indirect impacts on social and ecological receiving environments, both positive and negative. For this reason, a Strategic Environmental Assessment[4] (SEA) was initiated through a collaboration between the South African National Energy Development Institute (SANEDI), the Northern Cape Economic Development, Trade and Investment Promotion Agency (NCEDA), and Transnet National Ports Authority (TNPA). Given their experience in SEA[5], renewable energy, port and GH_2 planning, the Council for Scientific and Industrial Research (CSIR) were asked to play a coordinating role.

Box SPM 2: What is a Summary for Policymakers (SPM)?

A Summary for Policymakers (SPM) is a concise synthesis of the key findings which emerge from large, sophisticated science-policy processes – Strategic Environmental Assessment (SEA) being one example. SPMs are used to communicate and disseminate the current state of knowledge, based on the best available evidence, in an accessible style and language. While the primary target audience of an SPM is policymakers – in view of guiding evidence-informed decision-making – SPM contents are made widely available to all interested stakeholders, from the private sector to civil society. In this way, SPMs provide a platform for credible, publicly available evidence synthesis, helping to guide decision-making while making it more transparent and publicly accountable.

The purpose of the SEA is to guide strategic planning for proposed infrastructure development in and around Boegoebaai, as well as the broader Namakwa region of the Northern Cape. Readers must be reminded that SEA is not a decision-making process, in the same way that, for example, an Environmental Impact Assessment (EIA) is. The purpose of the SEA is to, in a transparent way, guide downstream planning and decision-making processes that may, or may not, occur over many years, if not several decades into the future. Integrating a variety of best practice science-policy processes, SEA should provide an evidence-based, cross-disciplinary perspective on the main opportunities and constraints associated with the proposed port and SEZ, within the broader context of large-scale, regional GH_2 development. Given the multiscale scope of the SEA, its processes and outputs were split between two Work Packages (Schreiner et al., 2025). Please note that only the findings from Work Package 1 are reported in this SPM (Box SPM 2) publication. Another SEA report and SPM will be developed for Work Package 2, and made publicly available to all stakeholders, in early 2026.

[4] A Strategic Environmental Assessment (SEA) is a systematic process used to evaluate the social and ecological consequences of proposed policies, plans, or programmes before they are adopted and implemented. It is a broader and more high-level science-policy process than an Environmental Impact Assessment (EIA), which is done for individual projects on a case-by-case basis. SEA is often used to inform and guide local scale planning and decision-making processes.

[5] CSIR is South Africa's leading national science and technology research organisation. It conducts cutting-edge research, development, and innovation to support the country's industrial development, environmental sustainability, and socio-economic progress. CSIR has played a foundational role in bringing SEA to South Africa since the mid-1990s and since then has been globally recognised for its leading contributions to SEA theory and practice.

1.1 Work Package 1

Work Package 1 focused on developing a local-scale SEA report concerned with assessing the social and ecological sensitivities of the receiving environment (Table SPM 1), at relatively high resolution (often including fieldwork), around the proposed port and SEZ development, covering a spatial scale of approximately 33 500 hectares (ha). This was undertaken with the intention of guiding local-scale feasibility studies (especially for the proposed port) and future decision-making processes, like EIAs and other planning exercises. The spatial focus of Work Package 1, within the broader regional context, including competing land use trends, is provided in Figure SPM 1.

Box SPM 3: The contents of Work Package 1

Work Package 1 consists of seven chapters drafted by thirty-five authors, peer reviewed by eight independent peer reviewers, and includes contributions from various stakeholders involved in the process via a formally constituted Working Group.

The Work Package 1 chapters are as follows:

1. Introduction and Context Setting (Schreiner et al., 2025)
2. Marine ecology (Clark et al., 2025)
3. Terrestrial and inland aquatic ecology (van Rooyen et al., 2025)
4. Biodiversity offset framework (Botha, 2025)
5. Heritage (Orton et al., 2025)
6. Fisheries and coastal livelihoods (Gammage et al., 2025)
7. Sustainable port planning (Taljaard & Weerts, 2025)

Table SPM 1: Calibration of sensitivity categories for ecological receiving environments across the Work Package 1 study area

Category	Description
VERY HIGH	Highly vulnerable to disturbance with little/no capacity for recovery. Includes endangered species, critical habitats, heritage/social resources, or ecosystems with very narrow tolerances for change.
HIGH	Sensitive to ecological and social change but with better recovery potential. Lower concentrations of endangered species, critical habitats, heritage resources, or ecosystems with some tolerance for change.
MODERATE	Some resilience to stress or change. Systems can absorb moderate impacts without long-term harm, or irreversible loss. Includes adaptable species, less valuable social/cultural resources and moderately sensitive habitats.
LOW	Likely already severely degraded by past disturbance, or higher adaptive resilience and low vulnerability. Includes widespread social resources, ecosystems or species with broad ecological niches and high regenerative capacity.
TRANSFORMED VEGETATION	Plant communities that have been adversely altered from its expected original state by past human activities and environmental change.
EXISTING ANTROPOGENIC DISTURBANCE	Areas where human-built features (e.g. buildings, infrastructure, tracks and roads) and physical disturbance (e.g. mined areas, tailing heaps, stock posts) currently exists or are visible in the landscape.

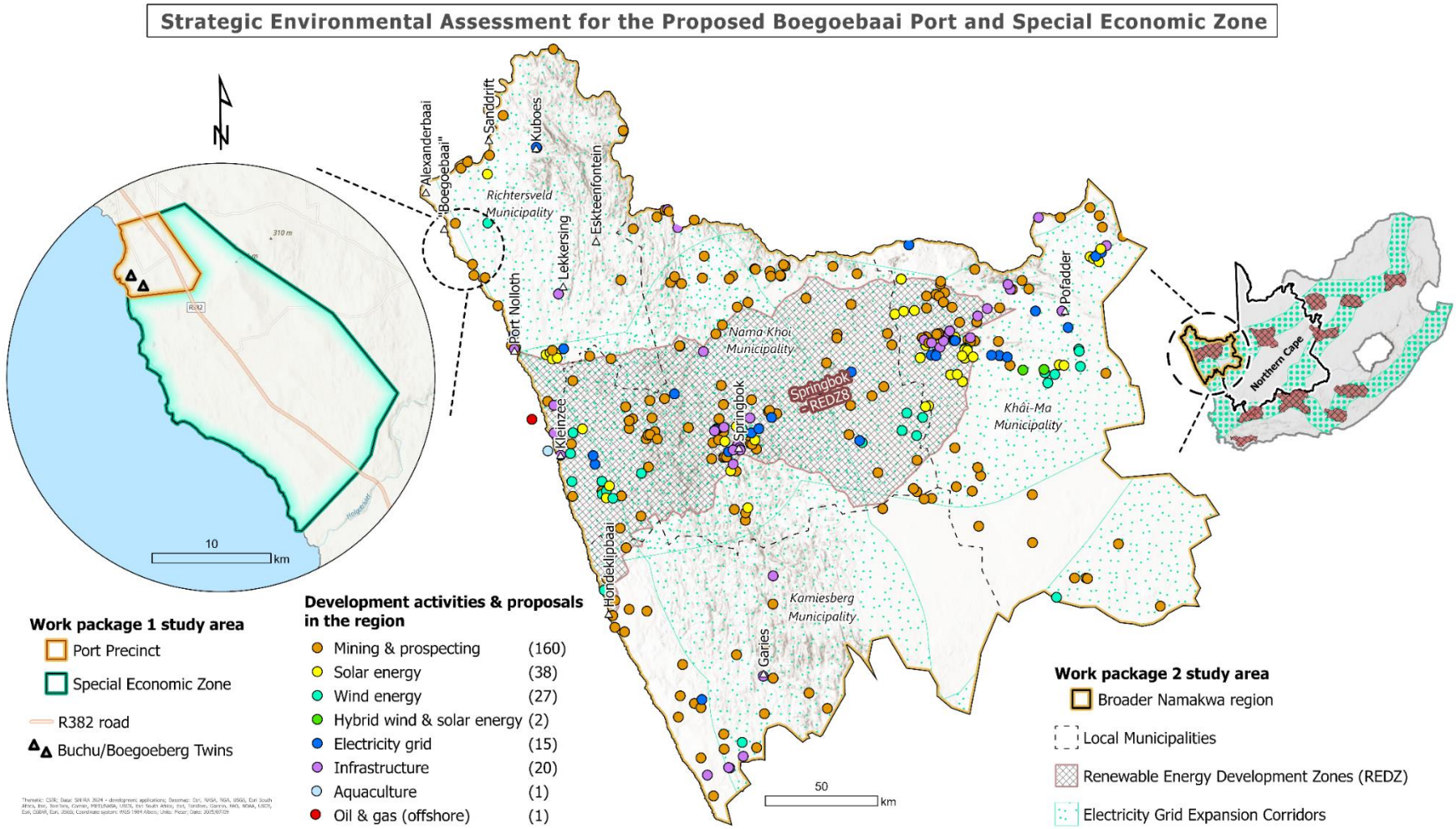


Figure SPM 1: The proposed Boegoebaai port and SEZ (Work Package 1 study area) are located in the Richtersveld Local Municipality, Namakwa District, of the Northern Cape Province. Economic activities include widespread mining and prospecting. Between Port Nolloth and Alexander Bay, including the land to the west of the R382 where to port and SEZ are proposed, has been mined for diamonds for over a century. A renewable energy sector is also emerging with established Renewable Energy Development Zones (REDZ) and Electricity Grid Infrastructure (EGI) Corridors.

Within the 33 500 ha port and SEZ area (inclusive of a proposed conservancy area adjacent to the port precinct), ten development zones have been proposed by policymakers, allocated as follows Figure SPM 2):

- **Zone 1:** Port Precinct - 2 187 ha
- **Zone 2:** Conservancy area – 1 170 ha
- **Zone 3:** Confirmed green ammonia facility – 4 508 ha
- **Zone 4:** SEZ Phase 1 – 499 ha
- **Zone 5:** SEZ Phase 2 – 411 ha
- **Zone 6:** SEZ Phase 3 – 833 ha
- **Zone 7:** Future green hydrogen facility – 3 713 ha
- **Zone 8:** Future expansion 01 – 3 408 ha
- **Zone 9:** Future expansion 02 – 15 067 ha
- **Zone 10:** Future tank farm – 1 704 ha

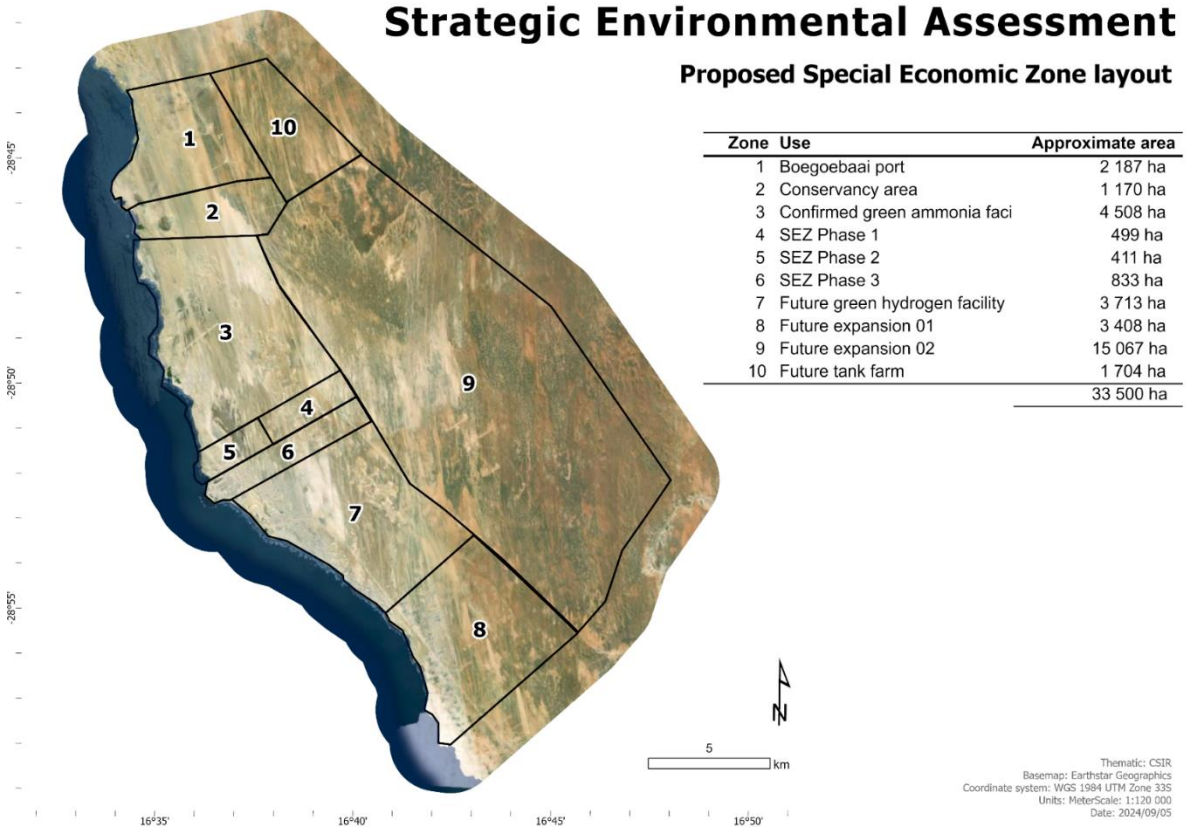


Figure SPM 2: The port footprint of the proposed Boegoebaai Port and phases of the proposed SEZ (Zones 1 – 10)

Zone 1, the Port Precinct, is designed as a new breakwater port, with Phase 1A accommodating a two-berth jetty for bulk liquid (ammonia, diesel oil), dry bulk (iron ore, manganese), and assorted break bulk cargo (lead, zinc), alongside essential infrastructure like storage tanks, conveyor systems, multi-purpose and dry bulk terminals, and administration buildings. Long-term plans for Phase 1B envision extended breakwaters, additional multi-purpose and liquid bulk berths, a container terminal, and a ship repair yard, along with rail connections. **Zone 2** is a Conservancy area, approximately 1 170 ha, specifically designated for the protection of conservation priorities, including the Boegoeberg koppies, a Cape fur seal colony, and an archaeological site. **Zone 3**, the Confirmed Green Ammonia Facility, will house a large-scale green hydrogen and ammonia production facility with an initial 5 GW electrolyser capacity by 2030, supported by

a 188 ML/day desalination plant, water treatment units, and storage tanks for hydrogen, oxygen, and ammonia. **Zones 4**, **5**, and **6** form the SEZ Industrial Park, intended for mixed-use purposes, manufacturing, logistics, warehousing, and offices, and will include a 2.7 ML/day desalination plant for its own use and for distribution to Port Nolloth. **Zones 7**, **8**, and **9** are designated as Future Green Hydrogen Facilities and Future Expansion Areas, planned for the replication of green hydrogen and ammonia production facilities, mirroring the initial setup in **Zone 3**. Zone **10** is identified as a Future Tank Farm, a proposed area of approximately 1 704 ha inland of the R382 road for additional storage.

Box SPM 4: The multi-author team model

A multi-author team, in the context of SEA refers to a structured, pluralistic authorship model designed to integrate diverse perspectives and expertise across an assessment process. For the Boegoebaai SEA, multi-author teams were constituted through a consultative process with the Working Group (which included representatives from government, academia, NGOs, and other stakeholders) to nominate researchers who possess the required niche knowledge of this remote region, along with an understanding of strategic infrastructure impacts, academic credibility, and expertise in high-level strategic assessments.

Multi-author teams were assembled for Work Package 1 and asked to develop peer reviewed reports identifying the key sensitivities and impacts associated development at the scales proposed. The summaries of these findings are communicated in Section 2 of this SPM. In addition to the multi-author teams (which, in part, function as a method of diversifying participation), wider participation was facilitated through a formally mandated project Working Group (Box SPM 5).

Box SPM 5: The SEA Working Group

The Working Group is a multi-sectoral team of experts drawn from national, provincial, and local government departments, state agencies, academic and research institutions, non-governmental and community-based organisations, as well as industry and the private sector. Its purpose is twofold: to provide expert input throughout the SEA process; and to act as an information conduit, with members acting as links between their constituencies and the SEA, facilitating two-way communication, transparency, and inclusive engagement throughout the assessment.

Stakeholder engagement was also a key part of the SEA, for both Work Packages. In the context of Work Package 1, to date, this has included the dissemination of accessible information via the SEA website, local notices/posters, newspaper adverts, radio interviews and formal Working Group meetings. Additional Working Group sessions and in-person public briefings are planned across seven locations, where draft SEA findings will be presented and direct community input will be encouraged through these consultation sessions.

1.2 Work Package 2

This regional-scale SEA report is currently nearing completion (end-2025) and will cover the main sustainability issues associated with an expansive Northern Cape GH_2 economy, assessed more strategically from the perspective of cumulative risk and opportunity, but at a lower resolution than Work Package 1. Work Package 2 does not include any fieldwork.

The spatial scale of Work Package 2 covers parts of the Namakwa District, delineated by the Richtersveld, Nama Khoi, Kamiesberg and Khâi Ma Local Municipalities. Work Package 2 will, in a highly structed risk/opportunity framework, assess the magnitude of impacts at regional scale across various future scenarios. Work Package 2 will seek to guide local and regional planning, through processes like Spatial Development Frameworks (SDFs), Integrated Development Plans (IDPs) and Environmental Management

Frameworks (EMFs), obviously including any EIA processes that may be undertaken in the region. The strategic issues covered in Work Package 2 include ecology, biodiversity and conservation planning (including biodiversity offsets), water resources and aquatic ecology, heritage, infrastructure and planning, and socio-economic impacts.

Table SPM 2: Summary of the SEA Work Packages across different spatial scales, methods, and data collection practices.

	Work Package 1	Work Package 2
Spatial scale	Local (33 500 ha) covering the extent of the proposed port and SEZ.	Regional (>5 million ha) across four Local Municipalities, including the 33 500 ha extent covered by Work Package 1.
Methods	High resolution determination of receiving environment sensitivity with a view to practicing avoidance (top of the mitigation hierarchy).	Determination of the cumulative social and ecological impacts of a regional expansive GH_2 economy across development scenarios.
Resolution	Fieldwork, coupled with desktop reviews (peer reviewed and grey literature) and other sources where necessary (e.g., interviews).	Desktop reviews (peer reviewed and grey literature, interviews etc.) and other publicly available data and sources.

2. KEY FINDINGS FROM WORK PACKAGE 1

The key findings from the independent, peer reviewed specialist chapters are outlined in the SPM sections which follow.

2.1 The sensitivity of the receiving environment

2.1.1 Marine ecology (after Clark et al., 2025)

Rocky headlands within Zone 1 range from HIGH to VERY HIGH sensitivity around proposed Port Precinct, which serves as an important breeding site for Cape fur seals (Figure SPM 3) and threatened seabirds. Development around Boegoebaai Point (characterised by cliffs and a rocky headland), including within 300 meters north and south of the colony, particularly the construction of a breakwater and port, poses a high risk of disturbance and displacement to these species, with potentially irreversible ecological consequences, leading to a strong recommendation for considering alternative breakwater locations (See Figure 2-6.1 of SEA Chapter 2).

Box SPM 6: What are Critical Biodiversity (CBA) and Ecological Support Areas (ESA)?

CBAs are terrestrial or aquatic areas identified as being important for conserving biodiversity and maintaining ecosystem functioning. These areas are essential for achieving national biodiversity targets. ESAs are areas that support the ecological functioning of CBAs and other natural systems, and play a role in sustaining biodiversity and ecosystem services. While CBAs should be maintained in a natural or near-natural state, ESAs may allow for more flexible land uses, provided ecological processes are sustained.

Figure SPM 3: Cape Fur Seal colony at breeding location (rocky headland at Boegoebaai Point). (Source: L. Snyman-vd Walt, 2024).

Soft bottom subtidal habitats around Boegoebaai are listed as "endangered" by the National Biodiversity Assessment (NBA, 2018)[6] due to limited protection and threats from Orange River flow reduction and diamond mining, with much of this habitat being designated as Critically Biodiversity Area (CBA)-Restore or Ecological Support Area (ESA). Similarly, rocky subtidal habitats, including shallow kelp forests, are classified as "vulnerable" and largely fall within CBA-Restore or ESA, necessitating careful management. These habitats were assigned **MEDIUM** sensitivity.

Box SPM 7: The seal colony at Boegoebaai

The Cape fur seal colony at Boegoebaai, South Africa's northernmost, began breeding around 2010 and remains small but is growing (107 pups counted in 2007). Located along a unique 1 km stretch of rocky coastline, the site's steep cliffs likely make it suitable for breeding. Protected under the Sea Birds and Seals Protection Act of 1973, seals may not be disturbed or harmed without authorisation. However, proposed breakwater and port construction at Boegoebaai poses a serious threat to this seal colony and nearby breeding seabirds.

Mixed rocky shores and subtidal reefs hold MEDIUM to HIGH sensitivity due to their biodiversity value, habitat complexity, and limited formal protection. While sandy beaches (Box SPM 8) generally exhibit lower sensitivity, reflective and intermediate sandy shores show higher sensitivity due to the presence of the endangered giant isopod, *Tylos granulatus*, a species highly sensitive to disturbance and light pollution. Surf zone habitats, however, are considered **LOW** sensitivity due to low species richness. The offshore region around Boegoebaai supports important national fisheries, but are not particularly important (**MEDIUM** to **LOW**) for major commercial fisheries, and other activities like demersal trawling and abalone ranching concessions are not expected to be significantly affected, according to Clark et al., 2025. In contrast, according to Gammage et al., 2025, although commercial fisheries do not operate in the immediate area, they could act as important nursery grounds for commercially important fish species, and development of the area may affect recruitment of these species and future catches in the two most important commercial fisheries in South Africa - the small pelagic and commercial hake industries.

Box SPM 8: Recovery and protection of sandy beach habitats

Following cessation of mining and with proper rehabilitation, sandy beach faunal communities in the Boegoebaai area can recover to near-natural conditions, as shown in comparable sites north of the Orange River. It is recommended that a representative range of sandy beach habitats within the Boegoebaai area (away from the footprint of the proposed development) are earmarked for rehabilitation and are afforded some form of protection going forward. Priority should be given to the dissipative beaches which support the richest faunal communities.

2.1.2 Terrestrial and aquatic ecology (after van Rooyen et al., 2025)

Inland aquatic ecosystems, though not rich in number, are of high importance for terrestrial fauna. Ephemeral pans and rock pools, particularly the larger pans (Visagiespan, Rietfontein, Rietfonteinpan), are presumed to support rare aquatic invertebrate communities with high levels of regional endemism and are classified as Critically Endangered (CR) depressions in the Namaqualand Sandveld Bioregion. These natural depressions are specifically identified as having **VERY HIGH** sensitivity, with artificial wetlands at **HIGH**

Box SPM 9: What does Critically Endangered (CR) mean?

Critically Endangered is a formal conservation status used to describe species and ecosystems that face an extremely high risk of extinction or collapse. A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction. For ecosystems, CR status means ecosystem function is nearing collapse. It highlights urgent national conservation priorities, requiring immediate action to prevent irreversible biodiversity loss and support recovery efforts.

[6] The National Biodiversity Assessment is South Africa's primary scientific assessment of the state of the country's biodiversity, led by the South African National Biodiversity Institute (SANBI) in collaboration with numerous partners.

sensitivity, and buffer zones around depressions at **MEDIUM** sensitivity. The Orange River Estuary, although not on-site, is a nationally and internationally important Ramsar Wetland in close proximity, and any direct or indirect threats from the development would negatively impact its already precarious condition. Development layouts must avoid these critical inland aquatic systems.

From an avifaunal perspective, the Boegoebaai Port and SEZ development site (spanning across various zones) exhibits predominantly MEDIUM and HIGH sensitivity. It hosts, or potentially hosts, a variety of priority species, including South African Red List species, endemics, near-endemics, and range-restricted species such as the Damara tern, black harrier, and Ludwig's bustard.

For bats, important foraging and roosting sites are deemed to be of VERY HIGH sensitivity. Temporal water sources of **HIGH** sensitivity, and livestock aggregation areas of **MEDIUM** sensitivity, with light pollution and water-cooling tower designs identified as significant impact risks.

Box SPM 10: What are Species of Conservation Concern (SCCs)?

Species of conservation concern are species that are important for conserving South Africa's biodiversity. This includes not only species listed as threatened but also those classified as Extinct in the Wild, Regionally Extinct, Near Threatened, Rare, Critically or Extremely Rare, Declining, and Data Deficient due to insufficient information. These species are recognised because of their conservation status, rarity, or lack of information, indicating a need for monitoring and potential conservation action.

The mammal, reptile, and amphibian assessment revealed VERY HIGH sensitivity for ecosystems like the Richtersveld Coastal Duneveld (CR) and Namib Seashore Vegetation (CR), as well as areas providing suitable habitat for 10 Species of Conservation Concern (SCC)[7], including the De Winton's golden mole[8] and the desert rain frog, both confirmed on-site. Other areas like saline depressions, Western Gariep Plains Desert, and ecological corridors linking coastal and inland habitats are rated **MEDIUM** to **HIGH** sensitivity. Habitat loss and alteration, especially for species reliant on specialised dune ecosystems, and disturbances from increased human activities like noise, light pollution, and dust, are critical concerns.

The vegetation and flora assessment indicates that the site hosts numerous priority habitats for biodiversity conservation, resulting in VERY HIGH sensitivity ratings for both the Plant Theme and the Relative Terrestrial Biodiversity Theme. These include two ecosystems (Richtersveld Coastal Duneveld (CR) (Figure SPM 4a) and Namib Seashore Vegetation (CR), habitat for approximately eight critically endangered[9] plant species (CR), large areas of irreplaceable CBAs, portions included in the National Protected Area Expansion Strategy (NPAES, 2018)[10], and inclusion in an internationally recognised Key Biodiversity Area (KBA)[11], with the critically endangered Namib Lichen Fields in close proximity (CR) (Figure SPM 4b). **The loss of habitat in these VERY HIGH sensitivity areas is considered unacceptable as it compromises conservation targets and cannot be offset.**

[7] The faunal community on site includes 10 SCCs. Confirmed mammal SCC include the brown hyaena, with De Winton's golden mole and Grant's golden mole likely to occur. Among the reptiles, both the Namaqua dwarf adder and the Namib web-footed gecko have been confirmed on site.

[8] Although not confirmed on site, the De Winton's golden mole and Grant's golden mole have a high likelihood of occurrence. The species was recorded with eDNA samples along the West Coast from Lamberts Bay to Visagiesfontein.

[9] SANBI is currently updating ecosystem threat assessments for this region. The number of critically endangered species is likely to change as new data becomes available.

[10] The National Protected Area Expansion Strategy (NPAES) is South Africa's long-term plan to expand and strengthen protected areas in a cost-effective way, aiming to conserve biodiversity, enhance ecosystem resilience to climate change, and promote ecological sustainability. It sets clear targets, identifies priority areas, and outlines mechanisms for implementation

[11] Key Biodiversity Areas (KBAs) are sites that are internationally recognised for their exceptional importance to global biodiversity. They are identified using globally standardised criteria, based on the presence of threatened species, endemic species, or unique ecosystems.

a)

b)

Figure SPM 4: a) CR Richtersveld Coastal Duneveld vegetation type in the proposed port precinct zone with a view of the Boegoeberg Twins; and b) Namib Lichen Fields approximately 13 km north of the proposed Boegoebaai Port and SEZ study area. (Source: L. Snyman-vd Walt, 2024).

2.1.3 Heritage (after Orton et al., 2025)

Several sensitive heritage resources are evident across the zones. Palaeontological[12] sensitivity is generally **LOW** for the SEZ, but **MEDIUM** sensitivity is noted in Zone 1 (Port Precinct) where excavations might encounter the buried late Pliocene[13] Hondeklipbaai Formation.

Box SPM 11: What is Heritage?

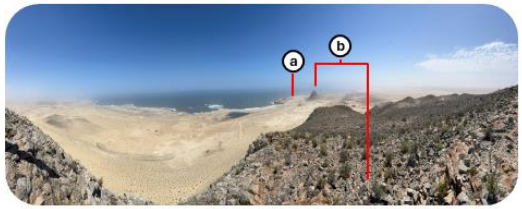
In the context of the National Heritage Resources Act (NHRA), heritage includes South Africa's tangible and intangible cultural and natural assets, such as historic sites, traditions, and indigenous knowledge, that hold historical, social, spiritual and scientific value, among others. The NHRA protects such resources and requires Heritage Impact Assessments to guide sustainable development, ensuring that economic growth respects and preserves the country's diverse and valuable heritage for current and future generations.

Isolated Early Stone Age[14] material has been found in deflated areas (Zones 3, 4, 6 & 7), and a Middle Stone Age occurrence is identified in Zone 1 (Port Precinct) at Namakwakop, with the possibility of highly significant sites containing pre-modern human remains in buried shelters. Significant occurrences of Later Stone Age shell middens and other occupation debris are present along the coast (Zones 1, 3, 7 & 8), at pans (Zones 3, 4, 6 & 7), and inland near water sources (Zone 9). Coastal areas (within 0.5 km) with these sites are considered of **VERY HIGH** archaeological sensitivity, while those 0.5-4.5 km from the coast are of **HIGH** sensitivity.

Three known graves exist in Zone 2 at the western foot of Boegoeberg South, and oral history highlights the significance of the Boegoeberg area (Zones 1 & 2) for the Nama people, with known graves allocated VERY HIGH sensitivity. For maritime heritage, one pre-1965 shipwreck is highly likely to be within the sea adjacent to the SEZ study area, with four others also highly likely, leading to **MEDIUM** sensitivity for areas mentioned in literature.

Living heritage areas, particularly those used by local herder communities for seasonal grazing (Swartbank and Witbank in Zones 2, 9 & 10), are rated as HIGH sensitivity, as development would disrupt their traditional transhumance cycle[15]. The cultural landscape, particularly the R382, coastline, Boegoeberg Twins (Zone 1, 2), and pans, are identified as highly sensitive areas from a visual perspective, as the proposed industrial development would be highly visible and contrast strongly with the existing landscape, indirectly impacting the nearby Richtersveld Cultural and Botanical Landscape World Heritage Site [16]

[12] Palaeontological refers to fossilised remains of ancient plants, animals and other organisms preserved in the geological record. These remains are considered heritage resources under the NHRA due to their scientific, cultural, and historical significance.
[13] The Late Pliocene refers to a period in Earth's geological timescale that occurred approximately 3.6 to 2.58 million years ago, marked by global cooling and the evolution of early hominins, with fossil sites from this time protected as heritage resources under the NHRA.
[14] The Early Stone Age refers to the earliest phase of human technological development, dating from about 2.6 million to 250 000 years ago, characterised by the use of simple stone tools by early hominins.
[15] The traditional transhumance cycle is a seasonal, often cyclical movement practiced by indigenous pastoralist communities, such as those who move with their livestock between coastal grazing areas in winter and inland areas in summer.
[16] The Richtersveld Cultural and Botanical Landscape is a 1,600 km^2 mountainous desert in South Africa's Northern Cape, communally owned and managed by the Nama people. It showcases a unique cultural landscape where the Nama practice traditional seasonal herding and live in portable *haru oms* homes. The area is rich in endemic succulent plants and reflects nearly 2,000 years of sustainable land use and cultural heritage, making it a globally significant World Heritage Site for both natural and cultural conservation.



↑ North north east view from Boeboeberg South towards Boegoeberg North and Boegoebaai headland.

← South view from Boegoebaai headland towards Boegoeberg Twins.

← Example of 'mined out' landscape in the proposed port precinct (zone 1), looking east.

a) Boegoebaai headland (significant for Cape fur seals and seabirds)
b) Boegoeberg twins (significant for fauna, flora and heritage)
c) Namakwakop
d) Visagiesfonteinkop
e) Swartbank heuweltjies
f) Ephemeral pans
g) Plant species of conservation concern (widespread)
h) Bird species of conservation concern (widespread)
i) Transhumance pastoralism (widespread east of R382)
j) R382 scenic route
k) Past and ongoing mining (widespread)

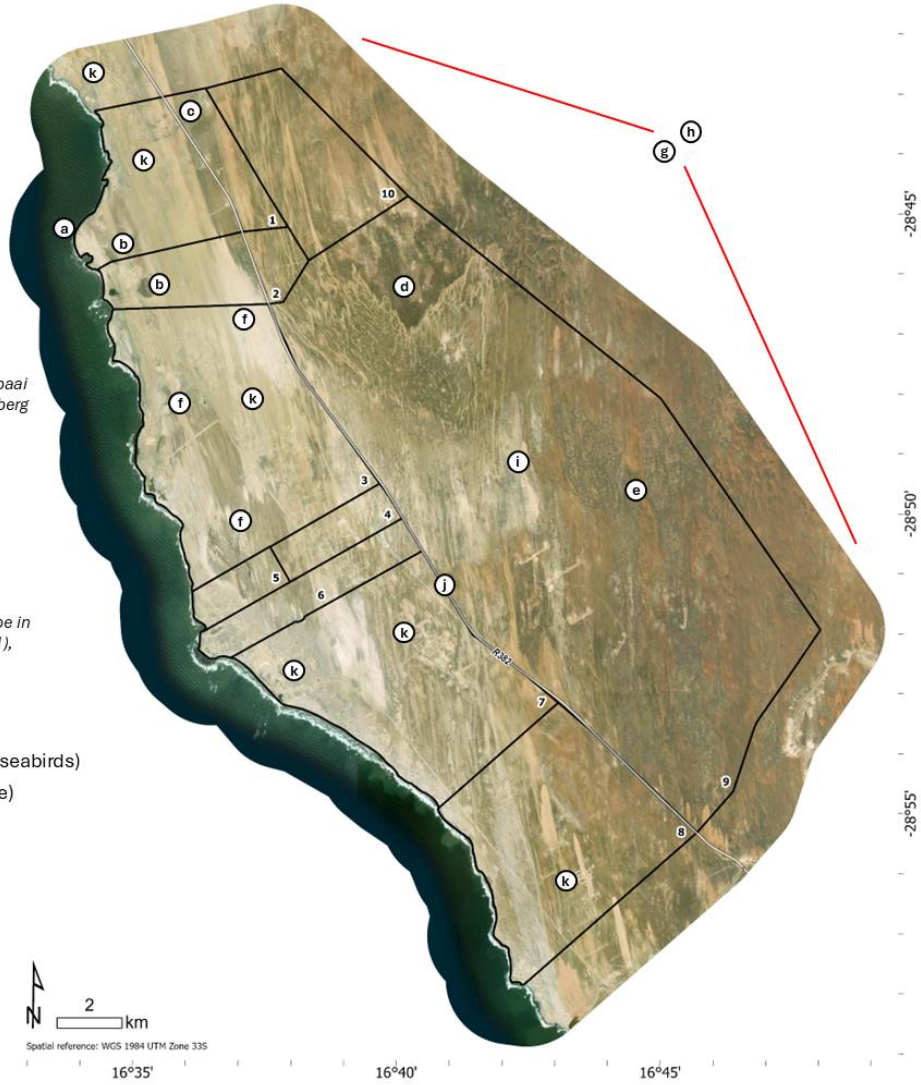


Figure SPM 5: A snapshot of the key ecological, heritage and land-use features in the proposed port precinct and SEZ study area.

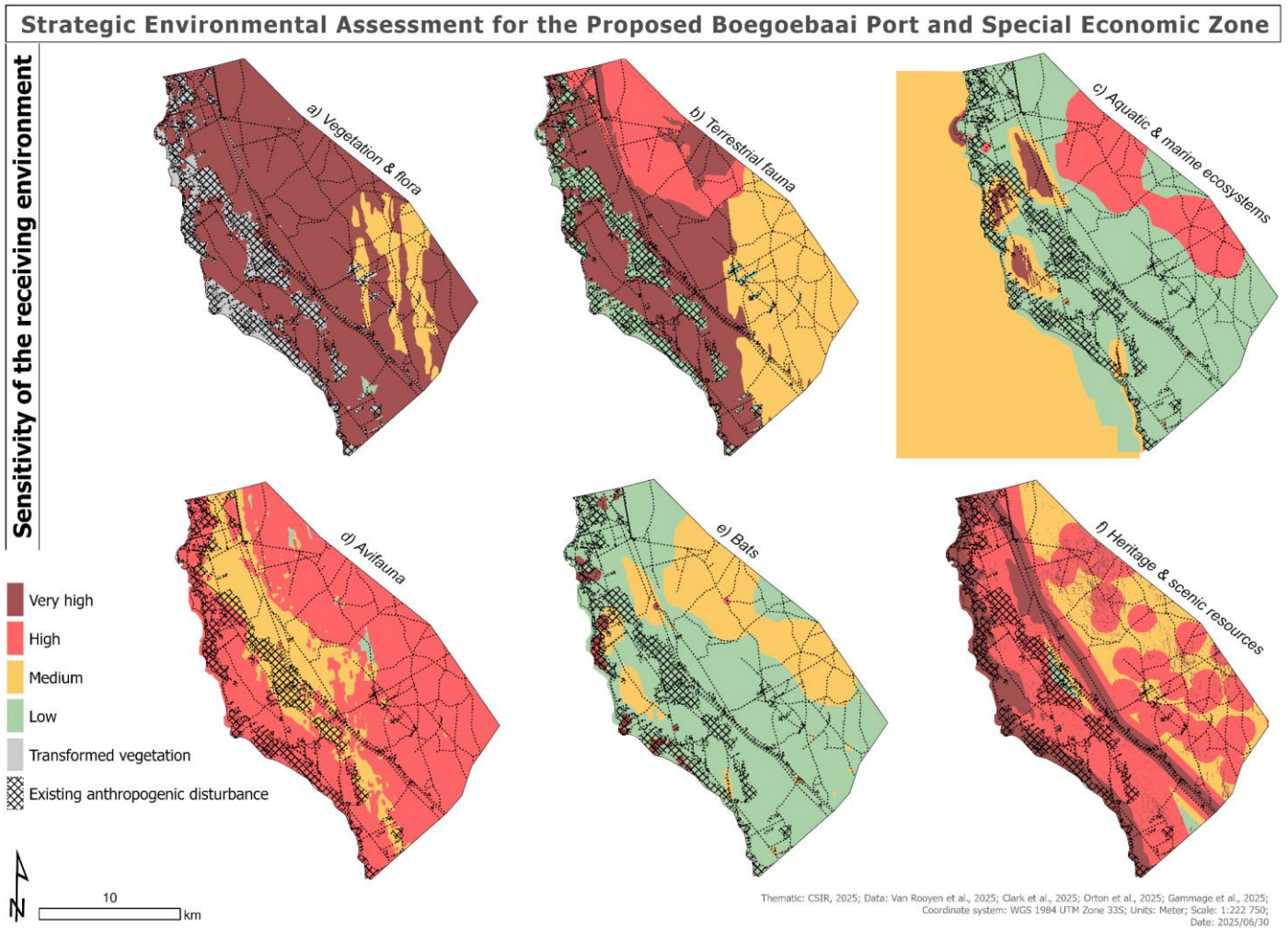


Figure SPM 6: Sensitivity of the receiving environment for the proposed Boegoebaai Port and SEZ for the respective themes of Work Package 1 – (a) vegetation and flora, (b) terrestrial fauna, (c) aquatic and marine ecosystems, (d) avifauna, (e) bats, and (f) heritage and scenic resources.

2.1.4 Coastal livelihoods (after Gammage et al., 2025)

Box SPM 12: The legacy of mining in this region

Mining has profoundly shaped the socio-economic and environmental landscape of the region. Historically, towns like Alexander Bay and Kleinzee were established around diamond extraction, with operations led by companies such as Alexkor and De Beers. While mining once provided prosperity and employment, its decline has left communities facing economic hardship, deteriorating infrastructure, and rising unemployment. The legacy includes restricted coastal access, particularly for small-scale fishers who have lost traditional fishing grounds due to mining-related security zones. Environmental degradation, including siltation and habitat disturbance, has impacted marine ecosystems and reduced fish stocks, further threatening coastal livelihoods. Cultural heritage has also suffered, with ancestral graves and sacred sites in the Boegoebaai area at risk from industrial activity. Despite these challenges, some towns have begun transitioning toward alternative livelihoods such as aquaculture and tourism. However, the mining legacy continues to influence land use, access rights, and community vulnerability. Future development must address these historical impacts through inclusive planning, restoration of access, and protection of cultural and ecological assets to ensure sustainable and equitable growth.

The social environment surrounding the proposed Boegoebaai Port and SEZ is HIGHLY sensitive, largely due to the profound historical and cultural connections of local communities to the land and sea, compounded by the lingering impacts of past injustices from previous industrial developments, particularly diamond mining. Several coastal towns are the primary communities adjacent to the Boegoebaai development, including Alexander Bay, Port Nolloth, Kleinzee, and Hondeklipbaai. Each community's livelihoods and social fabric have been deeply shaped by resource extraction. Alexander Bay, a formerly prosperous mining town, has experienced economic decline, deteriorated infrastructure, and high unemployment as diamond extraction scaled down. While agriculture and tourism are emerging, opportunities remain scarce. Recreational fishing at the Orange River mouth is popular.

Port Nolloth is a traditional fishing community with strong intergenerational ties to the sea. It supports various fishing rights holders, including small-scale cooperatives targeting snoek and Cape bream, and commercial rights for West Coast Rock Lobster (WCRL). However, access to traditional fishing grounds has become increasingly restricted due to marine mining activity, high fuel costs, stock depletion, and limited infrastructure. Kleinzee, another former De Beers mining town, has attempted to diversify into aquaculture (abalone, seaweed farming) and seasonal tourism, providing some formal employment. Recreational fishing here has been severely impacted by siltation from past mining operations. Hondeklipbaai, a small, traditional fishing village, relies on small-scale fishing and growing tourism, but faces challenges such as declining WCRL stocks, limited fishing rights, and poor infrastructure.

Although the Boegoebaai area itself currently has no permanent residents or formal dwellings (being part of a restricted mining concession) it holds deep cultural, spiritual, and historical significance for surrounding Nama communities. Local oral histories point to long-standing traditional use of the area, including transhumance grazing routes and fishing grounds. On account of local stakeholders, the site is known to include at least 17 known Nama graves, including that of Kaptein Swartbooi, as well as culturally significant Buchu plants. It also historically formed part of traditional fishing grounds for small-scale fishers from Port Nolloth, access to which has been lost due to mining restrictions.

A core aspect of the social sensitivity stems from the Nama communities' traditional land use. Oral history confirms Nama herders from the Richtersveld historically followed a transhumance cycle encompassing the entire study area, including parts now within the SEZ. Their access was prevented by security fences erected after the discovery of diamonds in 1925, with further fencing in the mid-1950s. Crucially, portions of Farm 2 (the Korridor Wes farms), including Swartbank and Witbank (located in Zones 2, 9 & 10), were returned to the community in 2007, allowing stock owners to re-establish seasonal grazing. The proposed development, by preventing access to these areas, would directly disrupt this re-established traditional transhumance cycle, further impacting the livelihoods of these local herders. It would also necessitate complex consultation processes around consent, zonation and implementation of any required mitigation measures.

2.2 Aspects and impacts register

2.2.1 Spatially delimited ecological and heritage impacts

Table SPM 3 presents a consolidated summary of the potential positive and negative impacts identified across specialist studies (marine ecology, terrestrial and inland aquatic ecology, and heritage) for the planned Boegoebaai Port and SEZ infrastructure components. Each infrastructure aspect, activity or SEZ subzone is linked to potential impacts and the corresponding receiving environment of concern. The table offers an integrated overview of likely impacts that could inform future EIAs, the identification of areas requiring avoidance, targeted mitigation strategies, or knowledge gaps requiring future, fine-scale, specialist attention.

Table SPM 3: Spatially delimited aspects and impacts register across ecological and heritage themes

	Infrastructure aspect, activity or SEZ zone	Potential impacts	Receiving environments of concern
MARINE ECOLOGY	Jetties, breakwaters and quays (Zone 1)	**Disturbance and harm to marine fauna**, including physiological and behavioural effects, recruitment disruption, and species displacement or mortality.	Marine fauna, including seal colony.
		Degradation of benthic and demersal communities, including habitat loss, smothering and altered community structure.	Benthic and demersal communities in CBA1 restore and ESA.
		Hydrodynamic alterations, such as changes in longshore currents and littoral drift, potentially affecting coastal sediment transport and ecosystem stability.	Littoral drift zones and Coastal sediment systems.
	Dredging, intake/outfall pipelines and general housekeeping (Zone 1, Zone 3 & Zones 4-6)	**Loss and degradation of marine habitats**, including permanent loss of unconsolidated seafloor and associated communities due to infrastructure placement.	Benthic macrofauna and demersal communities.
		Disturbance and smothering of benthic fauna from dredging and spoil disposal.	Spoils dump site and dredge footprint.
		Degradation of water quality due to spills, litter, and runoff.	Marine fauna and coastal ecosystems.
	Port and industrial operations, vessel activity, marine infrastructure and maintenance (Zone 1, Zone 3 and Zones 4-6))	**Disturbance to marine fauna**, caused by elevated underwater noise levels, light emissions, ship strikes, and seawater intakes.	Marine fauna (e.g. seabirds, marine mammals, turtles, cetaceans).
		Degradation of water quality, resulting from routine vessel discharges, operational spills, brine discharges, increased turbidity, and remobilisation of sediment-bound contaminants.	Marine fauna; nearshore and coastal ecosystems.
		Loss and alteration of marine habitats, including permanent loss of unconsolidated seabed and disruption of associated benthic communities.	Benthic communities in dredge zones and around marine structures.
	Vessels, bunkering and pipelines (Zone 1, Zone 3 & Zones 4-6)	**Degradation of water quality** due to accidental hydrocarbon spills / releases (e.g. vessel accident, bunkering and pipe rupture)	Marine fauna, benthic communities, and coastal habitats (e.g. rocky shores, beaches).

	Infrastructure aspect, activity or SEZ zone	Potential impacts	Receiving environments of concern
INTEGRATED TERRESTRIAL AND AQUATIC ECOLOGY	**Aquatic Ecosystems**		
	Boegoebaai Port Development Footprint (Zone 1)	**Disturbance to broader possible recharge areas** of nearby wetlands or pans, potentially threatening their sustainability due to uncertain hydrological drivers.	Potential recharge area for BB1 pan (Visagiespan) (as shown in Day, 2025[17]) and springs; Boegoeberg North supporting ephemeral aquatic biota
	Conservancy Area (Zone 2)	**Positive: Potential protection of recharge areas** for the pan, its wetland, and associated spring if avoided as conservancy[18].	BB1 (including BB1A)
	Confirmed Green Hydrogen & Ammonia Facility (Zone 3)	Destruction and degradation of wetlands and pans, stormwater and vehicle disturbances	CR wetlands, largest and most important pans and springs in study area
	SEZ Industrial Park Phases 1-3 (Zones 4-6)	CR pan and wetland habitat destruction, nutrient enrichment, hydroperiod changes, physical disturbance	BB3 pan/wetland/spring system
	Future Green Hydrogen Facility (Zone 7)	Destruction of pans and wetland habitats, hydroperiod changes, physical disturbance	BB4, BB5 (artificial), BB6 (presumed natural) and recharge area
	Future Expansion 01 (Zone 8)	Destruction of presumed natural pan and wetland habitat, hydroperiod changes, degradation from altered flows	Southern extent of CR rated BB6, artificial BB7 & BB8 pans/wetlands (likely ecologically important)
	Future Expansion 02 (Zone 9)	Destruction of pan habitat, eutrophication, ecosystem degradation, biodiversity loss	Visagiesfonteinkop: ephemeral pans and rocky outcrops of **HIGH** sensitivity
	Terrestrial Ecosystems (including avifauna; bats; mammals, reptiles and amphibians; vegetation and flora)		
	Zone 1 Infrastructure (Port)	Vegetation loss, habitat fragmentation, loss of individuals of SCCs and protected and/or endemic plant or animal species, ecosystem service decline, erosion, sand movement smothering adjacent vegetation, disturbance to animal behaviour, potential animal mortality	**VERY HIGH** sensitivity mapped areas for terrestrial ecology subthemes (**Figure SPM 6** a, b, d, e)
	Zone 1 - Dry Bulk Handling (Manganese, Zinc, Lead)	Dust contamination, soil/water pollution, toxicity, air quality reduction	Locate in modified habitat areas only; avoid all sensitive natural areas
	Zone 1 - Conveyor Belts	Pollution (soil/water), conveyors will be barriers to animal movement	Air, soil and water near conveyor lines
	Zone 1 - Dust Control	Unspecified waste handling, possible **environmental contamination**	Dust collection points; Very High sensitivity mapped areas
	Zone 1 - Desalination Plant	**Marine fauna harm** (intake of seawater), concentrated brine discharge impacting marine ecosystems, **chemical pollution, thermal impacts**	Marine environment; intake/discharge areas
	Zone 1 - Sewage Infrastructure	Fertiliser from nutrient recovery, pollution, groundwater contamination, residual chemicals, sludge management	Wastewater treatment zones, groundwater table; Zone 1 sensitive areas

[17] See Chapter 3_1 (Terrestrial & Aquatic Ecology Supplementary Material) of the main SEA Report for a map and photographic illustrations of key inland aquatic ecosystem habitats in the study area.
[18] Designation of a conservancy zone alone does not necessarily constitute sufficient offset mitigation for the impacts anticipated from Zone 1 or the broader SEZ.

	Infrastructure aspect, activity or SEZ zone	Potential impacts	Receiving environments of concern
	Zone 1 - Stormwater Systems	Pollution, invasive species spread, groundwater impacts	Stormwater ponds; Zone 1 sensitive ecosystems
	Zone 1 - Electrical Infrastructure	Vegetation clearance, emissions associated with construction, electrocution risk, habitat fragmentation	Substation areas, powerlines; Zone 1 sensitive habitats (including birds)
	Zone 1 - Fuel Storage Zone 10 – Future Tank Storage	Fuel spills contaminating soil, water, and groundwater, harming plants and aquatic systems, VOCs emitted reducing air quality, fire and explosion risk	Zone 1 and Zone 10 sensitive habitats, Namib Lichen Fields, Boegoeberg Twins
	Zone 1 - Internal Roads & Bridges	Fragmentation, restricting animal movement, roadkills, erosion, pollution, dust, invasive species	Zone 1 sensitive habitats, habitat corridors; adjacent vegetation; lichens sites
	Zone 1 - External Roads (R382)	Expanded **vegetation loss** due to widening of R382, traffic pollution	Areas adjacent to R382, sensitive habitats
	Zone 2 - Conservancy Area	Positive: Intact vegetation and CR ecosystems (and refugia for animals) protection, enabling rehabilitation of mined areas Negative: **air pollution** risk on lichens in Zone 2, partial representation or protection of sensitive areas (including CBA1s and CR ecosystems), **increased mortality of SCC**	Boegoeberg Twins (include both Boegoeberg North and South), Cape fur seal colony (should also be included in Zone 2), BB1, CBA1s, CR ecosystems
	Zones 3–10 - SEZ Infrastructure	Extensive vegetation clearance, resource demands, habitat transformation	**VERY HIGH** sensitivity mapped areas
	Zone 3 - Desalination Plant	Marine discharge risks, vegetation clearance	**VERY HIGH** sensitivity mapped areas
	Zone 3 - Electrolyser	Water & energy demand, chemical pollution, safety risks (H_2 leak/explosion)	**VERY HIGH** sensitivity mapped areas
	Zone 3 - Ammonia Facility Zones 7–9 - Future Expansions	**Positive (Indirect): Reduced fossil fuel use**, emission-free green ammonia as fertiliser, energy carrier allowing renewable energy storage and transportation, cleaner ammonia production **Negative (including indirect): High resource demands** (energy from renewable sources), land and water intensive, safety risks, ammonia health risks, air/soil contamination, bat mortalities/injuries risk due to hot steam discharge	**VERY HIGH** sensitivity mapped areas; Namib Lichen Fields, Boegoeberg Twins
	Zone 3 - Firewater System	Salinity increases (when using seawater), foam pollutants, marine pollution	Seawater intake/discharge areas
	Zones 4–6 - Industrial Park	**Vegetation clearance**, desalination impacts	**VERY HIGH** sensitivity mapped areas
	Common to all Zones: Increased Corvids Predation	Development may increase corvid habitat, leading to higher predation and tortoise population declines.	All zones
	Common to all Zones: Noise, Dust, Lighting	Construction noise, lighting, and activity may disturb animal behaviour; increased injury or mortality risk; trenching further increases mortality risks.	All zones
	Common to all Zones: Earthworks	Roosting habitat destruction (birds/bats)	All zones
HERITAGE	Palaeontology		
	All zones	Construction could expose and/or destroy fossils	Marine deposits of late Pliocene Hondeklipbaai Fm. Behind cliffs in proposed port area (Zone 1). All unmined areas, but higher likelihood on coastal lowlands
	All zones	Backfilling of soils from dumps could **expose fossils**	Mine dumps used to backfill mine pits

	Infrastructure aspect, activity or SEZ zone	Potential impacts	Receiving environments of concern
	Zones 1, 2, 3, 5, 6, 7 & 8	Construction could expose and/or destroy raised beach deposits	Areas where raised beaches of the Curlew Strand Fm are preserved
	Terrestrial Archaeology		
	Zones 1, 2, 3, 4, 5, 6, 7 & 8	Construction could **expose and/or destroy MSA sites** in old sea cliffs buried by wind blown sand	All areas along the coast which have rocky outcrops, whether visible or buried
	Zones 1, 2, 3,4, 5, 6, 7 & 8	Construction could expose and/or destroy LSA shell scatters and middens	All areas where archaeological shell middens occur along undisturbed coastline
	Zone 1	Construction could expose and/or destroy MSA artefact scatters	The rocky outcrops of Namakwakop in the NE of Zone 1
	Zones 3, 4, 6 & 7	Construction could expose and/or destroy LSA shell scatters and middens	Around and within Visagiepan and Rietfontein Pan
	Zone 9	Construction could expose and/or destroy LSA shell scatters and contact period/historical scatters	**HIGH** sensitivity areas around granite outcrops in the eastern part of the SEZ
	Graves		
	Zone 2	Construction could **impact known graves**	Identified graves at western foot of Boegoeberg South
	All zones	Construction could expose and/or destroy unknown graves	Unmarked graves could occur anywhere that has not been mined
	Maritime Heritage		
	Zones 1, 2, 3, 5, 6, 7, & 8	Offshore construction work for the breakwater and other port facilities may **expose and/or destroy submerged shipwrecks**	Any areas where seabed impacts would occur through construction or dredging (Zone 1).
	Living Heritage		
	Zones 2, 9 & 10	Development would disrupt transhumant settlement patterns and prohibit access to the area	All areas used by small-scale pastoralists, especially areas known as Witbank/ Visagiesfonteinkop, Swartbank and Grondputs/Zwartwater
	All zones	Development of the Port and SEZ would massively alter the landscape context in which small-scale herding occurs through the addition of industrial facilities	Entire Port and SEZ study area
	Cultural Landscape		
	All zones	Despite the existing mining, development will irrevocably **alter the sense of place** of the region through the addition of industrial facilities	Entire Port and SEZ study area

1

2.2.2 Socio-economic and coastal livelihood impacts

2.2.2.1 Potential benefits

The Boegoebaai Port and SEZ development presents an important opportunity to stimulate inclusive economic growth and promote strategic investment in the Northern Cape. If designed and implemented with sustainability, equity and local participation at its core, the project could offer a range of environmental, economic and social benefits.

The work programme could unlock substantial employment and livelihood opportunities directly and indirectly linked to the fisheries sector and beyond (e.g. tourism). Aquaculture operations may also benefit from expanded water access, energy supply, and downstream support services. The diversification of income streams may reduce vulnerability in communities currently reliant on declining or seasonal fisheries and could mitigate some of the negative impacts associated to ocean squeeze.

Box SPM 13: Example of marine-based economic diversification

Kleinzee, a former mining town, has transitioned toward aquaculture and seasonal tourism, with abalone and seaweed farming now the primary employers. Its existing infrastructure and service delivery make it a pilot site for marine-based economic diversification. Tourism driven by wildflowers and birdwatching also contributes to livelihoods. This supports broader fisheries-linked economic resilience, though concerns remain about coastal pollution from vessel traffic. Stakeholder feedback reflects cautious optimism about the proposed Boegoebaai Port development's potential to boost local revenue.

Upgrades to marine and land-based infrastructure will improve operational efficiency and safety for fishers in towns like Port Nolloth. Improved service delivery could support new or underutilised value chains such as dried fish products, kelp processing and marine tourism. Expanded water supply and electrification may also enable shore-based aquaculture activities and provide opportunities for co-operative-led enterprises to scale up production. Improved harbour infrastructure may reduce post-harvest losses and improve the quality and shelf life of landed catch.

Box SPM 14: Infrastructure and capacity gaps in small-scale fishers

In Port Nolloth, small-scale fishers face declining fish stocks, high fuel costs, and restricted access to traditional fishing grounds due to mining. Infrastructure is limited, with only one operational jetty and persistent water shortages affecting tourism and development. While aquaculture and fisheries are central to livelihoods, local capacity for offshore operations is lacking. Skills development is minimal, and cooperatives struggle with resource constraints. These challenges underscore the need for improved infrastructure and targeted capacity-building in marine sectors.

Technical training and mentorship programmes offer the potential to build capacity within fishing and coastal communities. This includes upskilling in marine safety, vessel maintenance, post-harvest handling, seafood processing, aquaculture operations, environmental monitoring, and marine stewardship. Targeted training for youth and women may broaden access to previously male-dominated or capital-intensive sectors, supporting inclusive local development. Skills development linked to port and SEZ operations may also enable intergenerational transfer of knowledge and provide pathways into formal marine employment sectors.

If implemented inclusively, the development could catalyse improved local governance arrangements, offering a platform to strengthen fisher cooperatives and associations through improved access to finance, business support services, and policy engagement spaces. Access to better-quality water, energy, and transport systems could significantly strengthen the viability of coastal aquaculture initiatives, particularly in towns like Kleinzee. Formalised support may enable pilot projects in integrated multi-trophic aquaculture (IMTA), seaweed farming, or small-scale mariculture to grow into sustained livelihood opportunities.

Infrastructure could also enable greater value addition through local processing, packaging, and cold storage, increasing income retention within communities.

The port may improve the logistical feasibility of deploying patrol vessels and monitoring crews to combat illegal, unreported, and unregulated (IUU) fishing in the northwest of the EEZ. Strengthened surveillance and compliance capacity may benefit both conservation objectives and local fishers, by protecting their resource base from overexploitation and ensuring more equitable access to shared stocks.

Box SPM 15: What is IUU fishing and the role of ports?

Illegal, unreported, and unregulated (IUU) fishing refers to the unlawful harvesting of marine resources, where foreign vessels operate in a country's exclusive economic zone (EEZ) without authorisation or use harmful fishing methods. Ports and the countries that manage them are vital in overseeing fisheries and maritime activities. International law requires inspection of vessels and fish entering ports, helping identify illegal fishing, unsafe vessels and poor labour conditions, and ensuring such violations are detected and addressed.

By improving transport, utilities and market access, niche tourism offerings that include local fisheries culture (e.g. seafood festivals, fisher-for-a-day experiences, or heritage boat tours) could be established. Infrastructure upgrades may also allow communities to monetise intangible heritage and cultural assets (e.g. traditional knowledge, coastal landscapes, artisanal crafts), particularly during the flower season.

Diversified income opportunities and improved infrastructure may help coastal communities adapt to environmental and economic volatility. With fisheries increasingly impacted by climate change (e.g. shifting stocks, marine heatwaves) and market pressures (e.g. rising fuel costs), support for improved aquaculture, tourism and seafood value chains together with opportunities to diversity skills beyond fisheries, could enhance household resilience by reducing reliance on any single resource or season.

2.2.2.2 Potential negative impacts

Spatial competition in an already congested marine zone will be intensified. This will negatively impacts already marginalised coastal and small-scale fishers who already face increasing displacement due to overlapping claims from mining, offshore oil and gas, conservation, and industrial shipping activities.

Box SPM 16: The "Ocean squeeze" phenomenon

Ocean squeeze is a phenomenon where the seaward-facing side of the coast becomes increasingly competitive, further reducing fishers' already limited operating space. It is reported that ocean squeeze has caused traditional fishing communities in Port Nolloth to lose both land and sea access to their fishing grounds. For example, fishers previously moved small boats (bakkies) over land via trailer to fish north of Port Nolloth, but mining restrictions have now closed off this access.

Access to traditional fishing areas has already been reduced by mining security restrictions (e.g., fishers are no longer able to trailer vessels to Boegoebaai), and further limitations threaten the sustainability of small-scale livelihoods. Climate change impacts, such as sea-level rise and altered species distributions, exacerbate these pressures.

As infrastructure improvements and new employment opportunities attract outside investors and higher-income groups, gentrification pressures on the existing communities will increase. This could risk raising property values and living costs, pricing out long-standing residents, and eroding traditional livelihoods. In towns like Port Nolloth and Alexander Bay, where unemployment is high and services are limited, such shifts could deepen socio-economic inequalities and displace vulnerable populations. Social cohesion may be disrupted, particularly if communities perceive that development benefits are externally captured.

Perceptions from local stakeholders are that current governance arrangements and stakeholder engagement processes are dominated by government and private sector interests, with limited inclusion of small-scale fishers, Nama communities, women, and informal resource users. This reproduces a legacy of inadequate consultation linked to previous development efforts in the region, contributing to community frustration and mistrust. Moreover, current frameworks fail to recognise indirect and hidden stakeholders or the complexity of the marine and coastal social-ecological systems, leading to poorly tailored interventions and reduced legitimacy.

Box SPM 17: Gentrification in the context of development?

Gentrification refers to the transformation of historically under-resourced or working-class areas through the introduction of higher-end housing, infrastructure, and commercial projects. While new developments can improve service delivery and attract investment, they often lead to rising property values and living costs. This can displace long-standing, lower-income residents and erode local cultures and livelihoods, as wealthier newcomers move in and reshape the social, economic, and physical landscape of the area.

3. STRATEGIC PLANNING AND GOVERNANCE RECOMMENDATIONS

Drawing from the findings of the multidisciplinary specialist inputs and grounded in the principle of precaution (Box SPM 18), this section outlines key strategic recommendations to guide policymakers in planning for, and governing, the proposed programme of development at Boegoebaai in a responsible way.

A key objective of Work Package 1 is to inform the layout of the port and SEZ to avoid planning development footprints in areas that are highly constrained and with a very low likelihood of receiving Environmental Authorisation and/or expensive and complex mitigation (Box SPM 19). Given the scale and impact potential of the programme of work, it is essential that any future decisions are informed by high quality evidence, underpinned by social equity considerations, and are in alignment with broader South African sustainability ambitions. The recommendations presented here focus on the mitigation of key risks, the potential for developing cross-sectoral, cross-constituency coordination and governance, and enhancing and diversifying any long-term benefits that may accrue from this programme of work.

Box SPM 18: Embracing a stepwise and precautionary approach

The precautionary principle presupposes that if a development is suspected of causing harm to the public or to the biophysical environment, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those advocating for the project (DEA&DP, 2013). In other words, it's the project proponents who must prove that the proposed activity will not lead to significant harm, rather than the public or environmental groups having to prove that it will. South Africa has given effect to the precautionary principle in the NEMA. Large-scale infrastructure development associated with the proposed Boegoebaai port and SEZ must apply a risk-averse and cautious approach that considers the limits of current knowledge about the receiving environments and technologies and infrastructure being developed.

3.1 The position of the breakwater and port precinct

A key issue is the positioning of the breakwater and port precinct relative to areas of VERY HIGH environmental sensitivity. The construction of a breakwater and associated port infrastructure in this location would almost certainly result in unacceptable ecological disturbance. Policymakers should consider relocating the port breakwater to avoid this area. **Figure SPM 7** offers some alternatives for where the breakwater and port may be more ecologically appropriate. While the bathymetry to the north of (currently proposed) Boegoebaai Point could be technically less favourable, areas to the south appear to carry fewer environmental constraints and offer more favourable offshore bathymetric conditions for breakwater construction.

Box SPM 19: Alternative port location

A strategic opportunity exists to reconsider the location of the proposed port to reduce ecological risks. Preliminary analysis suggests that a site just north of Port Nolloth (outside of the SEA Work Package 1 study area) may offer a more suitable alternative. This area is already disturbed by historical mining, lies within 10 km of existing harbour, and lacks biodiversity features that would trigger exclusionary thresholds.

Although indicative, this guidance provides a reference point for steering development away from ecologically irreplaceable areas and should inform early-stage planning to derisk the development and support a more sustainable project outcome.

3.2 Targeting degraded areas and managing windblown sand

Approximately 5 000 ha (15 % of the 33 500 ha study area) is transformed habitat and has already been subject to ecological disturbance, primarily because of historic and ongoing mining activities. This includes areas of intense historic mining and zones where natural ecological processes have been disrupted to the extent that recovery is limited or unlikely without intervention. These activities have left a visible legacy of degraded landscapes, including areas stripped of natural vegetation, exposed soils, and extensive windblown sand plumes, particularly west of the R382. These areas are rated as either **TRANSFORMED** or of **LOW** ecological sensitivity across multiple themes, including mammals, reptiles and amphibians, vegetation and flora. Similarly, the inland aquatic and bat sensitivity themes largely rated these areas as **LOW** sensitivity. Only the avifaunal theme assigned **MEDIUM** to **HIGH** sensitivity to some of these disturbed areas, on account of their potential use by certain bird species.

Boegoebaai GH_2 development scenarios (which form the basis for Work Package 2) estimate that the port and industrial infrastructure in the SEZ would require in the range of ~ 1,700 - 4,600 ha of land land-take / physical footprint (Box SPM 20)**.** Areas identified as potentially 'more suitable' for development (~8,500 ha) (see Section 3.4) target degraded land and should comfortably support planned port and SEZ-related infrastructure.

Box SPM 20: The land requirements to produce GH_2 and PtX products

Power-to-X means that renewable energy (e.g. electrons produced from e.g. wind and solar resources) are captured and converted into an alternative energy carrier, namely molecules (e.g. hydrogen, ammonia). The vast majority of infrastructure requirements lie with the renewable energy development component. In the case of the proposed Boegoebaai GH_2 development programme:

- The port and industrial infrastructure in the SEZ is estimated to require in the range of ~ 1,700 - 4,600 ha of land (direct footprint of infrastructure);
- Ancillary infrastructure such as new road, rail, pipeline and powerline could require in the range of ~ 4,750 – 12,183 ha of land; whilst
- Renewable energy (wind and solar development) could require between16,000 and 128,000 ha of land.

Renewable energy thus accounts for upwards of 70% of the infrastructure land requirements to produce PtX products. Renewable energy is likely to be sourced from wind and solar facilities located in the broader Namakwa region, and beyond, thus the need for the SEA to consider a regional component (WP2).

It is recommended that the proposed port and SEZ footprint targets these existing anthropogenically transformed/disturbed areas for development. Siting land-based infrastructure for the port and SEZ within these transformed areas would significantly reduce the risk of an impact from biodiversity loss, provided that priority habitats are not negatively impacted by the development activities. However, to ensure long-term ecological sustainability, infrastructure planning must also factor in ecological corridors that support connectivity between key terrestrial, coastal and inland aquatic habitats. This includes avoiding **VERY HIGH** sensitivity mapped areas and integrating the impact management principles outlined in Section 4 below.

Box SPM 21: Stabilising mobile sand plumes

It is recommended that detailed modelling of sand and dust transport from the proposed development is conducted to understand potential downwind impacts. Priority must be given to implementing mitigation measures that stabilise sand movement before it reaches sensitive ecosystems, such as the Namib Lichen Fields and the Orange River Estuary. Furthermore, targeted interventions, alongside careful infrastructure planning, must be implemented to stabilise mobile sand plumes that threaten to smother rare vegetation remnants on the inselbergs and along the coast. This will help preserve unique, irreplaceable ecosystems vulnerable to wind-driven sand movement intensified by development activities.

Proactive measures must be taken to manage windblown sand, which poses both environmental and engineering risks. Stabilisation interventions, tailored to the shoreline dynamics and highly windy environment of this region, should be embedded into early development phases.

3.3 Areas that should be considered off limits for major development

No major development should be permitted east of the R382. This includes eastern portions of Zones 1 and 2 (Port and Conservancy area (Box SPM 22) and Zones 9 and 10 (Future Expansion 02 and Future Tank Farm). These areas contain a convergence of **VERY HIGH** ecological and **HIGH** heritage sensitivity, including Critically Endangered ecosystems, Critical Biodiversity Areas, bat roosting and foraging zones, archaeological sites, living heritage stockposts, and neighbouring landscapes of cultural and scenic importance. In addition, the following no-go areas have been identified:

- **VERY HIGH** sensitivity areas across integrated fauna, flora, and aquatic assessments;
- Natural pans and depressions, particularly in and around Zones 3 and 9), which are CR wetland systems;
- The Orange River Estuary (although not on site);
- Cape fur seal colony and coastal cliff habitats, which would otherwise be severely impacted by port infrastructure;
- **VERY HIGH** bat sensitivity areas, including rocky outcrops and ravines (e.g. Holgat River [although not on site], Boegoeberg Twins);
- Graves near Boegoeberg South (Zone 2), including the reputed burial site of Kaptein Paul Links, considered sacred to the Nama;.
- Living heritage stockposts in Zones 9 and 10 (Witbank and Swartbank), key to the Nama transhumance cycle and pastoralist way of life;
- Visual and cultural corridors, including the R382 scenic route and views towards the Boegoeberg Twins, which hold World Heritage value linked to the RCBL buffer zone.

Box SPM 22: Designing an optimal Boegoebaai SEZ conservancy zone.

The current layout of the SEZ and its designated "Conservancy area" reflects an effort to accommodate cultural priorities and ecological sensitivities. However, the Conservancy's effectiveness can be significantly improved through targeted redesign. Specifically, the Conservancy should be expanded and reconfigured to include:

- Fine-scale sensitive biodiversity sites identified by specialists (e.g. Chapter 3_5B & Chapter 3 of the SEA).
- Intact vegetation in **VERY HIGH** sensitivity zones, particularly areas east of the R382, including the Future Tank Farm and Future Expansion 01 zones and west of R328.
- Intact coastal vegetation adjacent to the nearshore, rather than degraded zones currently included in the conservancy.
- Full inclusion of both Boegoeberg Twins (i.e., including Boegoeberg North currently not entirely included in the designated Conservancy area). These mountains host exceptional biodiversity, including many threatened plant species and highly sensitive lichen and microbial communities.

The proposed programme of development excluded utility-scale renewable energy (RE) infrastructure within the SEZ, due to the limited footprint of the SEZ. In agreement with this original proposal, it is recommended that RE infrastructure be excluded from future considerations within the SEZ.[19] Its location should be determined in low-sensitivity areas outside the SEZ, identified through the regional SEA assessment (Work Package 2), to ensure minimal environmental and cultural disruption. Avoiding these sensitive areas is critical to safeguarding ecological integrity, preserving irreplaceable heritage resources, and respecting the living traditions and ancestral lands of the Richtersveld Nama communities.

3.4 A preliminary zonation scheme for development planning

A preliminary zonation scheme (development suitability) was broadly derived from the spatial sensitivity analyses (see Section 2.1), areas which are potentially degraded by existing anthropogenic disturbance (mainly mining) (see Section 3.2), and recommended areas where development is best avoided (see Section 3.3). The resulting scheme contains two relative development suitability classes (Table SPM 4)

[19] It is noted that the proposed Richtersveld Wind Energy Facility has received Environmental Authorisation in a part of the proposed Boegoebaai SEZ, east of the R382 road.

1
2

Table SPM 4: The two development suitability classes derived from overlaying social and ecological sensitivity polygons and areas already degraded by mining activities.

Development suitability	Implications for project planning
MORE SUITABLE	• May find potentially large-scale developable footprints during project screening and EIA phases, especially in areas already **TRANSFORMED** by historical mining activities. • Nonetheless, high likelihood of encountering mosaics of **HIGH** to **VERY HIGH** sensitivity resources, which may require, depending on the context, extensive fieldwork, complex EIAs and mitigation/management actions and/or offsetting.
LESS SUITABLE	• Very unlikely to find developable footprints during project screening and EIA phases. These areas have not been affected by mining and are largely intact, or have reasonable restoration potential, if there has been limited disturbance e.g., areas of windblown sand. • High likelihood of encountering vast areas of **VERY HIGH** sensitivity ecological and heritage resources. • Very low likelihood of obtaining Environmental Authorisation, apart (potentially) from small-scale infrastructure/development activities, such as tarring existing dirt tracks or low impact electricity distribution lines.

Areas identified as potentially **MORE SUITABLE** for development (~8,500 ha) (Figure SPM 7) target degraded land and should comfortably support the proposed infrastructure, which is estimated to require in the range of ~ 1,700-4,600 ha of land, representing around 5 - 15 % of the full ~33,500 ha extent preliminarily identified for the Boegoebaai SEZ. To put this into context, the established Saldanha Bay Industrial Development Zone (IDZ) and Coega IDZ have respective extents of approximately 356 ha (DTIC, 2017a) and 9,000 ha (DTIC, 2017b).

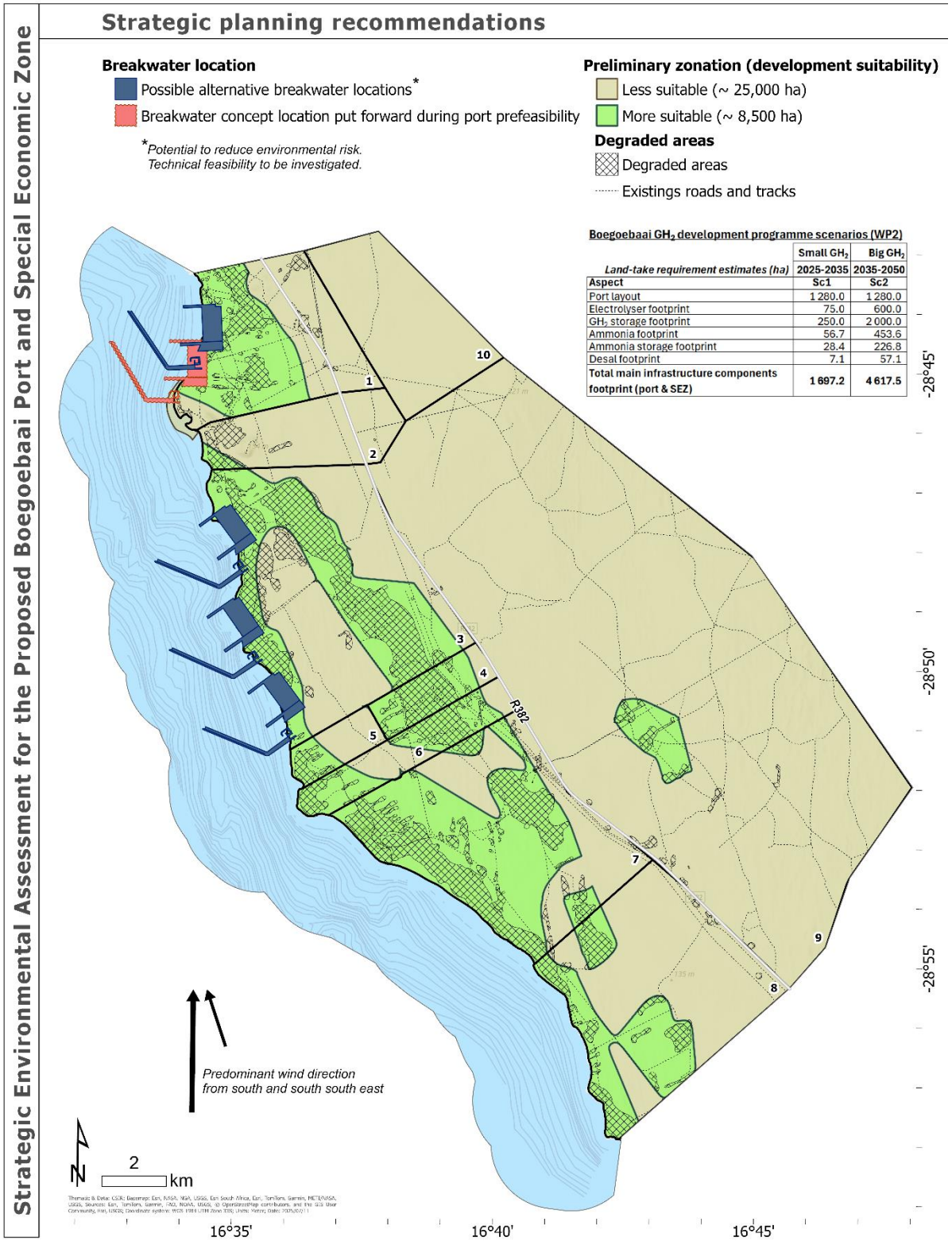


Figure SPM 7: Proposed zonation scheme for the proposed Boegoebaai port and SEZ focussing on potential alternative breakwater locations which avoid the most sensitive areas of the Boegoebaai head. Areas identified as potentially 'more suitable' for development (~8,500 ha) target already degraded land and comfortably support the envisaged spatial footprints of planned port and SEZ-related infrastructure, which is estimated to be in the range of ~ 1,700 to 4,600 ha of land.

3.5 Filling gaps in a data-poor environment

It is recommended that a long-term environmental monitoring programme be established early in the project lifecycle to address data gaps caused by the remoteness of the Boegoebaai site. This programme should prioritise the consistent collection of inter-seasonal field data on climate, oceanic processes, environmental quality, and biodiversity. This will provide the scientific foundation necessary for informed decision-making, effective environmental management, suitable offset areas and interventions, and climate resilience planning throughout proposed development and operational phases.

3.6 Thinking strategically about biodiversity offsets

3.6.1 Terrestrial environment (after Botha 2025)

Box SPM 23: What are Biodiversity Offsets?

Biodiversity Offsets are the measurable outcomes of compliance with a formal requirement contained in an environmental authorisation to implement an intervention that has the purpose of counterbalancing the residual negative impacts of an activity, or activities, on biodiversity, through increased protection and appropriate management, after every effort has been made to avoid and minimise impacts, and rehabilitate affected areas.

Offsets will be triggered due to the presence of restrictive statutory planning features such as CBAs and listed threatened ecosystems, as well as habitat for many SCC, which cover large parts of the SEZ and its immediate vicinity. While the scale of impact varies significantly, from over 21,000 hectares for a Small GH_2 scenario to more than 144,000 hectares for a larger one (see Work Package 2), approximately 40,000 hectares of offsets might be required for a Small GH_2 scenario alone (if the early layout plans put forward are pursued).

Box SPM 24: What is Ecological Compensation?

The outcome of measurable actions to protect, restore and manage priority biodiversity, aimed at compensating for residual negative impacts on irreplaceable biodiversity and ecological infrastructure where these impacts cannot be offset and which should, instead and in the first instance, be avoided.

If the potentially significant impacts posed by the currently proposed port and SEZ development on several threatened, rare or conservation-worthy biodiversity features (most of which are considered strictly "non-offsetable"), cannot be avoided, mitigation should be reframed as Ecological Compensation (Box SPM 24) rather than "offsets *sensu strictu*". This distinction is important for clear communication with stakeholders, highlighting that some biodiversity losses are irreversible and impact conservation goals.

To minimise or address the need for offsets, all developments should be located on disturbed mining areas, as this aligns with the mitigation hierarchy and would not trigger offsets. For areas affected by windblown sand and sand plumes, while not considered similarly transformed, low offset multipliers are proposed, as restoration in these areas might still be possible and desirable to reduce risks to GH_2 facility and infrastructure management. Crucially, habitat loss in areas of **VERY HIGH** sensitivity, particularly those with irreplaceable biodiversity value, is deemed unacceptable as it may compromise the ability to meet conservation targets, and residual impacts on such irreplaceable biodiversity cannot be offset.

There are dangers associated with project-level offset assessment and ad hoc implementation of offsets, as suitable sites may become unavailable over time or costs could become unacceptably high. Therefore, the primary task for project-level EIAs is not merely the technical calculation of loss:gain metrics, but to identify, negotiate, and secure access to suitable offset sites and the most appropriate and durable implementation or management arrangements. Proactive offset schemes are preferred because they are better at addressing cumulative impacts, managing threats, and ensuring successful implementation and outcomes (Box SPM 25). Three large-scale offset receiving environments for offsetting the impacts related to the port and SEZ are proposed, suggesting that most SEZ impacts can plausibly be compensated within these areas (Figure SPM 8). Additionally, sufficient area exists within identified and approved protected area (PA) expansion priority focus areas to offset impacts from regional RE developments– dealt with in Work Package 2. Regional RE generation will also require offsetting in affected ecosystems. An existing proactive offset scheme pilot around Namaqua National Park could be expanded to receiving environments near the SEZ for local impacts, and to other parks or reserves for regional impacts.

Box SPM 25: Coordinated offset planning and implementation

To avoid the risks of fragmented, sequential offsetting, such as loss of suitable sites, legal delays, land use conflicts, and poor conservation outcomess, offset areas for the Boegoebaai Port and SEZ should be proactively identified, secured, effectively protected and rehabilitated. Funding should be guaranteed for long-term management through an endowment-type instrument. This approach would offer greater certainty to regulators, authorities, communities, and stakeholder.

The Richtersveld CPA and all community structures should be proactively involved in the design and implementation of any biodiversity offset to build trust, ensure local benefit, and secure long-term success. Offsets should prioritise statutory protection of CPA-identified priority areas.

Furthermore, a dedicated coordination body should be established to oversee implementation, with governance (regulators and landowners) clearly separated from implementation (state or private entities), to reduce contestation and streamline delivery.

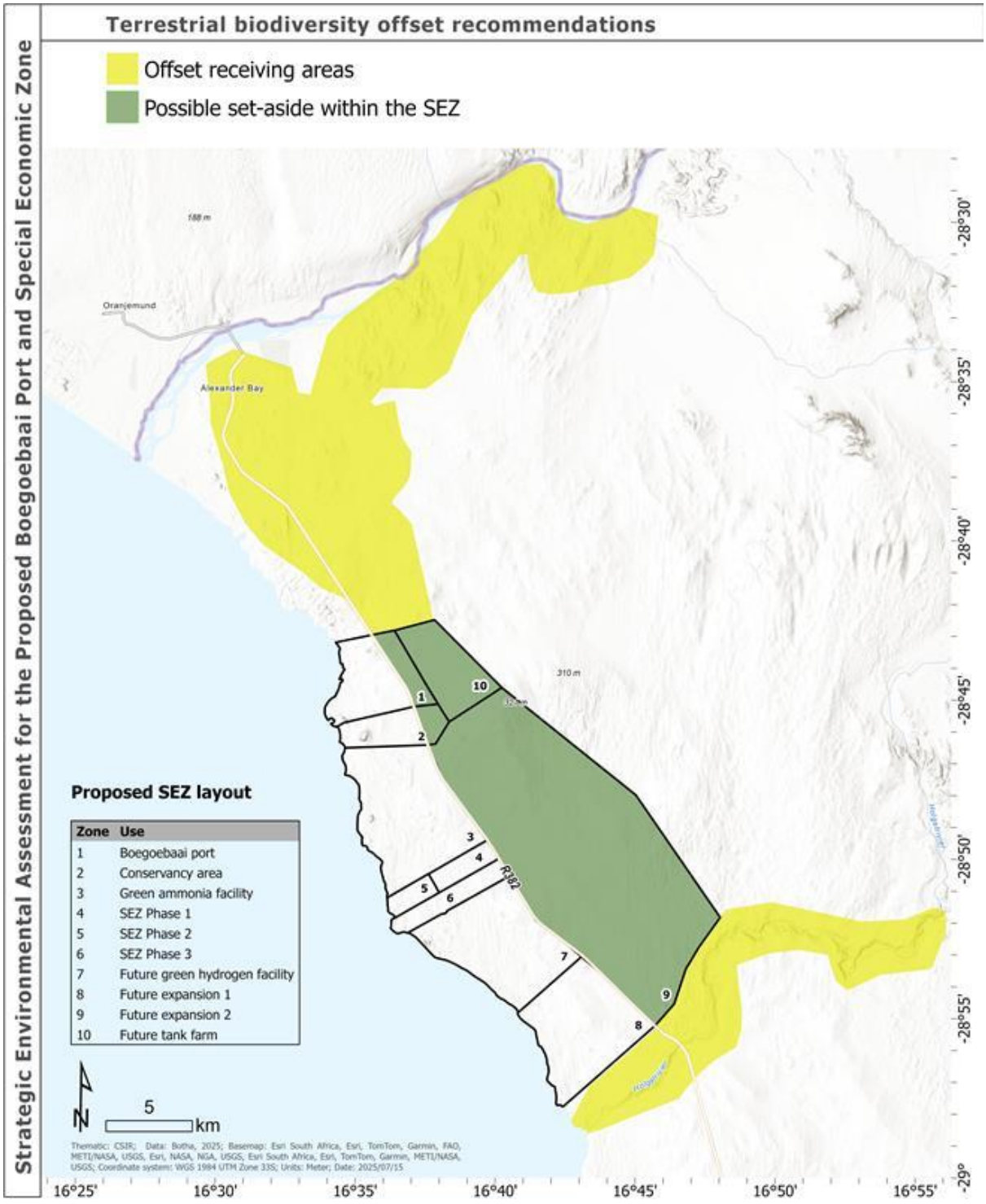


Figure SPM 8: Prospective Offset receiving areas around the SEZ. Note the *Possible set-aside within the SEZ* East of the R382 is also included in this figure, in line with the recommended areas where development is best avoided, as outlined in Section 3.3 above. No attempt to reflect high priority sites West of the R382 as set-asides or to optimally redesign the "conservancy" zone as an Offset receiving area is made (see Box SPM 22:, Section 3.3).

3.6.2 Coastal/marine (after Clark et al., 2025)

According to the Draft Marine Biodiversity Sector Plan (DFFE, 2023), the establishment of a new port is considered incompatible with areas classified as CBA Natural or CBA Restore. The environmentally preferrable option is to avoid such areas altogether. However, complete avoidance may not always be feasible, as numerous small CBA Natural areas are widely scattered along the coast, and a significant portion of the offshore marine environment in the study area is classified as CBA Restore. In circumstances where avoidance is demonstrably not possible, best practice guidance recommends the application of biodiversity offsets or the identification of alternative CBA areas to meet conservation targets. However, it is strongly advised that such provisions do not apply to Boegoebaai Point, which is considered irreplaceable due to its very high ecological sensitivity.

South Africa's National Biodiversity Offset Guidelines (2023) apply to terrestrial and freshwater systems and are not applicable to marine and estuarine environments. While the guidelines do not explicitly explain this exclusion, they do clarify that this does not exempt marine and estuarine systems from offset responsibility. Considering this regulatory gap, deferring to the International Finance Corporation (IFC) biodiversity offset requirements is considered appropriate in this context. IFC Performance Standard 1 requires that biodiversity offsets be applied only after all feasible avoidance, minimisation and restoration measures have been implemented, to address residual impacts on natural habitat. According to IFC Performance Standard 6, offsets must deliver measurable, on-the-ground measurable conservation outcomes to achieve like-for-like or better ecological value and scale. The decision to undertake a biodiversity offset cannot act as a replacement for mitigation and management measures to avoid significant impact.

The following key steps are recommended for designing biodiversity offsets to mitigate impacts on CBA Natural and CBA Restore areas:

- Scoping, in consultation with relevant stakeholders, of potential conservation activities or offset sites within the landscape that could benefit the biodiversity values potentially impacted by the project (i.e., "like-for-like or better").
- Assessing if the loss of biodiversity at the project site can be compensated by gains at the offset site.
- Identifying means for securing offset activities over the long term, including, for example, legal protections.
- Establishing an effective process for communities affected by the offset to participate in the design and implementation of the biodiversity offset.
- Defining the specific offset activities and how they will be implemented in a biodiversity offset management plan, including the roles, responsibilities, and budget projections for the involved parties.
- Establishing a funding mechanism to support the offset for as long as project impacts persist.
- Designing a system for monitoring, evaluation, and adaptive management.
- Ensuring that the project meets all applicable laws, regulations, and policies pertaining to biodiversity offsets.

3.7 Principles guiding sustainable port planning (after Taljaard & Weerts, 2025)

To plan a sustainable port, it is essential to implement a balanced approach that integrates economic growth, environmental protection, and social progress from the earliest planning stages to ensure long-term viability and secure its 'license to operate'. A robust Framework for Sustainable Port Planning and Development (SPP&D), aligned with best practices, is crucial, covering governance, environmental, social, and economic domains. In terms of governance, key criteria include establishing a legislative framework, fostering an organizational culture geared towards sustainability, allocating dedicated budgets, implementing public communication mechanisms, and setting up formal institutions for engaging both port customers and external stakeholders, alongside fostering collaborative arrangements with adjacent local authorities. This also necessitates comprehensive environmental assessment and management throughout the project lifecycle, encompassing SEAs, EIAs with associated Environmental Management Programmes (EMPrs), and contingency planning.

Box SPM 26: What are Sustainable Ports?

Sustainable ports can be defined as:
"Ports which adhere to the concept of resource saving and environment-friendly development, actively fulfilling its social responsibilities, and comprehensively adopting technologies and management measures that are conducive to saving resources and energy, protecting environment and ecology, and coping with climate change" Guo and Liu (2018)

Environmental considerations are paramount and include eco-efficiency measures such as water and energy use efficiency, selecting eco-friendly materials, robust waste management (including recycling and minimising construction waste), and efficient, responsible land/sea use through spatial planning, along with addressing climate mitigation. There must be transparent reporting on potential impact sources like atmospheric emissions, noise, wastewater discharges, and solid/hazardous waste, ensuring compliance with environmental standards and conducting regular audits. Environmental quality must be effectively monitored for air, noise, marine water, marine sediment, soil, and groundwater quality, along with controlling marine invasive species and assessing the status of terrestrial and marine habitats and biodiversity.

Box SPM 27: Key Sustainability Criteria developed for the proposed Boegoebaai Port

To align port sustainability planning with performance assessment and reporting, consistent frameworks and indicators are essential. The port sustainability performance (PSP) Index, developed with TNPA, guided the sustainability criteria for the proposed Port of Boegoebaai. These criteria are structured under four sustainability pillars and aligned with relevant SDGs. They include legislative support, institutional arrangements, and sound management practices, ensuring planning integrates measurable, globally comparable, and locally relevant sustainability outcomes for effective sustainability performance assessment and reporting.

Crucially, planning must incorporate sensitivity assessments to avoid habitat loss in areas of VERY HIGH sensitivity, particularly those with irreplaceable biodiversity value, as residual impacts on such irreplaceable biodiversity cannot be offset and compensation would not be feasible. Where impacts are unavoidable, biodiversity offsets serve as significant effective ecological compensation, with a preference for proactive offset schemes to better address cumulative impacts and ensure successful outcomes.

Developers should also prioritize locating facilities on disturbed mining areas where possible, as this aligns with the mitigation hierarchy and would not trigger offsets. Social sustainability requires attention to community wellbeing through corporate social initiatives, ensuring access rights where appropriate, community-based environmental education, supporting sustainability-related community enterprises, and investing in research, development, and innovation. Support for local and small businesses is vital, as are sound port-municipal relations and, importantly, the protection of cultural heritage assets. Employee satisfaction and wellbeing, including training, engagement forums, and addressing grievances, are also integral.

From an economic perspective, planning must account for climate resilience, including preparedness, early warning systems, and incident assessment. It involves ensuring high service quality and efficiency through technical capacity, potable water supply, customer satisfaction, security, digitalization, and maintaining

infrastructure quality. The port should contribute to economic growth and development through revenue generation, employment opportunities, and fostering new business production. Effective inter-connectivity, both hinterland and international, is also a key economic criterion. Finally, foresight of likely future development plans (industrial, urban, suburban) is essential for spatial planning to avoid future port-city and port-community conflicts. Given the remoteness of some areas, securing access to long-term, inter-seasonal field data on climate, oceanic processes, environmental quality, and biodiversity is a critical challenge that must be resolved early in the planning process.

3.8 Equitable consultation and negotiations (after Atkinson et al., 2025 & Gammage et al., 2025)

The Boegoebaai region, located in the Richtersveld of the Northen Cape holds deep cultural and ecological significance. Historically, the area was shaped by mining, particularly through operations by Alexkor, which led to restricted access and displacement of traditional uses. The Richtersveld community, through the Richtersveld Communal Property Association (RCPA), reclaimed land rights in a landmark restitution case. This land now forms the basis for major developments, including the proposed Boegoebaai Port and SEZ. As such, the RCPA must be a central actor in any development and land-related negotiations. The RCPA would be crucial in facilitating community-level engagement by acting as intermediaries between external developers and local communities.

The proposed development promises transformative economic potential, but it has also raised concerns. The area surrounding Boegoebaai contains ancestral graves, sacred natural features, and traditional fishing grounds that are central to the identity and heritage of local communities. Past experiences of exclusion from decision-making, limited benefits from mining, and environmental degradation have created a legacy of mistrust. Without meaningful engagement, there is a risk of repeating patterns of marginalisation and cultural erosion. A constructive and inclusive dialogue must go beyond conventional stakeholder consultation. It should be **early** in the project design stage, **inclusive, culturally appropriate, continuous, collaborative,** and communities be resourced to participate meaningfully.

The principle of Free, Prior and Informed Consent (FPIC) is a globally recognised standard for engaging Indigenous and local communities in decisions that affect their land, resources, and cultural heritage. The Socio-economic Report for Work Package 2 (Atkinson et al., 2025) of the SEA draws on the Initiative for Responsible Mining Assurance (IRMA) in outlining that FPIC is not just a one-time engagement tool but a comprehensive principle grounded in Indigenous people's rights to self-determination, land, culture, development, and a healthy environment. as a right grounded in self-determination. The framework outlines practical steps to ensure constructive and inclusive engagement with Indigenous people during consultation processes:

Box SPM 28: FPIC Principles

- **Free:** Consent must be voluntary and without coercion.
- **Prior:** Engagement must occur before any project decisions or activities begin.
- **Informed:** Communities must receive full, accessible, and culturally appropriate information.
- **Consent:** Communities have the right to approve or reject, and to withdraw consent.

- **Tailor engagement methods** to each Indigenous group's preferences and context.
- **Jointly identify affected rights and interests,** ensuring that community concerns guide discussions.
- **Collaborate on further assessments** to fully understand potential impacts, including commissioning independent research if needed.
- **Support informed participation** by addressing capacity constraints through funding, training, and joint learning activities (e.g. workshops or site visits).
- **Promote broad community involvement** to avoid over-reliance on representatives and ensure collective input.

It is highlighted that FPIC is not a once off but a continuous process. It must be embedded in governance structures and respected by all stakeholders, including developers, government and financiers.

To ensure equitable consultation and uphold FPIC, the following are recommended (but not limited to):

- Integrate and implement the FPIC framework within project governance structures and decision-making processes, and ensure it is a continuous process.
- Undertake inclusive negotiations with the landowners in all stages of the development process.
- Conduct independent pre-negotiation scoping to assess community readiness and expectations.
- Ensure that land access agreements are negotiated transparently to obtain full support of the CPA and affected communities.
- Respect the land restitution history and communal governance structures, avoiding top-down impositions.
- Adopt a collaborative, community-centred approach from the project scoping and design stage, ensuring that diverse local needs, knowledge systems, and priorities are meaningfully integrated into planning and decision-making to achieve more inclusive, flexible, and sustainable outcomes.
- Provide financial and technical support to communities to engage effectively.
- Engagement should be culturally appropriate, multilingual, and accessible.
- Create independent grievance redress systems that are legally supported and culturally sensitive.
- Establish citizen science and community-led monitoring to track environmental and social impacts.
- Develop benefit-sharing models that prioritise historically marginalised groups.
- Ensure post-project transitions include land restoration, cultural preservation, and economic diversification.

4. IMPACT MANAGEMENT PRINCIPLES AND PRACTICES

This section presents a summary of the potential impacts and synthesises suggestions for management principles and actions which might mitigate negative impacts and enhance positive ones.

Table SPM 5: Summary of potential impacts and associated recommended management principles and actions for the proposed Boegoebaai Port and SEZ

	Impact	Principles/actions for management (enhancement and mitigation)
MARINE ECOLOGY	Disturbance and harm to marine fauna, including physiological and behavioural effects, recruitment disruption, and species displacement or mortality.	Consider relocating the port to avoid areas of high ecological sensitivity (especially seal and seabird colonies); avoid construction during sensitive life stages of fauna.
	Degradation of benthic and demersal communities, including habitat loss, smothering and altered community structure.	Avoid development in areas designated as CBA-Restore and ESA; consider biodiversity offsets (in line with applicable guidelines) where impacts cannot be avoided.
	Hydrodynamic alterations, such as changes in longshore currents and littoral drift, potentially affecting coastal sediment transport and ecosystem stability.	Consider alternative sites with less ecological sensitivity and similar bathymetric suitability; avoid locations where wave and current patterns are critical to habitat stability.
	Loss and degradation of marine habitats, including permanent loss of unconsolidated seafloor and associated communities due to infrastructure placement.	Avoid infrastructure placement in critical or irreplaceable habitats like rocky reefs and CBA-Restore zones; use the mitigation hierarchy: avoid → minimise → offset.
	Disturbance to marine fauna, caused by elevated underwater noise levels, light emissions, ship strikes, and seawater intakes.	Avoid areas where seals and cetaceans breed or aggregate; consider relocating to avoid risk zones; restrict activity near colonies.
	Degradation of water quality, resulting from routine vessel discharges, operational spills, brine discharges, increased turbidity, and remobilisation of sediment-bound contaminants.	Site desalination plant discharges away from ecologically sensitive zones; control pollution from ships and ensure monitoring of effluent impacts.
	Loss and alteration of marine habitats, including permanent loss of unconsolidated seabed and disruption of associated benthic communities.	Avoid ecologically sensitive unconsolidated habitats; if unavoidable, consider habitat rehabilitation and offsetting strategies.
	Accidental hydrocarbon spills / releases (e.g. vessel accident, bunkering and pipe rupture)	Develop spill contingency plans and ensure rapid response capacity; avoid port placement in highly sensitive coastal environments.
INTEGRATED TERRESTRIAL AND AQUATIC ECOLOGY	**Aquatic Ecosystems**	
	The planned Boegoebaai Port development in Zone 1 may extend into recharge areas of nearby wetlands or pans, threatening their sustainability due to uncertain hydrological drivers.	Avoid development in recharge-sensitive areas; include hydrological buffers and retain natural flow paths.
	Inclusion of northern section of BB1 in the Zone 2 conservancy area resulting in potential protection of recharge areas for the pan, its wetland, and associated spring.	Include or designate upper section of BB1 pan in conservancy; protect full recharge zones.
	Construction of the confirmed Green Hydrogen and Ammonia Facility in Zone 3 may lead to wetland and pan degradation, stormwater and vehicle disturbances	Avoid high sensitivity areas (CR wetlands); buffer wetland edges; manage stormwater impacts.
	Development of Phases 1–3 of the SEZ Industrial Park in Zones 4–6 may result in destruction of CR pan and wetland habitat (BB3), nutrient enrichment, and	Avoid watercourse BB3 (ephemeral pan with wetland elements); maintain hydroperiods; control nutrient and runoff loads.

	Impact	Principles/actions for management (enhancement and mitigation)
	hydroperiod disruption.	
	The proposed future Green Hydrogen Facility in Zone 7 may destroy presumed natural (BB6) and artificial pan (BB4 and BB5) and wetland habitats and alter hydroperiods through physical disturbance.	Avoid southwest of Zone 7 (presumed natural pan BB6); maintain flow paths; restrict development in sensitive zones.
	Development in Zone 8 may lead to the destruction of presumed natural pan and wetland habitat and artificial pans BB7 and BB8, hydroperiod disruption, and flow-related degradation.	Avoid northern part of Zone 8; protect surface flows and ground-truth habitats.
	Expansion activities in Zone 9 may result in destruction of pan habitats, eutrophication, broader ecosystem degradation, and biodiversity loss.	Avoid sensitive aquatic features, rock blasting, flattening of slopes and/or loss of rocky outcrops that could include ephemeral rock pool and pan habitat; establish runoff controls and ecological corridors.
	Terrestrial Ecosystems (including avifauna; bats; mammals, reptiles and amphibians; vegetation and flora)	
	Construction of port infrastructure in Zone 1 and SEZ infrastructure across Zones 3 to 10 may cause vegetation loss (part of a CR ecosystem, irreplaceable CBA1 or optimal CBA2, a Priority Focus Area of the NPAES and a KBA), habitat fragmentation, loss of SCC and endemic species, ecosystem service decline, erosion, and faunal disturbance.	Avoid Very High sensitivity areas; prioritise disturbed sites west of R382 (provided priority habitat are not negatively impacted).
	Handling manganese, zinc, and lead in Zone 1 may lead to dust emissions, air pollution, and toxicity affecting soil and water quality.	Use enclosed handling; monitor and manage emissions; avoid sensitive habitats.
	Conveyor systems planned for Zone 1 may pollute soil/water and act as barriers to animal movement.	Fully enclose; monitor emissions; design to allow fauna passage.
	Dust suppression activities in Zone 1 may result in environmental contamination if not properly managed.	Develop clear waste protocols and manage dust control measures responsibly.
	Operation of the desalination plant in Zone 1 and Zone 3 may harm marine fauna via intake systems and brine discharge, and introduce thermal/chemical pollution.	Specialist input (marine ecologist) on intake/discharge sites; monitor discharge and mitigate thermal impacts.
	The sewage infrastructure in Zone 1 may lead to groundwater contamination, nutrient pollution, and challenges with sludge management.	Avoid sensitive areas; use robust treatment systems and secure sludge management. Positive impacts could arise if nutrients are recovered and used as fertilizers.
	Stormwater infrastructure in Zone 1 could spread pollution, introduce invasive species, and impact groundwater.	Separate clean/dirty water; install filters; monitor and manage runoff.
	Installation of electrical infrastructure in Zone 1 will add to vegetation clearance, construction emissions, electrocution risk, and habitat fragmentation.	Avoid high sensitivity areas; plan routes to minimise impact; bird-safe infrastructure.
	Fuel storage infrastructure in Zone 1 and Zone 10 may lead to soil and groundwater contamination, VOC emissions, and fire/explosion risks.	Avoid sensitive ecosystem, containment infrastructure; air movement modelling (in consideration of Namib Lichen Fields); fire risk protocols.
	Construction of roads, bridges, pipelines and powerlines in Zone 1 may fragment habitats, restrict fauna movement, increase roadkill risk, and promote erosion and invasive species.	Avoid sensitive areas; fauna underpasses; erosion control; alien species management.
	Widening of the R382 in Zone 1 may cause additional vegetation loss and increase pollution from traffic.	Minimise footprint; implement pollution and erosion controls.
	Establishing a conservancy in Zone 2 may lead to partial protection of CR ecosystems and remnant intact vegetation, however air pollution from the	Refine boundary to include the entire Boegoeberg North; all development to avoid Zone 2; monitor lichen health; enhance ecological representation (rehabilitation).

	Impact	Principles/actions for management (enhancement and mitigation)
	neighbouring development could negatively affect lichens in this zone pollution. Extending the area across the R382 without suitable fauna crossing will likely result in SCC mortality increase.	
	The electrolyser facility in Zone 3 may create high water and energy demand, chemical pollution, and explosion risks.	Avoid Very High sensitivity areas; optimise resource efficiency; ensure chemical safety and leak detection
	The ammonia facility in Zone 3 and across Zones 7 to 9 may result in ammonia toxicity, air/soil contamination, and bat mortality from hot steam discharge.	Monitor emissions; include bat protection; avoid sensitive roost zones
	Use of a firewater system in Zone 3 could increase salinity when using seawater and introduce marine pollution when using firefighting foams.	Use environmentally compatible systems; specialist guidance on use and containment.
	The proposed development (across all zones) may create habitat for corvids that predate heavily on small, slow-moving tortoises. Predation can lead to population declines in tortoises.	Discourage nesting structures; manage corvid populations adaptively.
	Construction activities across all zones may disturb fauna, increase injury/mortality risk, and cause trench-related deaths.	Limit noisy/lighted work to daytime; restore trenches immediately.
	Earthworks across all zones may destroy roosting habitats for birds and bats.	Avoid active roost zones; rehabilitate areas post-disturbance.
HERITAGE	**Palaeontology**	
	Fossil material may be uncovered during bulk earthworks or excavation, or during backfilling of soils from mine dumps across all zones.	Include palaeontologist in EIA stage to determine the need for a palaeontological specialist study; apply standard palaeontological chance find protocol.
	Construction could expose and/or destroy raised beach deposits.	
	Terrestrial Archaeology	
	Construction could expose and/or destroy MSA scatter at Namakwakop in Zone 1 and MSA sites in old sea cliffs buried by wind-blown sand along the coast (Zones 1, 2, 3, 5, 6, 7 & 8).	Undertake detailed archaeological field surveys for each development or project - archaeologists will be required to identify and prioritise sites that are most representative of each development footprint for sampling (this may include the selection of sites of lower individual significance where they contribute meaningfully to understanding the broader archaeological context of the area); Conduct continuous archaeological monitoring during earthworks, particularly in coastal zones where buried middens may be present.
	Destruction of LSA middens and other occupation debris along the coast (Zones 1, 3, 7, 8 and likely other coastal zones), at the pans in Zones 3, 4, 6 & 7 and at inland locations at water sources (Zone 9).	
	Graves	
	Known graves at Boegoeberg South may be impacted by the development.	Engage with local communities and heritage authorities prior to development to assess potential for reburial of human remains. Implement chance finds protocol; halt work immediately and notify heritage authorities if graves are found
	Chance uncovering of unmarked or undocumented graves across all zones during construction.	
	Maritime Heritage	
	Construction of offshore port infrastructure could disturb submerged shipwrecks.	A Maritime Heritage specialist study will need to be included in the heritage application for the Port development, as well as any other developments that might require, for example, undersea pipelines.
	Potential disturbance to shipwrecks during installation of undersea infrastructure (pipelines/cables) in Zones along the coast (Zone 3, 5, 6, 7 & 8).	

	Impact	Principles/actions for management (enhancement and mitigation)
	Living Heritage	
	Development would disrupt transhumant grazing and herder movement patterns and prohibit access to the area, particularly in Zones 2, 9 and 10.	Engage with the local herder community to understand the impact of losing winter grazing areas, specifically Swartbank and Witbank. Consultations should explore the reasons for selecting these areas, their seasonal value, possible alternatives, and the cultural significance of the grazing landscape.
	Development of the Port and SEZ would massively alter the landscape context in which small-scale herding occurs through the addition of industrial facilities.	
	Cultural Landscape	
	Development of the Port and SEZ will irrevocably alter the sense of place of the region through the addition of industrial facilities; affecting scenic integrity and altering cultural landscape continuity.	Visual Impact Assessments required. Engagement with local communities, SANParks, UNESCO, SAHRA, and tourism operators is essential. Discussions should also be initiated with the South African Government and UNESCO about possible effects on the RCBL's World Heritage status.
FISHERIES & COASTAL LIVELIHOODS	Local communities, especially small-scale fishers and Nama groups, feel excluded from current governance processes, leading to mistrust.	Establish a cross-sectoral, inclusive marine governance platform that includes historically marginalised and hidden stakeholders.
	Past stakeholder engagement has lacked transparency, inclusivity, and cultural sensitivity, limiting trust and participation.	Develop transparent, culturally appropriate, ongoing stakeholder engagement processes based on co-creation, shared monitoring, and legal grievance mechanisms.
	Fragmented environmental and social impact assessments risk underestimating cumulative and long-term impacts.	Integrate cumulative impact assessments and harmonise regulatory frameworks through interdepartmental coordination and shared data systems.
	Fishing and coastal communities lack access to training and technical skills for marine sector opportunities.	Invest in localised skills development and just transition support, especially targeting youth, women, and informal workers.
	Infrastructure development risks gentrification and displacement of vulnerable local residents.	Plan for affordable, climate-resilient housing and ensure basic services are available to prevent community displacement.
	Absence of baseline data and long-term monitoring impairs adaptive management and learning.	Develop participatory monitoring, evaluation, and learning frameworks for ecological and socio-economic indicators.
	Small-scale fishers face threats to their livelihoods and cultural heritage from industrial encroachment and systemic exclusion.	Prioritise equitable benefit-sharing for disadvantaged groups through inclusive procurement, hiring, and training policies.
	Spatial competition from mining, oil/gas, and shipping displaces small-scale fishers and threatens ecosystem sustainability.	Use ecosystem-based Marine Spatial Planning to protect fishery areas and ensure access for small-scale fishers.
	The Boegoebaai project is a strategic test case for inclusive, sustainable marine development in South Africa.	Align development with national sustainability goals by embedding Indigenous knowledge, co-management, and equitable governance.

5. IMPLEMENTING GOOD EIA PROCESSES AND DE-RISKING PROJECTS

Diligent, proactive and best-practice planning and implementation of robust EIA processes are a key tools for de-risking projects. "Managing the Impacts of a Green Hydrogen/Power-to-X Economy: An Environmental Assessment Guideline for South Africa" (Schreiner et al., 2024) provides extensive guidance on this. This section summarises these recommendations.

5.1 Appointing the Environmental Assessment Practitioner

When a proponent initiates project conceptualisation in some detail, in consultation with engineers, and made an initial decision to proceed, one of the first steps is to appoint a suitably qualified, experienced, and professionally registered Environmental Assessment Practitioner (EAP)[20]. Developers should engage an EAP to work collaboratively with the technical and financial teams at the earliest stages of project planning. This will allow the EAP to develop a full appreciation of the complexity and scale of the project and to de-risking the project from an environmental and social perspective (Figure SPM 9).

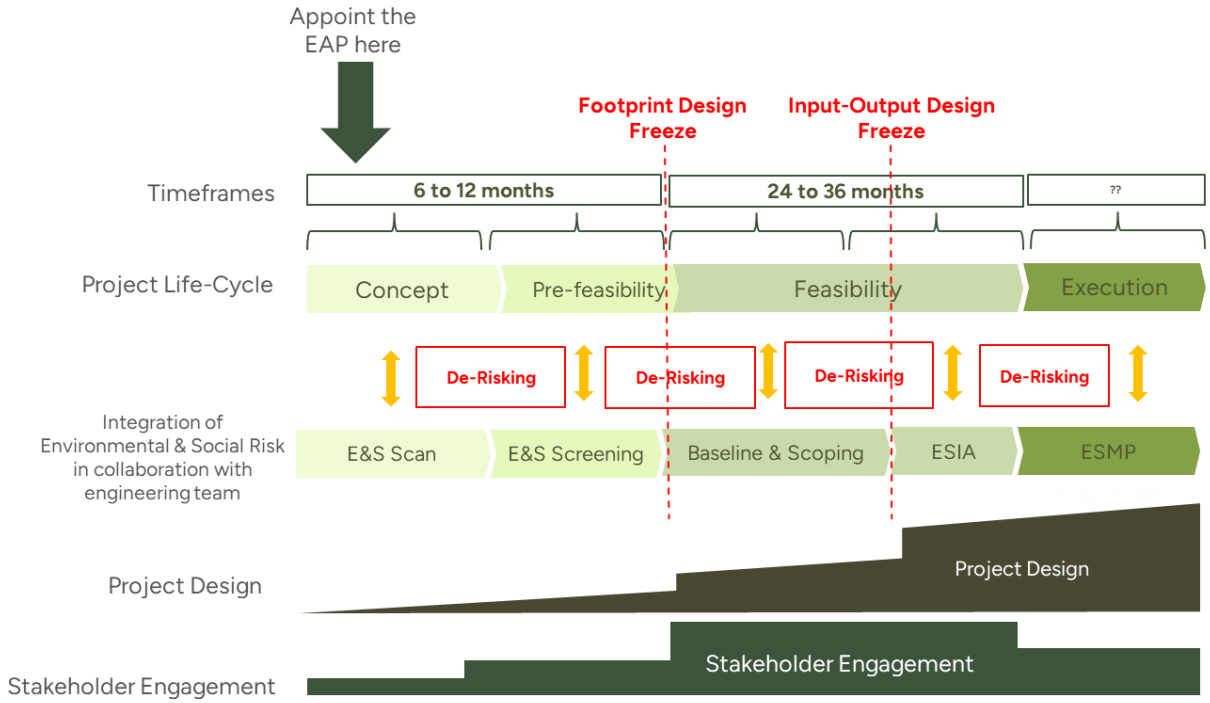


Figure SPM 9: Early appointment of an Environmental Assessment Practitioner and integration of environmental and social risks into the large-scale port and GH_2 project development lifecycle is critical to de-risking projects. (Source: SLR in Schreiner et al., 2024)

5.2 Integrating lender considerations

Large-scale development projects often rely, fully or partially, on financing from third party banks, lenders and investors who may subscribe to the Equator Principles and International Finance Corporation (IFC) Performance Standards (PS) (Table SPM 6). To unlock such funding, project proposals and EIAs will need

[20] EAPs must be registered with the Environmental Assessment Practitioner Association of South Africa (EAPASA), mandated in terms of Section 24H of the NEMA.

to be aligned with both the local EIA Regulations as well as international lender standards. Different financial institutions have different sustainability requirements, but typically most banks or lenders will use the Equator Principles and IFC Performance Standards to identify and manage environmental and social risks for their investment.

Table SPM 6: Summary of the Equator Principles and IFC Performance Standards that need to be met to unlock funding from major third party banks, lenders and investors.

Standard	Objective
Equator Principles (2020)	The Equator Principles consist of a set of principles and procedures adopted by financial institutions to ensure that the environmental and social issues associated with a project financed by those institutions are respected. The Equator Principles are summarised below: • *Principle 1 – Review and Categorisation*: The projects are classified into three categories according to the potential environmental and social risks they represent. • *Principle 2 – Environmental and Social Assessment*: It is necessary to carry out an environmental evaluation of the project that addresses the risks identified during the analysis and categorisation. • *Principle 3 – Applicable Environmental and Social Standards*: The projects implemented in emerging countries, apart from complying with local laws, must also follow the IFC Performance Standards and the WBG EHS Guidelines. • *Principle 4 – Environmental and Social Management System (ESMS) and Equator Principles Action Plan*: The projects must have an action plan to address the risks identified during the environmental evaluation. • *Principle 5 – Stakeholder Engagement:* It is necessary to promote and carry out consultations with the stakeholders in a culturally appropriate and structured manner. • *Principle 6 – Grievance Mechanisms:* It is necessary to establish mechanisms for ongoing involvement of interested and affected parties, to allow for the submission of grievances or issues, during all phases of project development. • *Principle 7 – Independent Review:* The environmental performance must be audited by independent experts, with experience in the area covered by the project. • *Principle 8 – Covenants:* The laws and regulations, licensing, and action plans, must be carried out in all aspects. • *Principle 9: Independent Monitoring and Reporting:* The projects should appoint an independent environmental and social expert to carry out the monitoring and produce additional reports. • *Principle 10 – Reporting and Transparency:* The financial institutions must publish information on the loans granted, at least annually, in accordance with the rules of the Equator Principles.
IFC Performance Standards (2012)	The IFC Performance Standards are applied to a project to manage E&S risks and impacts throughout the life of an investment. There are eight performance standards which establishes: • The importance of undertaking an integrated approach to identifying the E&S impacts, risks, and opportunities of projects; effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and effective management of E&S performance throughout the life of the project; and • Objectives and requirements to avoid, minimise, and where residual impacts remain, to compensate / offset for risks and impacts to workers, affected communities, and the environment. • PS 6 requires clear identification of biodiversity risks and appropriate mitigation, including offsetting.

5.3 Adequate consideration of alternatives

Alternatives are defined as different means of meeting the general purpose and requirements of the activity (Table SPM 7). Alternatives that maximise resource use efficiency (e.g., land, energy and water-use efficiency) and minimise waste production must be sought by the EAP. Although alternatives are to be considered as early as possible in the process, the necessity to consider modifications and changes, to prevent and/or mitigate impacts identified during the assessment process, may also arise.

Table SPM 7: Types of alternatives that should be considered during for large-scale port and GH_2 development projects, adapted after DEA&DP (2013)

Type of alternative	Explanation
Location	Refers to both alternative properties at regional or national scale, as well as alternative sites on the same property.
Activity	Where it is possible to undertake an activity which has the same project outcome but comes with less ecological and social costs.
Design or Layout	Different architectural styles, engineering designs, and technologies, or consideration of different spatial configurations on a particular site (e.g., siting solar PV away from wetlands).
Input	Input alternatives are applicable to applications that may use energy sources in their process (e.g., PtX projects considering wind versus solar PV inputs).
Routing	Consideration of alternative routes generally applies to linear developments such as power line servitudes, transportation, and pipeline routes.
Scheduling and timing	Where several measures might play a part in an overall programme, but the order in which they are scheduled might contribute to the overall effectiveness of the end result.
Scale and magnitude	Activities that can be broken down into smaller units and can be undertaken on different scales (e.g., sizing of solar PV facilities).
'No-Go' option	EIAs must include the "no-go" option as a baseline against which all other alternatives must be measured. The option of not implementing the activity must always be assessed and to the same level of detail as the other feasible and reasonable alternatives.

5.4 Identification of Listed Activities and specialist studies

The South African EIA Regulations (as amended in 2014), have been promulgated in terms of Chapter 5 of the NEMA. Their purpose is to regulate the preparation, evaluation, submission, processing, consideration of, and decision on, applications for Environmental Authorisation (EA) for the commencement of activities, subjected to environmental assessment, to avoid detrimental impacts on the environment and to mitigate impacts to an acceptable level when avoidance is not possible, and to enhance positive environmental impacts.

The key identified activities, that trigger the need for EA, that are likely applicable to port and PtX projects are outlined in Table SPM 8. Other identified activities may be relevant, depending on project design and specifications.

Box SPM 29: Other permits and approvals required.

In addition to EA various other permits and approvals will be required for infrastructure development, depending on the Project Description and receiving environment, including, but not limited to:

- Heritage Approval
- Atmospheric Emissions Licence
- Coastal Discharge Permit
- Use of vehicles in a coastal area
- Waste Licence
- Water Use Licence
- Approval to use land surface in a way which may contradict the Mineral and Petroleum Resources Development Act

Various specialist assessments will be required as input studies to inform, decisions on certain authorisations, permits and approval applications. Each specialist assessment should include an up-to-date review of the latest literature and legislation related to the specific theme it is assessing. Impacts must be assessed according to the project phases, i.e., construction, operation and decommissioning and in terms of their nature, extent, duration, consequence, probability of occurrence, irreplaceability, reversibility, potential for mitigation, cumulative effects, and overall significance. Clear ToRs for Offset specialist studies should be included, especially where these point to eligibility for participation in any established proactive offset scheme, and the required consents and interventions to secure offset outcomes – over a bland statement of biodiversity losses and gains.

The EAP, in consultation with stakeholders and with the use of the National Environmental Web-based Screening Tool will determine the most appropriate specialist studies for the project on a case-by-case basis, depending on the description and extent of the proposed project, and the state of the receiving environments. The following specialist studies might be required for large scale port and GH_2 development projects:

1. Marine Ecology Assessment
2. Fisheries Assessment
3. Terrestrial Biodiversity Assessment
4. Terrestrial Plant Species Assessment
5. Terrestrial Animal Species Assessment
6. Aquatic Biodiversity Assessment
7. Dispersion Modelling Study
8. Sediment Movement Study
9. Bird Assessment (+pre-construction monitoring)
10. Bat Assessment (+pre-construction monitoring)
11. Invertebrate Assessment
12. Agricultural and Soils Assessment
13. Archaeological and Cultural Heritage
14. Palaeontology Assessment
15. Socioeconomic Assessment
16. Noise Assessment
17. Visual and Landscape Assessment
18. Hydrology Assessment
19. Civil Aviation Assessment
20. Defence Assessment
21. Traffic Study
22. Major Hazardous Installation Risk Assessment
23. Radio Frequency Interference Assessment

Table SPM 8: Likely Listed Activities (non-exhaustive) which may be triggered for port and GH_2-related projects in the proposed Boegoebaai SEZ, per technology type, across Listing Notices 1, 2 and 3.[21]

Technology type	Listing Notice 1	Listing Notice 2	Listing Notice 3[22]
Port development	Activity 14; Activity 16; Activity 18; Activity 19A; Activity 23[23]	Activity 4; Activity 12; Activity 14; Activity 15[24]; Activity 23[25]; Activity 26	Activity 2 (g); Activity 3(g); Activity 12(g); Activity 14(g)
Seawater RO	Activity 9; Activity 12; Activity 16; Activity 17 (i) (e); Activity 19A; Activity 25	Activity 6; Activity 15; Activity 26	Activity 12(g); Activity 14(g)
Hydrogen via electrolysis	Activity 16; Activity 24(ii); Activity 25; Activity 27; Activity 28(ii)	Activity 4; Activity 7 (ii); Activity 15	Activity 12(g)
Ammonia via Haber-Bosch	Activity 16; Activity 24(ii); Activity 25; Activity 27; Activity 28(ii)	Activity 4; Activity 6; Activity 7 (ii); Activity 15	Activity 12(g)
Linear infrastructure (Roads, Pipelines, Powerlines)	Activity 9(i); Activity 10(i); Activity 11(i); Activity 24(ii); Activity 27; Activity 56(i)(ii)	Activity 9	Activity 4(g); Activity 18(g)
Onshore wind (likely to be developed in the broader region, not confined to the SEZ)	Activity 12; Activity 14; Activity 19; Activity 24; Activity 56	Activity 1; Activity 15	Activity 12(g)
Solar PV (likely to be developed in the broader region, not confined to the SEZ)	Activity 12; Activity 14; Activity 19; Activity 24; Activity 56	Activity 1; Activity 15	Activity 12(g)

[21] Listed Activities outlined do not reflect the full list of activities that would be applicable to a specific GH_2/PtX project. The full list of applicable Activities must be identified on a case-by-case basis by the EAP.
[22] The applicable Listing Notice 3 Activities would be identified on a case-by-case basis depending on potential triggers with regard to the thresholds or geographical restrictions related to the Northern Cape Province outlined in the listing notice.
[23] In the event that a wastewater treatment works is constructed and such works has a daily throughput capacity of more than 2 000 m^3 but less than 15 000 m^3.
[24] In the event that the Proposed Development will occur on an area of land of 20 hectares or more where such land has not been disturbed by mining or any other activity.
[25] This Listed Activity may be applicable subject to the piling mechanism selected, i.e., a piled structure over a gravity structure for the construction of a quay.

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Work Package 1:

Strategic Environmental Assessment for the proposed Boegoebaai Port and Special Economic Zone

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