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Project Nr: STS 24 - 2052

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TECHNICAL MEMORANDUM
HIGH-LEVEL ALTERNATIVES ANALYSIS FOR THE PROPOSED BIODIVERSITY OFFSET INITIATIVE FOR THE MACASSAR WASTEWATER TREATMENT WORKS (WWTW) EXPANSION PROJECT, MACASSAR, WESTERN CAPE.

1. PROJECT BACKGROUND

The existing Macassar Wastewater Treatment Works (WWTW) is located along the False Bay coastline at Macassar. The WWTW was constructed in ~ 1977 and is currently operated in terms of a water use licence (Reference 19/G22H/F/582) as issued by the then Department of Water Affairs and Forestry (now Department of Water and Sanitation (DWS)), dated 21 July 2011. The Macassar WWTW receives sewage from Gordon's Bay, Strand, Somerset West and Macassar via the existing Macassar pump station, located near to the WWTW. Due to significant development in the catchment area, the WWTWs plant must be further extended. The upgrades will entail the construction of additional facilities and infrastructure for the treatment of wastewater on the property.

The WWTW utilizes Conventional Activated Sludge treatment processes, with no primary settling (i.e. no primary sludge is generated, only secondary sludge). The present design capacity of the WWTW is about 30Ml/d (Ml/d = Mega litres per day) average dry weather flow. It is proposed to expand the hydraulic capacity of the WWTW by 50Ml/d to a final design capacity of 80Ml/d for the entire, upgraded WWTW. Installation of additional electrical infrastructure is also proposed as part of the refurbishment of the WWTW, to supply power to the site from the nearest Eskom substation.

The proposed new facilities at the WWTW will extend into undeveloped areas adjacent to the existing WWTW. Part of the proposed development area appears to have been utilized historically (>10 years ago) as oxidation ponds/sludge beds, but these are no longer in use and have largely re-vegetated, albeit in a degraded manner. The proposed development will also result in the discharge of additional treated wastewater to the Eerste River Estuary.

The location and extent of the WWTW (which encompasses a Medium Voltage (MV) electricity cable and the WWTW itself (hereafter "WWTW Area of Influence") is illustrated in Figures 1 – 2.

A basic assessment is currently being undertaken to obtain environmental authorization for the project. According to best practice, the offset principles indicate that a biodiversity offset would most likely be required. Additionally, following botanical evaluations of the area to be impacted, Dr Boucher (of C Boucher Ecological Surveys) recommended a 30: 1 offset ratio for the area (Boucher, 2023[1]).

2. PURPOSE OF MEMORANDUM

This report aims to present a specialist memorandum that includes: 1) an overview of the habitat characteristics associated with the WWTW and the Target Offset Site, and 2) the identification,

[1] Boucher, C., (2023) Project Number: 265. An Evaluation of the Vegetation Impacted by the Proposed Upgrade and Expansion of the Macassar Wastewater Treatment Works.

selection, and screening of potential offset options within the relevant property and/or broader region, along with an evaluation of their suitability to meet offset requirements.

3. LEGISLATIVE REQUIREMENTS

The following legislative documents were considered:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA[2]) (as amended);
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA[3]);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA[4]);
    - Government Notice (GN) number 2747 (Gazette Number 47526): The revised National list of Ecosystems that are Threatened and in need of Protection, dated 18 November 2022, as it relates to the NEMBA;
    - GN number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated September 2020 as it relates to the NEMBA;
    - GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the NEMBA;
    - GN 3009: Regulations Pertaining to Threatened or Protected Terrestrial Species and Freshwater Species in Government Gazette 47984 dated 3 February 2023, as it relates to the NEMBA;
    - GN 3569: National Biodiversity Offset Guideline, in government Gazette 48841 dated 23 June 2023, as it relates to the NEMBA[5]; and
    - GN 3012: List of Terrestrial and Freshwater Species that are Threatened or Protected, Restricted Activities that are Prohibited, and Restricted Activities that are Exempted, in Government Gazette 47984 dated 3 February 2023, as it relates to the NEMBA.

4. ASSUMPTIONS & LIMITATIONS

The following assumptions and limitations are applicable to this report:

- The Offset strategy will be applicable provided the proponent receives environmental authorisation for the proposed WWTW expansion activities;
- Data in this report pertaining to the WWTW Area of Influence and Target Offset Site was based on available ecological assessments (BlueScience (2024[6]) and Boucher (2023)) and a single high-level site visit of the WWTW Area of Influence (undertaken by SAS on 1 October 2024). The effects of natural seasonal and long-term variation in the ecological conditions are therefore unknown, and as terrestrial ecosystems are dynamic and complex, it is possible that aspects of the ecology, some of which may be important, could have been overlooked; and
- It is important to note that the initial phase of the Offset Report development, specifically the alternatives analysis as presented in this memorandum, is a dynamic process in which offset options may evolve. Following discussions with governmental authorities and potential landowners, adjustments to the proposed offset sites may be necessary. As government and landowner engagements have yet to take place at this early stage of the Offset Initiative, the potential Candidate Offset Sites as well as the quantum of the offset should not be considered definitive.

[2] National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA). Available at: https://www.dffe.gov.za/legislation/nema.

[3] National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA). Available at: https://www.dffe.gov.za/legislation/nempaa

[4] National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA). Available at: https://www.dffe.gov.za/legislation/biodiversityact

[5] Department of Forestry, Fisheries, and the Environment (DFFE) (2023). National Biodiversity Offset Guideline. Government Gazette No. 48841, Notice No. 3569, 23 June 2023. Pretoria: Department of Forestry, Fisheries and the Environment.

[6] Bluescience (2024). Aquatic Biodiversity Assessment for the Proposed Expansion of the Existing Macassar Wastewater Treatment Works, Cape Town.

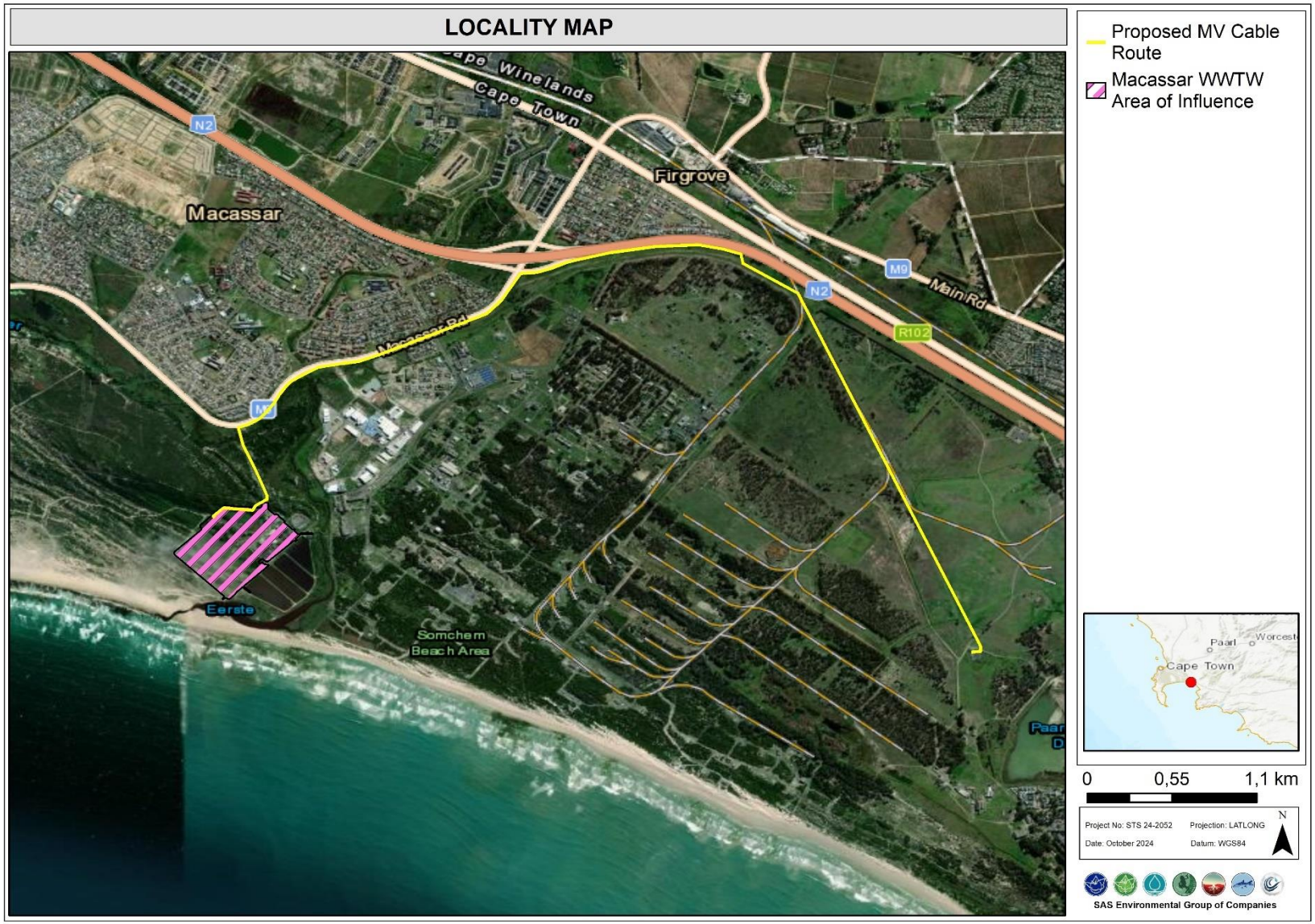

Figure 1: Locality map illustrating the location of the Macassar WWTW.

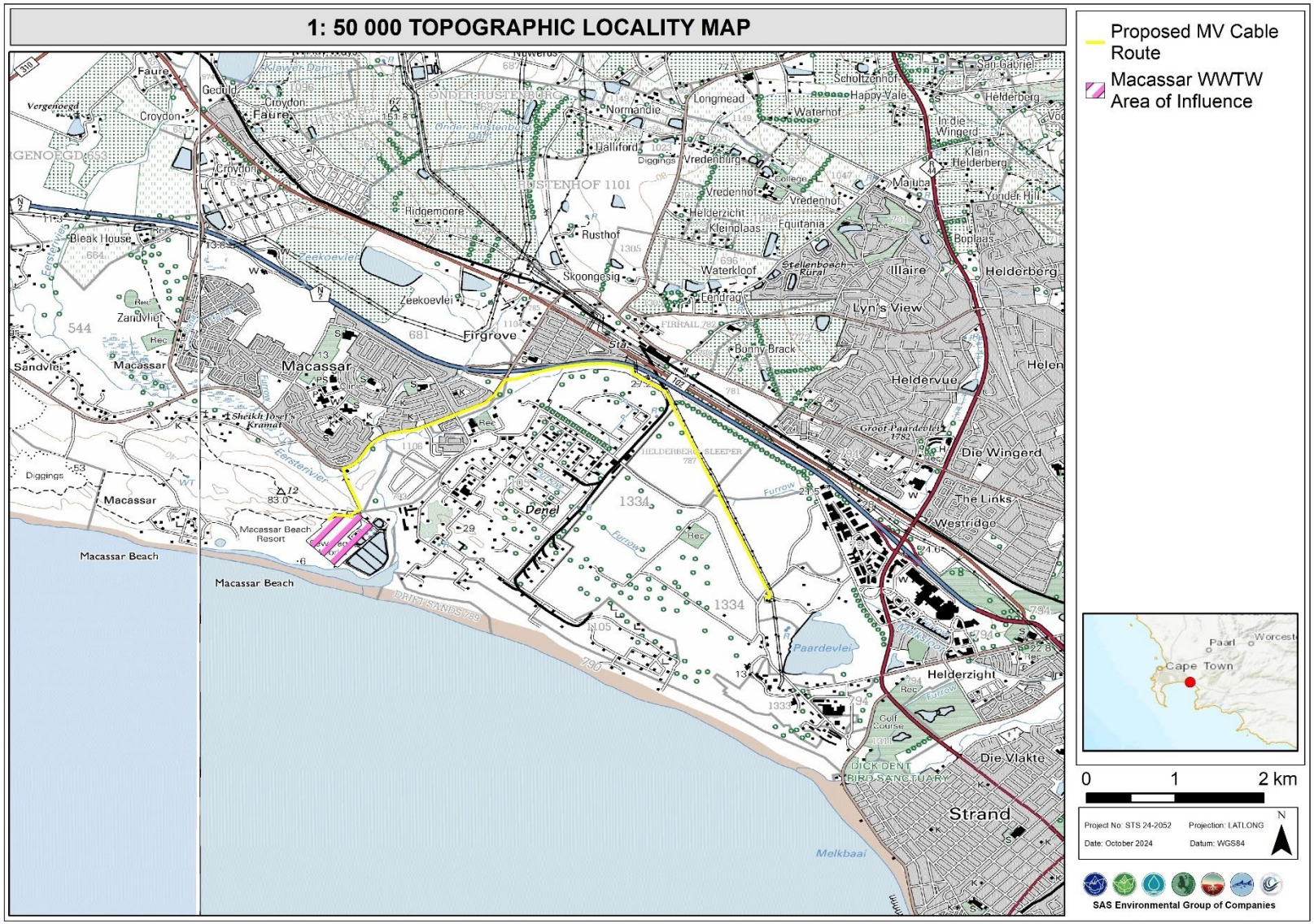

Figure 2: 1: 50 000 topographic map illustrating the location of the Macassar WWTW.

5. OVERVIEW: OFFSETS & ECOLOGICAL COMPENSATION

5.1 The Mitigation Hierarchy

Offsets are implemented as part of the mitigation hierarchy and are specifically intended to mitigate or compensate for the residual environmental impacts of development/mining (often referred to as "compensatory mitigation") after all viable measures have been taken to first avoid or prevent, minimize or reduce, and remediate or rehabilitate those impacts (SANBI & DWS, 2016; Figure 3). The 2023 Biodiversity Offset Guidelines emphasize that offsets are essential for achieving no net loss or a net gain in biodiversity, particularly where significant residual impacts on ecosystems remain despite the application of other mitigation measures. Following the mitigation hierarchy, the following principles apply to offsetting:

- **Avoidance:** the proposed development/mining should first attempt to avoid or prevent negative impacts on biodiversity and ecosystem services by exploring alternative development types, locations, scales, layouts, and the siting of development/mining components;
- **Minimization and rehabilitation:** when avoidance is not possible, efforts must be made to minimize negative impacts and to rehabilitate or remediate affected areas to reduce residual impacts; and
- **Offsetting:** residual impacts that remain after minimization and rehabilitation must be compensated for through biodiversity offsets. Offsets are designed to counterbalance these residual impacts by providing measurable conservation outcomes that ensure the overall biodiversity value is maintained or enhanced.

Environmental offsetting provides a means by which to slow – and possibly even reverse – "ecological deficit" by counterbalancing the degradation, destruction, and depletion of natural resources through protection, rehabilitation, restoration and replenishment. Offsets are not only a means of compensating for lost habitat but also a critical tool for maintaining the ecological integrity and long-term security of priority biodiversity and ecosystem areas. According to the 2023 Biodiversity Offset Guidelines, offsets for both terrestrial and freshwater ecosystems, including wetlands, are vital for sustaining biodiversity and the ecosystem services that these habitats provide.

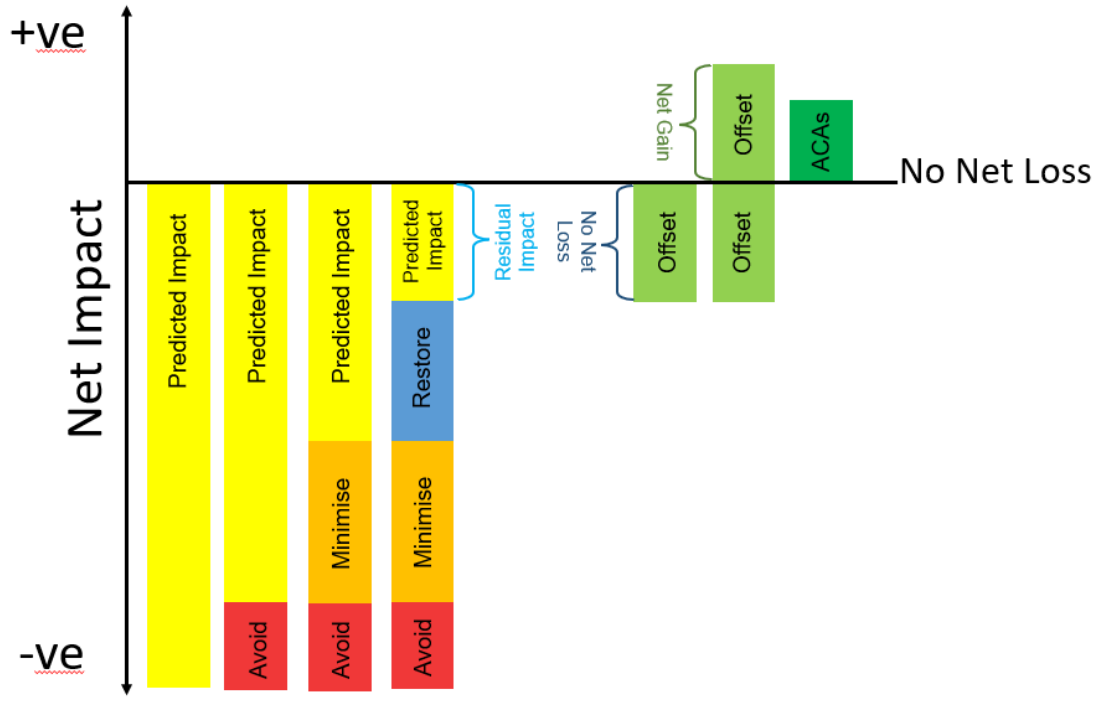

Figure 3: Depiction of the mitigation hierarchy and where offsets and additional conservation actions (ACAs) fit into the overall goal of achieving NPI. Image adapted from Temple et al., (2012[7]).

[7] Temple, H.J., et al. (2012). Biodiversity Offsetting: Policy and Practice. Gland: IUCN.

5.2 Biodiversity Offsetting

Biodiversity offset calculations are essential in ensuring that the ecological impact of development activities is effectively mitigated. According to the 2023 guidelines, these calculations take into account several key principles, including like-for-like conditions, which emphasize that the offset should replace the same type of ecosystem or habitat that was impacted. This principle ensures that the biodiversity value, including species composition, ecosystem functions, and ecological processes, is maintained as closely as possible to its original state. In addition, the guidelines prioritize spatial and temporal equivalence, ensuring that offsets are located near the impacted area and are implemented promptly. The overarching goal is to achieve No Net Loss, or preferably a Net Gain, of biodiversity. Moreover, offsets must adhere to the principle of additionality, ensuring that the benefits provided go beyond existing conservation efforts. Lastly, ongoing monitoring and adaptive management are vital to ensuring the success and efficacy of biodiversity offsets over time.

5.3 Trading-up

The "Trading-up" principle in biodiversity offsetting and compensation refers to a strategy where a loss of biodiversity in one area is compensated by conserving or enhancing biodiversity in another area with higher ecological value. The principle prioritises not just replacing the quantity of biodiversity lost but improving the quality of biodiversity in a way that contributes to overall conservation goals. In practice, "trading-up" involves focusing on habitats or species of higher conservation priority. For instance, if a development project causes damage to a common habitat, the offset might involve protecting a more threatened habitat or species elsewhere, thereby providing greater ecological benefits. This approach aims to contribute to net positive biodiversity outcomes by directing resources towards areas where conservation efforts can have the most significant impact. The "trading-up" principle is often applied in situations where it is challenging to achieve like-for-like compensation due to the rarity or irreplaceability of certain habitats or species. It helps to ensure that biodiversity offsetting leads to long-term conservation gains rather than just mitigating losses. In the case of the WWTW, no trading-up offsets were investigated.

5.4 Offset Ratios

In addition to like-for-like, offset ratios are determined based on the conservation status of the ecosystem, the irreplaceability of the habitat, and the condition of the impacted area. For ecosystems that are more threatened or have higher conservation importance, higher offset ratios are required. This approach not only aims to maintain biodiversity value but also seeks to enhance it by contributing to the preservation and restoration of threatened, rare, or keystone species and ecosystems. By adhering to these principles, biodiversity offsets ensure that the ecological integrity of the affected area is upheld, and in some cases, improved, thereby supporting broader conservation goals and ecological resilience. Please refer to Section 10 and Appendix D for specific explanations of the applicable offset ratios as defined in the National Biodiversity Offset Guidelines of 2023.

5.5 Ecological Compensation

In contrast with offsets, ecological compensation may be employed when achieving a strict like-for-like offset is not feasible. Ecological compensation allows for broader and sometimes more flexible conservation actions that do not necessarily match the exact type of biodiversity or ecosystem services lost. While it still seeks to balance the negative impacts of development/mining, compensation can involve different types of habitats, species, or even broader ecological goals, such as enhancing connectivity or restoring degraded landscapes that may not directly replace the impacted area. Compensation might also focus on providing other ecosystem services or addressing conservation priorities that are indirectly related to the impacts. While ecological compensation may not always aim for a strict like-for-like net gain, it can still contribute to net gain outcomes by addressing broader conservation needs. For example, ecological compensation might involve actions such as the restoration of a degraded ecosystem that is of greater conservation priority than the impacted area, thereby adding value to the overall biodiversity landscape. Through these broader conservation actions, ecological compensation can contribute to a net gain in biodiversity, even if the exact species or habitats lost are not directly replaced.

Both offsetting and ecological compensation provide measurable and lasting benefits, supporting the overall goal of no net loss or a net gain of biodiversity. The careful planning and implementation thereof

are essential to ensuring that development and/or mining activities do not result in irreparable harm to the natural environment and that critical ecosystem services are preserved for future generations.

6. DESIRABILITY AND NEED OF THE PROJECT

The Macassar WWTW expansion project provides necessary infrastructure development that is needed to meet the increasing demand for wastewater treatment from surrounding communities, including Khayelitsha, Somerset West, and Gordon's Bay. The expansion project not only safeguards human health, but environmental health and water resource management too.

Without this necessary upgrade, the WWTW will soon reach its capacity, leading to potentially severe socio-economic and ecological consequences. Overflows and untreated sewage leakage could degrade nearby ecosystems, including the Eerste River and its estuary, which in turn would affect the Helderberg Marine Protected Area (MPA). The potential for pollution would not only compromise water quality but could also result in significant harm to marine life, including species reliant on the estuarine ecosystem for part of their lifecycle.

From a socio-cultural perspective, the health and wellbeing of local communities are directly linked to the proper functioning of the WWTW. Untreated or inadequately treated wastewater would pose significant risks to human health, especially in densely populated areas, where access to safe sanitation is vital. The risk of waterborne diseases increases with untreated sewage spills and contaminated water supplies, which could disproportionately affect vulnerable groups in these rapidly growing urban areas. Ensuring that the Macassar WWTW operates efficiently is therefore key to preventing these potential health concerns and supporting sustainable urban growth.

Furthermore, the expansion of the WWTW is essential to protect local water resources, ensuring that the Eerste River, which flows into the Helderberg MPA, maintains its ecological function. The MPA is a marine biodiversity hotspot that plays an essential role in sustaining local fisheries, maintaining water quality, and conserving marine biodiversity (DEA 2019[8]). Without the expanded WWTW, untreated wastewater would threaten not only freshwater systems but also marine ecosystems, further emphasizing the project's broader environmental significance.

Although the WWTW expansion will impact threatened vegetation types, its role in addressing the socio-economic needs of the area and protecting water resources cannot be understated. Proper wastewater treatment is important to prevent landscape degradation and ecosystem collapse that would occur without such infrastructure. The expansion will aid in the prevention of overflows, seepage, and contamination that could otherwise lead to both human health issues and the degradation of surrounding terrestrial and aquatic ecosystems.

Given these considerations, the need for a biodiversity offset strategy remains a necessary requirement to mitigate the unavoidable impacts on the impacted vegetation types that is overwhelmingly to benefit of community health and wellbeing as well as water resource management. By balancing development with conservation through well-planned offsets, the project supports the dual goals of addressing urgent socio-economic needs human health protection and ensuring environmental protection.

7. APPLICATION OF THE MITIGATION HIERARCHY

The Macassar WWTW holds the responsibility of mitigating negative impacts on biodiversity while enhancing opportunities to achieve long-term positive outcomes for ecological health and biodiversity, in line with regulatory and environmental commitments. Following the mitigation hierarchy, in the case of the Macassar WWTW, avoidance of impacts is not possible. Given the location of the existing WWTW and the pressing socio-economic need for the WWTW upgrades, impacts associated with the proposed development cannot be avoided. If environmental authorisation (EA) is received, the proponent will be required to implement mitigation measures (However, even with the implementation of strict mitigation measures lower in the mitigation hierarchy i.e. avoidance and minimisation, the construction and operation of the WWTW itself will still result in significant residual impacts to the receiving environment,

[8] Department of Environmental Affairs (DEA), 2019. "South Africa's Marine Protected Areas: Conserving Our Marine Heritage." This document outlines the importance of South Africa's MPAs in marine biodiversity and fisheries management.

e.g., loss of threatened vegetation type(s), loss of habitat connectivity, etc. To address this, rehabilitation measures will need to be implemented to rehabilitate any temporarily disturbed areas, ensuring that as much of the natural habitat as possible is rehabilitated post-construction. However, given the irreversibility of certain losses, particularly in threatened vegetation types, the final option in the mitigation hierarchy, i.e., offsetting, is deemed necessary.

To address these residual impacts, an Offset Strategy is being developed to compensate for the loss of biodiversity and habitat, especially following the recommendation for an offset by Boucher (2023). This strategy will ensure compliance with best practice and the principles of ecological sustainability.

In contrast to the WWTW construction, the MV cable installation will not result in significant residual impacts. By following the mitigation hierarchy, minimisation and rehabilitation measures within habitat impacted by the instillation of the MV cable can be implemented during and after construction. As a result, the surrounding habitat will not experience significant residual impacts, as mitigation efforts should effectively address and rehabilitate any environmental disturbances. For this reason, only proposed activities that will result in significant residual impacts, i.e., the construction of the WWTW itself which will result in the direct loss of a threatened vegetation type (EN Cape Flats Dune Strandveld), will be considered applicable for offsetting purposes.

8. OFFSET ALTERNATIVE ANALYSIS & SITE SELECTION

Achieving an effective offset requires enhancing the conservation status and protection of both the targeted species of conservation concern (SCC) and their habitats to ensure no net loss of ecosystems, including both terrestrial and freshwater systems. Typically, *candidate offset sites* are identified, followed by an alternatives analysis. This involves an iterative process to evaluate various options, ensuring that the most suitable site is selected for further planning and development of the offset strategy.

The 2023 Biodiversity Offset Guidelines provide key guidance for selecting candidate biodiversity offset sites, and emphasizes the following principles:

1. **Location in biodiversity priority areas**: candidate offset sites should ideally be situated in biodiversity priority areas, such as Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Freshwater Ecosystem Priority Areas (FEPAs), and/or within priority focus areas as per the National Protected Area Expansion Strategy (NPAES) as identified in spatial biodiversity plans;
2. **Ecological equivalence and trading-up**: sites should follow the "like-for-like" principle, ensuring ecological equivalence with the impacted area. Alternatively, "trading-up" is acceptable when it allows for the selection of sites with higher or more urgent conservation priorities;
3. **Guidance from existing plans**: site selection should be guided by existing biodiversity frameworks and priority areas, including the CBA and ESA networks, protected area expansion strategies, and/or strategic water source area;
4. **Connectivity and landscape context**: offsets should secure the best examples of the impacted biodiversity features and aim to improve ecological connectivity between protected and priority areas; and
5. **Other considerations**: practical factors, such as ease of management, conflicts in land use, land ownership, and potential threats to conservation, should be cautiously considered, ensuring that the overriding biodiversity outcomes are met.

Final offset site selection must ensure that suitable compensation for the loss of terrestrial habitat due to activities is achievable, while addressing the suitability of a site in terms of meeting (1) water resource and ecosystem service requirements, (2) biodiversity conservation targets, (3) long-term ecological sustainability, and (4) socio-economic and land-use compatibility. Additionally, the site must align with relevant regulatory frameworks and be capable of supporting the necessary management interventions to ensure the successful restoration and preservation of ecosystem function (as per criteria listed in Table C1 (Appendix C).

8.1 Alternative Analysis

Several options, including both on-site and offsite offset options, were initially evaluated on a desktop basis as potential offset sites. five (5) options were identified as potential candidate sites (given their

location within specific vegetation types, associations with the National Protected Area Expansion Strategy (NPAES), proximity to protected area (as per the South African Protected Area Database (SAPAD), etc). The identified candidate offset sites include (Figure 5):

1. An on-site offset option, encompassing approximately 97.3 ha, which is located within the same property as the proposed WWTW (i.e., Ptn 0 of Erven 1205, Ptn 0 of Ervem 702, Ptn 0 of Erven 703);
2. An offsite offset option, encompassing approximately 335.5 ha, which is located west of the WWTW, namely the properties associated with the informal 'Macassar Dunes Conservation Area'[9] (i.e., Ptn 2 of Farm Drift Sands 544 and a section of Ptn 0 of Farm Drift Sands 544);
3. An offsite offset option, encompassing approximately 509.83 ha, which is located approximately 10.5 km northwest of the WWTW. This land is owned by Denel SOC Ltd (i.e., Ptn 0 of Erven 75850);
4. An offsite offset option, encompassing approximately 110.6 ha, which is located approximately 12.7 km northwest of the WWTW. This site is located immediately north of the Driftsands Nature Reserve (Ptn 1 of Farm drift Sands 544); and
5. An offsite offset option, encompassing approximately 110.6 ha, which is located approximately 12.7 km northwest of the WWTW. This site is located immediately east of the existing WWTW (including a section of Ptn 0 of Erven 635). This land is owned by Denel SOC Ltd.

The candidate offset sites (Figure 5) were then screened for suitability following the criteria listed in Table C1 (Appendix C), with the findings presented in Table 1. Within the Table, a numerical score is given to each category that aligns to the criterion level investigated, i.e., a score out of three or four is assigned to the categories depending on the criterion level available for selection (i.e., ideal (4), acceptable (3), potentially acceptable (2), and generally unacceptable (1) *vs*. ideal (3), acceptable (2), and unacceptable (1)). Refer to Appendix C for further information.

Table 1: Alternatives analyses for offset and compensation for the Macassar WWTW. Refer to Section 7 for further details.

Criterion	Option 1	Option 2	Option 3	Option 4	Option 5
Like-for-like (Figures 6 - 7)	Ideal (4)	Ideal (4)	Ideal (4)	Ideal (4)	Ideal (4)
Conservation Planning (Figures 8 – 11)	Ideal (3)	Ideal (3)	Acceptable (2)	Potentially acceptable but generally undesirable (1)	Acceptable (2)
Habitat Condition	Acceptable (2)	Acceptable (2)	Generally Unacceptable (1)	Acceptable (2)	Generally Unacceptable (1)
Local Biodiversity Value	Acceptable (2)	Acceptable (2)	Acceptable (2)	Acceptable (2)	Acceptable (2)
Long-term Ecological Viability (Figures 12 - 13)	Acceptable (3)	Acceptable (3)	Generally unacceptable (1)	Ideal (4)	Acceptable (3)
Land-legal Viability	Acceptable (3)	Acceptable (3)	Potentially acceptable but generally Undesirable (2)	Potentially acceptable but generally Undesirable (2)	Potentially acceptable but generally Undesirable (2)
Rehabilitation Opportunities/Potential	Ideal (3)	Ideal (3)	Ideal (3)	Acceptable (2)	Acceptable (2)
Total score	**20**	**20**	**15**	**17**	**16**

8.2 Offset Selection Rationale

Available offset options are limited due to the extensive development and urbanisation within the Cape Flats Dune Strandveld. Consequently, there is a scarcity of intact Cape Flats Dune Strandveld within the Cape region. This makes identifying suitable offset areas particularly challenging, especially when considering the need for large, contiguous sites and the difficulties associated with purchasing or

[9] Not a formally protected area under the NEMPAA.

establishing stewardship agreements with existing landowners. Despite this, four (4) potential offset options were considered.

Offset Options 1 and 2 were identified as the most suitable candidates for offset purposes. Both options received the highest total score of 20 in the alternatives analysis, indicating their strong alignment with the required offset criteria. Option 1 is especially favourable as it is located within key biodiversity areas, such as CBA habitat, and part of the proposed offset area falls within the same farm portion as the WWTW (Ptn 0 of Erven 1205). Additionally, Option 1 includes Ptn 0 of Erven 703 and Ptn 0 of Erven 702, both of which are state-owned, making them ideal for long-term stewardship agreements. State-owned land presents fewer challenges compared to privately owned land, where high asking prices and reluctance to enter into stewardship agreements often hinder progress. Both options are also located within the EN Cape Flats Dune Strandveld.

Option 2 is also ideal for offsetting purposes, sharing many of the same benefits as Option 1. Like Option 1, it scored highly in the key categories, particularly in terms of conservation planning, habitat condition, and long-term ecological viability. Both options offer significant rehabilitation potential and are well-positioned to meet the offset requirements for the project. Erosion is of particular concern within the dunes associated with the landscape (Boucher (2024)), thus rehabilitation efforts can be aimed at addressing such concerns.

The Macassar Conservation Area, part of Option 2, is an informal conservation area not yet proclaimed under the NEMPAA, encompassing Ptn 0 and Ptn 2 of Farm Drift Sands 455. It is state-owned and located near key biodiversity features, such as CBA Category 1b, making it an ideal candidate for formal declaration as a protected area. Although this site is currently under negotiation for formal protection, the proponent could provide funding to assist in the process of formalisation and to provide funding for targeted rehabilitation and restoration work within this area.

While the biodiversity offset guidelines emphasise additionality, which suggests that offsets should contribute conservation value beyond what would occur otherwise, the use of the Macassar Conservation Area as an offset offers significant benefits. Given the scarcity of intact Cape Flats Dune Strandveld due to extensive urbanisation, the available options for offsetting are severely limited in terms of both size and suitability. This makes the identification of other large, contiguous areas for offsetting highly challenging.

By incorporating the proponent’s efforts into the formal protection and active management of the Macassar Conservation Area, the project can assist in ensuring its long-term ecological sustainability. The proponent’s commitment to contribute to the management of the site would enhance its conservation value, addressing challenges such as habitat degradation, invasive species control, and overall ecological restoration. Formal protection along with restoration would result in tangible, long-term biodiversity gains that surpass what could be achieved through the current informal protection and more limited management, thereby enhancing the area's overall conservation status.

Incorporating these efforts into a single, strategically located initiative would likely result in a more effective and focused conservation outcome, as opposed to attempting to securing and managing multiple smaller or fragmented sites in a piecemeal manner. By strengthening the conservation of this critical area, which is situated in an EN vegetation type, the proponent can make a meaningful contribution towards meeting biodiversity offset targets in a landscape where alternative options are scarce.

Although Option 5 scored fairly low (16 points), the use of this site together with Option 1 and 2 will allow for a linear, connective corridor to be established within the landscape. Given the significant fragmentation of the Cape Flats Dune Strandveld, a large, connective corridor such as the one proposed with the use of Offset Options 1, 2 and 5, will allow for connectivity and ecological function to be reestablished within the immediate area. Given that much of these areas overlap with CBA habitat, the connective feature of this proposed offset will also contribute to provincial biodiversity targets (by conserving CBA habitat of a threatened vegetation type).

The combined extent of Options 1, 2 and 5 is approximately 528 ha.

Offset Options 3 and 4, while providing some potential, were ultimately deemed less suitable. Option 3 scored 15 points, indicating its limitations in key categories such as habitat condition and long-term ecological viability. Although it offers ideal opportunities for rehabilitation, its overall suitability is compromised by its generally unacceptable ecological viability (i.e., the site is significantly fragmented and cut off from surrounding areas of intact vegetation communities). Similarly, Option 4, with a score of 17, performed poorly in areas such as conservation planning and land-legal viability, making it a less favourable choice. Its smaller size and less desirable land-legal status make meeting the target offset ratio unfeasible.

As a result, Options 1, 2 and 5 were selected as the preferred Target Offset Site, providing the most appropriate and feasible offset option thus ensuring the project's biodiversity and habitat offsetting goals are met effectively. As part of the offset initiative, the following is recommended: 1) an appropriate Rehabilitation, restoration and Management Plan be designed to address long-term ecological conditions within the entire Target Offset Site, and 2) the section of the Target Offset Site overlapping with the informal Macassar Conservation Area be formally proclaimed as a protected area under the NEMPAA.

As an Additional Conservation Action (ACA), rehabilitation efforts that focus on the Eerste River, located immediately east of the WWTW (Figure 4) will take place. This area is degraded, as evidenced by the presence of invasive species such as *Cenchrus clandestinus* (formerly *Pennisetum clandestinum*) and *Acacia cyclops*, as well as areas of erosion. Targeted rehabilitation activities in this area would significantly benefit the ecosystem, particularly as the river flows into the estuary.

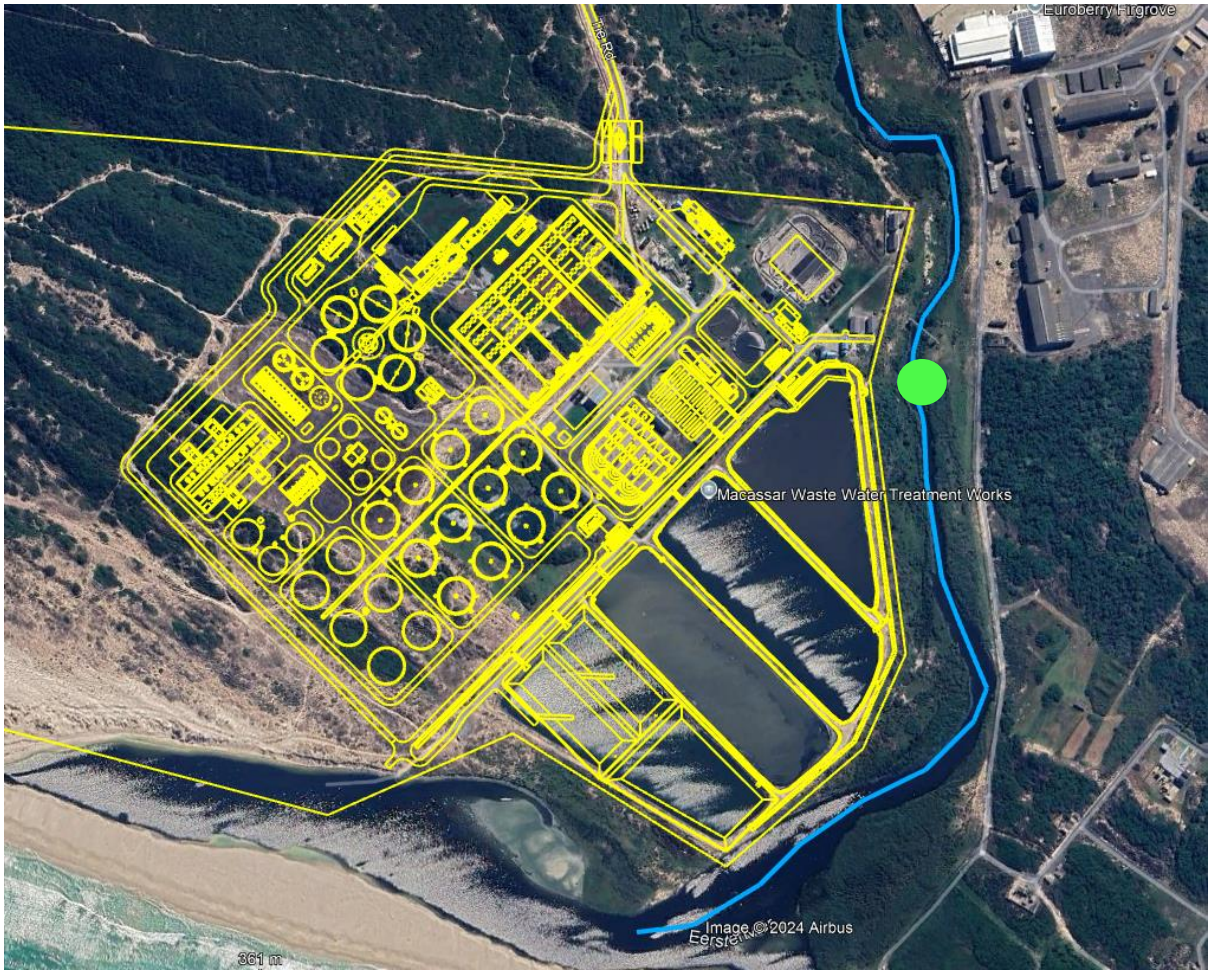

Figure 4: Digital satellite imagery illustrating the area targeted for ACA actions (indicated by the green circle) along the Eerste River (included by the blue line).

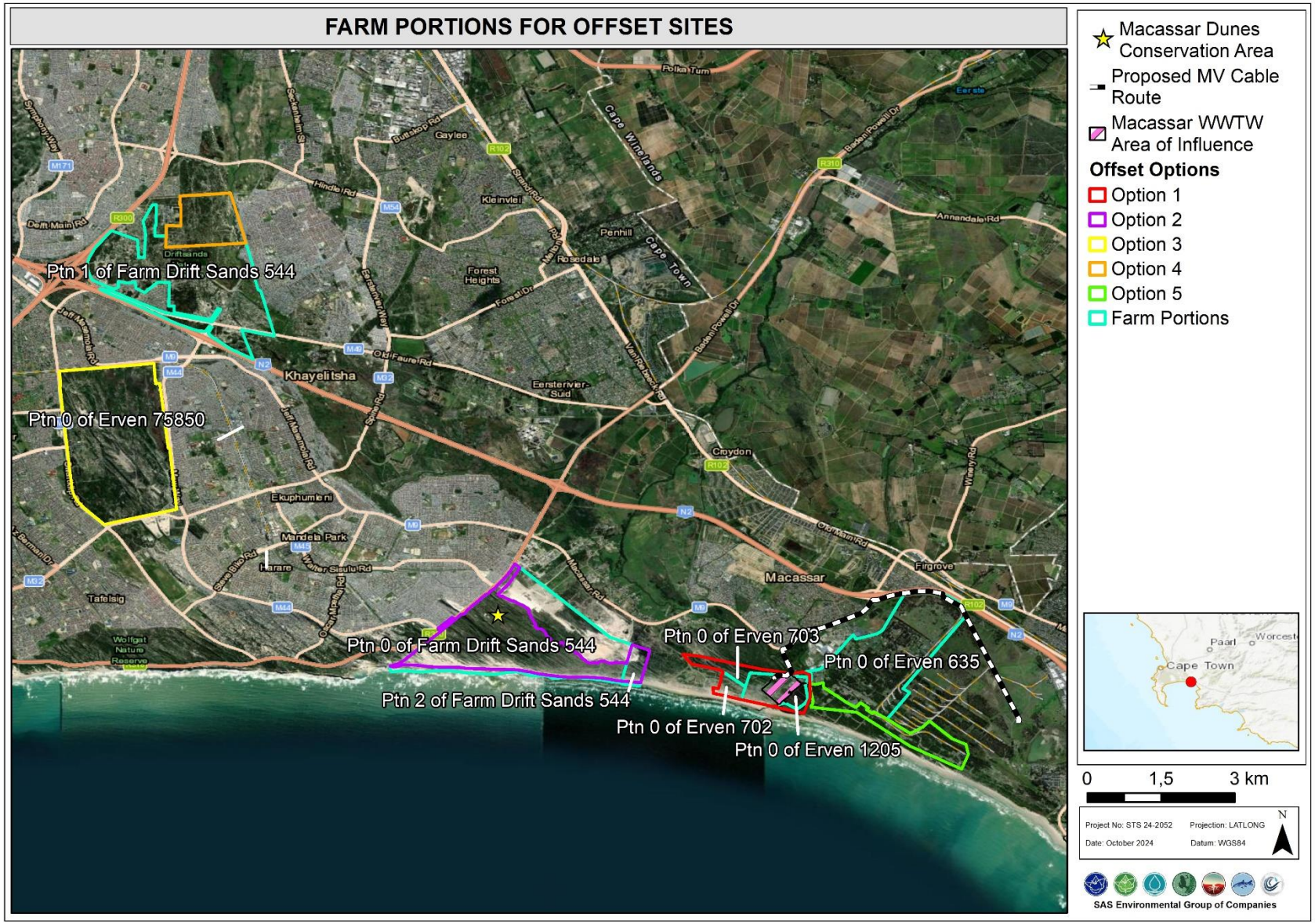

Figure 5: Map illustrating the candidate offset sites investigated for potential use as an offset.

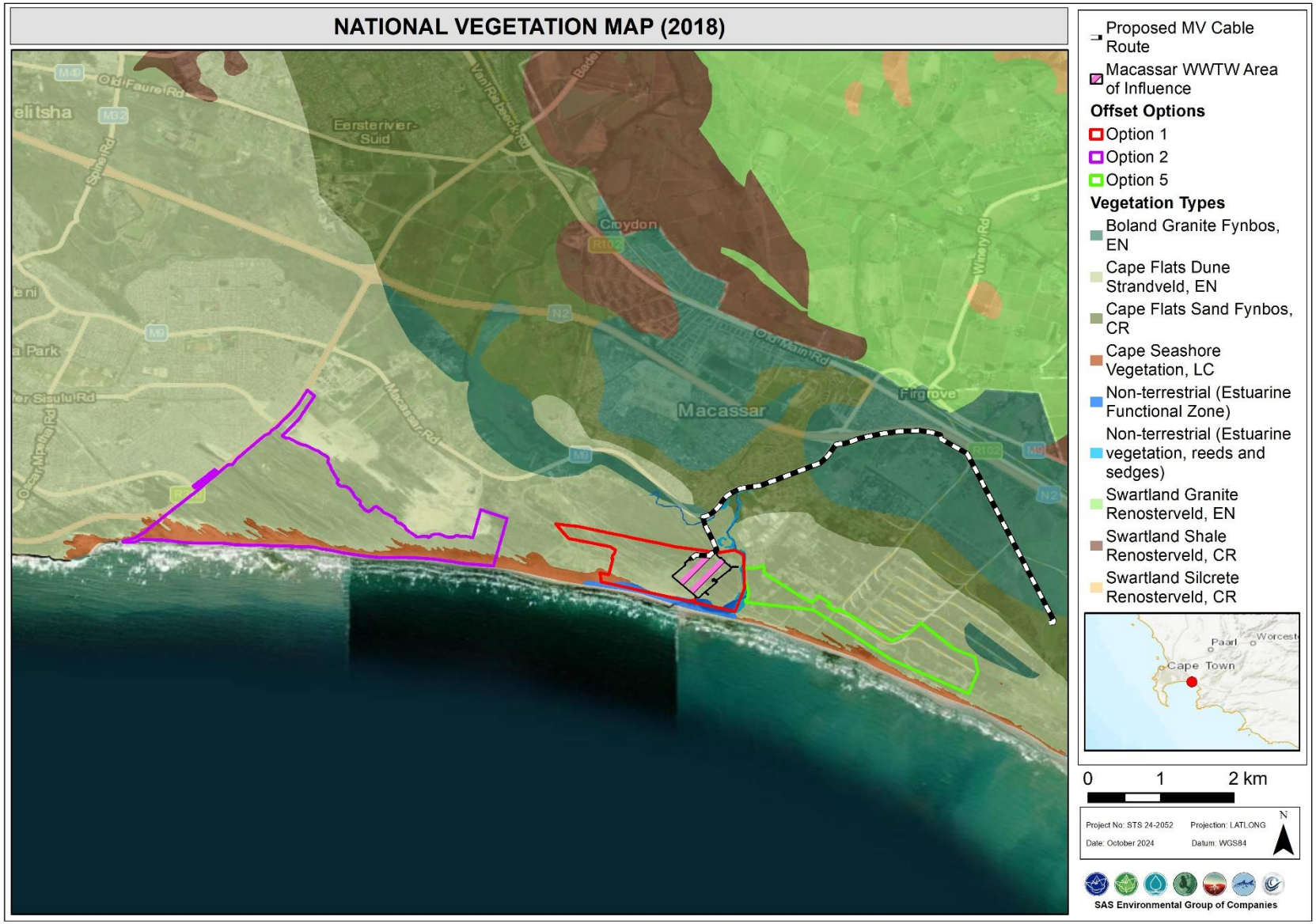

Figure 6: Map illustrating the vegetation types associated with the candidate offset site options 1, 2 and 5.

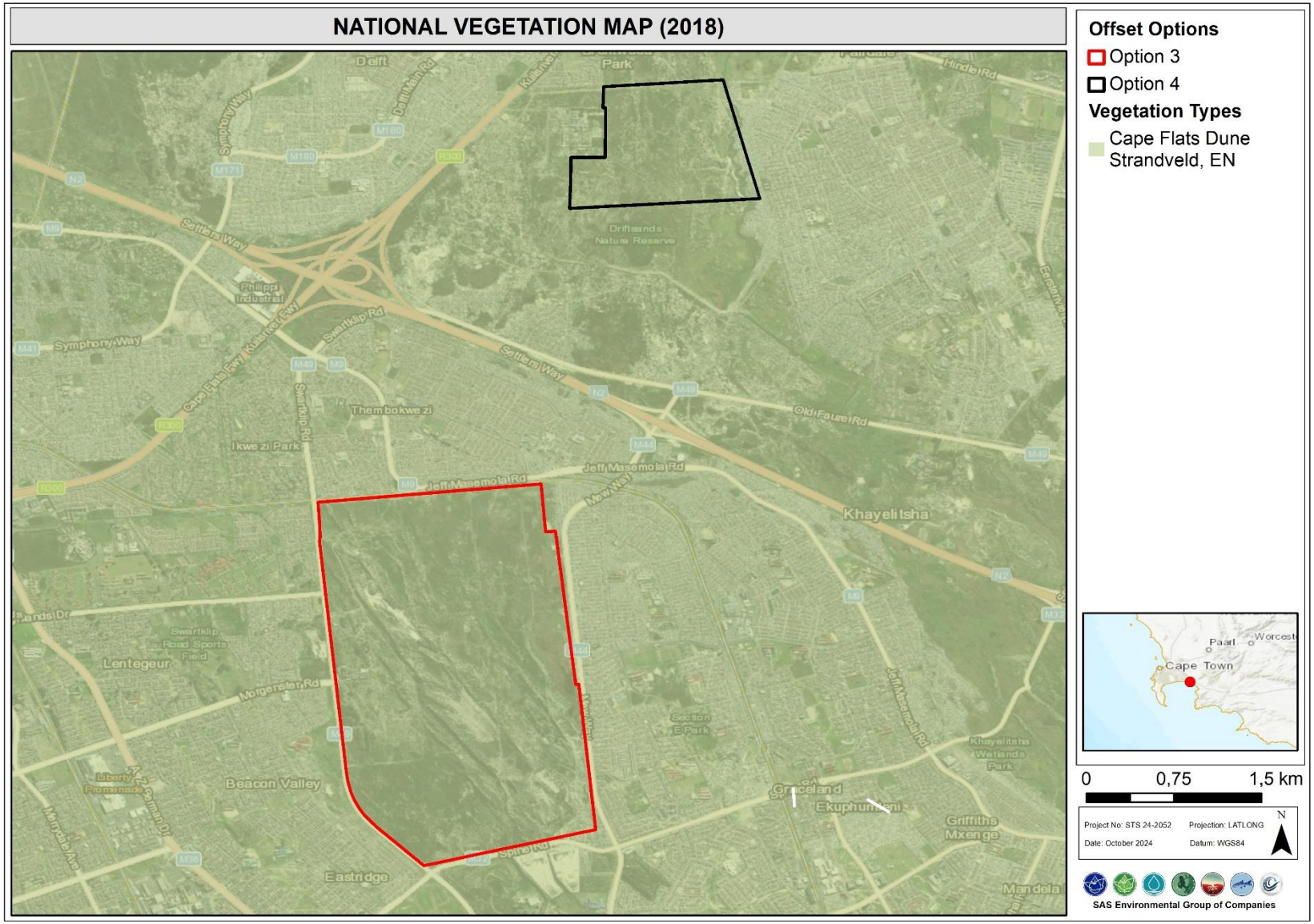

Figure 7: Map illustrating the vegetation types associated with the candidate offset site options 3 and 4.

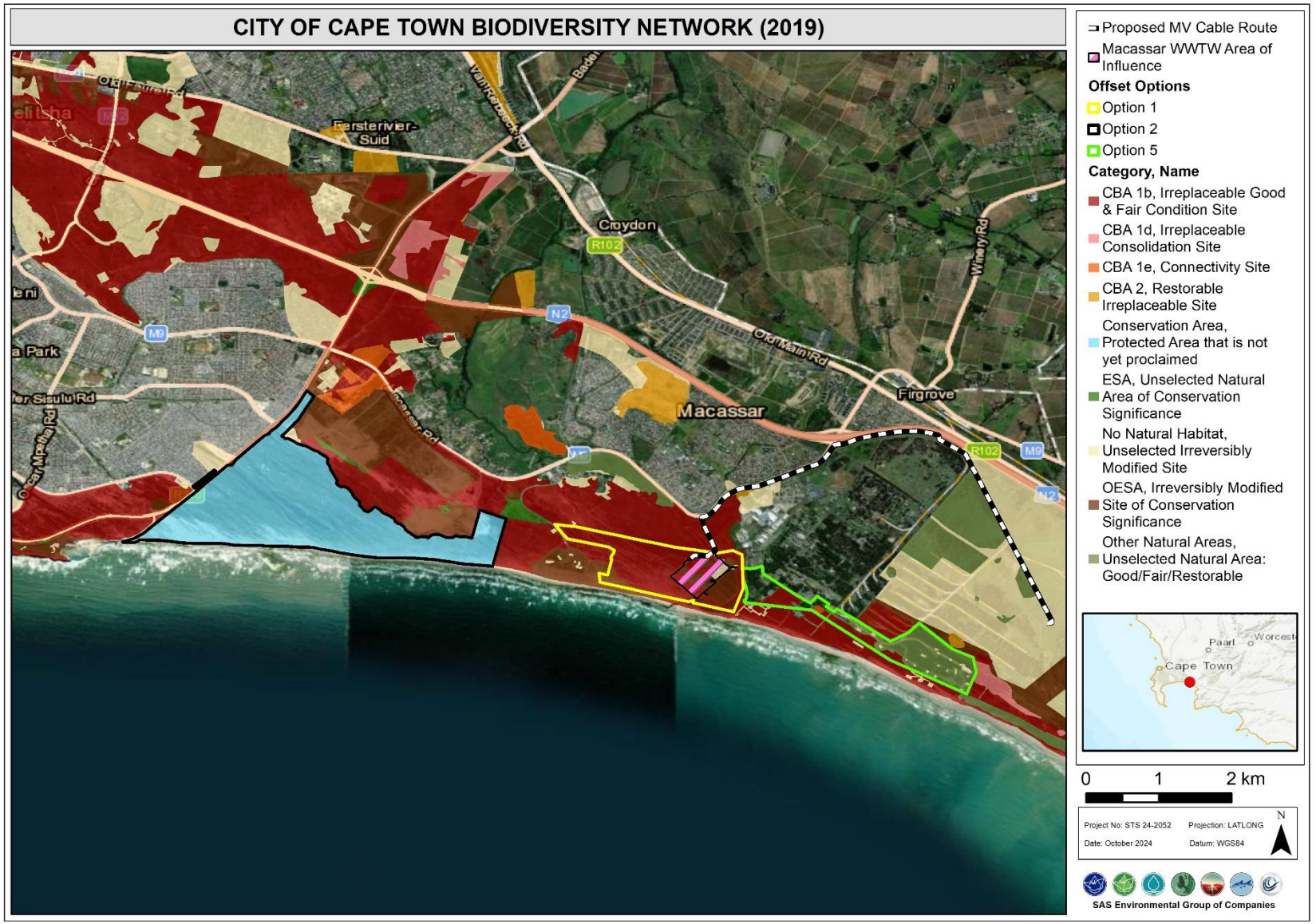

Figure 8: Map illustrating the provincial conservation features associated with the candidate offset site options 1, 2 and 5.

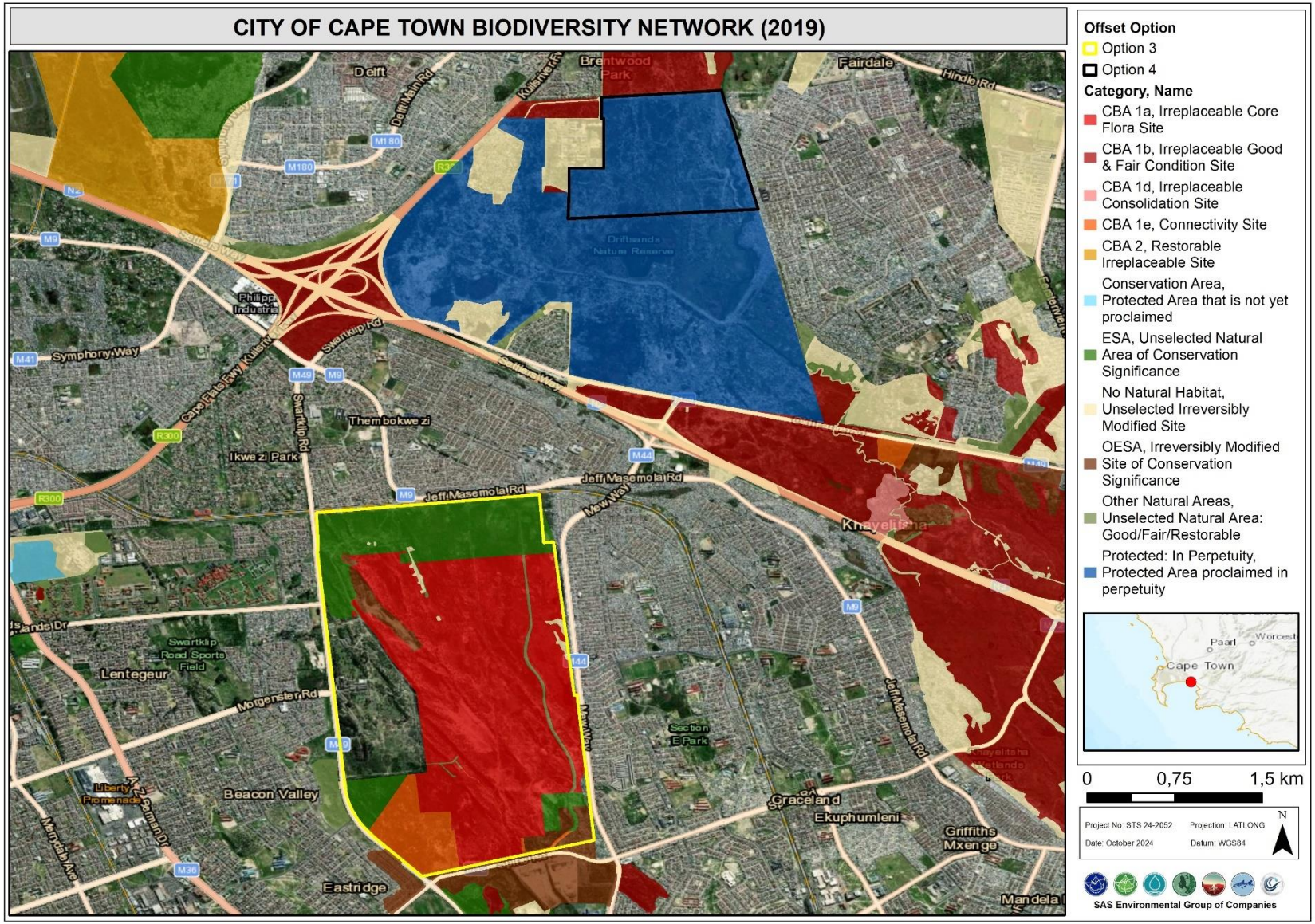

Figure 9: Map illustrating the provincial conservation features associated with the candidate offset site options 3 and 4.

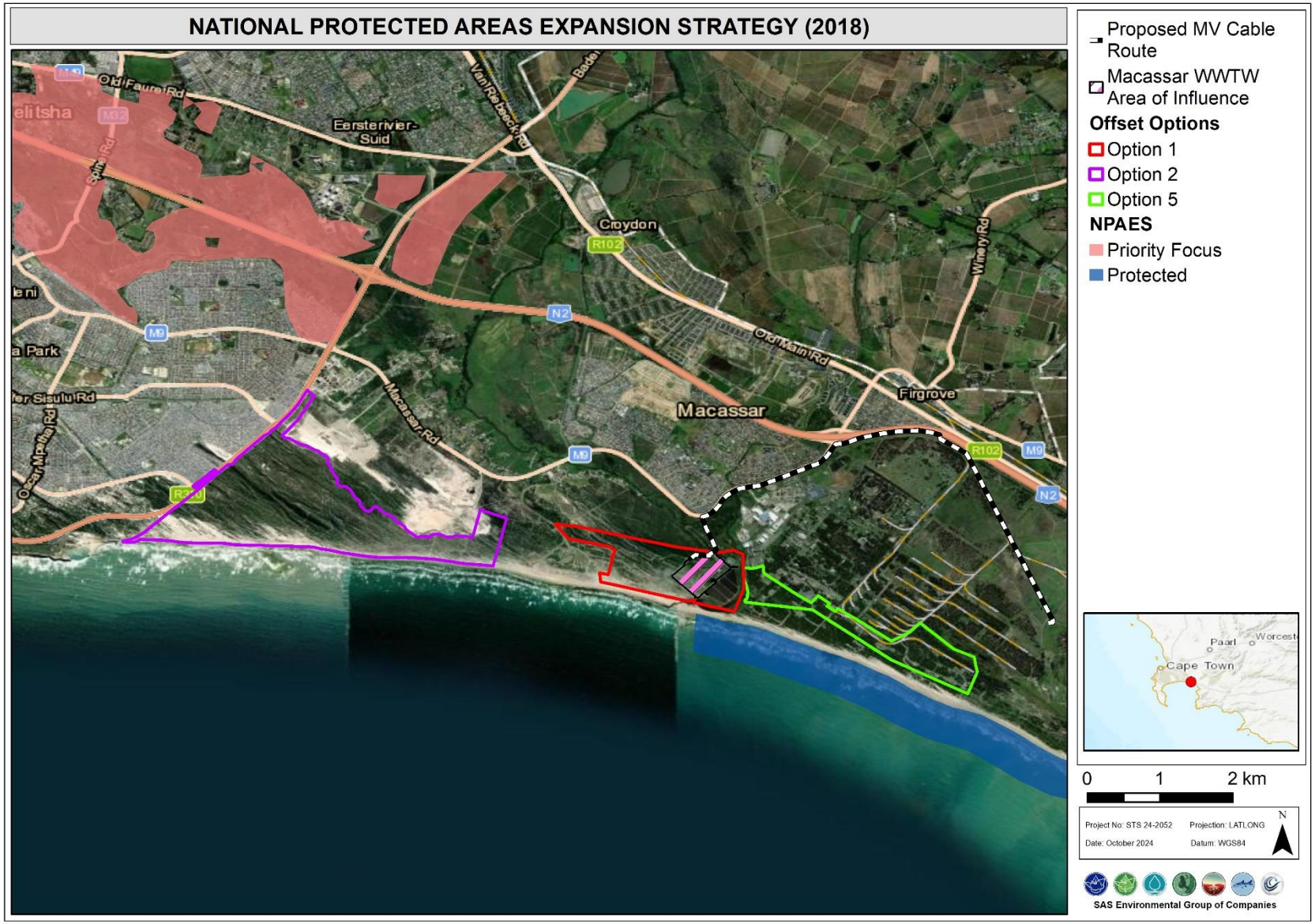

Figure 10: Map illustrating the candidate offset site options 1, 2 and 5 in relation to categories of the 2018 NPAES database.

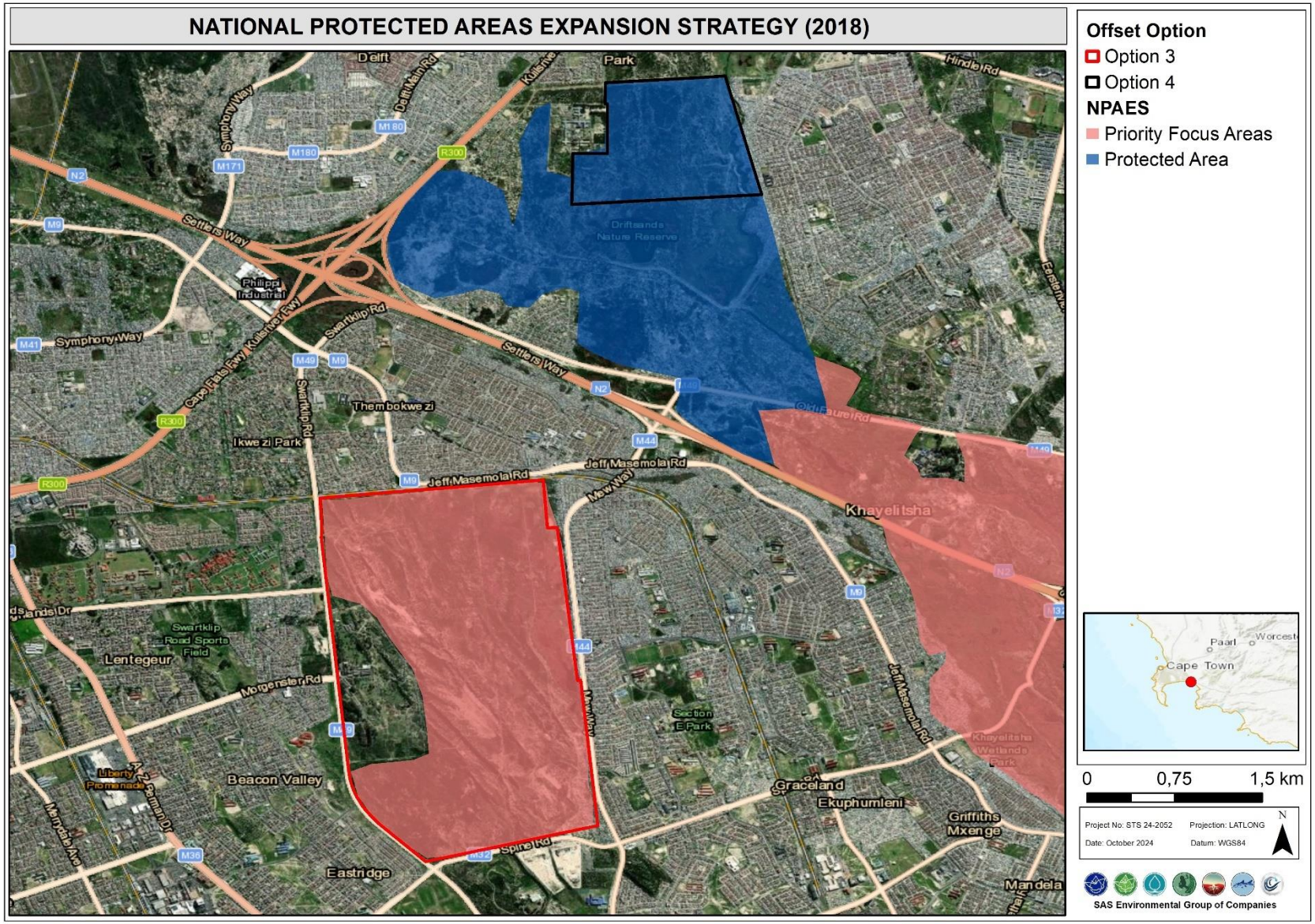

Figure 11: Map illustrating the candidate offset site options 3 and 4 in relation to categories of the 2018 NPAES database.

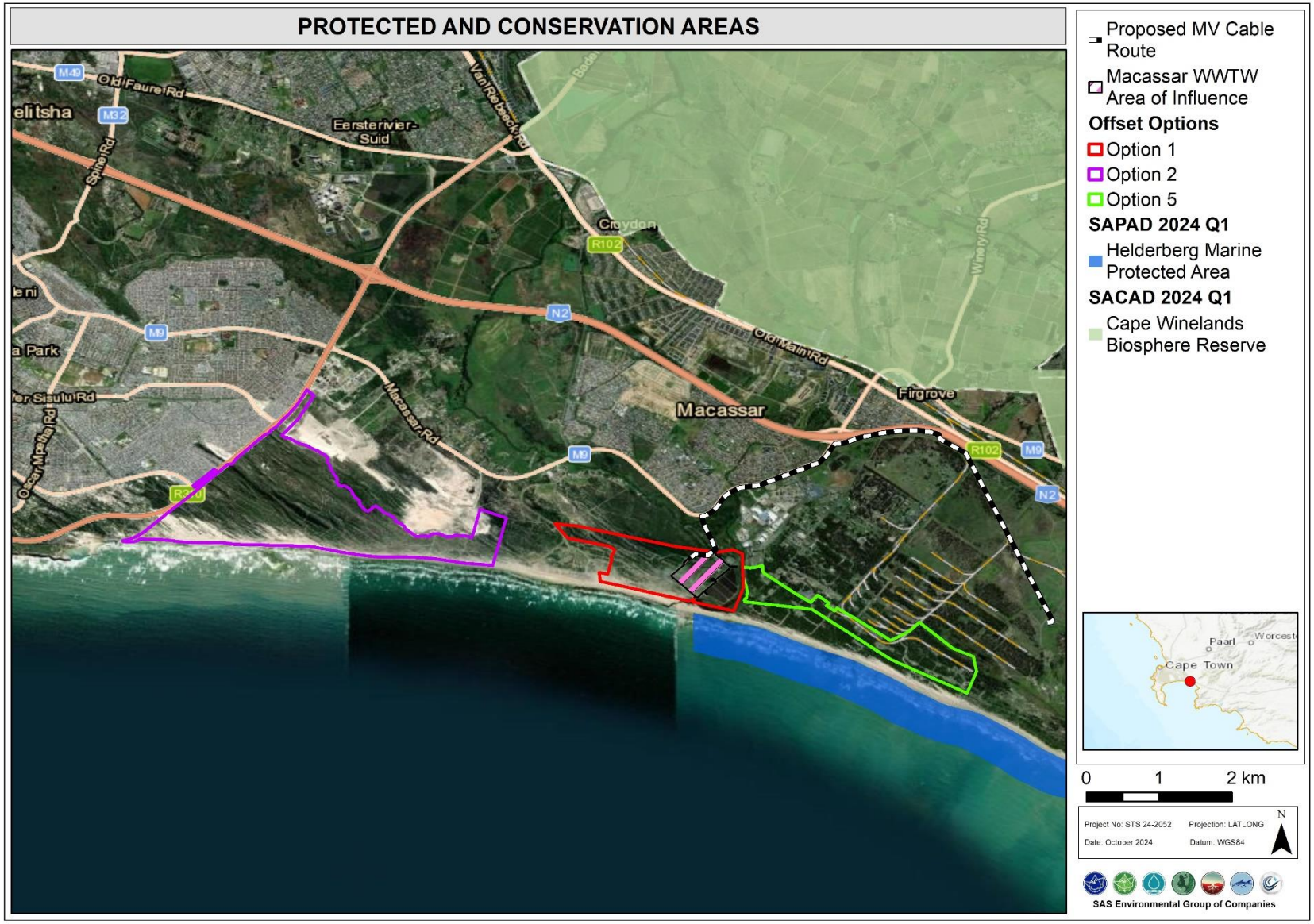

Figure 12: Map illustrating the candidate offset site options 1, 2 and 5 in relation to formally protected and conservation areas.

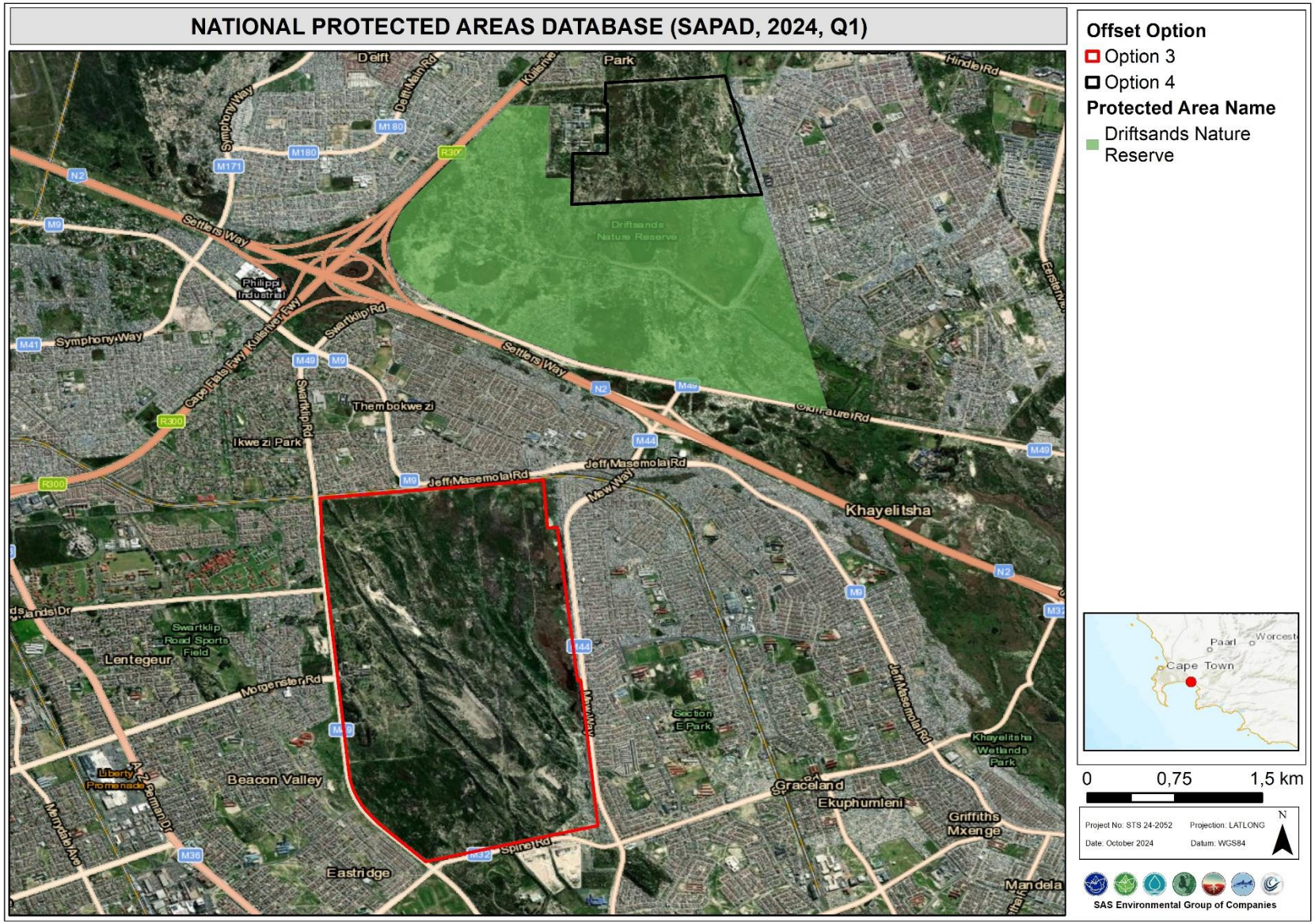

Figure 13: Map illustrating the candidate offset site options 3 and 4 in relation to formally protected and conservation areas.

9. CHARACTERISATION OF THE MACASSAR WWTW AREA OF INFLUENCE AND THE TARGET OFFSET SITE

To effectively apply the various assessment methods and offset calculators, it is crucial to have a comprehensive understanding of the biodiversity and freshwater characteristics of both the impacted area to be offset (i.e., the Macassar WWTW Area of Influence) and the area designated for offsetting (i.e., the Candidate Offset Sites). The section below provides an overview of the Macassar WWTW Area of Influence, where development and water treatment activities have occurred, in terms biodiversity features and characteristics. Additionally, a section is included to examine the ecological attributes of the Candidate Offset Site Options which are essential for the successful implementation of the Offset Strategy.

This section outlines the characteristics of the Macassar WWTW Area of Influence (i.e., where proposed activities will occur) and 2) the Target Offset Site (i.e., Candidate Offset Site Options 1 and 2) from a biodiversity perspective.

Note: Habitat characteristics pertaining to the MV cable are not included in the discussions below as this habitat is not considered for offset purposes (refer to Section 7 for further information).

9.1 Broadscale Habitat Characteristics

The Macassar WWTW Area of Influence is located within the Fynbos Biome (and the associated West Strandveld Bioregion). The reference vegetation type includes the **Cape Flats Dune Strandveld**. The Cape Flats Dune Strandveld is classified as EN according to Mucina and Rutherford (2006), the updated 2018 Vegetation Map of South Africa, Swaziland, and Lesotho (SANBI, 2018a), as well as the latest 2022 Red List of Ecosystems (RLE) database (Figure 6 and Table 2). Furthermore, the Cape Flats Dune Strandveld is moderately protected.

Table 2: Vegetation type descriptions and photographs as per Mucina & Ruthorford (2006).

Vegetation Type	Description
Cape Flats Dune Strandveld (EN)	Flat to slightly undulating (dune fields) landscape covered by tall, evergreen, hard-leaved shrubland with abundant grasses and annual herbs in gaps. 

From a desktop perspective, the following information is applicable to the Macassar WWTW Area of Influence:

- The Macassar WWTW Area of Influence is associated with three (3) categories according to the 2019 City of Cape Town Biodiversity Network, including CBA 1b (Irreplaceable: Good and Fair condition site), Other Ecological Support Areas (OESA) (Irreversibly Modified Site of Conservation Significance, and no natural remaining areas (Figure 8);
- In terms of protected and conservation area dynamics, the NPAES (2018 dataset) indicates that the Area of Influence is not within an **Area Under Negotiation, Priority Focus Areas or a Protected Area.** Furthermore, as per the (1) SACAD (2024 Q1) dataset[10] and (2) SAPAD (2024 Q1) dataset[11], the Area of Influence does not occur within a protected or conservation area (Figure 10); and
- In terms of Animals Species sensitivity, as per the DFFE screening tool outcomes, northern and northeastern sections of the Area of Influence fall within high sensitivity areas, with majority of the Area of Influence categorized as medium sensitivity. Triggering species include (1) birds such as *Circus ranivorus* (African Marsh Harrier, EN), *Circus maurus* (Black Harrier, EN), *Sterna caspia* (Caspian Tern, vulnerable (VU)), *Pelecanus onocrotalus* (Great White Pelican, VU), and *Afrotis afra* (Southern Black Korhaan, VU), and (2) invertebrates such as *Frankenbergerius opacus* (DD), and *Aneuryphymus montanus* (Yellow-winged Agile Grasshopper, VU). For the Plant Species Theme, the Area of Influence is located in areas of medium sensitivity. Triggering floral species include: 53 EN, nine (9) CR, 47 VU and 34 Sensitive species[12]. A very high sensitivity was indicated for the Terrestrial Biodiversity Theme, with triggering features including the presence of key conservation features such as CBA 1: Terrestrial, ESA 2: restore from plantation or high-density AIPs, and the EN Cape Flats Dune Strandveld.

9.2 Fine Scale Habitat Characteristics

A previous assessment conducted by Boucher (2023), mapped four (4) broad vegetation communities associated with the WWTW Area of Influence (Figure 14):

- **Sediment and Settling Dam Overflow Ponds**: These are areas where sediment-laden water was previously or is currently discharged. Each pond differs in species composition due to various factors such as duration and depth of flooding and the source of the discharged water. The vegetation typically consists of ruderal and weedy species, particularly annual weeds that have adapted to survive brief periods of exposure to harsh sludge conditions;
- **Inter-Dune Wetlands**: Inter-dune wetlands are common in this littoral environment, that receives rainwater during winter, along with discharge and seepage from sediment ponds and runoff from hard surfaces. The shrub *Senecio halimifolius* is a dominant emergent species in these saline wetlands, which also support various saline-tolerant shrubs, herbs, and grasses, including *Chasmanthe aethiopicum*, *Cissampelos capensis*, *Erodium moschatum*, *Geranium incanum*, *Nidorella foetida*, *Phragmites australis*, *Salvia africana-lutea*, *Bolboschoenus maritimus*, *Searsia crenata*, *Searsia laevigata*, *Stenotaphrum secundatum*, and *Zantedeschia aethiopica*. An invasive species, *Echium plantagineum*, is also prevalent;
- **Dune Grassy Shrublands**: Dune Grassy Shrubland vegetation is present in recently disturbed areas due to construction, trampling, and cattle grazing. This vegetation represents a development stage of Dune Scrub, found in wind-sheltered regions behind dunes and in disturbed areas of stable larger dune systems. The area hosts various indigenous low shrubs, including *Searsia glauca* and *Searsia laevigata*, as well as herbs and grasses such as *Arctotheca calendula, Bromus diandrus, Carpobrotus acinaciformis, Ehrharta villosa, Exomis microphylla* var. *axyroides, Metalasia muricata, Pentzia suffruticosa, Senecio elegans, Senecio littoralis, Sutera uncinata, Tetragonia fruticosa, Trachyandra divaricata*, and *Tribulus terrestris*.

[10] **SACAD (2024):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

[11] **SAPAD (2024):** The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act No. 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the "System of Protected Areas", which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention Act; 6. Marine protected areas declared in terms of the Marine Living Resources Act; 7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and 8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

[12] As per the best practice guidelines as stipulated by the South African National Biodiversity Institute protocol (SANBI), the name of sensitive species may not appear in the public domain as a means to protect the identity and potential location of such species.

The indigenous species present are pioneers or colonizers that can facilitate revegetation efforts; and

- **Dune Scrub**: The Cape Flats Dune Strandveld is present in various stages of maturity, corresponding to post-disturbance intervals. The mature phase of this vegetation on the undulating dunes is characterized by scrub dominated by *Euclea racemosa, Helichrysum crispum, Olea exasperata, Osteospermum moniliferum, Osyris compressa, Pterocelastrus tricuspidatus, Salvia africana-lutea, Searsia crenata*, and *Searsia glauca*, along with local patches of *Sideroxylon inerme*. Interspersed within the scrub are shrubs such as *Eriocephalus racemosus, Metalasia muricata, Passerina corymbosa, Passerina paleacea*, and *Tetragonia fruticosa*. Additionally, woody climbers like *Cissampelos capensis, Galium tomentosum*, and *Microloma sagittatum* are present, while *Ehrharta villosa* is abundantly scattered throughout the area.

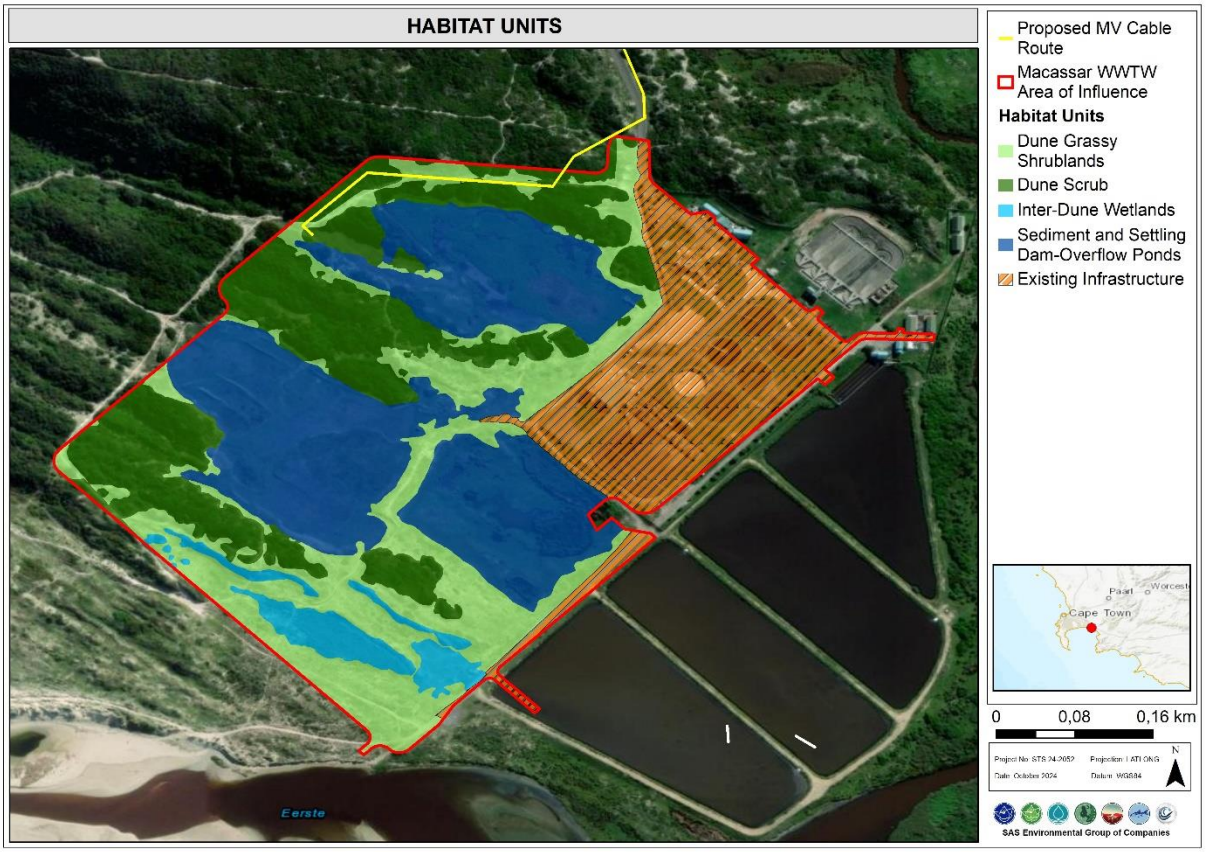

Figure 14: Map illustrating the vegetation communities in the WWTW Area of Influence as identified by Boucher (2023).

9.3 Biodiversity Characterisation: Target Offset Site

This section outlines the characteristics of the Target Offset Site (i.e., Candidate Offset Site Options 1 and 2) from a biodiversity perspective.

9.3.1 Broadscale Habitat Characteristics

The Target Offset Site share many conservation characteristics with the Macassar WWTW Area of Influence (Section 9.1). Additional habitat characteristics associated with the Offset Alternatives include:

- The Target Offset Site is situated in the same vegetation type as the Macassar WWTW Area of Influence that will require offset, i.e., the Cape Flats Dune Strandveld (Figures 6 and 7);
- Large portions of the Target Offset Site are designated as CBAs, both Category 1b (Irreplaceable: Good and Fair Condition Site) and Category 1e (Connectivity Site), as well as ESAs (Unselected Natural Area of Conservation Significance), Conservation Areas (Protected Area that is not yet proclaimed) and areas Protected: In Perpetuity (Protected Area proclaimed in perpetuity). This indicates that these areas provide essential ecological and biological functions crucial for conservation efforts (Figures 8 and 9); and

- In terms of Animals Species sensitivity, as per the DFFE screening tool outcomes, sections of the Target Offset Site are located within high and medium sensitivity areas. Triggering faunal species include (1) birds such as *Circus ranivorus* (African Marsh Harrier, EN), *Circus maurus* (Black Harrier, EN), *Hydroprogne caspia* (Caspian Tern, VU), *Pelecanus onocrotalus* (Great White Pelican, VU), *Sagittarius serpentarius* (Secretarybird, VU) and *Afrotis afra* (Southern Black Korhaan, VU), (2) invertebrates such as *Conocephalus peringueyi* (VU), *Frankenbergerius opacus* (DD), *Pachysoma aesculapius* (VU) and *Aneuryphymus montanus* (Yellow-winged Agile Grasshopper, VU), and (3) arachnids such as *Spermophora gordimerae* (DD). For the Plant Species Theme, the Target Offset Site is located in areas of medium sensitivity. The status of the floral triggering species includes CR, EN, VU and Sensitive Species in similar number to the Area of Influence. A very high sensitivity was indicated for the Terrestrial Biodiversity Theme, with triggering features including the presence of key conservation features such as CBA 1: Terrestrial, ESA 1, ESA 2: restore from plantation or high-density AIPs, and the EN Cape Flats Dune Strandveld.

9.3.2 Fine Scale Habitat Characteristics

A field assessment was conducted on 2 October 2024, focusing on portions of Offset Areas 1 and 2 to evaluate site conditions and identify potential rehabilitation interventions for implementation. These sites are predominantly natural, featuring Cape Flats Dune Strandveld vegetation, with numerous dune slack wetlands also observed within the offset areas.

During the assessment, discussions were held with officials from the City of Cape Town's Biodiversity Management Department. The officials indicated that portions of Offset Areas 1 and 2 are managed by the City on behalf of private landowners, as these properties are recognised for their heritage significance. The officials highlighted several management challenges, including indiscriminate waste disposal, wildlife poaching, and the construction of informal settlements. Rubble was observed in some of the more disturbed sections of the offset sites, primarily along informal footpaths and vehicle tracks. Livestock grazing and trampling is also likely to be problematic.

Livestock grazing was also noted within the Macassar Dunes Conservation Area, which overlaps with parts of Offset Areas 1 and 2, further contributing to the disturbance of these sites. These anthropogenic impacts provide insight into the potential rehabilitation interventions that could be undertaken within the offset areas to restore their ecological integrity.

Detailed field assessments will be required to provide fine-scale habitat characteristics of the Target Offset Site.

10. BIODIVERSITY OFFSET & COMPENSATION METHODOLOGY

This section outlines the methods involved in the development of the Biodiversity Offset Strategy component. Most of the outlined methodology is provided in **Appendix D**; where relevant, reference to this Appendix and the appropriate figures and/or tables is defined in the sub-sections below.

10.1.1 Residual Impact Assessment: Biodiversity

Residual impacts, which are the negative effects on biodiversity remaining after the implementation of a development or mining project, were calculated using key ratios defined by the DFFE. Offsets must be applied according to these ratios, which are determined based on the ecological importance, sensitivity, vulnerability, and conservation status of the ecosystem. The standard approach for determining these ratios focuses on Ecosystem Extent, Ecosystem Protection Level (EPL), and Ecosystem Threat Status. Additionally, it is important to consider the classification of the area within biodiversity priority areas, such as CBA2s, to ensure that biodiversity priorities are met even in areas not selected due to ecosystem threat levels. The methods for determining offset ratios are detailed in **Appendix D**, with a high-level summary of the biodiversity offset determination methodology provided below:

- Ecosystem-Based Offset Ratio Calculation: the size of a biodiversity offset is determined by calculating an ecosystem-based offset ratio, which is the area required to offset the residual negative impact relative to the area affected. This ratio is influenced by the following factors:

  - Ecosystem Extent: if less than 30% of the ecosystem remains, a high offset ratio (e.g., 30:1) is applied. For ecosystems with 30-70% remaining, ratios vary based on the extent and protection level; and
  - Ecosystem Protection Level (EPL) and Threat Status: the offset ratio increases for ecosystems that are critically endangered, endangered, or vulnerable.
- Standard Offset Ratios: the following key ratios were defined by the DFFE (2023) which are then refined based on threat status and protection levels. Other aspects such as size, habitat intactness and species composition must also be considered:
  - A 30:1 ratio for '*critically endangered (CR)*' ecosystems, where an offset would be appropriate only in exceptional circumstances;
  - A minimum ratio of 10:1 for '*EN* ecosystems;
  - A 5:1 ratio for '*VU* ecosystems; and
  - No offset for '*least threatened (LC)*' ecosystems.
- Urban Development Considerations: in urban settings, offset ratios may be adjusted downward due to the scarcity of space and natural areas.
- Like-for-Like and Trading Up: offsets should generally replace the same type of ecosystem ("like-for-like"). However, "trading up" to protect higher-priority biodiversity may be justifiable if motivated by a lack of suitable areas for like-for-like offsets; and
- Adjustments for Conservation Priorities: if impacts occur in areas of lower conservation priority (e.g., CBA 2), the offset ratio may be adjusted upward by a factor of 1.5, up to a maximum of 30:1.

Appropriate offset ratios must align with the goal of achieving no net loss or a net gain in biodiversity. Ratios are typically higher for ecosystems with high conservation value or where the residual impact is significant.

11. BIODIVERSITY OFFSET RESULTS

The sections below provide the results pertaining to the Biodiversity Offset Strategy component. For the purposes of the offset determination SCC were assessed in this process and not the wetland offset determination to align to the National Biodiversity Offset Guidelines of 2023.

11.1.1 Residual Impact Assessment & Biodiversity Offset Target Ratios

The focus of the offset calculations will encompass areas that have not previously been modified by the existing WWTW (i.e., Dune Grassy Shrublands and Dune Scrub – refer to Section 9.3.2 and Figure 14); significantly degraded and/or modified areas (e.g., Sediment and Settling Dam Overflow Ponds – refer to Section 9.3.2 and Figure 14) will not be considered in the offset calculations as these areas are not deemed applicable for offset purposes.

Within the WWTW Area of Influence, the above habitats are present with the following extents:
- Dune Grassy Shrublands (5.1 ha);
- Dune Scrub (5.0 ha); and
- Sediment and Settling Dam Overflow Ponds (7.5 ha); and
- Interdunal Wetlands (0.9 ha).

The above habitats corelate to the Cape Flats Dune Strandveld reference vegetation type.

Although the proposed WWTW expansion activities will not impact on the entire extent of habitats within the WWTW Area of Influence (i.e., small sections of habitat will remain unimpacted), the entire Area of Influence is considered for offset purposes to account for secondary impacts (e.g., AIP proliferation, habitat fragmentation, etc).

11.1.2 Ratio Quantum Analyses

Table 3 provides pertinent information for calculating biodiversity offset ratios pertaining to the vegetation types associated with the Area of Influence.

Table 3: Summary of broadscale vegetation characteristics.

Component	Aspect
Cape Flats Dune Strandveld	
Ecosystem Remaining Extent	56
Ecosystem Protection Level	Moderately protected
Ecosystem Threat Status	EN

Following the methods provided in **Appendix D**, the following **basic offset ratio(s)** were determined:

1. The Cape Flats Dune Strandveld (EN) is moderately protected and is estimated to have a remaining extent of 56 %. Given this information, a **basic offset ratio of 2: 1** was calculated (see Table D1, Appendix D);
2. Following consideration of the threat status of the vegetation type (VU), a pre-determined **basic offset ratio of 10: 1** for VU ecosystems is recommended by the 2023 Biodiversity Offset Guidelines; and
3. Using the precautionary principle, the higher of the ratios would generally be used in further calculations. Thus, a basic offset ratio of 10: 1 was determined.

Basic offset ratios can be adjusted based on the presence of key biodiversity areas, such as CBAs. The Area of Influence has been identified as containing important biodiversity features, specifically Category 1b (Irreplaceable: Good and Fair Condition Site) and Category 1e (Connectivity Site) habitats. Following ground-truthing field assessments, all habitats within the Area of Influence, except for the Settling Ponds, were confirmed to support intact, functioning CBA habitat.

Following the methods provided in **Appendix D**, the following **adjusted offset ratio** was determined:

- **Habitats within CBA habitat**: habitats confirmed as supporting functioning CBA habitat, require a higher offset ratio. Consequently, the **adjusted offset ratio for these habitats was adjusted at a factor of 3** (up to a maximum of 30: 1). Thus, the following adjusted ratio was determined:
    - The Cape Flats Standveld within confirmed CBA habitat: 30: 1.

Given the above determined offset ratios, the following was calculated in terms of the required habitat offset extents (Table 4). **Note**: Sediment and Settling Dam Overflow Ponds are excluded from calculations as this is not considered for offset purposes given the already modified nature thereof.

Table 4: Biodiversity quantum offset analyses for the Macassar WWTW.

Fine scale Habitat Unit	Residual Loss (ha)	Adjusted Ratio	Habitat Required within Offset Target (ha)
Habitat overlap with CBA habitat			
Dune Grassy Shrublands	3.9	30: 1	**117**
Dune Scrub	4.8		**144**
Interdunal Wetlands	0.9		**27**
Habitat overlap with non-CBA habitat			
Dune Grassy Shrublands	1.2	10: 1	**12**
Dune Scrub	0.2		**2**
Interdunal Wetlands	0		**0**
Total		**NA**	**302.0**

Thus, it was established that **302.0 ha** of Cape Flats Dune Strandveld habitat is needed to be compliant with the biodiversity offset guidelines of 2023.

11.2 Biodiversity Offset Gains

The selected Target Offset Area encompasses approximately 528 ha which are available for offset purposes. The suitability of this site is reinforced by the use of a like-for-like vegetation type and the significant potential for ecological enhancement through targeted rehabilitation activities. Several factors make the selected Target Offset Area (encompassing Offset Options 1, 2 and 5) a highly suitable choice for achieving the long-term conservation goals associated with the project (Table 5).

Table 5: Summary of biodiversity offset gains.

Target Offset Area	Aspect	Adequate qualification in meeting or exceeding the target
Like-for-like offset	Cape Flats Dune Strandveld (EN)	✓
Terrestrial habitat	302 ha	✓
Proclamation of Nature Reserve	Formal protection of the informal Macassar Conservation Area	✓

The 528 ha of offset is sufficient to compensate for the approximate 302 ha of residual impact, which was calculated using a 30:1 and 10:1 ratio, depending on the CBA status. This results in the addition of 226 ha being incorporated into the offset, providing an adequate buffer to address the impacts from the WWTW expansion and operational activities. From a conservation perspective, the offset is expected to yield notable biodiversity gains, particularly by enhancing and securing landscape connectivity and supporting key landscape features of the Cape Flats Dune Strandveld.

To further bolster the effectiveness of the Offset Strategy, it is recommended, in accordance with the guidelines, that the Macassar Conservation Area be formally proclaimed under the NEMPAA. This proclamation would provide additional legal protection and management oversight, ensuring the long-term conservation of the EN habitats and enhancing the overall conservation network in the region.

12. CONCLUSION & NEXT STEPS

The WWTW expansion project represents a significant infrastructural upgrade that is critical to accommodate the increasing wastewater load from the growing population and associated urbanisation. However, this expansion will result in unavoidable residual impacts on the surrounding environment, particularly the loss of an EN vegetation type, including the Cape Flats Dune Strandveld. This development is overwhelmingly to the benefit of the local community and water resource conservation as well as protecting the Helderberg MPA.

Through the application of the mitigation hierarchy, efforts to avoid, minimize, and rehabilitate impacts have been carefully considered. However, given the extent of unavoidable habitat loss, a biodiversity offset has been deemed necessary to ensure appropriate mitigation of the loss of biodiversity. This strategy aligns with best practice principles as outlined in the 2023 Biodiversity Offset Guidelines, ensuring compliance with national conservation objectives.

Following a detailed alternatives analysis, Offset Options 1, 2 and 5 were identified as the most viable candidates to meet the offset requirements for the project. These options are located within key biodiversity areas, including CBAs, and offer (in part) long-term ecological viability through state-owned land, reducing challenges related to land-legal issues and increasing the potential for successful stewardship agreements. With a combined extent of approximately 528 ha, these options adequately address the 302-ha (residual impact) required for offset purposes and allow for some flexibility in final planning, thus adequately compensating for the residual impacts associated with the proposed expansion activities.

The inclusion of the Macassar Conservation Area in the Offset Initiative offers more than just a location for biodiversity offsets; it provides significant ecological, cultural, and community benefits. The White Milkwood trees (*Sideroxylon inerme*) growing within the Macassar Conservation Area are legally protected, adding conservation value that is important for maintaining the ecological integrity of the region. Furthermore, the site already serves as a valuable resource for local communities, such as the Khayelitsha and Macassar populations. For instance, the Traditional Healers' Association uses the area to potentially sustainably, and in a controlled manner, harvest plants for medicinal purposes, demonstrating the direct, tangible benefits the conservation area offers.

In addition to these community benefits, the Macassar Conservation Area is a key hub for environmental education. A partnership between Cape Flats Nature, the Macassar Dunes Co-management Association (MDCA), and iLitha Lomso (an environmental youth organisation) utilises the site as an outdoor classroom, drawing hundreds of learners from nearby schools each year. This educational role further underscores the site's importance in fostering environmental stewardship and community engagement.

By using the Macassar Conservation Area as an offset site, the proponent can contribute to its ongoing management and enhancement, addressing the site's current challenges while reinforcing its role as a conservation and community asset. This approach not only will assist in meet biodiversity offset targets but also strengthens the area's capacity to support long-term conservation, educational, and cultural objectives.

The offset strategy proposed for the Macassar WWTW ensures that the residual impacts from the project are not only mitigated but compensated for through meaningful biodiversity gains. By securing and managing high-priority conservation areas, this strategy contributes to the broader regional conservation objectives and ensures the long-term sustainability of critical biodiversity in the False Bay area.

Following initial investigation and options analyses, a comprehensive Biodiversity Offset Report will be prepared, in which the following key aspects will be addressed:

- Engagement with the relevant authorities to assess the applicability of the proposed offset and initiate discussions with landowners of potential offset sites. These discussions will explore offset options, including land purchase options by the proponent and/or the establishment of stewardship agreements (where applicable);
- Development of a Rehabilitation and Management Plan for the Target Offset Site detailing the actions necessary (where applicable) to restore and maintain ecological functions, mitigate potential risks, and ensure alignment with biodiversity targets; and
- Compilation of a detailed report outlining the findings and recommendations for the Offset Strategy. This report will include an assessment of potential offset sites, an evaluation of biodiversity losses and potential gains, proposed measures to meet offset targets, and a robust rehabilitation and management plan to ensure the long-term success and sustainability of the offset initiative.

APPENDIX A: INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as the available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and STS and its staff reserve the right to, at their sole discretion, modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B: LEGAL FRAMEWORK

Table B1 tabulates each legislative document and the aspects that are relevant to the offset strategies.

Table B1: legislative document and the aspects that are relevant to the offset strategies.

The National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, refer specifically to biodiversity management in the following Clause: (4)(a) *Sustainable* development requires the consideration of all relevant factors including, (i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. This Maintenance and Management Plan has been developed in fulfilment of the requirements as defined in the Environmental Impact Assessments EIA Regulations, 2014 (as amended) (No. R. 327) where a "maintenance management plan" is defined as a management plan maintenance purpose defined or adopted by the competent authority. The following EIA Regulation triggers the need for this MMP: Activity 19, Listing Notice 1: The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (N.B. Points (d) and (e) does not apply as these activities fall within the coastal zone).
The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)	The NEMPAA provides the legal framework for the declaration and management of protected areas, including national parks. It outlines the requirements for conservation, management, and development within a protected area, focusing on biodiversity, sustainable use, and community involvement. The Act also details the process for declaring protected areas and the responsibilities of the management authorities, such as SANParks. The main objectives of NEMPAA are: 1. **Establish a Protected Areas Network**: To provide for the declaration and management of a comprehensive system of protected areas in South Africa that conserves biodiversity and landscapes, and preserves cultural heritage. 2. **Conservation of Biodiversity**: To protect ecosystems, species, and genetic resources, ensuring their persistence and resilience over time, contributing to national and global biodiversity conservation efforts. 3. **Sustainable Use of Resources**: To promote sustainable use of natural resources within protected areas, ensuring that economic activities, such as eco-tourism and resource extraction, are balanced with conservation goals. 4. **Ecological Integrity and Ecosystem Services**: To ensure the maintenance of ecological integrity and the continued provision of ecosystem services, such as water regulation, climate stability, and flood control. 5. **Cultural and Natural Heritage Protection**: To protect areas of natural and cultural significance, including landscapes, sacred sites, and areas with unique historical or archaeological value. 6. **Public Participation and Benefit Sharing**: To ensure that the establishment and management of protected areas involve community participation and provide benefits to local communities, particularly those who have been historically marginalized. 7. **Alignment with International Conventions**: To align South Africa's protected areas framework with international commitments, such as the Convention on Biological Diversity (CBD) and the Ramsar Convention on Wetlands, promoting global conservation initiatives. 8. **Enhancing the National Protected Areas Estate**: To facilitate the expansion and effective management of protected areas, ensuring the protection of key biodiversity areas through cooperative governance across sectors and with various stakeholders.

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The objectives of this act are (within the framework of the National Environmental Management Act) to provide for: ➢ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ the use of indigenous biological resources in a sustainable manner; ➢ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➢ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➢ to provide for co-operative governance in biodiversity management and conservation; and ➢ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof. **National Environmental Management: Biodiversity Act (NEMBA) (Alien and Invasive Species Regulations, 2014):** NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as: (a) a species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2014): ➢ **Category 1a**: Invasive species that require compulsory control. ➢ **Category 1b**: Invasive species that require control by means of an invasive species management programme. ➢ **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➢ **Category 3**: Ornamentally used plants that may no longer be planted.

Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act 36 of 1998) as amended	GN 4167 outlines the parameters and process of a General Authorisation (GA), which replaces the need to apply for a licence in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice **replaces GN 509 of 2016.** The GA sets out the need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) the outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake, or dam; b) in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans. The GA only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is **Low** as determined through the application of the Risk Matrix as prescribed in the Notice. The GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses. The GA may be exercised as follows: i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken *without* being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include *inter alia* emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken *without* being subject to the requirement of a risk assessment and subject to the general conditions of the GA; iv) Maintenance work associated an existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix can be undertaken; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the GA. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a

	registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
Government Notice 3569: National Biodiversity Offset Guideline, in government Gazette 48841 dated 23 June 2023, as it relates to the NEMBA	The purpose of the National Biodiversity Offset Guidelines is to provide a framework for mitigating the impacts of development on biodiversity. These guidelines emphasize the principle of "like-for-like" offsetting, ensuring that any biodiversity loss from development activities is compensated by conserving or restoring an equivalent type and amount of biodiversity elsewhere. The guidelines aim to achieve no net loss, or ideally a net gain, in biodiversity, supporting ecological sustainability and resilience. They establish standards for identifying suitable offset sites, calculating offset ratios, and ensuring long-term management and monitoring of offset areas to maintain their ecological integrity.

APPENDIX C: OFFSET ALTERNATIVES CRITERIA

In the first phase of the offset study, several *offset candidate sites* are considered. Candidate sites may include both on-site and off-site wetland offset options. A suite of site selection criteria has been identified by the National Wetland Offset Guidelines (DWS & SANBI, 2014[13]) and adapted by STS to reflect both freshwater and biodiversity targets. The selected criteria are summarised in Table C1. Final offset site selection must ensure that suitable compensation for the loss of freshwater and biodiversity features due to the proposed development is achievable, while addressing the suitability of a site in terms of meeting biodiversity targets (as per criteria listed in Table C1).

Table C1. Offset site selection and screening tool to meet ecosystem conservation targets. Selection criteria adapted from the Wetland Offset Guidelines to meet biodiversity requirements (DWS & SANBI, 2014).

Criteria	Site attributes	Acceptability Guideline
Like-for-like Habitat Type	**1. Vegetation type – Habitats (vegetation types) selected should ideally be of the same habitat type ('Like-for-like' principle).**	
	Same vegetation type.	Ideal
	Same vegetation type and/or different vegetation type of increased conservation significance (i.e., trading-up).	Acceptable
	Same vegetation type but in a degraded state / vegetation communities illustrate a significant deviation from the reference vegetation type.	Potentially acceptable but generally undesirable i.e. should only be considered if no viable offsets sites that are ideal / acceptable
	Not the same vegetation type and/or vegetation type of lower conservation significance.	Generally unacceptable
Conservation Planning	**2. Landscape/Conservation planning – offset site selection should be aligned with regional and national conservation plans where possible.**	
	Terrestrial habitat and/or freshwater features have been identified as being of high importance in national, provincial and municipal conservation plans e.g. Critical Biodiversity Areas (CBAs), and/or focus and/or priority areas for protected area expansion (as per the 2018 National Protected Area Expansion Strategy (NPAES)).	Ideal
	Terrestrial habitat has been identified as moderately important in national, provincial and municipal conservation plans e.g. Ecological Support Areas (ESAs).	Acceptable
	Terrestrial habitat has not been specifically identified as important in national, provincial and municipal conservation plans.	Potentially acceptable but generally undesirable
Habitat Condition	**3. Habitat condition – the habitat condition should ideally be in a moderately modified condition with good rehabilitation potential (Class C or D for freshwater features) and good/better than that of the impacted site prior to development.**	
	Offset site is of good ecological condition[14].	Ideal
	Offset site is of fair ecological condition[15].	Acceptable
	Offset site is of poor ecological condition[16].	Generally

[13] Department of Water and Sanitation (DWS) & South African National Biodiversity Institute (SANBI). (2016). Wetland Offsets: A Best Practice Guideline for South Africa. Pretoria: South African National Biodiversity Institute.

[14] Good ecological areas are areas that are natural or near natural, i.e., an ecological condition class in which composition, structure and function are still intact or largely intact.

[15] Fair ecological areas are areas that are moderately modified, semi-natural, i.e., an ecological condition class in which ecological function is maintained even though composition and structure have been compromised.

[16] Poor ecological areas are areas that are severely or irreversibly modified, i.e., an ecological condition class in which ecological function has been compromised in addition to structure and composition.

Criteria	Site attributes	Acceptability Guideline
		unacceptable
Local Biodiversity Value	**4. Local biodiversity value – habitat that is unique or that is recognised as having high local biodiversity value should be prioritised for protection.**	
	The habitat is characterised by habitat and/or species of high biodiversity value i.e. presence of unique and noteworthy biodiversity attributes like high species or habitat diversity, rare species or habitat, unique features etc.	Ideal
	The habitat is characterised by habitat and/or species of moderate biodiversity value (i.e. some noteworthy features present).	Acceptable
	The habitat is characterised by habitat and/ species of low biodiversity value.	Generally unacceptable
Long-term Ecological Viability	**5. Ecological viability of site – ecological connectivity and consolidation with other intact ecosystems together with the potential linkage between protected areas is preferable. Also, catchment land use transformation (current and planned) should be low to moderate to reduce risk of indirect impacts.**	
	The offset provides an opportunity to consolidate / expand existing protected areas. Catchment threats and pressures are low.	Ideal
	The offset site is well connected to other intact natural areas and there are no obvious land use threats to its long-term persistence.	Acceptable
	The offset site is moderately connected to other intact natural areas and there are measurable land use threats to its long-term persistence that can be managed.	Potentially acceptable but generally undesirable
	The offset site is poorly connected with other intact ecosystems/ there are land use threats to its long-term persistence and/or catchment highly transformed / catchment land uses have intense hydrological and geomorphological impacts.	Generally unacceptable
Land-legal Viability	**6. Land-legal Issues – the rezoning of the site to a formal conservation use is legally and practically feasible and does not contradict / is in line with current land use planning.**	
	Offset site is located on privately or state-owned land with no conflicting current or future land use zoning and is located within a single cadastral unit / property.	Ideal
	Offset site is located on privately or state-owned land with no conflicting current or future land use zoning and is located across 2-4 properties.	Acceptable
	Offset site is located on privately or state-owned land with no conflicting current or future land use zoning and is located across 5-8 properties.	Potentially acceptable but generally undesirable
	Offset site is located on privately or state-owned land with conflicting current or future land use zoning or development applications / rights and/or is located across >8 properties and/or the wetland is located within tribal authority land.	Generally unacceptable
Rehabilitation Opportunities / Potential	**7. Rehabilitation opportunities – sites with a lower cost to benefit ratio for achieving functional gains and with good rehabilitation potential are preferable over sites that require extensive and costly rehabilitation to achieve habitat with representation of the reference vegetation type.**	
	Habitat within offset site has good rehabilitation potential that can be achieved by relatively cost-efficient interventions.	Ideal
	Habitat within offset site has good rehabilitation potential that can be achieved by costly and extensive interventions.	Acceptable
	Habitat within offset site has poor rehabilitation potential. OR Habitat within offset site has moderate rehabilitation potential that can be achieved by costly and extensive interventions.	Generally unacceptable

APPENDIX D: BIODIVERSITY OFFSET DETERMINATION METHODOLOGY

The starting point for determining the size of a biodiversity offset is calculating an applicable ecosystem-based biodiversity offset ratio. A biodiversity offset ratio provides the area-based size of a biodiversity offset relative to the area of the residual negative biodiversity impact.

Given that the focus of this section is on ecosystems, the standard approach for determining ratios is based on Ecosystem Extent, Ecosystem Protection Level (EPL) and Ecosystem Threat Status. It is also recommended that it is taken into consideration which type of biodiversity priority area the relevant area is classified as. This is to ensure that biodiversity priorities can still be met in areas that are CBA2s but were not selected because of ecosystem threat level.

DETERMINING THE BASIC OFFSET RATIO

The standard approach to determining a basic biodiversity offset ratio is based on biodiversity targets. Those targets are, in turn, based on Ecosystem Extent, Ecosystem Protection Level and Ecosystem Threat Status of the various ecosystem types identified in the ecosystem assessment conducted as part of the determination of ecosystems that are threatened and in need of protection in terms of the National Environmental Management: Biodiversity Act, 2004.31 The proposed applicable ratios are listed in the look-up table, which is attached, marked Annexure A, of the offset guidelines (https://cer.org.za/virtual-library/policy/national-biodiversity-offset-guideline-23-june-2023). The look-up table also sets out the rationale for the standard approach in greater detail and will be reviewed periodically and updated, if and when necessary.

The standard approach is shortly as follows:

1. If the Ecosystem Extent is less than or equal to 30%, the precautionary principle demands that a 30:1 ratio must be applied; and
2. If the Ecosystem Extent is between 30 and 70%, the ratios provided for in the look-up table, which takes into consideration Ecosystem Extent and EPL, should be applied. The ratios in that range of Ecosystem Extent vary between 1:22 to 1:1 depending on the extent of the ecosystem remaining and how much of the relevant ecosystem type is protected. In the table below, ratios were assigned to 6 different “bands” based on remaining ecosystem extent and ecosystem protection level (Table D1 & Figure D1).

Table D1: Ratio look-up table based on remaining ecosystem extent and ecosystem protection level (as per the 2023 Biodiversity Offset Guidelines).

Remaining Ecosystem Extent (%)			Not Protected		Poorly Protected		Moderately Protected		Well protected	
Bands	Low	High	Low	High	Low	High	Low	High	Low	High
1	0	30	TPC Ratio Applied							
2A	30	40	12.0	22.0	8.0	15.0	4.0	8.0	2.0	4.0
2B	40	50	7.0	12.0	4.0	8.0	2.0	4.0	0.0	2.0
3A	50	60	3.0	7.0	2.0	4.0	0.0	2.0	0.0	0.0
3B	60	70	0.0	3.0	0.0	2.0	0.0	0.0	0.0	0.0
4	70	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

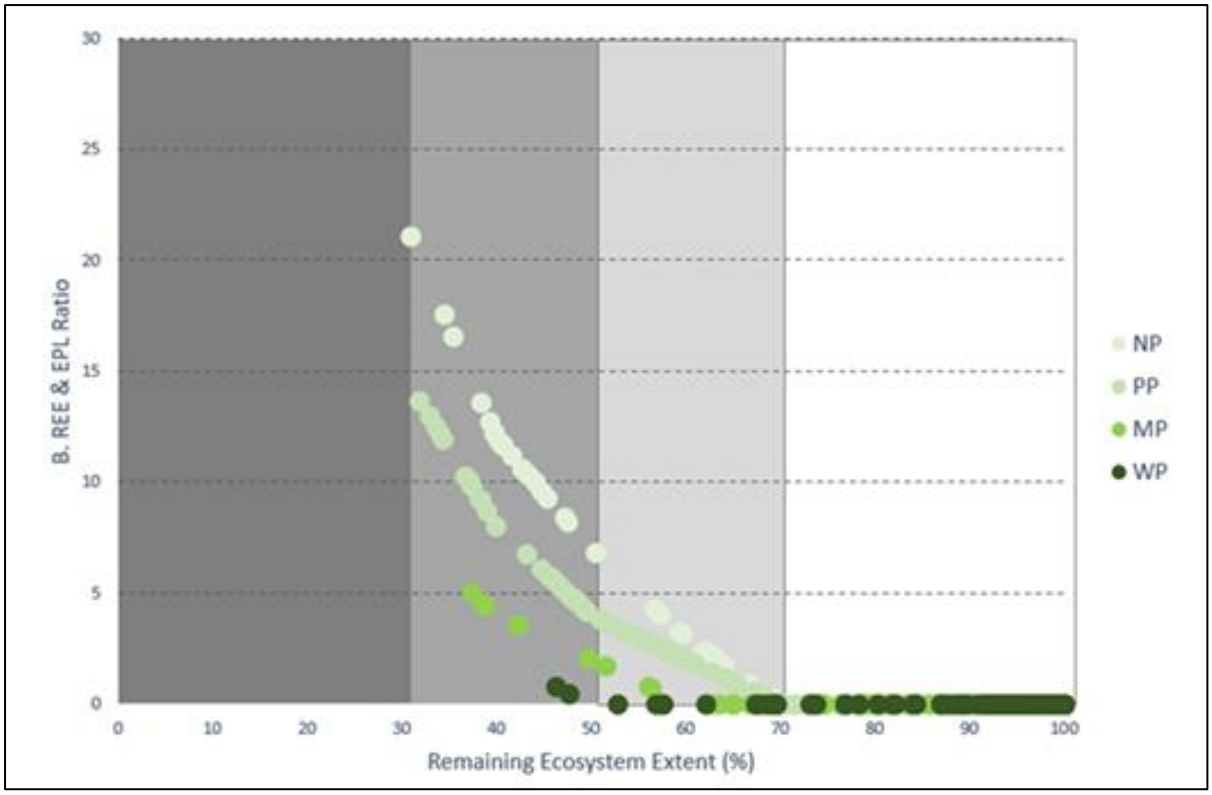

Figure D1: Starting Ratios based on Ecosystem Extent and EPL; NP = not protected, MP = moderately protected, WP = well protected, REE = remaining ecosystem extent, and EPL = ecosystem protection level (as per the 2023 Biodiversity Offset Guidelines).

3. Take into consideration the ecosystem threat status: it is recommended that the following ratios are applied for the different ecosystem threat statuses:
    - Critically Endangered: 30:1;
    - Endangered: 10:1; and
    - Vulnerable: 5:1.

Ecosystems are not only threatened by a reduction in range. They are also threatened for other reasons.

4. Following the precautionary approach, it is recommended that the highest of the two ratios described in 2 and 3 above is selected as the starting ratio.

It should be noted that a biodiversity offset could still be required for an activity, or activities, that are likely to have a significant residual negative impact on an ecosystem of Least Concern with an Ecosystem Extent of greater than 70%. In those cases, the starting ratio would be based on the information before the decision-maker, such as the reasons why the biodiversity offset is required.

It is emphasised here that the standard approach is not binding, but a guide based on relevant scientific information on ecosystems. Competent authorities (CAs) must apply their minds to each case, which would involve considering additional factors, such as the size of the historical extent of the ecosystem measured against the extent of the residual negative impact (if a large percentage of the extent of the ecosystem would be impacted on, a higher ratio would be justified) and the cumulative residual negative impact of the activity, or activities, on biodiversity.

Some provincial conservation authorities or CAs have adopted, or may in future adopt, province specific approaches to determining biodiversity offset ratios, based on province-specific biodiversity targets. Those approaches take precedence over the standard approach provided for in this guideline provided that they are scientifically defensible. Consideration also needs to be given to how ratios are determined for development in the urban setting. It is likely that there would be good reasons for adjusting biodiversity offset ratios down for activities in the urban setting given the relative scarcity of space and

natural areas in those areas. In this regard, consideration should be given to approaches for determining biodiversity offset ratios for development in the urban environment.

'Like-for-better' biodiversity offsetting/ 'trading-up'

Wherever possible, a 'like-for-like' biodiversity offset should be required and provided to ensure that residual negative impacts on the affected biodiversity features are appropriately compensated. In exceptional cases, targeting biodiversity of greater conservation concern (for example, ecosystems that have higher threat status than the impacted ecosystem, or areas of higher biodiversity priority as indicated in applicable systematic biodiversity plans), may be justifiable. Where such an approach of 'trading up' is being considered, a strong motivation should be provided for this choice (for example, when it can be shown that there are no suitable areas of the same or proxy habitat available). Such motivation should also show the relationship between the biodiversity offset site's biodiversity and impacted biodiversity.

DETERMINING THE ADJUSTED BIODIVERSITY OFFSET RATIO

To ensure that biodiversity priorities are considered as part of the determination of the size requirement for a biodiversity offset, the relevant CBA Map must also be considered as part of that process. While any loss in a CBA 1 is generally considered irreplaceable, if it is found that the negative significant impact on biodiversity will take place in a CBA 2, it is recommended that the basic biodiversity offset ratio should be adjusted by increasing it by a factor of 1.5 up to a maximum of 30:1.