

Plett Botanical Estate, Erf 8010, Plettenberg Bay, Western Cape.

Specialist Aquatic Biodiversity Assessment



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- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
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- All the particulars furnished by me in this document are true and correct.



Specialist: Dr. James Dabrowski (Ph.D., Pr.Sci.Nat. Water Resources – Reg. No 114084)

Date: April 2026

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1. INTRODUCTION

Confluent Environmental was appointed by HilLand Environmental to undertake an aquatic assessment for a proposed residential and commercial development on Erf 8010, near Plettenberg Bay. The property is located approximately 6 km southwest of Plettenberg Bay's town centre with the closest formal road being Robberg Road, which runs along the northern boundary of the property (Figure 1). The Robberg Airport is located immediately to the west of the property. The closest perennial watercourse is the Piesang River, approximately 3.5 km north of the property. The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA).

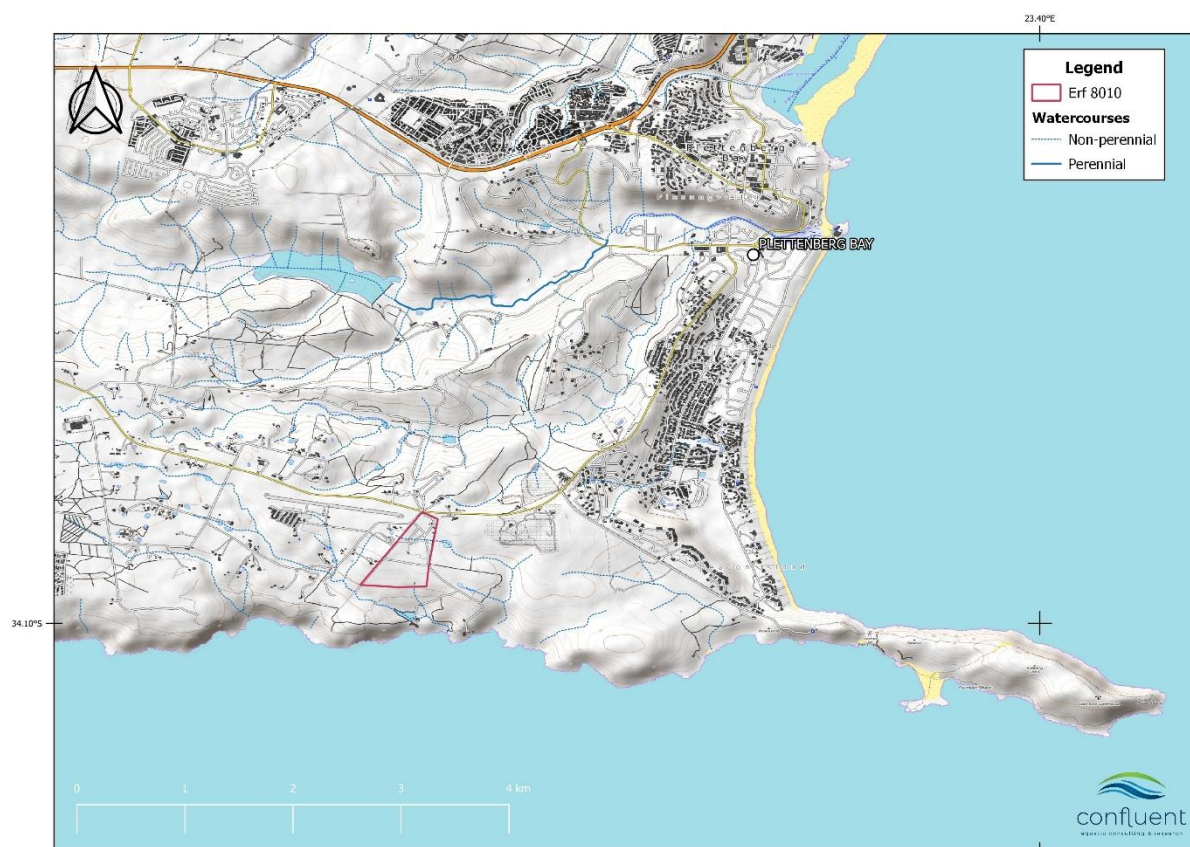


Figure 1: Map indicating the location of Erf 8010 west of Plettenberg Bay, Western Cape.

1.1 National Environmental Management Act

According to the protocols specified in GN 1540 (Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when Applying for Environmental Authorisation), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool (screening tool). An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of:

- **Very High** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment; or

- **Low** sensitivity for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.

According to the protocol, a site sensitivity verification must be undertaken to confirm the sensitivity of the site as indicated by the screening tool which has been classified as **Low**.

1.2 National Water Act (NWA, 1998)

The Department of Water & Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be watercourse, and
- A reference to a watercourse includes, where relevant, its bed and banks.

For the purposes of this assessment, a wetland area is defined according to the NWA (Act No. 36 of 1998):

“Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

Wetlands must therefore have one or more of the following attributes to meet the NWA wetland definition (DWAf, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

No activity may take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). According to Section 21 (c) and (i) of the National Water Act, an authorization (Water Use License or General Authorisation) is required for any activities that impede or divert the flow of water in a watercourse or alter the bed, banks, course or characteristics of a watercourse. The regulated area of a watercourse for section 21(c) or (i) of the Act water uses means:

- a) The outer edge of the 1 in 100-year flood line and/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 100m from the edge of a watercourse where the edge of the watercourse is the first

identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or

- c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

According to Section 21 (c) and (i) of the NWA, any water use activities that do occur within the regulated area of a watercourse must be assessed using the DWS Risk Assessment Matrix (GN 4167 of 2023) to determine the impact of construction and operational activities on the flow, water quality, habitat and biotic characteristics of the watercourse. Low Risk activities require a General Authorisation (GA), while Medium or High Risk activities require a Water Use License (WUL).

1.3 Scope of Work

The objectives of this assessment included the following:

- To undertake a desktop analysis and site inspection to verify the sensitivity of aquatic biodiversity as **Very High** or **Low**; and
- Compile an Aquatic Biodiversity Compliance Statement or Aquatic Biodiversity Specialist Assessment based on the site verification of the sensitivity of the site.
- Determine whether any activities fall within the regulated area of a watercourse as defined by the NWA.

2. APPROACH

The following rationale was adopted to determine the sensitivity of aquatic biodiversity within the footprint of the site:

- In the event that watercourses are confirmed to fall within the development footprint and that these watercourses will be impacted by the development, then the site sensitivity is confirmed as **Very High** and a full specialist freshwater assessment is required; and
- In the event that no watercourses are identified within the development footprint the site sensitivity is confirmed as **Low** and an Aquatic Compliance statement is required.

The determination of the site sensitivity relied upon the following approaches:

- Interrogation of available desktop resources including:
 - DWS spatial layers;
 - National Freshwater Ecosystem Priority Areas (NFEPA) spatial layers (Nel et al., 2011);
 - National Wetland Map 5 and Confidence Map (CSIR, 2018) – the latest national wetland inventory map for South Africa;
 - Western Cape Biodiversity and Spatial Plan (WCBSP) for Bitou (CapeNature, 2017).
- A site visit was undertaken, during which time the following activities were undertaken:
 - Identification and classification of watercourses within the footprint of the site according to methods detailed in Ollis et al. (2013);
 - Soil augering to confirm the presence of soil indicators (DWAf, 2005) that may indicate the presence of a wetland (if applicable); and

- Identification of hydrophilic plant species that may indicate the presence of wetland plant species (if applicable).

2.1 Wetland Delineation

Wetlands are described by the National Water Act (Act 36 of 1998) as:

“Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

According to DWAF (2005) wetlands must have one or more of the following attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of plants that grow in water saturated conditions (hyrdophytes or obligate wetland plants);
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.

The boundary of the wetland was delineated in accordance with DWAF (2005) guidelines which considers the following four specific indicators:

- The Terrain Unit Indicator: Identifies those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator: Identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation;
- The Soil Wetness Indicator: Identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation (i.e. mottling and gleying within 50 cm of the soil surface); and
- The Vegetation Indicator: Identifies hydrophilic vegetation associated with frequently saturated soils.

The boundary of the wetland was determined by identifying the presence or absence of the combination of indicators mentioned above at selected points in the field. The location of soil augering points used to assess soil wetness were marked on a hand-held GPS and saturation zones were classified according to the soil wetness indicators as follows:

- Temporary Zone: Short periods of saturation (less than three months per annum) characterised by few high chroma mottles and minimal grey matrix (< 10 %).
- Seasonal Zone: Significant periods of wetness (at least three months per annum) characterised by many low chroma mottles and a grey matrix.
- Permanent Zone: Wetness all year round characterised by a prominent grey matrix and few to no high chroma mottles.

Auger points that showed no sign of saturation were classified as 'Dry'. All augering points were imported into GIS software and, in combination with aerial imagery and other site observations of vegetation indicators, were used to plot the boundary of the wetland.

2.2 Buffer Determination

Buffer zones have been defined as a strip of land with a use, function or zoning specifically designed to act as barriers between human activities and sensitive water resources with the aim of protecting these water resources them from adverse negative impacts. Appropriate buffers were estimated based on buffer zone guidelines developed by Macfarlane and Bredin (2017). These guidelines estimate required buffer zone widths based on a combination of input parameters which include, *inter alia*, the nature of the activity and associated impacts, basic climatic and soil conditions, the PES and EIS of potentially affected watercourses and the implementation of appropriate mitigation measures.

3. ASSUMPTIONS & LIMITATIONS

- The assessment of the site visit represents a brief temporal snapshot of conditions on the site. Changes in season or short-term changes in climatic conditions may possibly result in the formation of aquatic habitats (e.g. temporary or seasonal wetlands) under significantly wetter conditions. Despite this limitation the sensitivity of aquatic biodiversity on the site was determined with a very high level of confidence.

4. DESKTOP SURVEY

The site falls within Primary Catchment K (Kromme) area and in Quaternary Catchment K60G (Figure 2). According to geospatial data sources, two non-perennial streams run through the property (Figure 3). The northern watercourse originates from the property to the west, flows through the northern third of Erf 8010 and into the neighbouring property on east. Another watercourse flows in a southerly direction, exiting the southern boundary of Erf 8010, before joining a perennial watercourse running through the neighbouring property to the south. A series of small dams have been created along the western boundary of the property and along the mapped northern non-perennial watercourse (Figure 3).

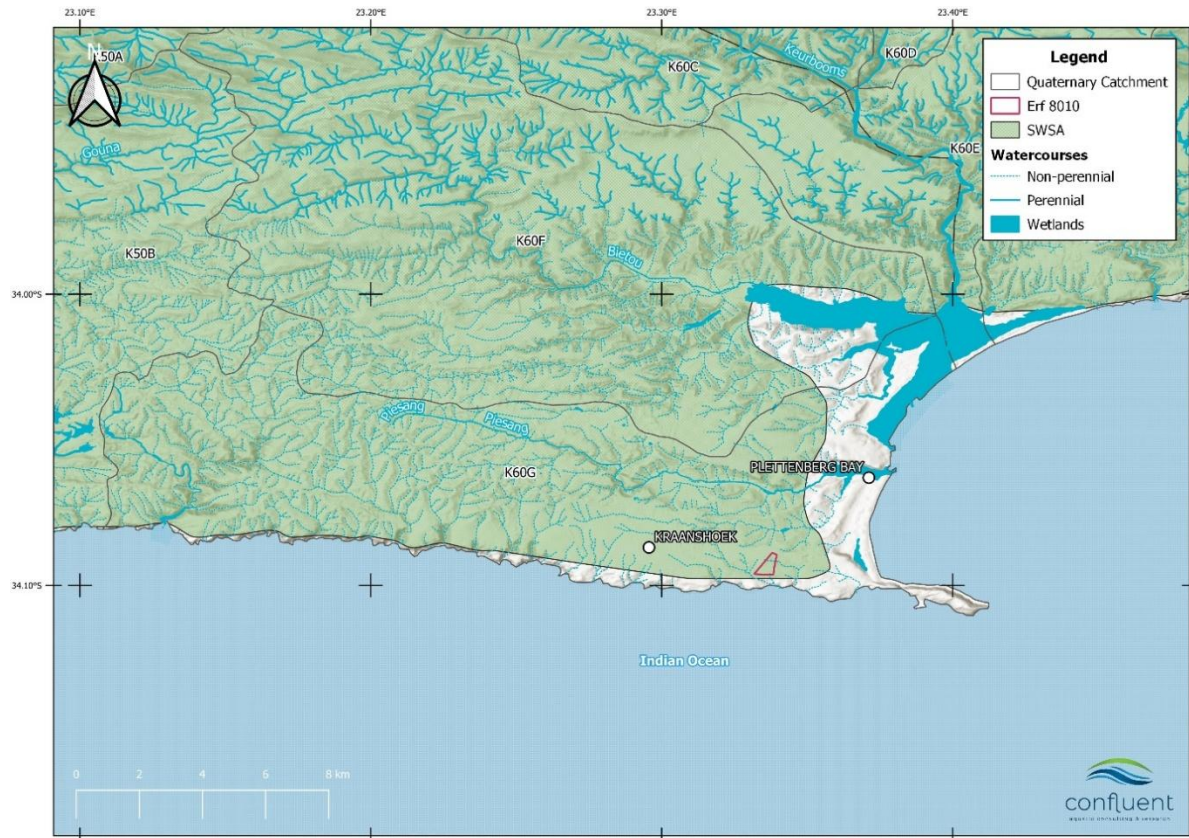


Figure 2: Location of Erf 8010 relative to quaternary catchments and mapped watercourses.



Figure 3: Map showing watercourses mapped on the property.

4.1 National Freshwater Ecosystem Priority Atlas

The study site is located within sub-quaternary catchment (SQC) 9144 (Figure 4), which, according to the National Freshwater Ecosystem Priority Atlas (NFEPA, Nel et al., 2011), has not been classified as a FEPA (Freshwater Ecosystem Priority Area). The development area therefore falls within an SQC that is not considered as being a priority for maintaining freshwater biodiversity at a national scale.

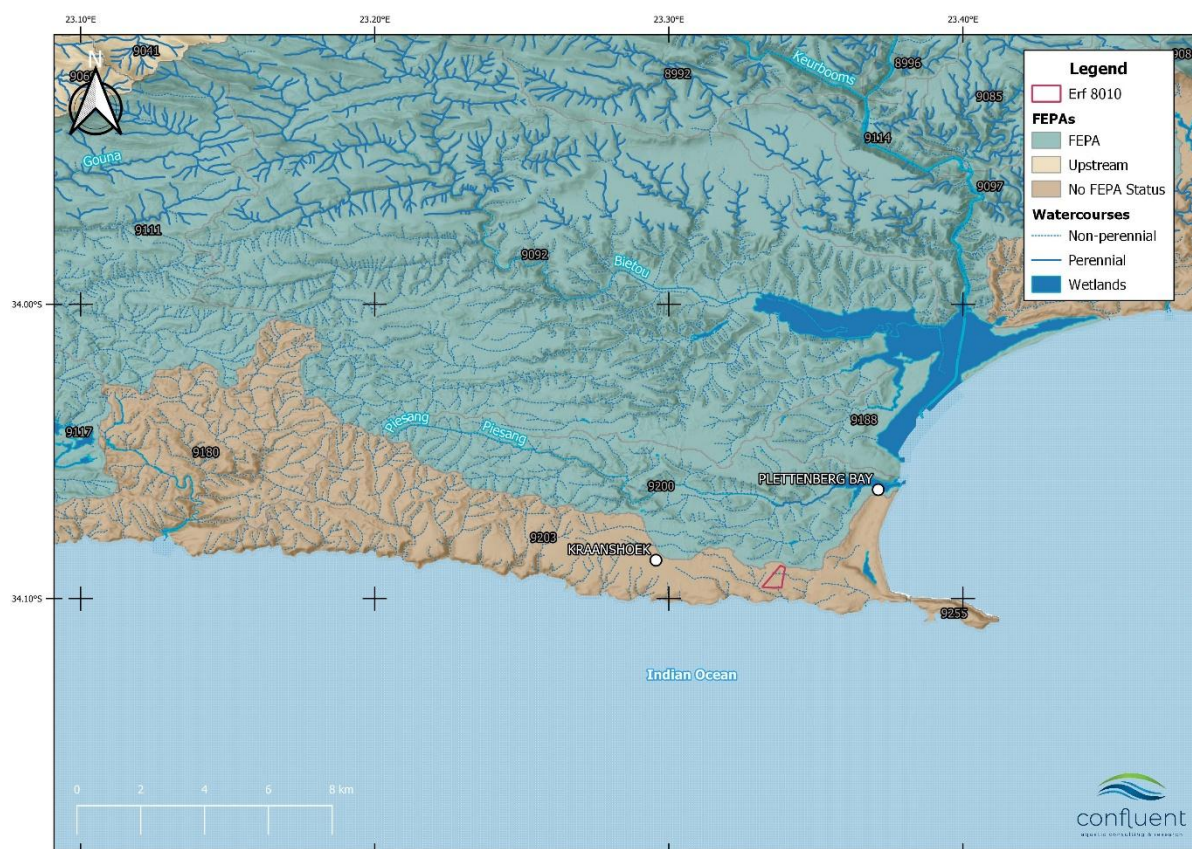


Figure 4: Map indicating the property location in relation to mapped Freshwater Ecosystem Priority Areas.

4.2 Strategic Water Source Area

The site does fall within the Outeniqua Strategic Water Source Area (SWSA) (Figure 2) which is considered to be of national importance. SWSAs are defined as areas of land that either:

- Supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or
- Have high groundwater recharge and where the groundwater forms a nationally important resource; or
- Areas that meet both criteria (a) and (b).

SWSAs are vital for water and food security in South Africa and also provide the water used to sustain the economy. Given this context, management and implementation guidelines have been developed with the objective of facilitating and supporting well-informed and proactive land management, land-use and development planning in these nationally important and critical areas (Le Maitre, et al., 2018). The primary principle behind this objective is to protect

the quantity and quality of the water they produce by maintaining or improving their condition. The proposed development footprint falls within an urban 'working landscape' and in this context the management objectives are to maintain at least the present condition and ecological functioning of these landscapes, to restore where necessary, and to limit or avoid further adverse impacts on the sustained production of high-quality water.

4.3 Western Cape Biodiversity Spatial Plan

According to the WCBSP for Bitou, no aquatic CBAs are indicated to occur with Erf 8010. The mapped non-perennial watercourses have been categorized as aquatic Ecological Support Areas (ESAs - Figure 5), which are relatively unimpacted aquatic features that are not considered important for meeting biodiversity targets, but are important for providing important supporting functions (Table 1). In this particular case, the streams have been identified as important water source areas. The management objective of ESAs is described in Table 1, which is to maintain in a functional near natural state, ensuring that the continued provision of ecological support services is not compromised.



Figure 5: Map of Erf 8010 relative to the Western Cape Biodiversity Spatial Plan.

Table 1: Definitions and management objectives of the Western Cape Biodiversity Spatial Plan.

Category	Definition	Management Objective
ESA1	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs and are often vital for delivering ecosystem services.	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.

5. SITE SENSITIVITY VERIFICATION

The site sensitivity verification focussed on likely presence of any watercourse prior to the construction of the dams on the property and was informed by both a historical assessment of aerial imagery of the site and a site visit conducted on the 22nd of March 2024.

5.1 Historical Assessment

Historical imagery from Google Earth and the Chief Directorate: National Geo-Spatial Information (CD:NGI) were used to determine the historical presence of watercourses on the property (Figure 6). The following observations are of relevance:

- 2004: Property prior to the establishment of the dams. While a dam is located on the neighbouring eastern property, there was no obvious visible indication of a watercourse with a distinct channel and associated bed and banks crossing Erf 8010 – although the . What appears to be a vegetated, depression wetland is located in the north-western corner of the property.
- 2016: The western boundary and much of the remainder of the property had become heavily invaded by *Eucalyptus sp.* No channel or obvious watercourse is present (apart from the wetland to the north).
- 2017: Clearance of vegetation on the site in 2017, revealed the presence of a small dam (A) along the western boundary. The presence of the depression wetland is clearly visible against the surrounding cleared vegetation. The deep green colour of the wetland vegetation (indicative of wet conditions) contrasts with the brown colour of the vegetation (indicative of drier conditions) as observed in the 2004 and 2016 image and indicates that the wetland experiences seasonal periods of inundation.
- 2018: The depression wetland had been excavated and enlarged to form an open water dam (B). The dam along the western boundary (A) is clearly visible.
- 2019: Additional dams along the western boundary were constructed (C to G) as well as a dam along the western edge of the main road passing through the property (H).
- 2020: An additional dam (I) was constructed in between Dam A and H.

With respect to the depression wetland, historical imagery indicates the presence of the wetland as far back as 1958 (Figure 7). These images also indicate the likely presence of a small watercourse that drains into a small dam to the east of the property.



Figure 6: Google Earth imagery indicating the progression of the construction of dams on the property.

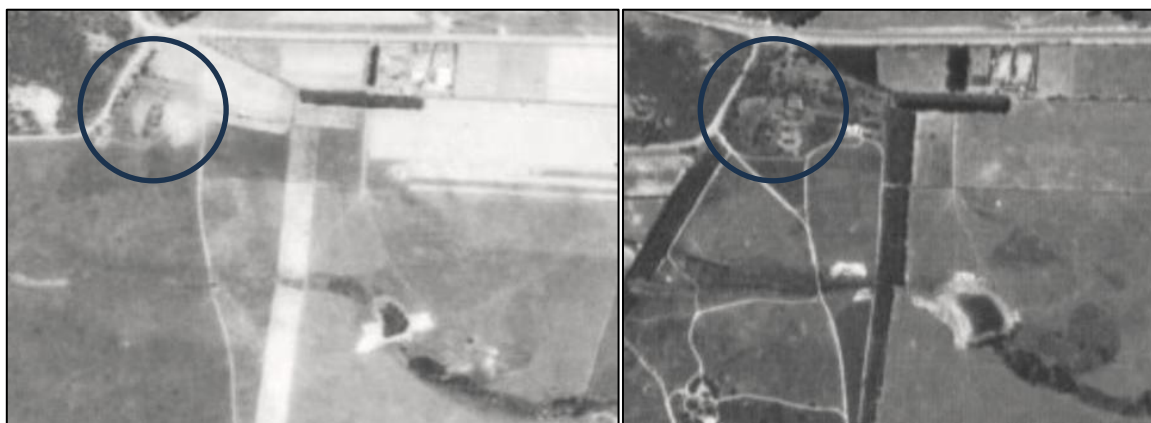


Figure 7: Historical aerial photographs indicating the presence of the depression wetland in 1958 (left) and 1972 (right).

5.2 Site Visit

The lowest point along which a natural watercourse would run coincides with the alignment of Dams A, I and H, which are located in a relatively broad shallow valley. Dam A receives stormwater via a formalised culvert that collects water from the road and airport precinct to the west. There was no sign of a natural watercourse upstream of Dam A (Figure 8). Water overflows from Dam A and into dams I and H. All of these dams were relatively well vegetated with aquatic vegetation and provided good habitat for a variety of bird species. Artificial wetland habitat (dominated by *Typha capensis*) had established downstream of Dam H at the point of where the dam overflows (Figure 9).

Dam B also received stormwater via a formalised culvert that drains the road and a large portion of the airport runway to the west. When filled, Dam B overflowed into Dam C to Dam G via pipes that connect the dams (Figure 10). While these dams were relatively low at the time of the site visit, historical imagery indicates that they are frequently full of water and provided habitat for a variety of bird species and other aquatic organisms. The ecological condition of the wetland prior to the establishment of Dam B cannot be verified with any certainty. Historical imagery does indicate the presence of what appears to be a depression wetland from as far back as 1958. More recent imagery indicates that the wetland received stormwater from the existing culvert prior to its excavation in 2018, which undoubtedly played a role in sustaining the wetland area. Given that Dam B sustained water levels in Dams C to G, it was evident that the wetland would have received substantial volumes of stormwater. Satellite imagery indicates that the dam was covered by vegetation throughout its extent and was most likely seasonally inundated following periods of high rainfall. A soil berm has been created around the perimeter of the property – presumably from material excavated out from each of the dams and from historical clearance of the site.

The start of the mapped non-perennial drainage line that just extends into the southern perimeter of the property is also a low point in the landscape and is a natural area of drainage. A more clearly defined channel and associated bed and banks only starts forming further down along the drainage line.



Figure 8: View to the west of Dam A, showing the road adjacent to the property. A stormwater channel is visible to the west of the road as well as a 600 mm pipe which discharges water from the channel into Dam A (top left); Dam A; Dam I; and Dam H.



Figure 9: View of the artificial wetland area created below Dam H.



Figure 10: Photographs of Dams B to G.



Figure 11: Photograph illustration the soil berm running along the perimeter of the property.

5.3 Site Sensitivity

- Dams A, I and H were located in a natural area of drainage (i.e. a low point in the landscape), which is confirmed by the historical images in Figure 7. It is unclear from the historical images whether the drainage displayed characteristics of a watercourse (i.e. a channel and clearly defined bed and banks). The dams were clearly sustained by significant inputs of stormwater runoff that originates from the airport business park and precinct to the west. While the drainage line did not show the characteristics of a clearly defined watercourse, it is a source area of water for downstream habitats.
- Dams C to G were not located within any natural watercourse and had been opportunistically located to capture stormwater runoff that overflows from Dam B. The sensitivity of these sites was considered to be **Low**.
- Dam B was most likely a natural depression wetland prior. As the site was not visited prior to the construction of the dam, it is not possible to verify the ecological condition of the wetland before it was transformed. Historical imagery suggests that the wetland was vegetated throughout its extent and experienced seasonal periods of inundation. The sensitivity of the wetland is considered to have been **Very High**. Rehabilitation of the wetland is recommended.
- While the southern non-perennial drainage line is not a clearly defined watercourse, it is a source area of water for downstream habitats. This drainage will receive stormwater inputs from the development and the sensitivity is confirmed as **Very High**.

6. DAM REHABILITATION

Subsequent to the original site visit it was determined that all of the above-mentioned dams had been constructed without the requisite authorisation from the Breede Olifants Catchment Management Agency (BOCMA). A pre-directive issued to the applicant required that these dams had to be removed and that Dam B should be rehabilitated to restore the former wetland characteristics. Since the original site visit all dams have subsequently been removed, allowing free flow of water through the property (Figure 12). Gabion structures have been incorporated into the drainage to dissipate stormwater energy along the drainage. The former

basins of the dam will serve as stormwater attenuation basins, releasing stormwater in a controlled manner to downstream habitats.

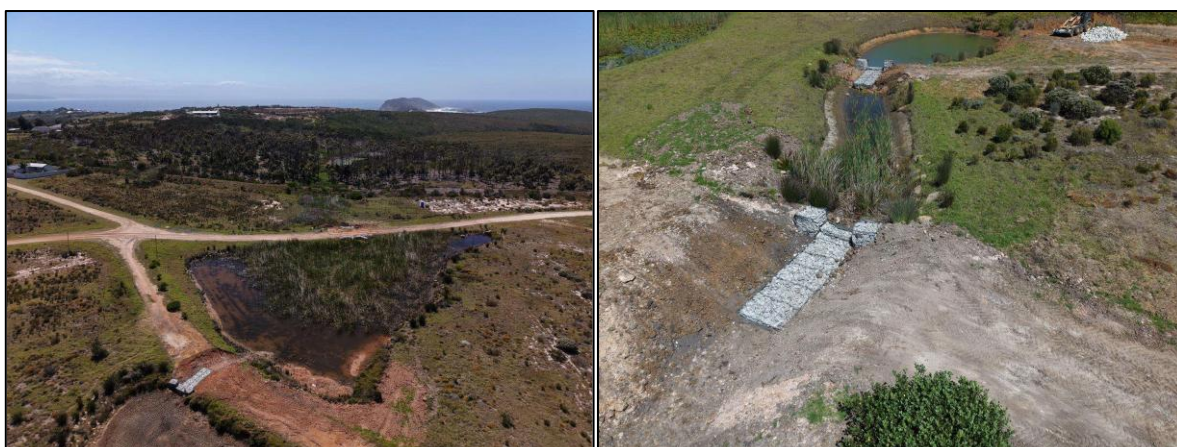


Figure 12: Photographs showing dam walls excavated out with gabion flow energy dissipation structures.

6.1 Rehabilitation of Dam B

The current landowner has opted to rehabilitate the unauthorised activities which will require that Dam B must be filled in and wetland vegetation allowed to re-establish. Depression wetlands drain inwardly and are formed by the long-term inundation of the soil profile, leading to saturated soil conditions and the establishment of associated wetland vegetation. The main focus of the rehabilitation should therefore be to re-establish a saturated soil profile within the current extent of the dam.

6.1.1 Rehabilitation Plan

- The current SDP allows for a 15 m buffer around the perimeter of the dam which is considered sufficient for the protection of the rehabilitated wetland in the long-term;
- Survey and peg the delineated dam and the planned open space around its perimeter;
- Water level in the dam must be drawn down to minimise turbidity throughout the water column and create drier working conditions;
- The dam must be filled in with appropriate subsoil and be covered with a minimum of 30 cm of topsoil. Soil must be graded to maintain a topographical depression so that water drains inwardly from the perimeter of the wetland. Reshape the area to smooth contours;
- Small pockets of open water can be left within the delineated area to provide habitat heterogeneity and to provide refuge for aquatic species currently inhabiting the dam (e.g. amphibian species). These areas must cover no more than 10 % of the total wetland area;
- No rocks, rubble or building material may be used to fill in the wetland;
- The patch of wetland vegetation along the eastern edge of the wetland (Figure 13) could serve as an important seedbank for passive revegetation of the wetland over time. This patch of vegetation must be demarcated and must not be disturbed during infilling and can be used as a reference to gauge the height of infilling required throughout the remaining area of the wetland.



Figure 13: Current stand of wetland vegetation which must be demarcated and left undisturbed.

- Initially it is anticipated that many of the seedlings to establish across the wetland would include alien invasive weeds, so regular weeding to remove young plants using hand-pulling as a preference is recommended. No use of herbicides is permitted within the delineated wetland area. This must be conducted on a monthly basis until such time as wetland vegetation re-establishes across the wetland;
- After approximately 6 months, the vegetation cover and composition should be re-assessed to determine the degree to which more active planting should be undertaken;
- Only indigenous wetland plants found in the area must be used. Based on observations during the site visit, it is anticipated that seasonal to permanent wetland plants would be required for replanting. The following plants are recommended:
 - *Elocharis limosa* (throughout the broader extent of the wetland)
 - *Juncus effusus* (throughout the broader extent of the wetland)
 - *Juncus lomatophyllus* (at the stormwater inlet)
 - *Isolepis prolifera* (at the stormwater inlet)
 - *Nidorella ivifolia* (around the outer margin of the wetland)
 - *Helichrysum cymosum* (around the outer margin of the wetland)
 - *Helichrysum petiolare* (around the outer margin of the wetland)
- Stormwater can continue to feed the wetland area, but water must not be purposefully drained out of the wetland.

6.1.2 Environmental Control Officer (ECO)

An Environmental Control Officer (ECO) must be appointed prior to the implementation of the rehabilitation plan. The ECO will be responsible for monitoring, reviewing and verifying compliance by the contractor responsible for rehabilitation with the environmental specifications of this Plan and the conditions of approval. The appointed ECO must be suitably qualified and have experience of environmental monitoring and control on similar scale projects within sensitive environments. The responsibilities of the ECO include but are not limited to the following:

- Develop a 'before' and 'after' photographic portfolio of the dam, elevated earth berm and fire break areas (for monitoring purposes all photos must be taken from fixed points and portfolio must be dated);

- Provide environmental induction training to contractors/workers on site prior to undertaking of the above-mentioned rehabilitation activities;
- Be fully knowledgeable of all licences and permits that may be required to undertake the rehabilitation work;
- Monitor compliance with this Rehabilitation Plan;
- Compilation of a Completion Statement to ensure compliance with the Plan and conditions of approval.
- The ECO must inspect the site during site establishment, preparation and during rehabilitation;
- Maintain a written record of environmental incidents (e.g. spills, impacts, legal transgressions etc.) as well as corrective and preventative measures taken;
- Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.

7. BUFFER

Buffer determination considered the implementation of mitigation measures specified in the impact assessment below and was determined based on catchment and buffer characteristics listed in Table 2. Based on these inputs the buffer for the wetland and drainage lines is set to 20 m (Figure 14). The development has been adapted to accommodate the buffer throughout.

Table 2: Input parameters used to determine buffer widths for watercourses.

Parameter	Value
MAP	Up to 1000
Rainfall Intensity	70.9 – Zone 4 (Very High)
Soil SCS	A/B
Slope of Catchment	Gentle (2 – 10 %)
Slope of Buffer	Moderate (10 -20 %)
Soil erosion potential	0.74 (Very High)
Vegetation Characteristics	Fair
Soil Permeability	Low
Buffer Width	20 m

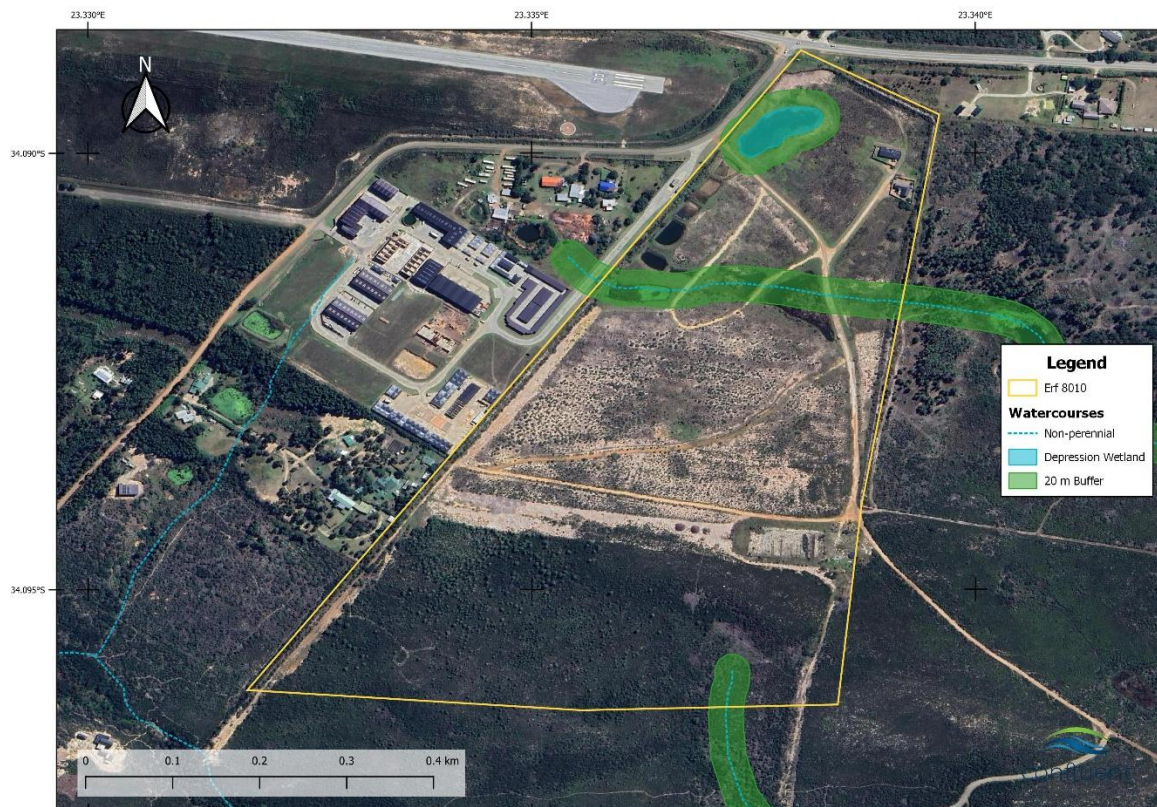


Figure 14: Map illustrating watercourses and recommended buffers

8. SITE DEVELOPMENT PLAN

The proposed zoning of the property includes general residential (group housing and flats/apartments) and a business zone (Figure 15). The dams and non-perennial drainage lines have been included in the private open space network of the development. The following

are aspects of the development are relevant with regards to impacts on watercourses and aquatic biodiversity:

- The Ganzevallei Wastewater Treatment Works in Plettenburg Bay currently has insufficient capacity to accept additional sewage flows from the development. Initially, wastewater will be treated at an onsite sewage package plant on a temporary basis until the capacity of the WWTW has been expanded. Treated effluent will be used for irrigation of open spaces.
- An existing borehole is located in the north-western corner of the property and will be used to supply the development with water in emergency situations. Water will also be used for irrigation of open spaces once the sewage package plant has been decommissioned.
- Stormwater from the northern section of the property will drain towards the northern non-perennial drainage and the rehabilitated dams A, I and H.
- Stormwater from the southern section of the property will drain towards the southern non-perennial drainage line. The stormwater outlet will discharge into a reno mattress stilling basin to dissipate energy.
- According to the engineering service report, Internal swales and attenuation dams will be incorporated into the open space network and will be sufficient to attenuate post-development stormwater flows to pre-development rates.

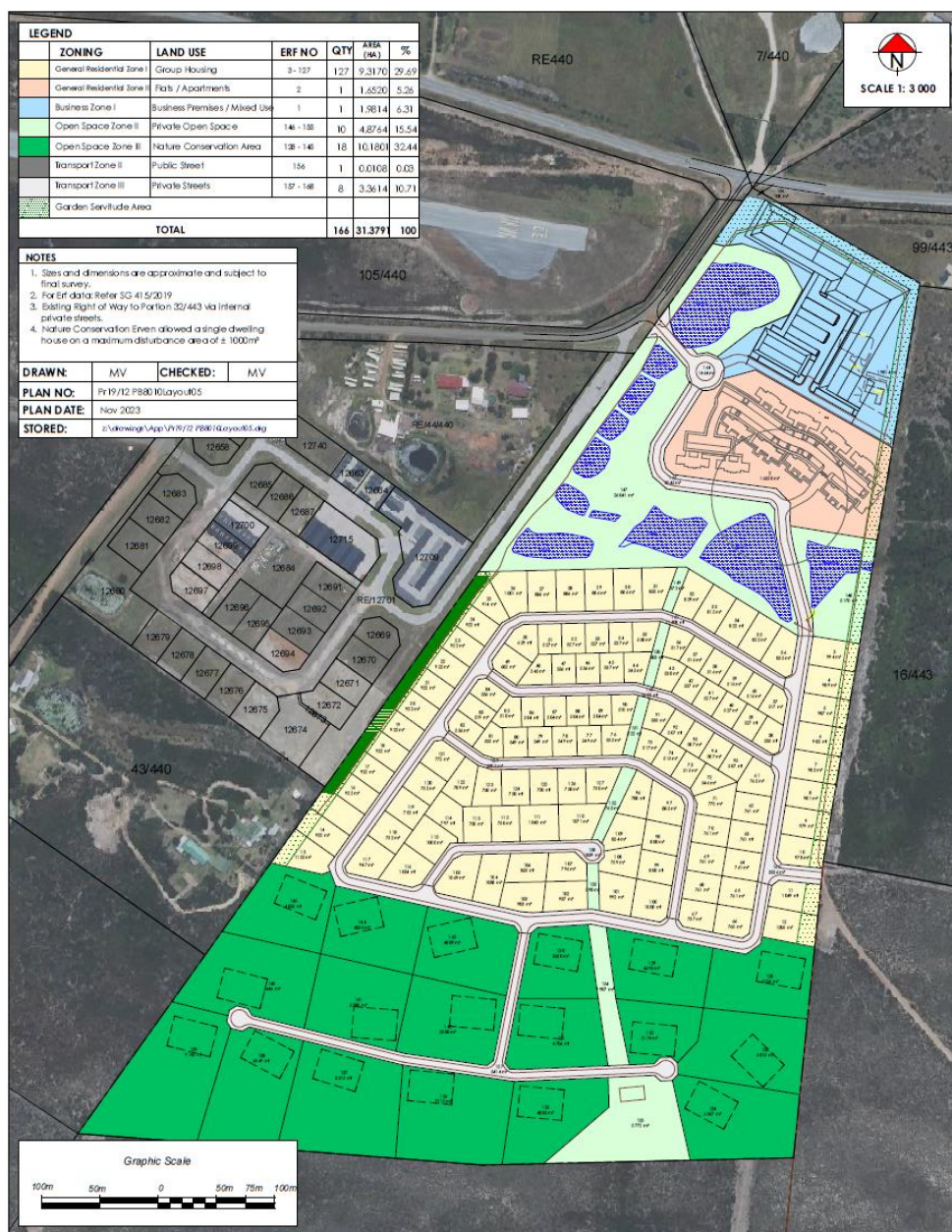


Figure 15: Proposed Site Development Plan for Erf 8010.

9. IMPACT ASSESSMENT

The impact assessment follows the principles of the mitigation hierarchy which states that the next step along the hierarchy should only be followed once the previous step is no longer viable, and with valid reason (Figure 16). The impact assessment methodology is provided in Appendix 1 of this report. The SDP addresses the primary step in the mitigation hierarchy by entirely avoiding any development within any delineated aquatic features as well as within their buffers (Figure 14). Impacts originating from outside of the buffer can however potentially occur during the construction and operational phases and the focus of the impact assessment is therefore mainly aimed at minimizing these impacts. The impact assessment focuses only on the unchannelled valley-bottom wetland that occurs adjacent to the camp site. No impacts on aquatic biodiversity are expected to occur during the construction and operation of the eco-chalets.

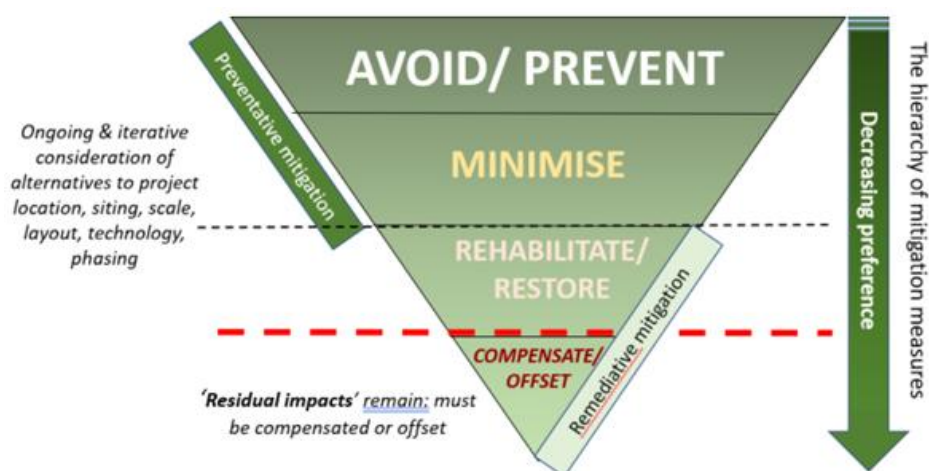


Figure 16: The mitigation hierarchy as presented in (Brownlie et al., 2023). The lower steps in the diagram should only be considered once the steps above have been duly considered.

9.1 Construction Phase

Impact 1: Sedimentation of aquatic habitat caused by clearance of the site.

Clearance of vegetation during the construction phase will expose bare soil which can erode and cause sedimentation of watercourses.

	Without Mitigation	With Mitigation
Intensity	High	Low
Duration	Short term	Brief
Extent	Limited	Limited
Probability	Almost Certain	Probably
Significance	-60: Minor	-28: Negligible
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- Ensure that construction activities do not cause any preferential flow paths and concentrated surface runoff during rainfall events.
- Clearly demarcate the construction area and ensure that heavy machinery does not compact soil or disturb vegetation outside of these demarcated areas.
- Reduce transport of sediment through use of structures such as silt fences and biodegradable coir logs placed along the contour below the development footprint.
- Ensure that vegetation clearing is conducted in parallel with the construction progress to minimise erosion and runoff.
- Revegetate exposed areas once construction has been completed.
- Ensure that stormwater and runoff generated by hardened surfaces is discharged in retention areas (i.e. swales or retention ponds), to avoid concentrated runoff and associated erosion.

- Stockpiling must take place outside of watercourses and associated buffers. All stockpiles must be protected from erosion, surrounded by bunds and stored on flat areas where run-off will be minimised; and
- Recommended buffers for each watercourse must be clearly demarcated and indicated as No-Go areas. Access into buffer areas is only permitted for construction of stormwater and sewage infrastructure and road crossings.

Impact 2: Disturbance and pollution of wetland habitat caused by construction activities.

The site is large and will result in the construction of a variety of infrastructure, including residential units, internal roads, sewage infrastructure, stormwater infrastructure, water reticulation network etc. This will result in high numbers of vehicles and construction workers on site and high quantities of construction materials brought onto the site. Laydown areas and stockpiles of construction materials and excavated topsoil will be required. Poor management of construction activities on site can result in physical disturbance of aquatic habitat and pollution through leaks and spills of hydrocarbons (i.e. fuel and oil from construction vehicles and machinery, bitumen for road surfacing etc.) and other construction materials (e.g. cement, paint etc.) The cumulative intensity of impact of these activities on aquatic habitat can be significant.

	Without Mitigation	With Mitigation
Intensity	High	Low
Duration	Medium Term	Short Term
Extent	Limited	Limited
Probability	Likely	Unlikely
Significance	-55: Minor	-24: Negligible
Reversibility	High	High
Irreplaceability	Medium	Low
Confidence	High	High

Mitigation:

- Recommended buffers for each watercourse must be clearly demarcated and indicated as No-Go areas. Access into buffer areas is only permitted for construction of stormwater and sewage infrastructure and road crossings.
- Restrict vehicle access to single points that are clearly demarcated;
- Working areas must be clearly demarcated and no vehicle access or disturbance must take place outside of demarcated areas;
- Excavators and all other machinery and vehicles must be checked for oil and fuel leaks daily. No machinery or vehicles with leaks are permitted to work in wetlands;
- No fuel storage, refuelling, vehicle maintenance or vehicle depots to be allowed within the buffer of the watercourse; and
- Refuelling and fuel storage areas, and areas used for the servicing or parking of vehicles and machinery, must be located on impervious bases and should have bunds around them (sized to contain 110 % of the tank capacity) to contain any possible spills;
- Contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be

kept clean so that they are a desired alternative to the surrounding vegetation) and must be routinely serviced;

- Stockpiling must take place outside of watercourses and associated buffers. All stockpiles must be protected from erosion, surrounded by bunds and stored on flat areas where run-off will be minimised;
- No dumping of construction material on-site may take place; and
- An alien invasive plant management plan needs to be compiled and implemented post construction to prevent the growth of invasives on cleared areas

9.2 Operational Phase

Impact 3: Erosion of watercourse caused by increased stormwater inputs.

An increase in the area of impervious surfaces (roads, building etc.) will result in the generation of increased volumes of stormwater. Energy dissipation and erosion protection has been incorporated into the design of stormwater headwall outlets to prevent erosion at outlets.

Additional stormwater input into watercourses will increase flow rates and flood peaks which can lead to erosion of the bed and banks and channel incision. This is a common problem in urban watercourses. High rates of erosion in the catchment area also affect sensitive downstream habitat.

Post development stormwater runoff is expected to increase. While energy dissipation at headwall outlets can mitigate against erosion of the embankments (at the point of discharge) – accumulated flow volumes within the channel will have a high likelihood of eroding and incising the channel of watercourses. This impact can only be mitigated by implementing Sustainable Drainage Systems (SuDS) on site aimed at encouraging attenuation and infiltration of water within the development prior to discharge into watercourses.

	Without Mitigation	With Mitigation
Intensity	High	Low
Duration	Permanent	Permanent
Extent	Local	Limited
Probability	Likely	Unlikely
Significance	-75: Moderate	-36: Minor
Reversibility	Moderate	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- Implementation of additional SuDS measures is required to attenuate stormwater onsite and reduce stormwater impacts to an appropriate level. It is recommended that the stormwater management plan for the development should align with the City of Cape Town urban stormwater impacts policy which requires 24 hour extended detention of the 1-year return interval, 24-hour storm event. According to the engineering service report, Internal swales and attenuation dams will be incorporated into the open space network and will be sufficient to attenuate post-development stormwater flows to pre-development rates.
- In addition to rainwater harvesting (which will be implemented as part of the stormwater management plan) the following must, *inter alia*, be considered:
 - Swales and attenuation dams can be incorporated into the open space network to attenuate stormwater runoff, encourage infiltration and reduce the speed, energy and volumes at which stormwater is discharged from the site;

- Use of permeable paving to encourage infiltration into the soil; and
- Use of retention ponds and artificial wetlands to capture stormwater runoff and prevent its discharge from the site.

Impact 4: Impairment of water quality caused by increased stormwater inputs.

Vehicles, gardens and maintenance activities will result in increased runoff of fertilizers, pesticides and hydrocarbons. Intentional disposal of chemicals and other household products (e.g. paint) into the stormwater intentionally discarded into stormwater drains can also have a significant effect on water quality. Implementation of a SuDS principles can mitigate this impact through increased attenuation and filtration of pollutants on site (prior to discharge into the environment).

	Without Mitigation	With Mitigation
Intensity	Moderate	Low
Duration	Ongoing	Ongoing
Extent	Limited	Limited
Probability	Almost certain	Probably
Significance	-72: Minor	-44: Minor
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- Implementation of SuDS as recommended for Impact 4 will also help to improve water quality.
- Guidelines for residents must be drawn up that prohibit dumping of hazardous materials into stormwater drains.

Impact 5: Impairment of water quality caused by irrigation of open spaces with wastewater.

The proposed WWTP will use a combination of conventional treatment (natural bacteria) and membrane technology (microfiltration) to treat the sewage effluent to comply with general water limits stipulated by the Department of Water Affairs.

	Without Mitigation	With Mitigation
Intensity	Moderate	Low
Duration	Ongoing	Ongoing
Extent	Limited	Very limited
Probability	Likely	Unlikely
Significance	-60: Minor	-30: Negligible
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High

Mitigation:

- Irrigation within the buffer of all watercourses must not be permitted.
- The proposed WWTP will use a combination of conventional treatment (natural bacteria) and membrane technology (microfiltration) to treat the sewage effluent to comply with general

water limits stipulated by the Department of Water Affairs. The wastewater will be treated to the Department of Water and Sanitation's General Discharge Limits

- The efficacy of the WWTP will rely on regular maintenance and a signed service agreement between the developer and a qualified service provider will be submitted as part of the Service Level Agreement with Bitou Municipality (refer appendix G for a similar agreement proposal). The WWTP will also be equipped with a back-up generator to cater for electrical downtime.
- A wastewater balance must be compiled to ensure that the volumes of wastewater generated on a daily basis do not exceed the irrigation requirement, thus leading to situations where higher volumes of wastewater would need to be released into the environment

Impact 6: Alteration of wetland hydroperiod (frequency and duration of saturation) caused by abstraction of water from borehole.

The wetland is classified as an endorheic depression. Water inputs are derived primarily by overland surface flow and have been augmented by stormwater. The depth of the borehole is 93 m and the impact of abstraction of groundwater is not expected to have any impact on the wetland.

	Without Mitigation	With Mitigation
Intensity	Negligible	Negligible
Duration	Ongoing	Ongoing
Extent	Very limited	Very limited
Probability	Unlikely	Unlikely
Significance	-24: Negligible	-24: Negligible
Reversibility	High	High
Irreplaceability	Low	Low
Confidence	High	High
Mitigation:		
<ul style="list-style-type: none"> • No mitigation required. 		

10. CONCLUSION

Watercourses on site had been highly modified from their natural reference site, largely due to the construction of instream dams and the input of high stormwater volumes from neighbouring properties. A directive from BOCMA has resulted in the removal of the dams and the rehabilitation of one dam back into a wetland state an improvement towards restoring the natural function and hydrology of aquatic features on the property. Removal of the dams (particularly A, H and I) allows free flow of water through the property, but maintaining the former extent of the dam basins and incorporating gabion energy dissipation structures will serve as an important stormwater attenuation function for existing and anticipated future stormwater flows. Implementation of recommended buffers will provide sufficient protection to watercourses for construction and operational phases of the development and it is recommended that environmental authorisation for the proposed development is granted.

In terms of water use authorisation, the installation of sewage rising mains that will cross or run in close proximity will automatically require a Water Use Licence Application (WULA). For this reason a DWS Risk Assessment matrix has not been compiled

11. REFERENCES

- CapeNature (2017). 2017 WCBSP Bitou [Vector] 2017. Available from the Biodiversity GIS website, downloaded on 26 March 2019
- Council for Scientific and Industrial Research (CSIR). (2018). National Wetland Map 5 and Confidence Map [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 30 September 2020.
- Department of Water Affairs and Forestry (DWAF) (2005). Final Draft: A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas.
- Le Maitre, D.C., Walsdorff, A., Cape, L., Seyler, H., Audouin, M, Smith-Adao, L., Nel, J.A., Holland, M. and Witthüser. K. (2018). Strategic Water Source Areas: Management Framework and Implementation Guidelines for Planners and Managers. WRC Report No. TT 754/2/18, Water Research Commission, Pretoria.
- Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. 1801/2/11. Water Research Commission, Pretoria, South Africa.
- Ollis, D.J., Snaddon, C.D., Job, N.M. and Mbona, N. (2013). Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria

APPENDIX 1: IMPACT ASSESSMENT METHODOLOGY

Individual impacts for the construction and operational phase were identified and rated according to criteria which include their intensity, duration and extent. The ratings were then used to calculate the consequence of the impact which can be either negative or positive as follows:

$$\text{Consequence} = \text{type} \times (\text{intensity} + \text{duration} + \text{extent})$$

Where type is either negative (i.e. -1) or positive (i.e. 1). The significance of the impact was then calculated by applying the probability of occurrence to the consequence as follows:

$$\text{Significance} = \text{consequence} \times \text{probability}$$

The criteria and their associated ratings are shown in Table 3.

Table 3: Categorical descriptions for impacts and their associated ratings

Rating	Intensity	Duration	Extent	Probability
1	Negligible	Immediate	Very limited	Highly unlikely
2	Very low	Brief	Limited	Rare
3	Low	Short term	Local	Unlikely
4	Moderate	Medium term	Municipal area	Probably
5	High	Long term	Regional	Likely
6	Very high	Ongoing	National	Almost certain
7	Extremely high	Permanent	International	Certain

Categories assigned to the calculated significance ratings are presented in Table 4.

Table 4: Value ranges for significance ratings, where (-) indicates a negative impact and (+) indicates a positive impact

Significance Rating	Range	
Major (-)	-147	-109
Moderate (-)	-108	-73
Minor (-)	-72	-36
Negligible (-)	-35	-1
Neutral	0	0
Negligible (+)	1	35
Minor (+)	36	72
Moderate (+)	73	108
Major (+)	109	147

Each impact was considered from the perspective of whether losses or gains would be irreversible or result in the irreplaceable loss of biodiversity of ecosystem services. The level of confidence was also determined and rated as low, medium or high (Table 5).

Table 5: Definition of reversibility, irreplaceability and confidence ratings.

Rating	Reversibility	Irreplaceability	Confidence
Low	Permanent modification, no recovery possible.	No irreparable damage and the resource isn't scarce.	Judgement based on intuition.
Medium	Recovery possible with significant intervention.	Irreparable damage but is represented elsewhere.	Based on common sense and general knowledge
High	Recovery likely.	Irreparable damage and is not represented elsewhere.	Substantial data supports the assessment