AQUATIC BIODIVERSITY IMPACT ASSESSMENT

Proposed Establishment of the Diepwalle Tented Forest Camp

Prepared for Cape EAPrac

by

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Updated in January 2024 to include revised and final Site Development Plan.

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I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

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• 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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• I do not have any influence over decisions made by the governing authorities;

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• All the particulars furnished by me in this document are true and correct.

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Expertise: > 10 years' experience working on aquatic ecosystems across South Africa, with a focus on the Southern Cape in the last 3 years. Includes research and consulting expertise, having published > 10 water-related research articles and compiled > 80 aquatic specialist reports. Research and consulting have been in a range of sectors including agriculture, urban developments, linear structures, renewable energy, conservation, and mining.

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1. INTRODUCTION

Confluent Environmental (Pty) Ltd. was appointed by Cape EAPrac to undertake a Freshwater specialist assessment for a proposed tented camp in a clearing in the Diepwalle Forest near Knysna, in the Western Cape Province. The camp is intended to operate in summer months only, with opening scheduled for November 2023. The tented camp is a collaboration between SANParks and Chiefs Tented Camp. The existing Diepwalle Forest Camp will provide reception services where the guests will leave their vehicles. Food preparation in conjunction with the community tea garden, and bulk storage will also take place at the existing main camp, and not at the tented camp.

1.1 Description of the Proposed Camp

The proposed tented camp site is in an existing clearing within Diepwalle Forest on RE/218 in the Knysna section of the Garden Route National Park. The clearing is approximately 13 km North-east of the town of Knysna in a straight line. Access is via a 1.6 km existing forest track off the R339 gravel road. The R339 provides current access to the existing Diepwalle camp and offices which are managed by SANParks.

The existing clearing in the forest for the proposed camp was used previously as the site for elephants during filming of the movie 'Kringe in 'n Bos' film. A pool that was present during historical woodcutting activity (late 1800s) was further excavated for use by elephants during filming.

The study site area being assessed as part of this Basic Assessment Report (BAR) is approximately 1.5ha in size, while the physical footprint of the abovementioned structures & infrastructure amounts to approximately 1508.5m².

The proposed camp is described as a luxury retreat which is temporal and mobile in nature. A conceptual layout was provided in the original report for assessment (Figure 1). During summer the camp will be operational, and during winter all moveable items will be removed. Guests and materials / supplies will be dropped off in an existing vehicle turnaround area. The Site Development Plan was originally adjusted to accommodate the presence of delineated aquatic features at the site (a wetland and excavated pool) and associated impact buffer zones (Figure 1). The original proposed infrastructure assessed in this report is described as follows:

- Guests would be accommodated on 15 5 m x 10 m wooden decks in gaps between the trees. The final layout of the camp decks is subject to change depending on the location of protected and endangered plant species (determined by botanist) and up to 4 decks could be placed in the wetland buffer delineated in this report;
- Shower and basin water from each deck to be discharged to a soak away. Guests will be encouraged to bring biodegradable personal hygiene products and staff will use biodegradable soaps for cleaning and personal hygiene.
- Two communal deck areas for meal-times and activities such as yoga will be constructed above ground in the wetland buffer;
- Staff tented area consisting of a kitchen tent, toilets, and recreation area;
- Grey water (water from cleaning etc.) and freshwater tanks at staff area. Freshwater tanks to be 10 000 L to accommodate water storage and reduce travelling back and forth for delivery;

- Raised wooden boardwalks linking communal areas. These will be on poles in the ground or placed on removable blocks;
- Two hot tubs and a swimming pool at the main deck area;

The site coordinates are: 33°57'24.85"S, 23°10'18.97"E. In terms of services for the camp, the following has been proposed:

- Water for the camp would be supplied by a combination of a gravity fed pipeline from the existing Diepwalle main camp reservoirs to storage tanks in the camp.
- Sewage would be handled using sealed chemical toilets (similar to Portaloo) which would be swapped for clean replacement containers as required off site. Used containers will be collected and emptied by a service provider at the Knysna Wastewater Treatment Works.
- Gas would be used for heating water and food. While a low decibel gas/diesel generator is proposed for lighting.

Figure 1. Conceptual layout of the camp at the clearing site.

1.1.1 Revised Layout January 2024

The Site Development Plan (SDP) underwent multiple revisions after that presented in Figure 1 until a final SDP was provided for submission of the Basic Assessment which is shown in Appendix 3. The final SDP was refined based on feedback from SANParks, the Department of Forestry, Fisheries and Environment (DFFE), as well as botanical, faunal and this aquatic specialist reports. Most changes relate to smaller footprints of various structures, and more detail was provided on certain services. Differences to the original layout and additional service details are not considered to change the outcome, findings, or recommendations of this original report in any way and are highlighted as follows:

Fixed infrastructure

- Guest tent platforms on reduced footprint of wooden decks to ±8.5m x 6m (reduced);
- Accommodation in dome tents () with chemical toilet, basin and shower;
- Drop-off area moved into the wetland buffer;
- Tent 12 platform and small section of wooden boardwalk moved into the buffer, but the yoga deck was moved out of the buffer;

Confirmed Services

- Water & Sewage: As per original description – no change
- Greywater: directed to soak-aways along existing slip-paths in forest. This is directed away from the wetland and buffer area.
- Heating: Gas for heating water and food. Meals to be cooked / prepared at SANParks Main Diepwalle Camp & transported to site.
- Lighting: Solar panel generator, with batteries on mobile trailer

1.2 Screening Tool

According to the Department of Environment, Forestry and Fisheries (DFFE) screening tool, aquatic biodiversity at the site has a **Very High** sensitivity. Two broad sensitivity features were identified as the Strategic Water Source Area (SWSA-sw) and the Freshwater Ecosystem Priority Area (FEPA) quinary catchment. While not addressed entirely in this report, the animal species theme sensitivity is also listed as High sensitivity due to the possible presence of the Endangered Knysna leaf-folding frog (*Afrixalus knysnae*). This is one of several animal species highlighted under the animal theme but is partially addressed in this report given the frog is dependent on aquatic habitat.

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).

1.3 Terms of Reference

According to the protocols specified in GN 320 (Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity) of the National Environmental Management Act (NEMA; Act No. 107 of 1998), 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.

1.4 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 verification of the sensitivity of the site. This includes assessment of the following:

  Interrogation of available desktop resources including:

  - DWS spatial layers (1:50 000 rivers)
  - National Freshwater Ecosystem Priority Areas (NFEPA) spatial layers (Nel *et al.,* 2011)
  - National Wetland Map 5 and Confidence Map (CSIR, 2018)
  - Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

  Conduct a site visit to determine the site sensitivity:

  - Identification and classification of watercourses within and adjacent to the site according to methods detailed by Ollis *et al*. (2013);
  - Determine the watercourse Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) using an appropriate method.

  Based on the outcome of the site visit compile either an aquatic biodiversity impact assessment or compliance statement.

1.5 Limitations

- The site assessment was conducted on two occasions during late-Summer, which provides a good representation of flora and fauna present at the site. In addition, databases such as iNaturalist and the Freshwater Biodiversity Information System (FBIS) were consulted to augment field data for the site.
- The clearing has an extended history spanning several disturbance events including being used as a film set in the 1990s and being used by wood cutters in the late 1800s. While aerial imagery can provide an insight into the state of the site post the 1930s, it is not possible to determine the dominant vegetation or degree to which the site was ‘wet’ or disturbed during initial clearing in the historical woodcutting period.

2. DESKTOP SURVEY

The site of the proposed camp is in quaternary catchment K60F (Table 1). Mean annual rainfall is relatively high in the area at 806 mm. Erosion potential of the soils is high, but the topography at the site itself is fairly flat, mostly draining away from the site (Figure 6). Furthermore, the site is densely vegetated with Afrotemperate Forest in the areas surrounding the clearing ensuring that soil is well stabilised. There are no mapped watercourses on the site itself (wetlands or streams), but the site drains in a north-easterly direction to a network of tributaries of the Bietou River (Figure 2). A small pool is present to the west of the clearing site which was excavated either during historical woodcutting activities or for the purposes of making the movie filmed at the site.

Table 1. Summary of relevant catchment features for the proposed development area.

Feature	Description
Quaternary catchment	K60F
Mean Annual Runoff	97.50 mm
Mean Annual Precipitation	806 mm
Inherent erosion potential of soils (K-factor)	0.52, High
Rainfall intensity	Very High
Ecoregion Level II	20.02: South Eastern Coastal Belt
Geomorphological Zone	Not applicable
NFEPA area	Sub-quaternary reach 9092, FishFEPA.
Mapped Vegetation Type	Southern Afrotemperate Forest (Least Concern; FOz1)
Conservation	Protected Area (Garden Route National Park) and World Heritage Site

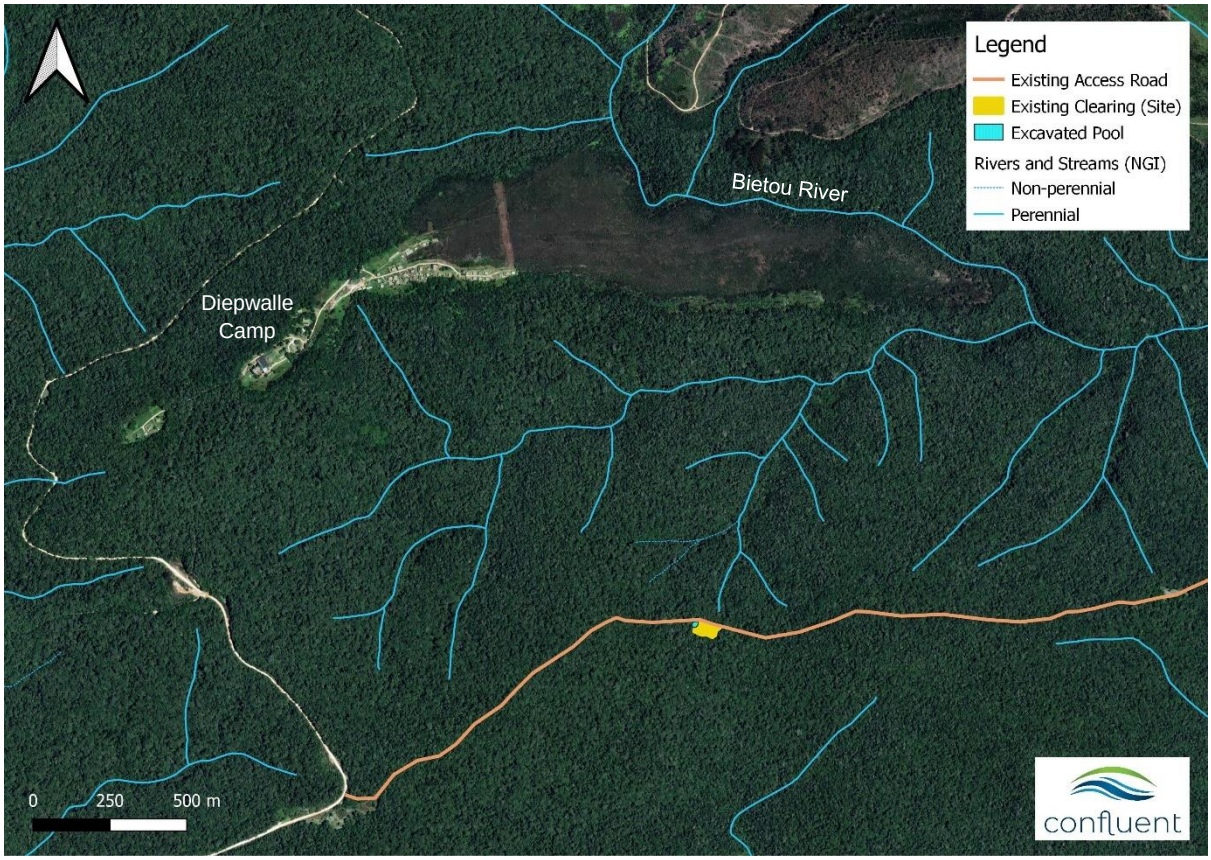

Figure 2. General location of the clearing in relation to mapped watercourses (wetlands, rivers and streams).

2.1 Aquatic Conservation

According to the National Freshwater Ecosystem Priority Atlas the study area is within area 9092 and is categorised as a Fish FEPA (Nel *et al.,* 2011). This is due to the presence of Endangered or Critically Endangered fish in the quinary catchment of the Bietou River. Fish recorded in the system include the extremely range restricted *Pseudobarbus* sp. nov. 'Keurbooms',(previously *Pseudobarbus tenuis*), *Pseudobarbus afer* (Endangered, Eastern Cape Redfin), and *Sandelia capensis* (Data Deficient, Cape Kurper).

Generally, *Pseudobarbus tenuis* occurs in the headwater streams while *Psuedobarbus afer* occurs in the forested peat-stained water. The main threats to these fishes is through the introduction of predatory alien fish species of bass and trout. Impacts related to forestry and agriculture are also known to affect populations. **As the site is not located near a flowing watercourse and is not altering the existing land cover in any significant way, the proposed land-use is very unlikely to impact on any local fish populations.**

2.2 Historical Assessment

The clearing measures approximately 2 900 m^2 (0.29 ha) and can be clearly observed in the oldest aerial photographs of the site in 1936 (Figure 3). In almost a century it hasn't changed in extent, but the margins presently appear less defined than in the 1936 and 1983 photos. The clearing was probably related to the historical woodcutting era as it is clearly rectangular in shape, and a very old concrete trough was observed near the road in the clearing. The small excavated pond is not visible on the historical images as it is too small and hidden by trees. Two distinct vegetation units are present in the clearing and can be distinguished clearly in the 2021 image. These are *Helichrysum petiolare* (licorice bush) which appears grey, and *Helichrysum cymosum* (fume everlasting) which appears dark green.

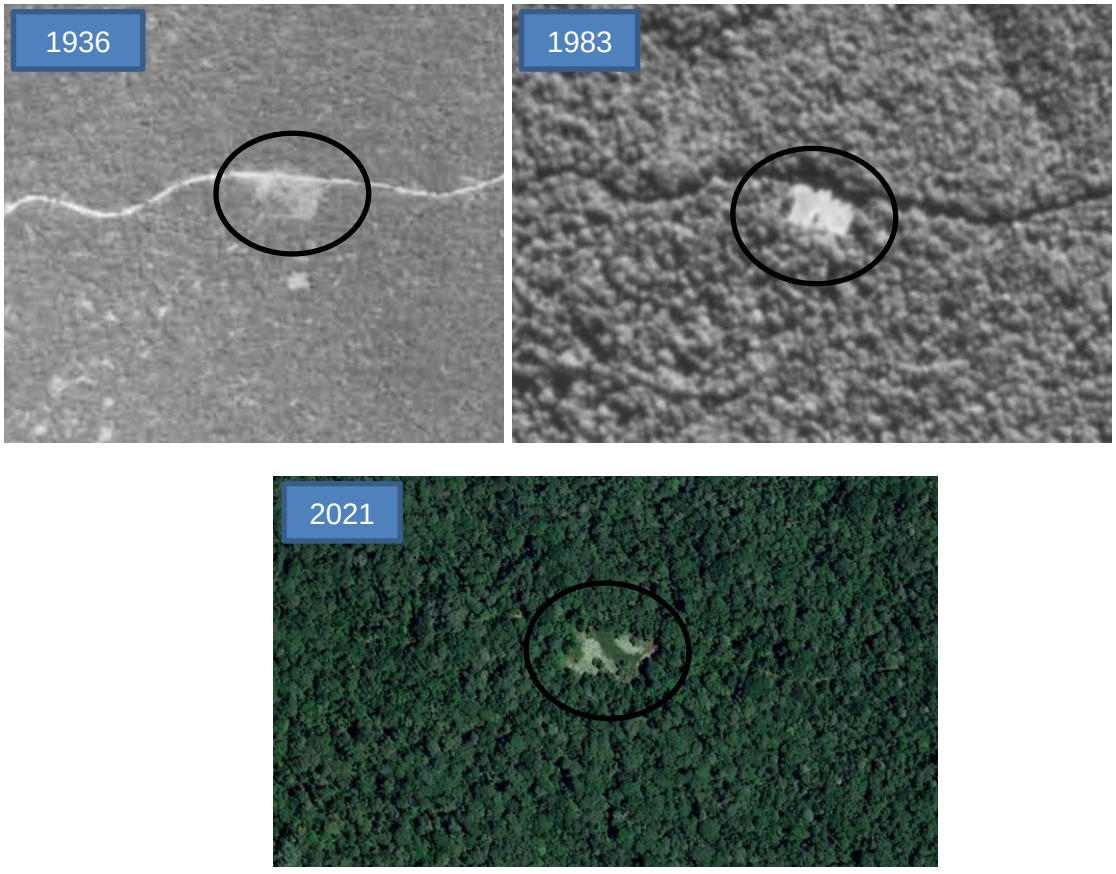

Figure 3. Historical images of the general site area indicating the approximate location of the clearing and tented camp.

3. SITE VISIT

The site was visited on 2 &12 March 2023, and the combined paths walked are shown in Figure 4. The first vist was following a dry spell, but the second visit was following significnat

rainfall in excess of 130 mm in the preceding week. The first site visit focussed on the excavated pool, while the second visit focussed on delineation of the seasonal wetland in the clearing. The entire site was traversed several times through dense vegetation in order to conduct the auguring necessary for wetland delineation. An extended time over several hours was spent on 2 March on recording and observing frogs in the excavated pool.

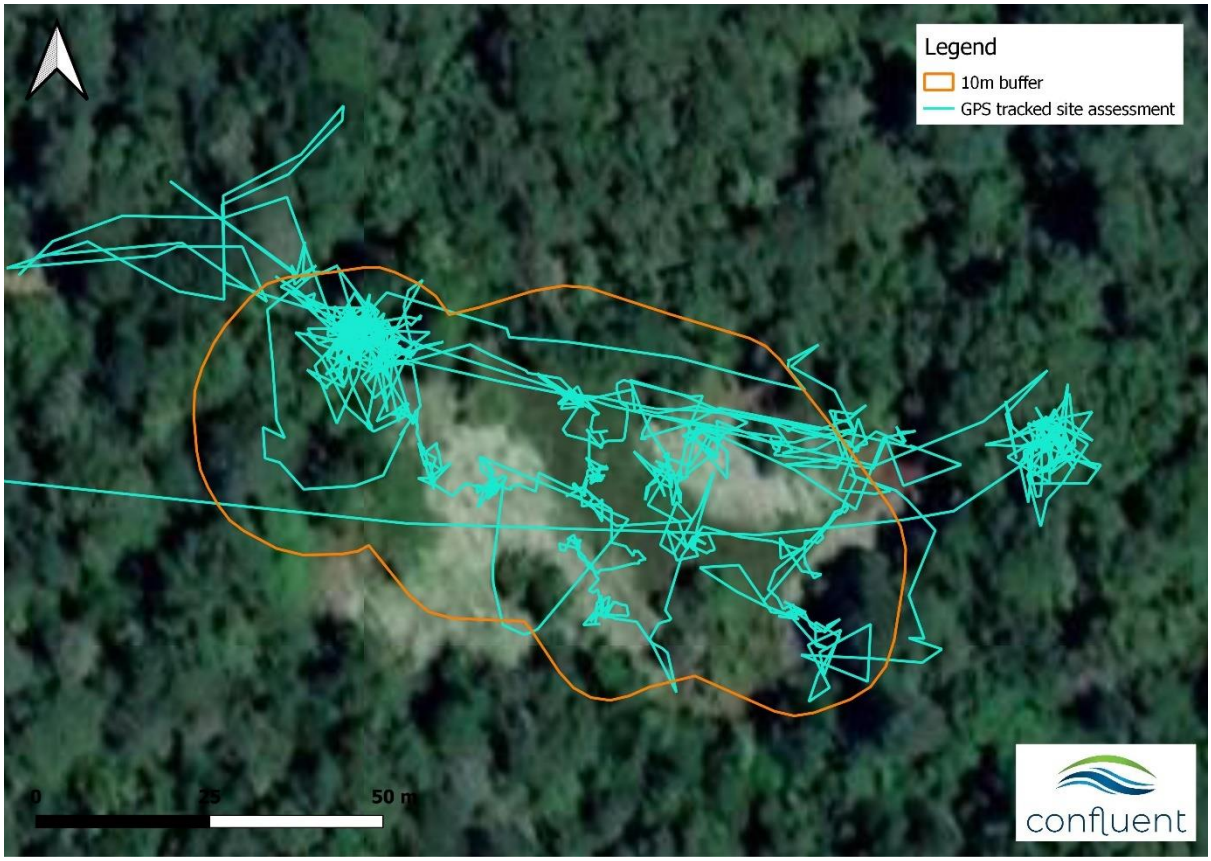

Figure 4. GPS track of path walked during site assessment.

4. ECO-CLASSIFICATION

4.1 Classification

Watercourses were classified using methods described by Ollis *et al.* (2016) and following the definition in the National Water Act (Act No. 36 of 1998) which states that "watercourse" means:

a) A river or spring;
b) A natural channel in which water flows regularly or intermittently;
c) A wetland, lake or dam into which, or from which, water flows, and
d) Any collection of water which the Minister may, by notice in the Gazette declare to be a watercourse.

4.1.1 Excavated Pool

The pool has been excavated and is therefore considered artificial and is not classified as a watercourse in terms of the NWA. However, as it has been present at the site for many decades, possibly over a century, and has attracted a range of hydrophytic (water loving)

plants and a population of at least two frog species. These are Cape River Frogs (*Amieta fuscigula*) and Clicking Stream Frogs (*Strongylopus grayii*). Given its location in a National Park and priority conservation area these are features which contribute to biodiversity in the area and warrant protection from disturbance.

Figure 5. The excavated pool (left) and a Cape River Frog (*Amietia fuscigula*) found in the pool.

4.1.2 Seasonal Saddle Seep Wetland

Extensive soil augering along transects in the clearing resulted in a range of seasonal and temporary wetland features. No permanent wetland areas were found. There is no channelled inflow or outflow from the wetland. The site topography and soils mean the soil profile is easily saturated which is due to the B soil horizon demonstrates a distinct textural change, with extreme mottling and wetness below this zone. This is typical of duplex soils in the area. The topographic location of the seep wetland is a 'saddle' (Figure 6) which is defined by Ollis *et al.* (2016) as follows:

"Saddles are relatively flat, high-lying areas flanked by down-slopes on two opposite sides in one direction and up-slopes on two opposite sides in an approximately perpendicular direction. The gradient of the surrounding slopes may vary from gentle to steep."

Figure 6. 5m contours at the site showing the clearing position described as a saddle.

4.2 Wetland Delineation

4.2.1 Methods

The wetland was delineated using methods developed by DWAF (2005). The outer edge of the temporary zone is used to define the edge of the wetland. The outer edge is identified using four indicators:

1. Terrain Unit Indicator
   Identify parts of the landscape where wetlands are more likely to occur.
2. Soil Form Indicator
   Identification of soil form as defined by the Soil Classification Working Group.
3. Soil Wetness Indicator
   Identifies morphological 'signatures' developed in the soil profile because of prolonged or frequent saturation.
4. Vegetation Indicator
   Identifies hydrophilic vegetation associated with frequently saturated soils.

Soil wetness indicators are the primary indicator with the other three indicators being used in a confirmatory role. This is because vegetation can respond quickly to changes in soil moisture and may be transformed, while soil wetness indicators are retained in the soil long after a wetland has been drained or altered (Figure 7).

The minimum set of indicators required to qualify an area as a wetland are soil wetness or vegetation indicators. Ideally at least two indicators should be present to confirm wetland conditions.

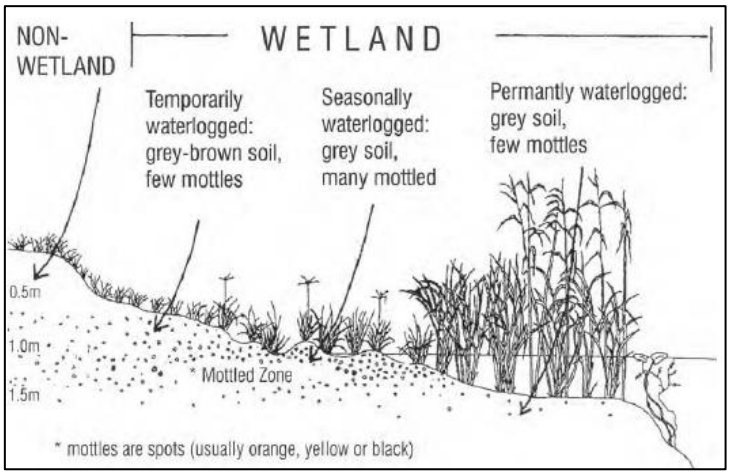

Figure 7. Cross-section through a typical wetland showing how soil wetness indicators and vegetation change along a gradient of decreasing wetness (DWAF, 2005).

4.2.2 Results

Soil augering across the clearing showed two distinct zones of wetness, being temporary and seasonal (Figure 8). These approximately corresponded with two zones of dominant vegetation being *H. petiolare* in the temporary zone and *H. cymosum* in the seasonal zone (Figure 9). However, these plants were interspersed throughout with alien invasive bramble (*Rubus* sp.) and bracken fern (*Pteridium aquilinum*). While these plants are not obligate or facultative wetland plant species, *H. cymosum* often grows in damp areas and is common in seasonal wetlands of the Southern Cape. Most plant species present in the clearing are considered pioneer species which grow rapidly following disturbance.

Figure 8. Delineated seasonal and temporary wetland areas, and excavated pool in the clearing area.

Plants in the clearing have grown to such a high density that the process of succession appears to have been halted. In places the growth of *H. petiolare* is > 2 m high. Plants growing along the wetland's edge adjacent to the road are more diverse and typical of obligate wetland plants consisting of species such as *Juncus lomatophyllus*, *Persicaria decipiens*, and various *Cyperus* spp.

Figure 9. Two aspects of the clearing showing dominant *Helichrysum petiolare* (left) and *Helichrysum cymosum* (right).

Soils in the wetland area had a thin layer of organic matter on the surface but were predominantly mineral (Figure 10). Soils in the temporary zone of the wetland showed few high chroma mottles within the brown soil matrix. The temporary zone is defined by short

periods of saturation for a duration of less than 3 months per year. The seasonal zone of the wetland showed grey-brown soil with many high chroma mottles and gleyed areas. The seasonal zone typically has a significant wet period for at least 3 months per year.

Figure 10.Typical soil auger samples from seasonal (left), temporary (middle) and non-wetland (right) areas of the clearing. All soils are collected within the upper 50 cm of the profile.

4.3 Present Ecological State (PES)

4.3.1 PES Methods

The wetland area was assessed using the Level 1 WET-Health assessment tool developed by Macfarlane *et al*. (2008, updated 2020). The tool aims to assess the integrity of a wetland which is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition. The method combines an assessment of hydrological, geomorphological and vegetation health in three modules.

Data collection involved a desktop review of the extent and intensity of catchment land use impacts and was undertaken using historical and recent aerial imagery of the site (Chief Directorate: National Geo-spatial Information and satellites). Fieldwork onsite involved the identification and recording of observable impacts to the wetland at the site of relevant activities as well as at reference points upstream and downstream of the activities. The magnitude of observed impacts to the hydrological, geomorphological and vegetation components of the wetland were calculated and combined as per the tool to provide a measure of the overall wetland condition of the wetland. The condition ranges in scale from 1-10 and resultant scores were then used to assign the wetland into one of six PES categories as shown in Table 2.

Table 2.Wetland Present Ecological State categories and impact descriptions.

Ecological Category	Description	Impact Score
A	Unmodified, natural.	0 – 0.9
B	Largely natural with few modifications / in good health. A small change in natural habitats and biota may have taken place but the ecosystem functions are still predominantly unchanged.	1 – 1.9
C	Moderately modified / fair condition. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	2 – 3.9
D	Largely modified / poor condition. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	4 – 5.9
E	Seriously modified / very poor condition. The loss of natural habitat, biota and basic ecosystem functions is extensive.	6 – 7.9
F	Critically modified / totally transformed. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota.	8 - 10

4.3.2 PES Results

The WET-Health assessment classified the PES of the seep wetland overall as **B, Largely Natural**. While the hydrology and geomorphology are relatively unimpacted, the vegetation is in the poorest condition, scoring a C (Table 3).The majority of impacts, while minor, relate to the existing road which runs through the lower portion of the wetland, the excavated pool, and the disturbed nature of the vegetation. The latter includes the presence of invasive alien plants such as *Rubus* sp. which is present in patches throughout the wetland.

Table 3. Summary of inputs used to determine the PES in the WET-Health assessment tool.

1. HYDROLOGY
Road creates a preferential flow path from the wetland area but is not eroding significantly.
The excavated pool may act to draw down the soil water level on a localised basis
Surface runoff is not as important as interflow or groundwater
Some earth-moving (excavation and soil piling) may have occurred historically, but cannot be visualised due to dense vegetation cover
No impeding features present that could further impact hydrology
Hydrology PES: A/B (Unmodified to Largely Natural)
2. GEOMORPHOLOGY
No dams are present which would alter flows or sediment transport in surface water in any way
No surface flow present that could result in stream diversion or shortening
No erosion or deposition present
Small areas possibly infilled where soil piling may have occurred historically.
Geomorphology PES: A (Unmodified)
3. **VEGETATION**
Minor loss due to shallow inundation and excavation for the pool
No historical agriculture at the site (old or new)
Alien vegetation (*Rubus* sp.) throughout *Helichrysum* spp. growth
Helichrysum spp. indicative of historical disturbance and clearing
Vegetation PES: C (Moderately Modified)
OVERALL PES: B LARGELY NATURAL

4.4 Knysna Leaf-folding Frog Habitat

Several hours were spent on 2 March 2023 assessing water quality and habitat in the excavated pool in terms of suitability as habitat for *Afrixalus knysnae* (Knysna leaf-folding frog). Active searching for frogs and tadpoles was carried out, calls were recorded with the use of a song meter, and abiotic measurements of water quality were undertaken.

4.4.1 Desktop records

Within 5 km of the site, the Freshwater Biodiversity Information System (FBIS) and iNaturalist records were consulted and several observations of *S. grayii* and *A. fuscigula* had been made.

4.4.2 Song meter records

The song meter was deployed during daylight hours between 11:30 and 13:30, with recordings made every minute during this time. Recordings were analysed and calls were analysed to confirm species. The only species recorded from the pool was *Strongylopus grayii* (clicking stream frogs). Calls were also observed during the second site visit on 21 March, and once again only *S. grayii* were noted calling.

4.4.3 Active searching

Adult and sub-adult specimens of *Amietia fuscigula* (Cape river frog) were observed and caught then released following identification. Tadpoles of *S. grayii* and *A. fuscigula* were numerous and observed in the pool.

4.4.4 Water quality & habitat

Basic physico-chemical parameters were measured *in situ* using a handheld multiparameter Hanna meter. Clarity was measured using a clarity tube. Unfortunately, the dissolved oxygen probe malfunctioned during the assessment. Although no definitive thresholds of tolerance or preference for water quality have been determined for *A. knysnae*, water clarity at the site was markedly more turbid than that observed at locations where *A. knysnae* are known to occur. The remaining parameters indicate relatively good water quality in the pool.

Table 4. Basic physico-chemical measurements taken in the excavated pool.

Parameter	Measurement
pH	6.6
Electrical Conductivity (µS/cm)	161.0
Total Dissolved Salts (mg/L)	80.0
Temperature (°C)	20.8
Clarity (cm)	26

Knysna leaf-folding frogs from other locations have been observed using the leaves of *Persicaria decipiens* for their nests. This plant is common around the excavated pool, as well as other soft linear-leaved plants which would be suitable for nest formation. It should be noted however, that *P. decipiens* is a widespread and commonly encountered wetland plant, and that *A. knysnae* are even able to use exotic vegetation such as kikuyu grass for their leaf-folding nests.

4.5 Ecological Importance and Sensitivity (EIS)

4.5.1 Methods

The revised method for the determination of the EIS of a wetland considers the three following ecological aspects (Rountree *et al*., 2013):

- **Ecological importance and sensitivity**
  - Biodiversity support including rare species and feeding/breeding/migration;
  - Protection status, size and rarity in the landscape context;
  - Sensitivity of the wetland to floods, droughts and water quality fluctuations.
- **Hydro-functional importance**
  - Flood attenuation;
  - Streamflow regulation;
  - Water quality enhancement through sediment trapping and nutrient assimilation;
  - Carbon storage
- **Direct human benefits**
  - Water for human use and harvestable resources;
  - Cultivated foods;
  - Cultural heritage;
  - Tourism, recreation, education and research.

Each criterion is scored between 0 and 4, and the average of each subset of scores is used to derive a score for each of the three components listed above. The highest score is used to determine the overall Importance and Sensitivity category of the wetland system (Table 5).

Table 5. Ecological importance and sensitivity categories for wetlands. Interpretation of average scores for biotic and habitat determinants.

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high: Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

4.5.2 EIS Results

The wetland seep has a Moderate EIS (Table 6). No unique or Red Data species were observed or are expected to occur within the habitat specifically. As an island of vegetation distinct from the surrounding forest, the wetland offers a heterogenous habitat within the largely uniform forest vegetation. From this perspective the importance of the habitat is increased, however, the actual vegetation in the wetland is not very sensitive.

Table 6. Wetland Ecological Importance and Sensitivity results.

Ecological importance and sensitivity	Score 0-4	Confidence 1-5	Motivation
Biodiversity support	**0.6**		
Presence of Red Data species	0	4	None observed, but not impossible
Populations of unique species	0	4	None observed, but not impossible
Migration/feeding/breeding sites	2	4	Alternative habitat for amphibians, reptiles, small mammals and birds
Landscape scale	**1.8**		
Protection status of wetland	3	5	Located within a national park
Protection status of vegetation type	1	5	Listed as Least Threatened
Regional context of the ecological integrity	1	4	Vegetation degraded, but hydrology functional
Size and rarity of the wetland types present	2	4	Rare within the afrotemperate forest, but small, and modified.
Diversity of habitat types	2	4	Artificially enhanced by excavated pool
Sensitivity of the wetland	**2.0**		
Sensitivity to changes in floods	1	4	No surface inflow on relatively flat topography, so low risk
Sensitivity to changes in low flows	2	4	Low abundance of natural wetland vegetation, disturbed vegetation is highly resilient to drought
Sensitivity to changes in water quality	3	4	Vegetation adapted to nutrient poor soils
Hydrofunctional Importance	**1.6**	**3**	
Direct human benefits	**1.3**	**3**	
ECOLOGICAL IMPORTANCE AND SENSITIVITY	**2.0**	**MODERATE**	

4.6 Wetland Buffer

The buffer zone width was determined using the site-based Riparian Buffer model developed by Macfarlane & Bredin (2017) which is the more comprehensive of the two available models. The model incorporates locally determined environmental factors such as soil type, slope, annual rainfall, soil erodibility and inherent runoff potential at the site.

A buffer of **10 m** is recommended around the wetland area and excavated pool. This buffer is considered a management setback line within which various activities are either supported or discouraged. The proposed tented camp represents a very low risk to the wetland area and the access road already runs through the buffer area of the wetland. It is therefore not considered a complete no-go area.

4.6.1 Buffer and wetland management recommendations

The purpose of aquatic buffer zones can be broadly categorised as protective measures against diffuse sources of water pollution, and protection of adjacent habitat for biodiversity support. The buffer in this case has no diffuse water pollution sources to mitigate. These are usually associated with irrigated agriculture or feedlots for instance, where runoff containing fertilisers or pesticides can be mitigated by a buffer. In terms of biodiversity, the open clearing and pool may attract wildlife to the area due to the alternative habitat provided at the site and drinking water availability. The buffer therefore has a more important function for maintaining access to the site and a corridor for movement of wildlife making use of this habitat.

The following general management recommendations will be incorporated into mitigation measures for the proposed development:

- No new infrastructure (platforms, walkways, roads or paths) in the wetland area;
- Vehicle traffic restricted to the existing road only;
- The buffer may include the communal platforms and boardwalks;
- Staff tents should be located outside of the buffer area;

5. SITE SENSITIVITY

As the proposed development site is located proximal to a seasonal wetland and has the potential to negatively impact water quality and / or associated biota the site sensitivity was confirmed as **Very High**. Impacts are assessed in the following section.

6. IMPACT ASSESSMENT

Methods used to compile the impact assessment are provided in Appendix 1, and were applied to the Design & Layout, Construction, Operational and Decommissioning Phases of the proposed camp. The latter is important because the camp will be partially dismantled each year in winter and may be entirely removed when the concession with SANParks concludes.

6.1 Construction Phase

The main disturbance during the construction phase will be from access by higher frequency and heavier than usual vehicles using the access road and turnaround area for offloading materials, facilities, and workers to the site. Anticipated impacts and recommended mitigation measures are explained below.

Transporting workers and materials to and from the site several times a day during the initial construction phase of the camp's development has the potential to negatively impact vegetation and soils associated with the wetland. This impact would be exacerbated under heavy rainfall conditions. As the access road is partially located in the wetland area it is possible this road could get very muddy. If/when this occurs drivers tend to move their vehicles to the side of the roade areas which have more stable vegetation. This is the correct choice in this situation as the vegetation adjacent to the road is considered wetland area and had a lot more diverse wetland vegetation.

Provided all the recommended mitigation measures are fully implemented, the anticipated impact can be reduced from a Minor Negative to a Negligible Negative level (Table 7).

Table 7. Construction Phase Impact: Movement of vehicles, materials and workers around wetland habitat.

Project phase	**Construction**			
Impact	**Movement of vehicles, materials and workers around wetland habitat**			
Description of impact	**Disturbance of vegetation, habitat and soils**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Check weather forecasts daily, and cease work during and immediately following rainfall. • Pre-construction the wetland and pool buffer must be surveyed and marked out wth temporary wooden survey poles and danger tape. On the existing road the delineated edge must align with the present road edge to ensure vehicles do not make the road any bigger. • All drivers and workers must be informed that the buffer and wetland beyond the danger tape is a 'No-go' area unless specifically working on construction of the communal platforms in the buffer or boardwalks along the buffer edge. • The vehicle parking area must be clearly indicated with danger tape and laminated signs. This should be limited to the turnaround / drop off point indicated in the SDP. • Areas for waste disposal including all litter and toilet facilities must be provided to accommodate workers, and no waste product of any sort may be disposed of at the site. • IF the road becomes very muddy and navigation becomes difficult, a combination some / all of the following methods can be implemented: Improve drainage with cutoff drains, low berms across the road, and shaping the crows to drain downstream; compact the base layer and add a binding agent such as cement if necessary; Add a surface layer of fractured stone, sand and fines and compact to a smooth surface. During construction, no cement must be mixed anywhere except on the road, and work must be undertaken during dry weather.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Short term	Impact will last between 1 and 5 years
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Likely	The impact may occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance	.			
Cumulative impacts	The assessment of this impact considers the fact that the impact is repetitive by nature in that the camp is dismantled on an annual basis			

Transporting vehicles and materials to and from the site, as well as construction of platforms and boardwalks, present the possibility of fuel leaks or spills. Disorganised storage of materials such as wood for the boardwalks can increase the footprint of disturbance into wetland or buffer areas. These impacts are easily mitigated as indicated in Table 8. Provided control measures are fully implemented, the impacts can be reduced to a Negligible Negative.

Table 8. Construction Phase Impact: Handling of fuel and other building materials.

Project phase	**Construction**			
Impact	**Handling of fuel and other building materials**			
Description of impact	**Potential pollution of sensitive aquatic habitats**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• All refuelling of vehicles must be done at the Diepwalle camp, and no fuel or oil for vehicles may be stored at the proposed camp site. • Vehicles entering the site must be checked for leaks of oil or fuel at the Diepwalle camp before being permitted to enter the development site. Any vehicle with leaks must be immediately removed from the site until repaired. • As far as possible, all wood cutting and preparation for decking and boardwalks must be done at the Diepwalle campsite so assembly is all that's required on site. • If tools like electric drills are required on site, a generator will be necessary. This shoudl be filled with fuel at the Diepwalle camp, and 2 x 5 L cans of fuel may be retained on site to refill the generator if required. Refilling must be undertaken with care outside of the wetland buffer at the site of the staff camp indicated on the SDP. • Wood for decking should be stockpiled in the staff quarters area, taking care to minimise the footprint of disturbance and not spread materials over an unnecessarily large area.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Immediate	Impact will self-remedy immediately
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	These conditions must apply for each time the camp is dismantled or rebuilt.			

The boardwalks and decks are located along and slightly encroaching into the wetland buffer. Therefore, care must be taken when undertaking their construction to ensure unnecessary disturbance to vegetation and soil is avoided. The impacts and proposed mitigation measures are provided in Table 9 and the impact in its mitigated state is a Negligible Negative.

Table 9. Construction Phase Impact: Construction of boardwalks and platforms (decks).

Project phase	**Construction**			
Impact	**Construction of boardwalks and platforms (decks)**			
Description of impact	**Degradation of habitat in the buffer**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Holes for pole supports for boardwalks and platforms must preferably be dug using an auger or by hand to minimise the footprint of disturbance. • Small gaps (15 - 20m) should be left between planks on the boardwalks to allow filtered light through so plants can still grow under the boardwalk. • Boardwalk sides should be left open to allow small animals to move in and out of the buffer area during quieter times. • Plants surrounding the work area will inevitably become trampled. Therefore, a maximum disturbance area of 2m either side of the deck and boardwalk is acceptable. However, wherever feasible steps should be taken to reduce the area disturbed. • All waste materials (screws, wood cuts etc) must be collected as work progresses for disposal off site.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Low	Natural and/ or social functions and/ or processes are somewhat altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Likely	The impact may occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable			

6.2 Operational Phase Impacts

The operational phase considers the day to day running of the camp and anticipates impacts which could result in degradation of the wetland, artificial pool, or buffer area.

It is clear from the assessment of operational phase impacts that selection of the glass pod-style of accommodation over more traditional canvas tents would add to the requirement for cleaning and disposal of grey water. Likewise, the pool and hot tubs will require additional transporting of water and removal of backwashed water. These additions to the camp increase the logistics in terms of transporting clean water in and dirty water out, which may have guest benefits, but will increase the impact to the access track and the burden of cleaning and maintenance.

The first impact concerns the operation of the pool and hot tubs. The worst-case scenario is that these pools are frequently backwashed into the wetland area discharging poor water quality and impacting aquatic biota and plants, and require frequent filling with heavy tanks of water. However, these impacts are easily mitigated, in which case the impact is determined as a negligible negative (Table 10).

Table 10. Operational Phase Impact: Overflow or backwashing of pool to the wetland / buffer.

Project phase	**Operation**			
Impact	**Overflow or backwashing of pool / hot tub water to the wetland / buffer**			
Description of impact	**Contamination due to chlorine and personal care products (eg. Sunblock)**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• Cover the pools when not in use to reduce the risk of them filling up and overflowing during rain. Covering will also reduce cleaning requirements and algal growth. It will also reduce the relatively low risk of small animals getting into the pool and drowning. • Backwashed water must be discharged to the wastewater tank for disposal at the Diepwalle camp site. • No pool / hot tub water may be discharged into the wetland or buffer area.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Brief	Impact will not last longer than 1 year	Immediate	Impact will self-remedy immediately
Extent	Very limited	Limited to specific isolated parts of the site	Very limited	Limited to specific isolated parts of the site
Intensity	Very low	Natural and/ or social functions and/ or processes are slightly altered	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	Medium	Determination is based on common sense and general knowledge
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts				

Table 11. Operational Phase Impact: Camp access for deliveries and removals.

Project phase	**Operation**			
Impact	**Access to camp for delivery of supplies and removal of waste**			
Description of impact	**Expanded road footprint into wetland area**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• All camp staff and guests must be made aware that the wetland and artificial pool are sensitive site features with restricted access • When any water is brought into or out of the camp , a maximum of 5 000 L of water may be transported on one vehicle, as the weight may cause damage to the access road. Should damage to the road begin to occur (deep rutting) then a lighter weight tank will need to be used. • All vehicles must stick to the existing access track and turnaround point indicated on the SDP. No new tracks can be made, and no vehicles may enter the buffer or wetland.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Medium term	Impact will last between 5 and 10 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Low	Natural and/ or social functions and/ or processes are somewhat altered
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	Medium	Determination is based on common sense and general knowledge	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Negligible - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable			

Table 12. Operational Phase Impact: Camp activities disturbing aquatic biota.

Project phase	**Operation**			
Impact	**Camp activities disturbing aquatic biota (animals)**			
Description of impact	**Disruption of normal behaviour, injury or death**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Lighting along all boardwalks and decks in / adjacent to the buffer must be 'warm' in colour, solar powered, and motion triggered. This is to minimise the attraction of insects which in turn influences the behaviour or frogs and other animals that feed on them. • At a reasonable time, all lights must be switched off so they don't continue to switch on with the motion trigger after 10pm. • A single bench can be placed at the artificial pool so guests can enjoy the frog calls and appreciate a different outlook. This can be reached from a small footpath from the access road provided this does not conflict with guidance from the faunal specialist in terms of animal access for drinking. • No driving after dark as far as possible. The aim is avoid driving over frogs or toads which may move onto the road at night. • No insect zappers are permitted in any part of the camp. The excavated pool and wetland provide habitat for many insects which in turn are prey for other animals. • No insect killer sprays (e.g. Doom) are permitted in camp. If mosquitoes cause annoyance then people can apply deterrant lotions or sprays, and wear long sleeves / trousers. • Emergency supplies or materials suitable for rapid response to spillage of waste (e.g. sewage) or diesel for the generator must be kept along with other safetey equipment like a fire extinguisher in the staff area. An example would be lime for spreading on spilt sewage, and spades for removing contaminated soil.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Likely	The impact may occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable			

Table 13. Operational Phase Impact: Disposal of grey water and wastewater.

Project phase	**Operation**			
Impact	**Disposal of grey water and waste water**			
Description of impact	**Pollution of aquatic habitat and surrounding buffer**			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	**• All staff MUST be trained that all grey water must be disposed of in the wastewater container on site. This includes buckets of dirty water used for washing glass pod windows (if selected as an accommodation option), dishes, cleaning tents, cleaning the pool etc. • Biodegradable, eco-friendly detergents must be sourced and used throughout the camp. • Washing of linen, towels and clothing must be done off site. • No buckets of dirty water may be thrown into the surrounding environment. • Clear instructions must be provided for guests and staff for the use and management of chemical toilets.**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Medium term	Impact will last between 5 and 10 years	Brief	Impact will not last longer than 1 year
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Probable	The impact has occurred here or elsewhere and could therefore occur	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environment will be able to recover from the impact	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Not applicable			

6.3 Decommissioning Phase Impacts

The camp will be partially packed up on an annual basis when closed during winter. It is understood that all moveable items will be removed from the site, but built structures such as the boardwalk, decks and pools would be left in place. The pools are the main concern as they must be secured against wildlife falling into them and becoming trapped, and against filling up with water. Mitigation measures are recommended in Table 14.

When the site is reconstructed for the tourist season, all construction phase impact mitigation measures are once again applicable.

Table 14. Decommissioning Phase Impact: Vehicles or workers removing materials from the site.

Project phase	**Decommissioning**			
Impact	**Vehicles or workers removing materials and structures from the site**			
Description of impact	**Disturbance to the wetland, excavated pool or buffer area**			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	**• Work to remove items from the site must be undertaken in a similar manner recommended for the camp construction in that vehicles must stick to the road and not be overloaded, work may not be undertaken during rainfall, and the wetland and buffer are No-go areas. • From the perspective of aquatic sensitivities, the boardwalks and platforms may be left on site when the camp closes during the winter months. It is envisaged that the accommodation would be removed (e.g. glass pods / tents), along with water and wastewater storage tanks and pumps. • Pools must be completely emptied and covered securely. They should preferably have covers made from decking underlain by irrigation plastic so they don't blow off in the wind and so that animals cannot fall into them, and they cannot be filled by rain. • The site must be completely cleared of all waste or litter. • When boardwalks and decking are removed completely (end of concession with SANParks) all wood must be stockpiled for removal at a site already disturbed (ie. the staff camp), and every hole in the ground must be completely refilled with soil from the area (SANParks to provide a suitable source)**			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	Impact will last between 1 and 5 years	Short term	Impact will last between 1 and 5 years
Extent	Limited	Limited to the site and its immediate surroundings	Very limited	Limited to specific isolated parts of the site
Intensity	Moderate	Natural and/ or social functions and/ or processes are moderately altered	Very low	Natural and/ or social functions and/ or processes are slightly altered
Probability	Likely	The impact may occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environment will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Minor - negative**		**Negligible - negative**	
Comment on significance				
Cumulative impacts	Provided all mitigation measures are followed for the construction phase and decommissioning phase each time de-camping and reconstruction occurs, the impacts should be minimised.			

7. RISK MATRIX

Methods used to determine scores in the Risk Matrix are explained in Appendix 2. The assessment considers the risks in their mitigated state, and it is therefore imperative that control measures to mitigate impacts are fully implemented for the level of risk to apply. The risk matrix considers the severity of risks to the flow regime, water quality, habitat (including geomorphology), and biota.

The same impacts considered in the impact assessment were included in the Risk Assessment Matrix. In their mitigated state, all impacts were considered to pose a **Low Risk** to the wetland at the proposed camp site (Table 15).

Table 15. Risk Matrix for the proposed Diepwalle Tented Camp

Phases	Activity	Aspect	Impact	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	PES AND EIS OF WATERCOURSE
CONSTRUCTION PHASE	Movement of vehicles, materials and workers around wetland habitat	Degradation of habitat and soil disturbance	Disturbance of vegetation, habitat and soils	0	1	2	1	1	1	2	4	1	2	5	1	9	36	Low	70	• Check weather forecasts daily, and cease work during and immediately following rainfall. • Pre-construction the wetland and pool buffer must be surveyed and marked out wth temporary wooden survey poles and danger tape. On the existing road the delineated edge must align with the present road edge to ensure vehicles do not make the road any bigger. • All drivers and workers must be informed that the buffer and wetland beyond the danger tape is a 'No-go' area unless specifically working on construction of the communal platforms in the buffer or boardwalks along the buffer edge. • The vehicle parking area must be clearly indicated with danger tape and laminated signs. This should be limited to the turnaround / drop off point indicated in the SDP. • Areas for waste disposal including all litter and toilet facilities must be provided to accommodate workers, and no waste product of any sort may be disposed of at the site. • IF the road becomes very muddy and navigation becomes difficult, a combination some / all of the following methods can be implemented: Improve drainage with cutoff drains, low berms across the road, and shaping the crows to drain downstream; compact the base layer and add a binding agent such as cement if necessary; Add a surface layer of fractured stone, sand and fines and compact to a smooth surface. During construction, no cement must be mixed anywhere except on the road, and work must be undertaken during dry weather.	
	Handling of fuel and other building materials	Spillage or discharge into sensitive aquatic habitat	Potential pollution of sensitive aquatic habitats	0	1	0	1	0,5	1	1	2,5	1	2	5	3	11	27,5		80	• All refuelling of vehicles must be done at the Diepwalle camp, and no fuel or oil for vehicles may be stored at the proposed camp site. • Vehicles entering the site must be checked for leaks of oil or fuel at the Diepwalle camp before being permitted to enter the development site. Any vehicle with leaks must be immediately removed from the site until repaired. • As far as possible, all wood cutting and preparation for decking and boardwalks must be done at the Diepwalle campsite so assembly is all that's required on site. • If tools like electric drills are required on site, a generator will be necessary. This shoudl be filled with fuel at the Diepwalle camp, and 2 x 5 L cans of fuel may be retained on site to refill the generator if required. Refilling must be undertaken with care outside of the wetland buffer at the site of the staff camp indicated on the SDP. • Wood for decking should be stockpiled in the staff quarters area, taking care to minimise the footprint of disturbance and not spread materials over an unnecessarily large area.	PES: C EIS: Moderately Modified

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	Construction of boardwalks and platforms (decks)	Disturbance in the wetland buffer	Degradation of habitat in the buffer	0	1	1	1	0,75	1	2	3,75	1	2	5	2	10	37,5	Low	80	• Holes for pole supports for boardwalks and platforms must preferably be dug using an auger or by hand to minimise the footprint of disturbance. • Small gaps (15 - 20m) should be left between planks on the boardwalks to allow filtered light through so plants can still grow under the boardwalk. • Boardwalk sides should be left open to allow small animals to move in and out of the buffer area during quieter times. • Plants surrounding the work area will inevitably become trampled. Therefore, a maximum disturbance area of 2m either side of the deck and boardwalk is acceptable. However, wherever feasible steps should be taken to reduce the area disturbed. • All waste materials (screws, wood cuts etc) must be collected as work progresses for disposal off site.	
	Overflow or backwashing of pool / hot tub water to the wetland / buffer	Release of water containing contaminants into the aquatic environment	Contamination due to chlorine and personal care products (eg. Sunblock)	0	1	0	1	0,5	1	2	3,5	1	2	5	1	9	31,5	Low	70	• Cover the pools when not in use to reduce the risk of them filling up and overflowing during rain. Covering will also reduce cleaning requirements and algal growth. It will also reduce the relatively low risk of small animals getting into the pool and drowning. • Backwashed water must be discharged to the wastewater tank for disposal at the Diepwalle camp site. • No pool / hot tub water may be discharged into the wetland or buffer area.	
	Access to camp for delivery of supplies and removal of waste	Driving on access track along wetland edge.	Expanded road footprint into wetland area	1	1	2	1	1,25	1	2	4,25	4	2	5	1	12	51	Low	70	• All camp staff and guests must be made aware that the wetland and artificial pool are sensitive site features with restricted access • When any water is brought into or out of the camp , a maximum of 5 000 L of water may be transported on one vehicle, as the weight may cause damage to the access road. Should damage to the road begin to occur (deep rutting) then a lighter weight tank will need to be used. • All vehicles must stick to the existing access track and turnaround point indicated on the SDP. No new tracks can be made, and no vehicles may enter the buffer or wetland.	

OPERATIONAL PHASE	Camp activities disturbing aquatic biota (animals)	Day to day camp operations and visitors to the camp.	Disruption of normal behaviour, injury or death	0	1	1	1	0,75	1	2	3,75	3	2	5	2	12	45	Low	80	• Lighting along all boardwalks and decks in / adjacent to the buffer must be 'warm' in colour, solar powered, and motion triggered. This is to minimise the attraction of insects which in turn influences the behaviour or frogs and other animals that feed on them. • At a reasonable time, all lights must be switched off so they don't continue to switch on with the motion trigger after 10pm. • A single bench can be placed at the artificial pool so guests can enjoy the frog calls and appreciate a different outlook. This can be reached from a small footpath from the access road provided this does not conflict with guidance from the faunal specialist in terms of animal access for drinking. • No driving after dark as far as possible. The aim is avoid driving over frogs or toads which may move onto the road at night. • No insect zappers are permitted in any part of the camp. The excavated pool and wetland provide habitat for many insects which in turn are prey for other animals. • No insect killer sprays (e.g. Doom) are permitted in camp. If mosquitoes cause annoyance then people can apply deterrant lotions or sprays, and wear long sleeves / trousers. • Emergency supplies or materials suitable for rapid response to spillage of waste (e.g. sewage) or diesel for the generator must be kept along with other safetey equipment like a fire extinguisher in the staff area. An example would be lime for spreading on spilt sewage, and spades for removing contaminated soil.	
	Disposal of grey and waste water	Disposal thereof and spills	Pollution of aquatic habitat and surrounding buffer	1	1	1	1	1	1	1	3	3	2	5	3	13	39	Low	80	• All staff MUST be trained that all grey water must be disposed of in the wastewater container on site. This includes buckets of dirty water used for washing glass pod windows (if selected as an accommodation option), dishes, cleaning tents, cleaning the pool etc. • Biodegradable, eco-friendly detergents must be sourced and used throughout the camp. • Washing of lineen, towels and clothing must be done off site. • No buckets of dirty water may be thrown into the surrounding environment. • Clear instructions must be provided for guests ans staff for the use and management of chemical toilets.	

DECOMMISSIONING PHASE	Vehicles or workers removing materials and structures from the site	Trampling vegetation, soil compacttion.	Disturbance to the wetland, excavated pool or buffer area	1	1	2	1	1,25	2	1	4,25	2	1	5	3	11	46,8	Low	75	• Work to remove items from the site must be undertaken in a similar manner recommended for the camp construction in that vehicles must stick to the road and not be overloaded, work may not be undertaken during rainfall, and the wetland and buffer are No-go areas. • From the perspective of aquatic sensitivities, the boardwalks and platforms may be left on site when the camp closes during the winter months. It is envisaged that the accommodation would be removed (e.g. glass pods / tents), along with water and wastewater storage tanks and pumps. • Pools must be completely emptied and covered securely. They should preferably have covers made from decking underlain by irrigation plastic so they don't blow off in the wind and so that animals cannot fall into them, and they cannot be filled by rain. • The site must be completely cleared of all waste or litter. • When boardwalks and decking are removed completely (end of concession with SANParks) all wood must be stockpiled for removal at a site already disturbed (ie. the staff camp), and every hole in the ground must be completely refilled with soil from the area (SANParks to provide a suitable source)	

8. CONCLUSIONS

The proposal to develop a tented camp in Diepwalle Forest, Knysna was assessed in terms of aquatic sensitivities of the site, and potential impacts to aquatic ecosystems. The camp will use the existing SANParks camp and offices as a base of operations. An existing access road will be used to transport guests in and out of the camp. Aquatic features at the site were identified as a small, excavated pool and a seasonal wetland at the site of historical clearing for woodcutting. The wetland area was delineated using soil and vegetation features, and a buffer of 10 m was recommended around the pool and wetland. The PES of the wetland was measured as B, Largely Natural, and the EIS was Moderate. Frogs were surveyed in the excavated pool and 2 species were confirmed present (*S. grayii* and *A. fuscigula*), with no *A. knysae* recorded. The wetland delineation and buffer were supplied to the developer and the Site Development Plan was adjusted to permit limited structures including the boardwalk, communal deck areas and 3 to 4 camp decks around the edge and as minor encroachments into the buffer area respectively. Recommended mitigation measures to minimise impacts were provided for the Construction, Operational, and Decommissioning phase of the proposed camp.

Development of the camp is supported from the perspective of aquatic ecosystems, as most impacts can be effectively mitigated to a negligible level, provided mitigation measures are fully implemented. The outcome of the Risk Matrix was determined to be Low, with the resulting recommendation that a General Authorisation is applicable for Section 21 c) and i) water uses defined in the National Water Act.

9. APPENDICES

9.1 Impact Assessment Methods

Criteria are ascribed for each predicted impact. These include the intensity (size or degree scale), which also includes the type of impact, being either a positive or negative impact; the duration (temporal scale); and the extent (spatial scale), as well as the probability (likelihood). The methodology is quantitative, whereby professional judgement is used to identify a rating for each criterion based on a seven-point scale (Table 16) and the significance is auto-generated using a spreadsheet through application of the calculations.

For each predicted impact, certain criteria are applied to establish the likely **significance** of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

These criteria include the **intensity** *(*size or degree scale), which also includes the **nature** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale). These numerical ratings are used in an equation whereby the **consequence** of the impact can be calculated. Consequence is calculated as follows:

Consequence = type x (intensity + duration + extent)

To calculate the significance of an impact, the **probability** (or likelihood) of that impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as negligible, minor, moderate or major, and the type would be either positive or negative.

Table 16. Assessment criteria for the evaluation of impacts

Criteria	Numeric Rating	Category	Description
Duration	1	Immediate	Impact will self-remedy immediately
	2	Brief	Impact will not last longer than 1 year
	3	Short term	Impact will last between 1 and 5 years
	4	Medium term	Impact will last between 5 and 10 years
	5	Long term	Impact will last between 10 and 15 years
	6	On-going	Impact will last between 15 and 20 years
	7	Permanent	Impact may be permanent, or in excess of 20 years
Extent	1	Very limited	Limited to specific isolated parts of the site
	2	Limited	Limited to the site and its immediate surroundings
	3	Local	Extending across the site and to nearby settlements
	4	Municipal area	Impacts felt at a municipal level
	5	Regional	Impacts felt at a regional level
	6	National	Impacts felt at a national level
	7	International	Impacts felt at an international level
Intensity	1	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
	2	Very low	Natural and/ or social functions and/ or processes are slightly altered
	3	Low	Natural and/ or social functions and/ or processes are somewhat altered

Criteria	Numeric Rating	Category	Description
	4	**Moderate**	Natural and/ or social functions and/ or processes are moderately altered
	5	**High**	Natural and/ or social functions and/ or processes are notably altered
	6	**Very high**	Natural and/ or social functions and/ or processes are majorly altered
	7	**Extremely high**	Natural and/ or social functions and/ or processes are severely altered
Probability	**1**	**Highly unlikely / None**	Expected never to happen
	2	**Rare / improbable**	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
	3	**Unlikely**	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
	4	**Probable**	Has occurred here or elsewhere and could therefore occur
	5	**Likely**	The impact may occur
	6	**Almost certain / Highly probable**	It is most likely that the impact will occur
	7	**Certain / Definite**	There are sound scientific reasons to expect that the impact will definitely occur

When assessing impacts, broader considerations are also considered. These include the level of confidence in the assessment rating; the reversibility of the impact; and the irreplaceability of the resource as set out in (Table 17, Table 18, & Table 19), respectively.

Table 17. Definition of confidence ratings.

Category	Description
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Table 18. Definition of reversibility ratings.

Category	Description
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact

Table 19. Definition of irreplaceability ratings.

Category	Description
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere

9.2 Risk Matrix Methods

The risk assessment matrix (Based on DWS 2016 publication: Section 21 c) and i) water use Risk Assessment Protocol) was implemented to assess risks for each activity associated with the construction and operational phase.

The first stage of the risk assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are as follows:

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An aspect is an 'element of an organizations activities, products and services which can interact with the environment'. The interaction of an aspect with the environment may result in an impact.
- Environmental impacts are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity.
- Resources are components of the biophysical environment and include the flow regime, water quality, habitat and biota of the affected watercourse.
- Severity refers to the degree of change to the status of each of the receptor. An overall severity score is calculated as the average of all scores receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- Spatial extent refers to the geographical scale of the impact (Table 21).
- Duration refers to the length of time over which the stressor will cause a change in the resource or receptor (Table 22)
- Frequency of activity refers to how often the proposed activity will take place (Table 23
- Frequency of impact refers to the frequency with which a stressor (aspect) will impact on the resource (Table 24).

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary.

In accordance with the method stipulated in the risk assessment key, all impacts for flow regime, water quality, habitat and biota were scored as a 5 (i.e. average Severity score of 5) as all activities occurred within the delineated boundary of the wetland.

Table 20. Scores used to rate the impact of the aspect on resource quality (flow regime, water quality, geomorphology, biota and habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland.	

Table 21. Scores used to rate the spatial scale that the aspect is impacting on.

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table 22. Scores used to rate the duration of the aspects impact on resource quality

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5

Table 23. Scores used to rate the frequency of the activity

Annually or less	1
Bi-annually	2
Monthly	3
Weekly	4
Daily	5

Table 24. Scores used to rate the frequency of the activity's impact on resource quality

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 25. Scores used to rate the extent to which the activity is governed by legislation

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5

Table 26. Scores used to rate the ability to identify and react to impacts of the activity on resource quality, people and property.

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

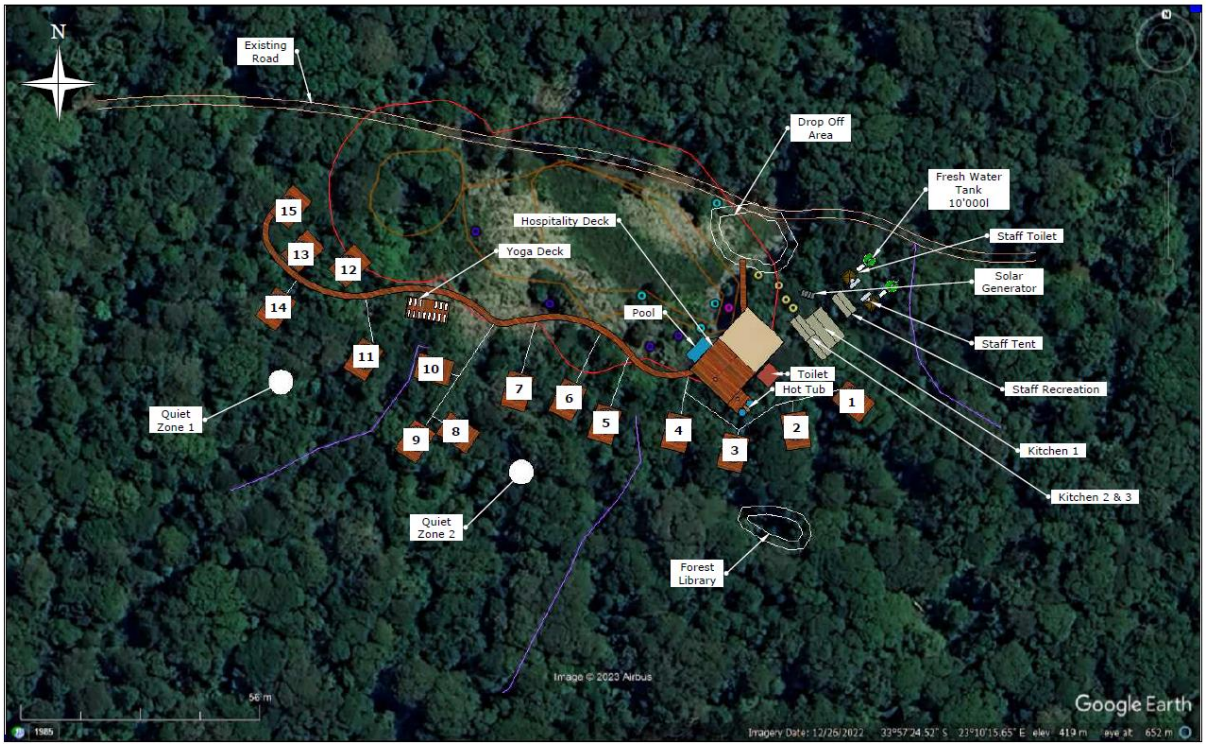
Table 27. Rating classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

Table 28. Calculations used to determine the risk of the activity to water resource quality

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence x Likelihood

9.3 Revised and Updated SDP: January 2024



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