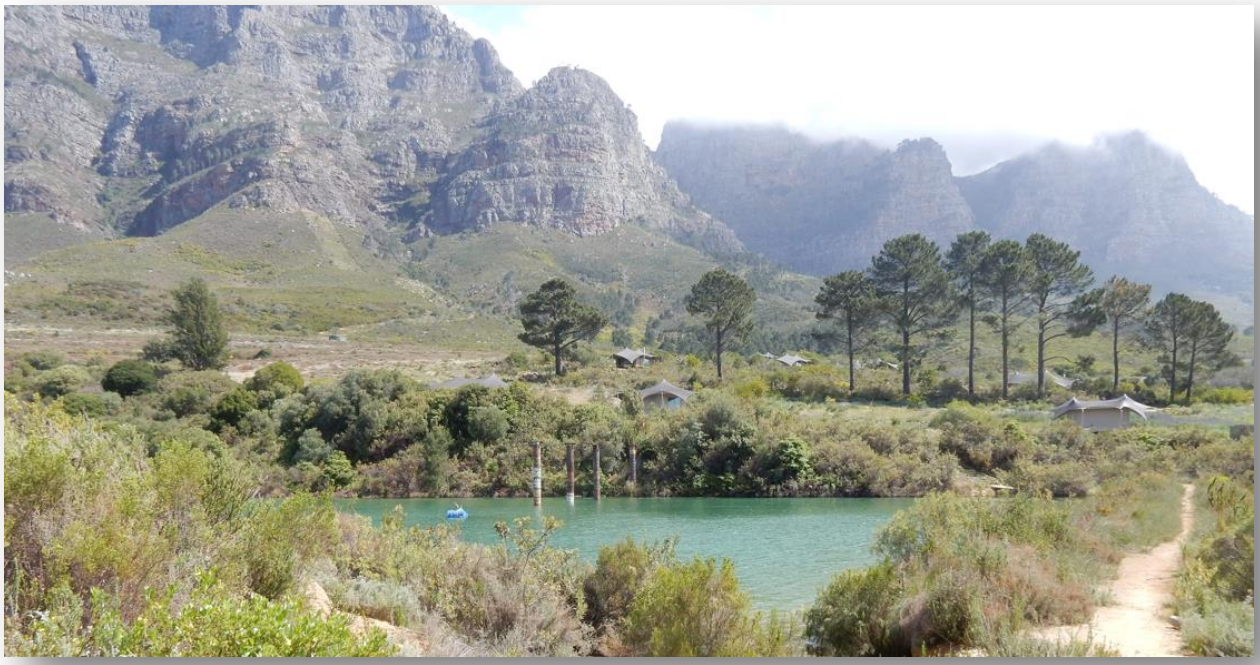
Freshwater Consulting

Environmental Impact Assessment of Founders Estate 5 Tented Camp, Boschendal Estate

Freshwater ecosystems



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DRAFT REPORT

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Submitted to: Chand Environmental Consultants

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1 Introduction

1.1 Background and Approach

The Freshwater Consulting Group (FCG) was approached by Chand Environmental Consultants to provide an environmental impact assessment (EIA) of the inland aquatic ecosystems potentially affected by development activities at the Tented Camp site on Boschendal Estate. The Tented Camp development is considered to be temporary, as the structures and services will be dismantled in the future. The inland aquatic ecosystems on the broader Boschendal Estate have been assessed by FCG on a number of occasions in the past, and a map of wetlands, watercourses and their recommended ecological buffers was provided for a Constraints Analysis of the whole site (see Figure 1.1), in March 2019 (Snaddon, 2019).

Specifically, the terms of reference for the EIA, and the approach followed, were as follows:

- Determine the location and extent of affected inland aquatic ecosystems. A site visit on 26th March 2020 enabled delineation (according the DWAF (2005) guidelines) of the inland aquatic ecosystems affected by the development. The ecosystems were mapped using a hand-held GPS, accurate to 2 – 3m. Suitable buffers were proposed around the aquatic ecosystems, based on the protocol of MacFarlane and Bredin (2016). The site was re-visited on 23rd September 2021, in order to further ground-truth the 2020 delineation.
- Assess the condition and ecological importance and sensitivity of the inland aquatic ecosystems: the accepted protocols for the assessment of ecological importance and sensitivity (EIS) and present ecological state (PES) were used.
- Describe and assess the impacts associated with the construction and operational phases of the development. The impacts expected to affect the inland aquatic ecosystems on and around the site were identified and described for the construction/removal and operational phases, according to the EIA regulations (April, 2017). The current layout was compared against the no go option.
- Provide input to water use authorisation: A number of Section 21 water uses are triggered by the development, and in addition, the development lies within the regulated area (within 500m of a wetland, and within 100m of a watercourse) for Section 21 (c) and (i) water uses. The relevant water uses were identified, and input provided for the authorisation process.
- Write a baseline report: the results of the site visit and the assessments described above are reported here. The report also highlights concerns regarding current development activities, and recommends mitigation measures for reducing or managing impacts.

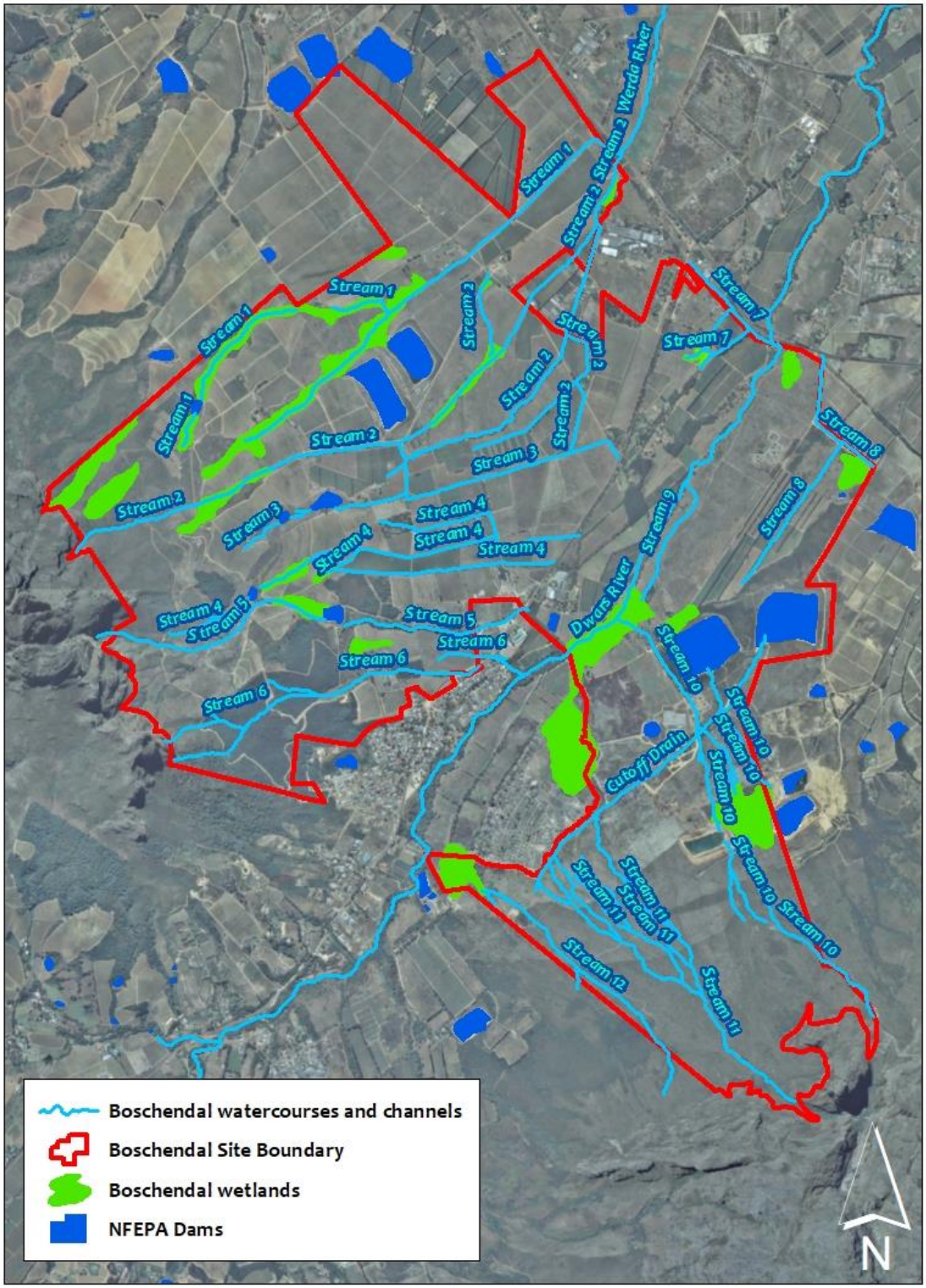

Figure 1.1 **Map of the wetlands and watercourses on Boschendal Estate, as mapped by the author of this report for a Constraints Analysis in 2019. Also shown are the farm dams as depicted on the National Freshwater Ecosystem Priority Area map for the area. Only some of the farm channels are mapped here, and only where they connect with a watercourse.**

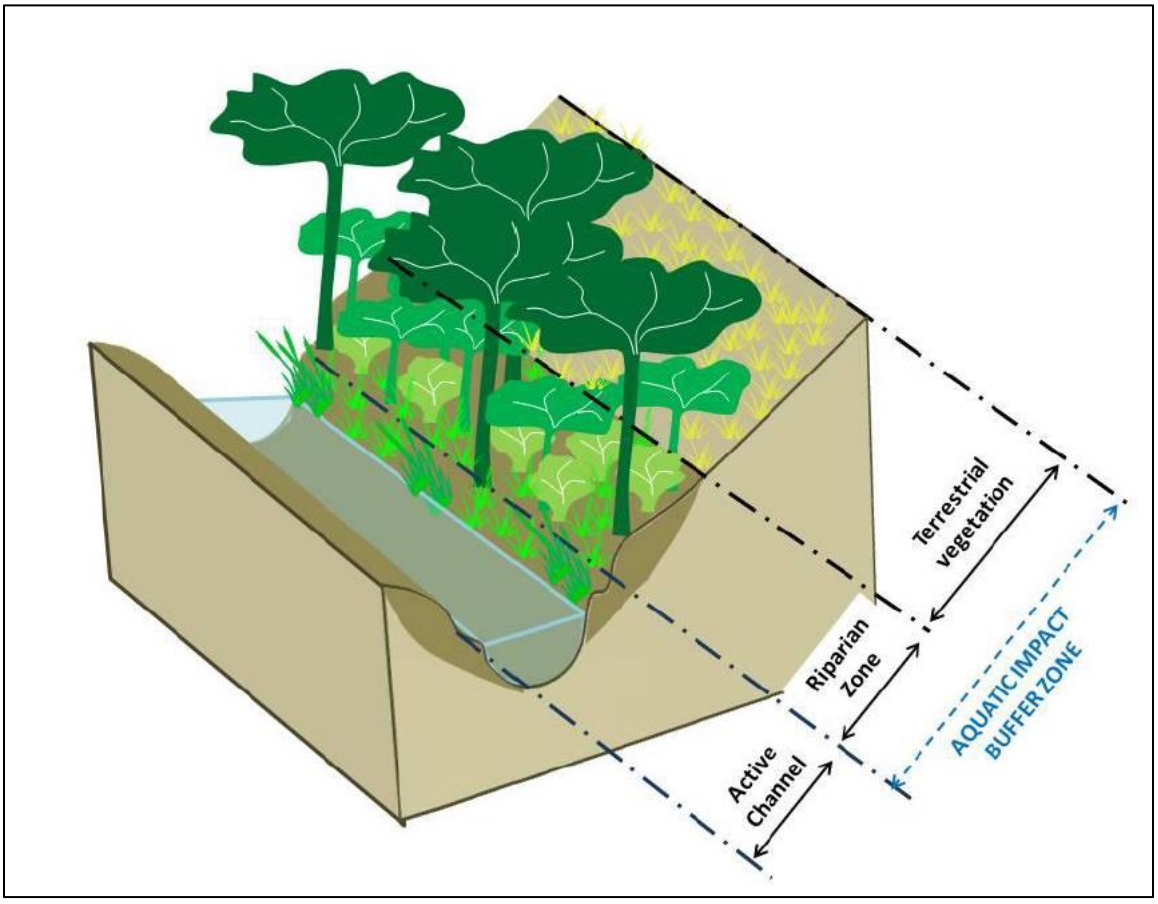

Figure 1.2 Schematic diagram indicating the boundary of active channel and riparian habitat, and the areas potentially included in an aquatic impact buffer zone (MacFarlane and Bredin, 2016). The buffer (measured from the edge of the active channel) protecting a watercourse must include the riparian zone, and can extend into terrestrial vegetation.

1.2 Definitions

The following definitions from the National Water Act (1998) are adhered to in this report:

- Watercourse:
    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 watercourse, and a reference to a watercourse includes, where relevant, its bed and banks;
- Wetland:
    - 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.
- Riparian areas or zones (see Figure 1.2):
    - Includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

1.3 Limitations

Mapping was done with a hand-held GPS in order to save time and costs. Accuracy is estimated as being approximately 2-3m. Delineation of wetlands was done using the indicators described in the DWAF (2005) guidelines for delineation of wetlands and riparian areas. Primary data were not collected from any of the aquatic ecosystems, however, the visual assessments done for this baseline assessment, and historical data collected on Boschendal Estate since 2005, are considered sufficient for the purposes of this project.

1.4 Use of this Report

This report reflects the professional opinions of its author. It is the policy of FCG that the full and unedited contents of this report should be presented to the client, and that any summary of the findings should only be produced in consultation with the author.

1.5 Declaration of Independence

This is to confirm that Kate Snaddon, the specialist consultant who is responsible for undertaking this study and preparing this environmental impact assessment report, is independent, and has no vested interests, financial or otherwise, in the development under consideration.

1.6 Specialist Details

The author of this report is an independent specialist consultant, with 23 years of experience in the field of freshwater ecology, registered with the South African Council for Natural Scientific Professions (Ecologist, registration number 400225/06).

2 Description of the affected area

The Tented Camp site is located in quaternary catchment G10C, in the Berg River Water Management Area, and the Stellenbosch Municipality. This catchment has a mean annual rainfall total of 1200 mm per annum, and lies in a high rainfall intensity zone (*sensu* Schulze, 2007).

The Boschendal Estate comprises a number of farms covering an area of approximately 1800 ha on either side of the Helshoogte Road (R310) which runs from Stellenbosch, *via* Johannesdal and Pniel, to the R45. Most of the Estate, and this site in particular, falls within the ecoregion known as the south western coastal belt (from Kleynhans *et al.*, 2005a) (see Table 2.1 for main attributes of the ecoregion).

Table 2.1 Main attributes of the ecoregions that intersect with the study area (from Kleynhans *et al.*, 2005a).

Ecoregion	Terrain morphology	Dominant vegetation types	Altitude	Mean Annual Precipitation	Rainfall seasonality
South Western Coastal Belt	Moderate relief plains; Closed hills; Mountains	West Coast Renosterveld; Sand Plain Fynbos; Mountain Fynbos	Mainly 0-300 mAMSL; hills up to 900 mAMSL	0 to 1500 mm/year	Winter

Historically, the vegetation across much of the Estate, including the Tented Camp site, would have been Boland Granite Fynbos (Skowno et al., 2019), with Swartland Alluvium Fynbos, which is typical of riverine valley floors and floodplains, around the Dwars River (Rebelo *et al.*, 2006). The Boland Granite Fynbos is an endangered vegetation type found in the Dwars River Valley and on the surrounding mid-slopes, while the Swartland Alluvium Fynbos is critically endangered.

Most of the Estate has been heavily disturbed through agricultural activities (primarily orchards), road construction and use, housing, and some industry (e.g. a logging operation in the eastern portion of the site), and very little of the original vegetation type remains.

A number of small tributaries of the Dwars or Berg River cross the study area on both sides of the R310. Those on the northern side of the road drain the Simonsberg Mountains, and many of these join to form a tributary (the Werda River) that flows directly into the Berg River. The watercourses on the southern side of the R310 originate on the Groot Drakenstein Mountains, and flow directly into the Dwars River. The streams on both sides of the R310 are relatively undisturbed in their upper catchments, arising on relatively pristine mountain slopes, but the watercourses are significantly altered from their natural state as soon as they flow into the cultivated areas – this is especially the case on the northern Simonsberg side. Many of the streams enter farm dams scattered across the Boschendal site. There are numerous agricultural drains crossing the site, serving to channel surface water away from houses and fields (some of these are mapped in Figure 1.1).

There are a few wetlands on Boschendal Estate, some of which are associated with the agricultural drains and channels, while some are remnants of more extensive wetland areas, which have been impacted (drained or filled in) by the surrounding activities.

The “Tented Camp” site is located adjacent to Stream 1, as mapped in 2007 and 2019. Stream 1 is a tributary of the Werda River, which ultimately flows in the Berg River. The riparian area around Stream 1 is typical of mountain streams in this area (see Section 3 for a description of the plant species characterising the riparian area). Stream 1 has good water quality (visual assessment) and seasonal surface flow.

Figure 2.1 Farm dam into which Stream 1 flows. The riparian vegetation around Stream 1 continues around the margins of the dam, and can be seen here. The Tented Camp can be seen in the background.

3 Delineation of inland aquatic ecosystems

The Department of Water and Sanitation has produced a wetland and riparian zone delineation manual (DWAF, 2005) that describes the indicative characteristics that can be used to distinguish between wetlands or riparian zones and the surrounding terrestrial landscape. These indicators are:

- **Vegetation**: the presence of plants adapted to or tolerant of saturated soils (hydrophytes) or alluvial soils;
- **Soils**: in the case of wetlands, the presence of wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation, and for riparian areas, the presence of alluvial soils and / or deposited material;
- **Hydrology**: a high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- **Terrain**: the position in the landscape that allows for retention of water and the development of wetlands, or for riparian areas, association with a watercourse.

All of the inland aquatic ecosystems observed and delineated for this study are **watercourses and their associated riparian areas**. The DWS delineation protocol requires the delineation of the outer boundary of the riparian areas, as these must be included as part of the aquatic ecosystem.

The delineation of riparian areas relies most heavily on the vegetation, as there is often insufficient saturation of soils in riparian areas to allow for the development of hydromorphic soils (DWAF, 2005). Furthermore, the water table can be relatively distant from the soil surface, and riparian plants are often deep-rooting individuals, seeking water at depth.

The outer boundary of a riparian area is frequently found where there is a noticeable change in:

- Plant species composition relative to the adjacent terrestrial area; and
- Physical structure, such as vigour or robustness of growth forms (e.g. health, size, structure), relative to the adjacent terrestrial areas.

There was a clear boundary between terrestrial vegetation and riparian vegetation at the Tented Camp site. The riparian vegetation typically comprised:

- Tree species of various ages, with a few mature individuals, including *Searsia angustifolia*, *S. glauca*, *Kiggelaria africana*, *Olea europaea* subsp*. africana*, *Brabejum stellatifolium*.
- Grasses such as *Pennisetum macrourum*, and restios;
- Shrubs such as *Leucodendron* spp., and bracken (*Pteridium aquilinum*) occur around the margins of the riparian area.

The delineated riparian area for the Tented Camp site is shown in Figure 3.3.

Figure 3.1 **(Top) Bracken and (bottom) tree species – *Kiggelaria africana* (middle), *Olea europaea* subsp. *africana* (right) and *Searsia angustifolia* (left) – typical of the riparian areas on the Tented Camp site, Boschendal Estate. The *Seriphium plumosum* (slangbos) in the foreground is characteristic of the more terrestrial vegetation.**

Figure 3.2 Riparian area below the dam wall at the Tented Camp site, showing the clear boundary between riparian and terrestrial vegetation (the pale grey *Seriphium plumosum*) (yellow dashed line).

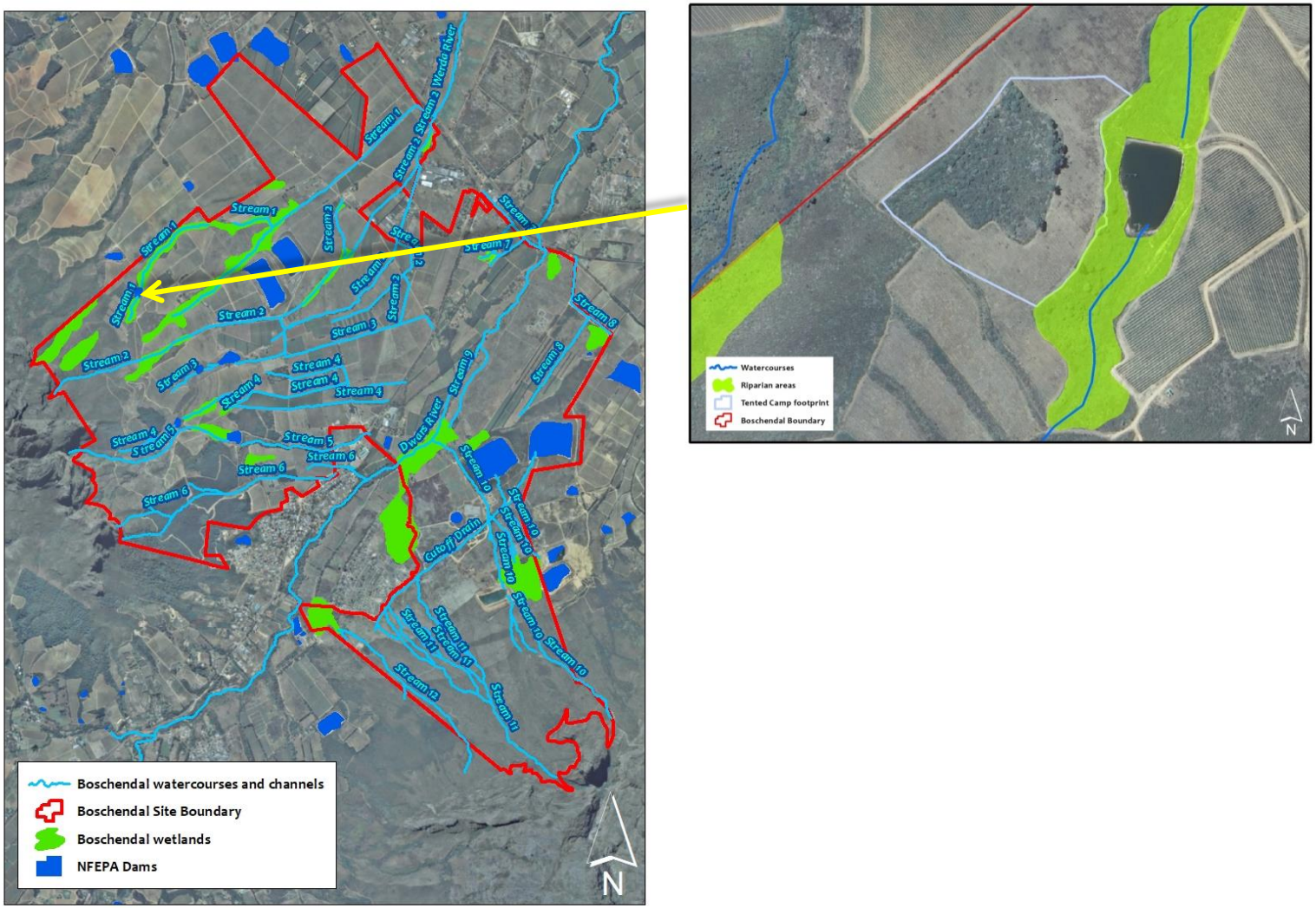

Figure 3.3 **Location of the Tented Camp site on Boschendal Estate (yellow arrow), and the riparian areas (green polygons) delineated at the Tented Camp site (top right).**

4 Assessment of conservation importance of the affected freshwater ecosystems

4.1 Conservation Status

According to the National Freshwater Ecosystem Priority Area (NFEPA) project maps, the sub-catchment in which the Tented Camp site lies has no FEPA status. The Western Cape Biodiversity Spatial Plan (Pool-Stanvliet et al., 2017) identified large areas on the Boschendal Estate as Critical Biodiversity Areas, however these lie predominantly on the Drakenstein side of the property (see Figure 4.2), and most of these CBAs are terrestrial. Stream 1 and its riparian area are categorised as Ecological Support Areas.

In summary based on the above, the Tented Camp sub-catchment is not of significant conservation importance, either regionally or nationally.

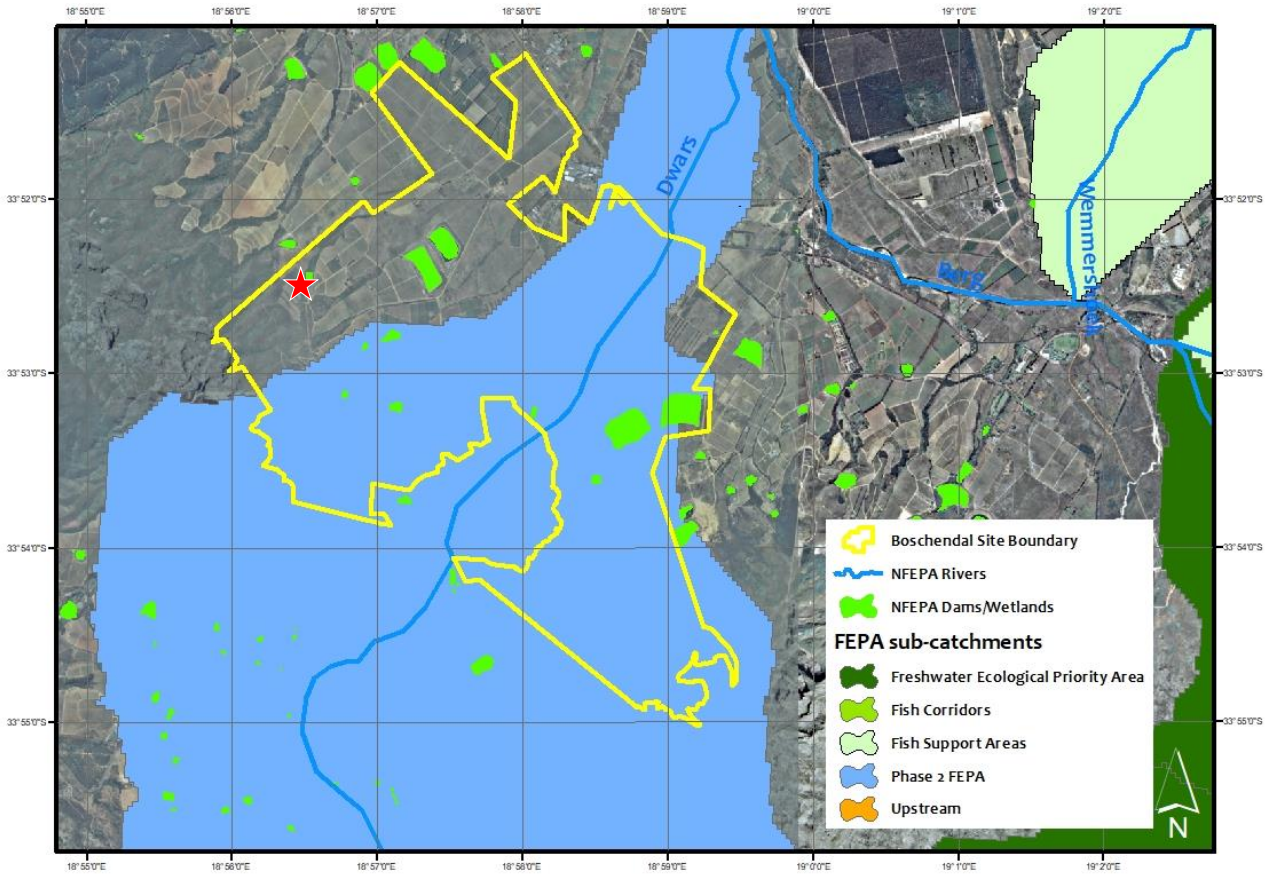

Figure 4.1 National freshwater priorities for the conservation of freshwater biodiversity and ecological processes in and around the Boschendal Estate. The Tented Camp site is marked as a red star. (Map adapted from the NFEPA map (Nel *et al.*, 2011)).

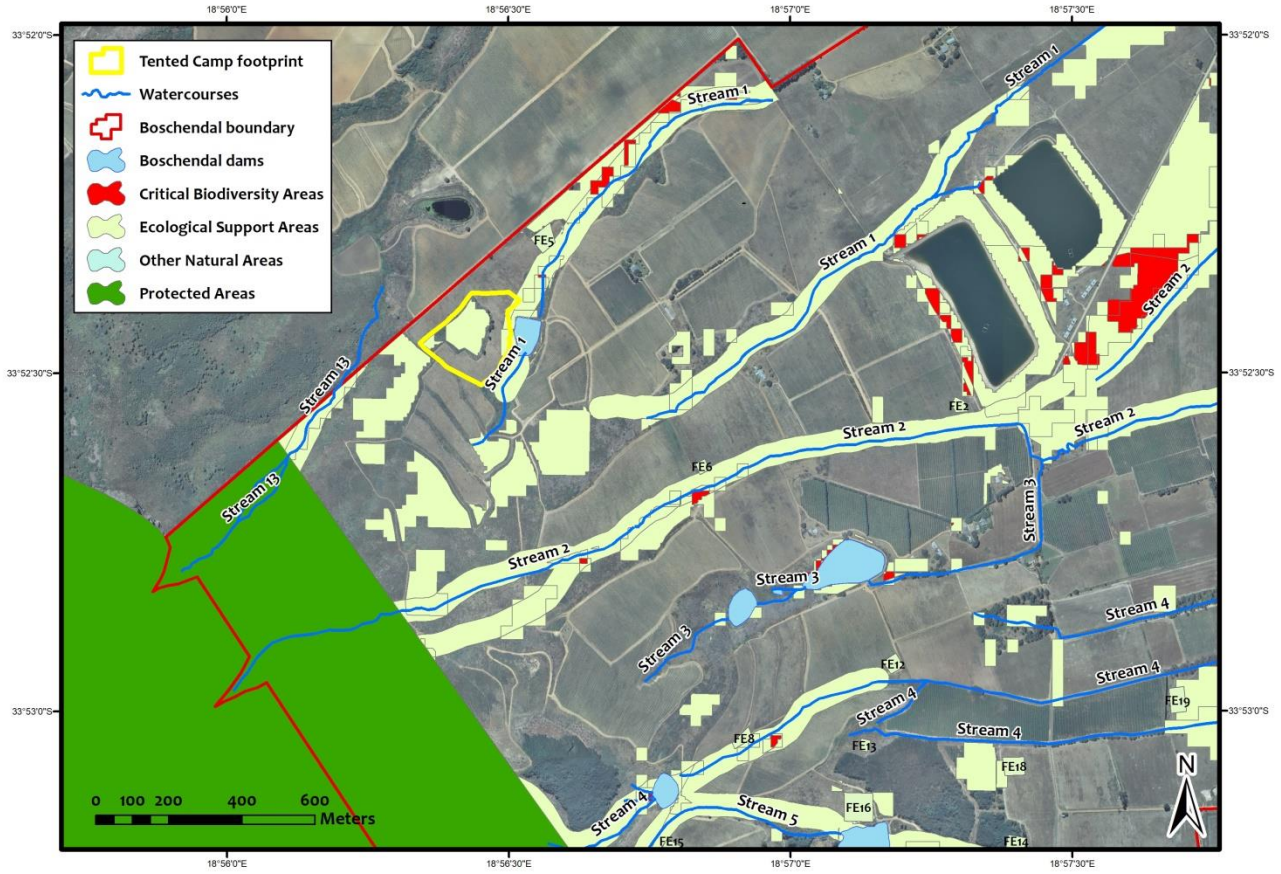

Figure 4.2 Map of Critical Biodiversity Areas, Ecological Support Areas and Protected Areas within and around the Tented Camp site. Adapted from the Western Cape Biodiversity Spatial Plan (Pool-Stanvliet et al., 2017).

4.2 Present ecological status, ecological importance and sensitivity of the inland aquatic ecosystems

4.2.1 Methods

An assessment of the conservation importance of an inland aquatic ecosystem (i.e. watercourse or wetland) should combine assessments of both the present ecological state (PES) or integrity of the ecosystem and its ecological importance and sensitivity (EIS). The *ecological integrity* of an ecosystem is defined as its ability to support and maintain a balanced, integrated composition of physico-chemical and habitat characteristics, as well as biotic components on temporal and spatial scales that are comparable to the natural characteristics of ecosystems of the region. The integrity of a system is directly influenced by its current state, and how much the system has been altered from the reference or unimpacted condition. The *ecological importance* of a freshwater ecosystem is an expression of its importance to the maintenance of ecological diversity (i.e. both species and habitat diversity) and functioning on local and wider scales. *Ecological sensitivity* (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience) (Resh *et al.,* 1988; Milner, 1994). Both abiotic and biotic components of the system are taken into consideration in an assessment of ecological importance and sensitivity. It is strongly biased towards the potential importance and sensitivity of a particular section of a stream or river, as it would be expected under *unimpaired* conditions.

4.2.1.1 Present Ecological State

In the 1990s, the then Department of Water Affairs (now Department of Water and Sanitation, DWS) Resource Directed Measures (RDM) approach provided methods for the assessment of ecological integrity and of ecological importance and sensitivity, in the context of the determination of the ecological management class for riverine ecosystems as part of the Reserve Determination procedure (DWAF, 1999). This procedure could be followed at different levels of detail – desktop, rapid, intermediate and comprehensive. In 2005, the methods were revised during the development of the EcoClassification approach (Kleynhans *et al.*, 2005b), and the indices were reviewed. EcoClassification refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative the natural or close to the natural reference condition. This approach also allows for different levels of assessment, depending on time and budget, and the requirements of the assessment.

The rapid approach was followed for this study. Essentially this approach was based on assessment of existing impacts on two components of the river - the **riparian** zone and the **instream** habitat, using visual information.

Assessments were made separately for both components, but data for the riparian zone were interpreted primarily in terms of their potential impact on the instream component. Criteria within each component are pre-weighted according to the importance of each, and each criterion is scored between 0 and 25, with six descriptive categories ranging from 0 (no impact), 1 to 5 (small impact), 6 to 10 (moderate impact), 11 to 15 (large impact), 16 to 20 (serious impact) and 21 to 25 (critical impact). The criteria are provided in Table 4.1. The total scores for the instream and riparian zone components were used to place the river reach in a habitat integrity category (A – E/F) for both components (Table 4.2).

Table 4.1 Criteria used in the assessment of Present Ecological Status of watercourses (from Kleynhans, 1996).

Criterion	Relevance
Water abstraction	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
Inundation	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
Water quality modification	Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
Flow modification – floods and low flows	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
Bed modification	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
Channel modification	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Exotic macrophytes	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
Exotic fauna	Invasion by exotic fauna will influence indigenous biodiversity, with possible knock-on effects for habitat quality and availability.
Solid waste disposal	This refers to litter and any other solid waste, i.e. a direct anthropogenic impact which may alter habitat structurally, obstruct flow, or have a direct impact on biota. Also a general indication of the misuse and mismanagement of the river.
Indigenous vegetation removal	Impairment of the vegetated buffer will reduce its ability to protect the river from sediment and polluted runoff from the surrounding catchment. Refers to physical removal for farming, firewood and overgrazing.
Exotic vegetation encroachment	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Riparian area habitat diversity is reduced, and timing and quality of food source (leaves, wood, etc) for aquatic biota altered.
Bank erosion	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

Table 4.2 PES categories for watercourses (from Kleynhans, 1996).

Category	Description	Score (%)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0

4.2.1.2 Ecological Importance and Sensitivity

The DWS-recommended method for the determination of the Ecological Importance and Sensitivity of a particular ecosystem considers the following ecological aspects of watercourses, in general (DWAF, 1999):

- Rare and endangered instream and riparian biota;
- Unique instream and riparian biota;
- Intolerant instream and riparian biota;
- Species richness, both riparian and instream;
- Diversity of habitat types or features;
- Refuge value of habitat types;
- Sensitivity of habitat to flow changes;
- Sensitivity to water quality changes;
- Migration route/corridor for instream and riparian biota, and
- Presence of Protected Areas and conservation areas.

Each criterion is scored between 1 and 5, and the medians of these scores are calculated to derive the EIS category (Table 4.3).

Table 4.3 Ecological importance and sensitivity categories for rivers.

Ecological Importance and Sensitivity Categories	General Description
Very high (score >3 and ≤4)	Reaches or rivers that are considered to be unique on a national or even international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to channel / bed modifications and have no or only a small capacity for use.
High (score >2 and ≤3)	Reaches or rivers that are considered to be unique on a national scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to channel / bed modifications but in some cases, may have a substantial capacity for use.
Moderate (score >1 and ≤2)	Reaches or rivers that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually not very sensitive to channel / bed modifications and often have a substantial capacity for use.
Low/marginal (score >0 and ≤1)	Reaches or rivers that are not unique at any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to channel / bed modifications and usually have a substantial capacity for use.

4.2.2 Results

Stream 1 is in good condition, apart from the impacts associated with removal of indigenous vegetation in the catchment (for agriculture) and the presence of the farm dam adjacent to the site. The upper portion of Stream 1 above the farm dam lies in an A category for PES, while the lower section below the dam is in a C category (Table 4.4).

Stream 1 is of high EIS. Although no primary data were collected from the stream, the quality of the habitat is such that the stream will support populations of unique species that are sensitive to changes in water quantity and quality. The stream is an important refuge for species, and provides essential ecological corridors in a highly transformed, cultivated landscape.

Table 4.4 Results of the assessment of Present Ecological State for Stream 1 flowing past the Tented Camp, Boschendal Estate.

Criterion	Score	
	Stream 1 above the farm dam	Stream 1 below the dam
Water abstraction	0	10
Inundation	0	0
Water quality modification	5	8
Flow modification - floods	0	10
Flow modification – low flows	5	15
Bed modification	5	8
Channel modification	0	5
Exotic or invasive macrophytes	0	0
Exotic fauna	Not assessed	Not assessed
Solid waste disposal	5	5
Indigenous vegetation removal	8	8
Exotic vegetation encroachment	5	5
Bank erosion	2	5
PES - Riparian	**89 (B)**	**73 (C)**
PES – Instream	**92 (A)**	**76 (C)**
PES – Overall	**90 (A)**	**74 (C)**

Table 4.5 Results of the assessment of Ecological Importance and Sensitivity for Stream 1 adjacent to the Tented Camp on Boschendal Estate.

EIS component	Score and Category	
	Stream 1 above the farm dam	Stream 1 below the dam
Rare and/or endangered species	0	0
Populations of unique species	2	2
Populations of intolerant species	2	2
Species/taxon richness	3	3
Diversity of aquatic habitat types or features	3	3
Refuge value of habitat type	3	3
Sensitivity to changes in hydrology	3	3
Sensitivity to changes in water quality	4	4
Migration route/corridor for instream and riparian biota	3	3
Proximity to National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas	3	3
Overall	**3 (High)**	**3 (High)**

A summary of the assessments is provided in Table 4.6.

Table 4.6 Summary descriptions of the reaches of Stream 1 assessed for the EIA. Also included are the PES and EIS categories for the two reaches.

Water-courses[1]	Watercourse type (geomorphological zone)	Comments	Photograph	PES Category	Ecological Sensitivity & Importance Category
Upper Stream 1 (above the farm dam at the Tented Camp site)	Mountain stream with associated riparian area	Stream flows down the slopes of the Simonsberg mountains, with a dense riparian growth of indigenous trees and shrubs with a few alien trees, such as pines. Water quality is good; and flow seasonal to ephemeral.	 **Riparian area of the upper reaches of Stream 1**	**A**	**High**
Upper Stream 1 (below the farm dam)	Upper foothill stream with associated riparian area	Stream flows below the farm dam for some distance and then is diverted to flow around agricultural fields.	 **Riparian area in Stream 1 below the farm dam**	**C**	**High**

[1] Watercourses refers to rivers or streams.

5 Legislation and guidelines governing the conservation and management of rivers and wetlands

5.1 National Environmental Management Act (Act 107 as amended by Act 62 of 2008)

The National Environmental Management Act of 2008 (NEMA), outlines measures that…."prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Of particular relevance to this assessment is Chapter 1(4r), which states that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Section 24 of NEMA requires that the potential impact on the environment, socio-economic conditions and cultural heritage of activities that require authorisation or permission by law, must be considered, investigated and assessed prior to implementation, and reported to the relevant regulatory authority.

For development outside the urban edge, many development activities within 32m of a watercourse, measured from the edge of the watercourse (taken to be the edge of the active channel), trigger the need for an environmental authorisation. This may be a basic assessment or a full environmental impact assessment, depending on the specifications of the activity.

5.2 Environmental Impact Assessment regulations issued in terms of NEMA (originally promulgated as Regulation 385, 2006, with new legislation adopted in December 2014)

These regulations identify activities deemed to have a potentially detrimental effect on natural ecosystems, including aquatic ecosystems, and outline the requirements and timeframe for approval of development applications. Different sorts of activities are listed as environmental triggers that determine different levels of impact assessment and planning required. The regulations detail the procedure to be followed for a basic or full environmental impact assessment.

5.3 Conservation of Agricultural Resources Act (Act 43 of 1983)

Key aspects include legislation that allows for:

Section 6: Prescription of control measures relating to the utilisation and protection of vleis, marshes, water sponges and water courses. These measures are described in regulations promulgated in terms of the Act, as follows:

Regulation 7(1): Subject to the Water Act of 1956 (since amended to the Water Act 36 of 1998), no land user shall utilise the vegetation of a vlei, marsh or water sponge or within the flood area of a water course or within 10 m horizontally outside such flood area in a manner that causes or may cause the deterioration or damage to the natural agricultural resources.

Regulation 7(3) and (4): Unless written permission is obtained, no land user may drain or cultivate any vlei, marsh or water sponge or cultivate any land within the flood area or 10 m outside this area (unless already under cultivation).

5.4 Biodiversity Act

To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act of **1998;** the protection of species and ecosystems that warrant

national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute.

5.5 Cape Nature Conservation Ordinance (Ordinance 19 of 1974; amended in 2000)

This ordinance provides measures to protect the natural flora and fauna, as well as listing nature reserves in the Western Cape that are managed by the Western Cape Nature Conservation Board (WCNCB). This ordinance, with the Western Cape Nature Conservation Board Act of 1998 was amended in 2000 to become the Nature Conservation Laws Amendment Act. Lists of endangered flora and fauna can be found in this act.

5.6 National Water Act (1998)

The main regulatory requirements with regards to aquatic features relates to the National Water Act No. 36 of 1998 (NWA). The NWA regulates 11 water uses that require authorisation, as follows:

a. Taking water from a water resource;

b. Storing water;

c. Impeding or diverting the flow of water in a watercourse;

d. Engaging in a stream flow reduction activity;

e. Engaging in a controlled activity identified and declared as such in terms of the Act;

f. Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

g. Disposing of waste in a manner which may detrimentally impact on a water resource;

h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

i. Altering the bed, banks, course or characteristics of a watercourse;

j. Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

k. Using water for recreational purposes.

The construction of river crossings and the laying of pipes over a watercourse or wetland can lead to the changes in flow in (Section 21 (c)) or alterations to the bed and banks/characteristics of (Section 21 (i)) the affected watercourse, and so a water use authorisation must be obtained for these specific activities. Should stormwater be discharged into seeps or streams, this is generally authorised (but requires registration) up to 2000 m^3 per day (Section 21 (f)). Volumes higher than this will be subject to a full water use licence application.

DWA have issued a number of **General Authorisations** (GA) in terms of Section 39 of the National Water Act. A water use may be generally authorised if it falls within a specific threshold or area. The GA of the 26th August 2016 (Government Notice 509 of 2016) provides the limits and conditions of Section 21 (c) and (i) water uses that may be generally authorised, and defines the regulated zone within which the GA applies. The draft GA of April 2012 (Government Notice 288 of 2012) covers the conditions for taking (Section 21 (a)) and storing (Section 21 (b)) water. This GA states:

"A person who owns or lawfully occupies a property or piece of communal land may, in terms of this authorisation, on the property or piece of communal land occupied store water not containing waste up to the maximum volume given in Table 1: Surface water abstraction and storage volumes in Appendix A for the catchment in which the stored water is taken" … (2000 m^3 for catchment G10)… "subject to the following specific conditions and the general conditions in this notice.

Specific conditions for storing of water:

- Water stored in terms of this authorisation may only be stored off-channel.
- Retaining structures for the storing of water in terms of this authorisation that are constructed after this authorisation comes into effect must have outlet works that enable the full storage volume to be released within 30 days.
- Up to the maximum volume of water given for the resource in Table 1: Surface Water Abstraction Rates and Storage Volumes in Appendix A may be stored in terms of this authorisation for use on one property or per person in communal land.

General conditions of this GA include:

- Water stored must be used efficiently, and the water user must investigate and use all reasonable water conservation measures.
- The storage of more than 10 000 m^3 on one property must be registered with DWS.

5.7 Western Cape Provincial Spatial Development Framework (March, 2014)

Policies regarding the protection of biodiversity and ecosystem services in the Western Cape are:

- The Western Cape's Critical Biodiversity Area (CBA) mapping, which CapeNature are currently updating and refining, together with the draft priority climate change adaption corridors, comprise the spatial extent of the Western Cape's biodiversity network. This must inform spatial planning and land use management decisions throughout the province.
- Using the latest available CBA mapping as a primary informant, regional, district and municipal SDFs must delineate Spatial Planning Categories (SPCs) that reflect suitable land use activities in the different CBA categories.
- To complement CapeNature's protected area expansion strategy and their Stewardship programme, SDFs should highlight priority areas outside the protected area network that are critical for the achievement of the province's conservation targets.

Policies regarding the management, repair and optimisation of inland water resources are:

- Given current water deficits, which will be accentuated by climate change, a 'water wise' planning and design approach in the W Cape's built environment is to be mainstreamed.
- Rehabilitation of degraded water systems is a complex inter-disciplinary intervention requiring built environment upgrading (i.e. infrastructure and the built fabric), improved farming practises, as well as the involvement of diverse stakeholders.
- Introduce and retrofit appropriate levels of water and sanitation systems technologies in informal settlements and formal neighbourhoods with backyard shacks as a priority.
- An overarching approach to water demand management is to be adopted – firstly efficiencies must be maximised, storage capacity sustainably optimised and ground water extraction sustainably optimised, with the last resort option of desalination being explored, if necessary.
- Protection and rehabilitation of river systems and high yielding groundwater recharge areas, particularly in areas of intensive land use (i.e. agricultural use, industry, mining and settlement interactions) should be prioritised.

- Regional Plans to be developed for Water Management Areas to ensure clear linkages and interdependencies between the natural resource base (including water resources) and the socio-economic development of the region are understood and addressed.
- Agricultural water demand management programmes to be developed with an emphasis on the Breede Valley and Oliphants / Doorn agricultural areas. Industrial water demand management programmes to be developed with an emphasis on Saldanha, Southern Cape and Cape Town. Settlement water demand management programmes to be developed with an emphasis on the Cape Town functional region.
- Government facilities (inclusive of education, health and public works facilities) to lead in implementing effective and efficient water demand management programmes.
- Continue with programmes (such as Working for Water) which reduce the presence of alien vegetation along river systems.

5.8 Western Cape Biodiversity Spatial Plan (2017)

The Western Cape Biodiversity Spatial Plan (WCBSP) is the product of a systematic biodiversity planning assessment that delineates Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and freshwater realms. These spatial priorities are used to inform sustainable development in the Western Cape Province. This product replaces all previous systematic biodiversity planning products and sector plans with updated layers and features.

5.9 Stellenbosch Municipality Spatial Development Framework

The principles contained in the Stellenbosch SPF that are pertinent to this study include:

- All rivers above a minimum size shall be protected by river conservation zones of 10-30m on either side of the bank, depending on the width and maturity of the river (as determined by an aquatic ecologist or land surveyor). These zones should be returned to their natural riparian status for passive recreational use only, and no urban development or intensive agriculture shall be permitted within them.
- No foundations of permanent buildings shall be located within the 1:100 year flood lines (as determined by a hydrological engineer).
- Peak water demand should be accommodated with supplementary storage and recycling (e.g. rainwater tanks, grey water recycling) of water so that the municipality can focus on satisfying base demand and meeting the needs of the poor.
- Urban water demand management programs should be implemented to ensure that urban water demand does not undermine agricultural needs, including:
    - Rainwater harvesting should be mandatory on all new urban developments, and retrofitting of rainwater harvesting should be encouraged on all existing developments (where heritage constraints allow for this).
    - Grey water recycling should be promoted on all residential, commercial and industrial units with gardens.
- Water conservation measures should be adopted, for example minimising unaccounted for water through leak repair and pressure adjustment, installing water meters, educating consumers about water saving, promoting water saving devices and promoting water-wise gardening.
- Technologies that facilitate the efficient use of irrigation water should be encouraged.

- Conservation areas should continue to enjoy the highest possible level of protection in order to ensure water quality and quantity at least in the upper reaches of the river system.
- The eradication of alien vegetation from all areas should be supported.
- Sensitive biodiversity areas should be mapped, and clear and appropriate guidelines introduced to conserve them.
- Crest lines should be kept free of buildings and intensive agriculture to protect biodiversity.
- Ridge lines should be used for properly managed walking trails to increase recreational potential, tourism and income.
- Outside of formal conservation areas, land owners should be encouraged to conserve vegetation classified by SANBI as Endangered or Critically Endangered (particularly along ridge lines) and to link to existing conservancies (e.g. through the CapeNature Stewardship Program). These land uses should be classified in the Core SPC.

6 Constraints to development

There are two considerations to bear in mind when determining development constraints – (1) the regulatory zone around inland aquatic ecosystems (watercourses and wetlands) within which environmental or water use authorisations are triggered, and (2) the protection of the inland aquatic ecosystems themselves through the establishment of ecological buffers or development setbacks, as details above in Section 6.2.

6.1 Regulatory zone

There are two regulatory zones to take into account:

- A 32m-wide regulatory zone (measured from the edge of the banks of a watercourse or the outer boundary of a wetland) within which an environmental authorisation (according to NEMA) is required;
- A regulatory zone that extends 500m from the outer boundary of a **wetland**, and 100m from the edge of the active channel or to the outer boundary of the riparian area of a **watercourse**, within which a Section 21 (c) or (i) water use (according to the National Water Act) may apply.

The 32m-wide regulatory zone is illustrated for the Tented Camp site in Figure 6.1. The development footprint encroaches into the NEMA regulatory zone along the boundary closest to the dam. Three of the tent decks, a fat trap, landscaping beds and gabions, roads and the bike path are located within the NEMA regulatory zone. A small proportion of the Tented Camp site also lies within the NWA regulatory zone, measured as the edge of the riparian area, as shown in Figure 6.1.

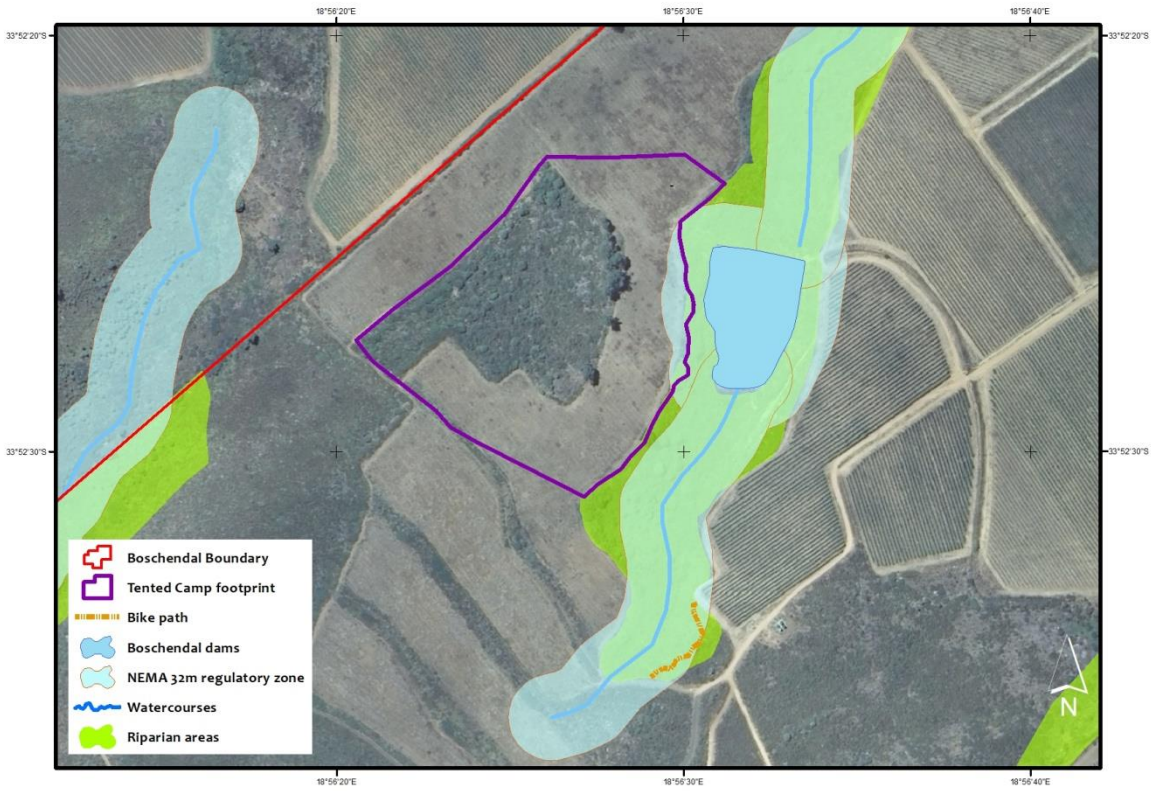

Figure 6.1 Tented Camp site showing the 32m regulatory zone specified in NEMA. The development footprint encroaches into the regulatory zone.

6.2 Development setbacks (ecological buffers)

In determining a development footprint that will have the least impact on an inland aquatic ecosystem, it is essential to establish the recommended development setback, or ecological buffer for each ecosystem. It is important to note that in order to protect the water resource, the development setback or buffer should be used instead of the blanket 32m or 100m setback requirements of the NEMA/National Water Act. The buffer for Stream 1 was determined using the site-based protocol for buffer determination of MacFarlane and Bredin (2016). In the 2019 Boschendal Estate Constraints Analysis, the buffer width tool was used to determine

The assessment is based on the PES and EIS of the watercourse (see Section 4.2), and the assumed quality of the buffer during both phases of the project. It was assumed that the current vegetation would be representative of the buffers for both construction and operational phases, as it is unlikely that the vegetation will change from the current state. The density of vegetation plays a major role in determining the effectiveness of a buffer – a well-vegetated buffer, with a high basal cover (such as grass or sedges) is the most effective buffer, due to the ability of the plants and their roots to trap sediments, toxins and other pollutants before they reach the wetland or watercourse.

The recommended buffer for **Stream 1 (above the dam) is 42m for the Construction Phase and 42m for the Operational Phase,** reducing to **36m for the Construction Phase and 33m for Operational Phase below the dam.** These buffers, measured from the edge of the active channel (effectively from the mid-line of the channel, as the channels are a maximum of 3m in width) are shown in Figure 6.2.

The protocol for the determination of buffers for watercourses states that the buffer must include the delineated riparian area (see Section 1.2), thus the final setback line for both sites follows the outer boundary of either the ecological buffer, or the riparian area, whichever is the widest (MacFarlane and Bredin, 2016). These lines can be seen in Figure 6.3.

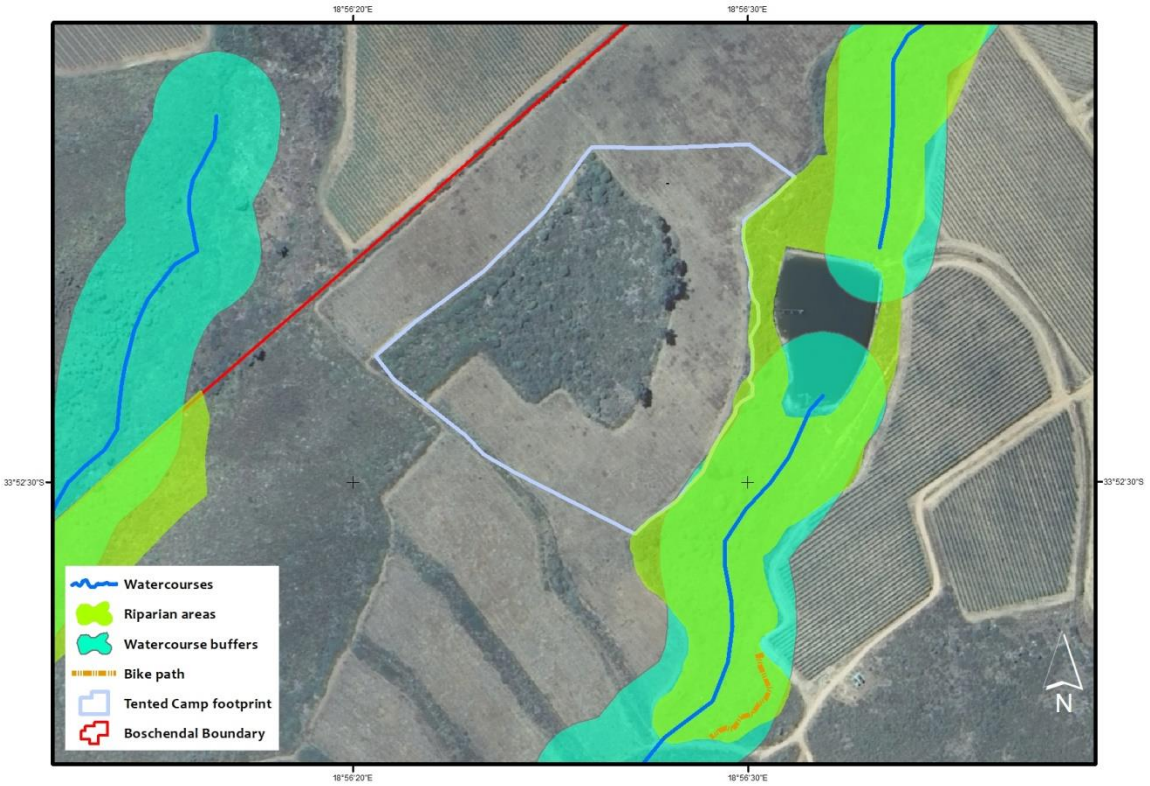

Figure 6.2 **Watercourses, riparian areas, and watercourse buffers delineated for the Boschendal Tented Camp site.**

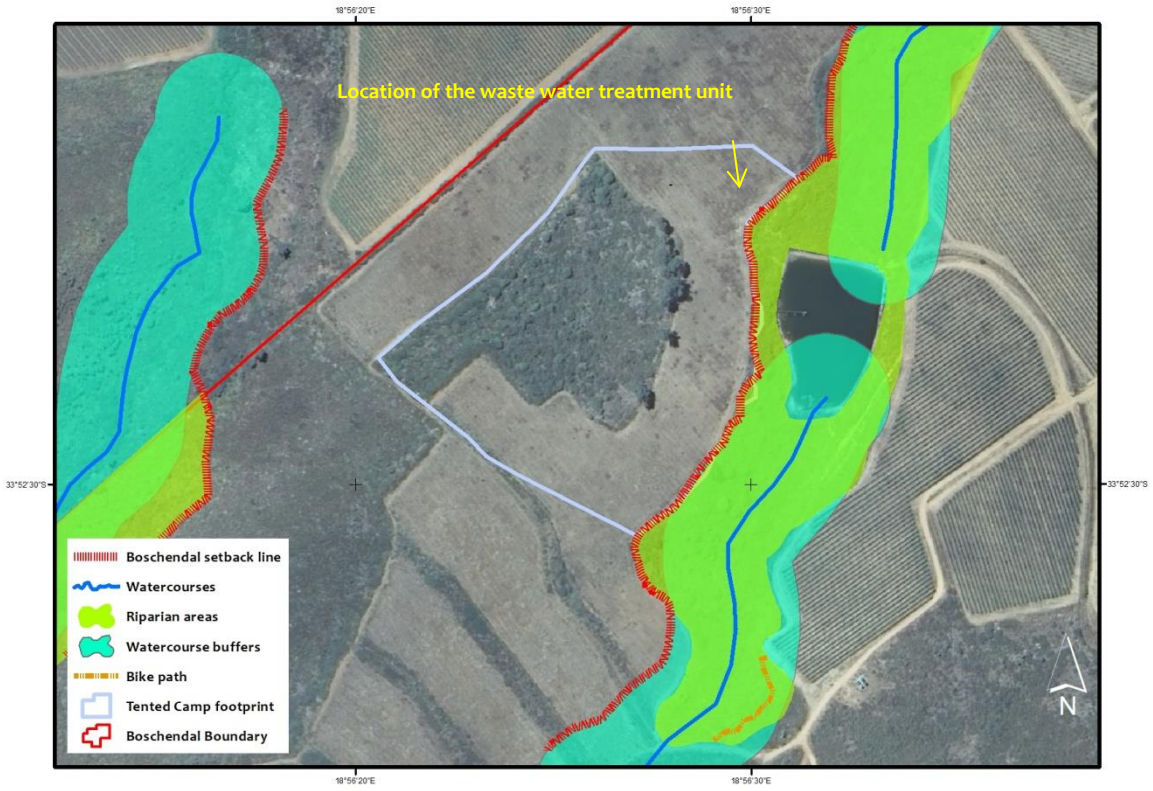

Figure 6.3 **Ecologically-based setback lines (red dashed lines) for the Tented Camp site.**

7 Environmental Impact Assessment

7.1 Description of the development

The Tented Camp development is considered to be a temporary development, as the structures and services will be dismantled in the future. The tents are placed on pre-cast concrete blocks that have been placed on top of the ground surface, for easy removal. All services are buried in shallow trenches and covered with rock and loose material, and will also be removed.

Services to and on the site include:

- Potable water from the farm reticulation system;
- Fire water from the farm system;
- Foul sewer reticulation to a set of Bio-Disks;
- Stormwater-surface discharge;
- Telecommunications;
- Electrical supply from the current Boschendal overhead reticulation system.

Only one layout was assessed – the existing layout – which was compared against the no development option. The assessment included impacts associated with construction and removal / demolition of the Camp, and the Operational Phase.

7.1.1 Potable water

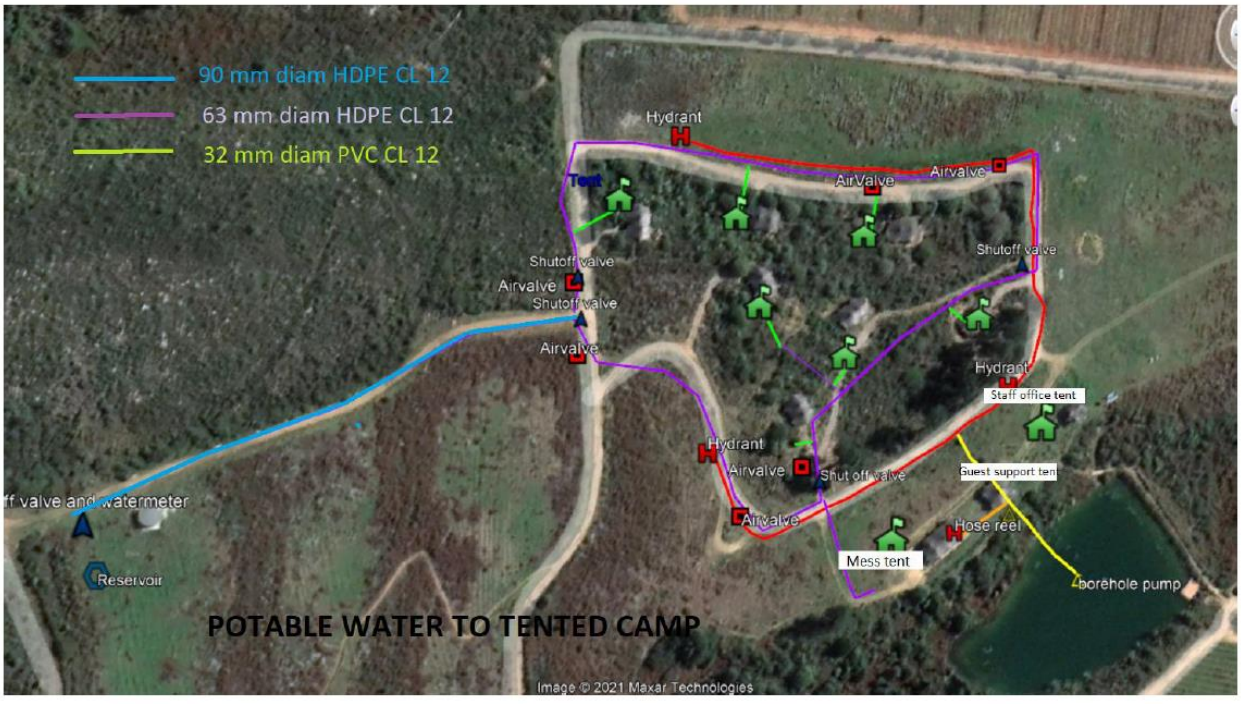

Figure 7.1 Potable water layout for the Tented Camp site.

Potable water is supplied from a reservoir some distance uphill of the site (at 413 mAMSL). A gravity supply line runs from the reservoir to the site, and then splits into the internal network (Figure 7.1). The reservoir and supply line were constructed for the development. Water is supplied to the reservoir from a natural spring close by, that provides a consistent supply of water throughout the year. An in-line aggregate filtration system and water purification system has been installed to improve water quality. A new in-line

ultra-violet water purification system will be installed prior to commissioning of the tented camp to ensure that regulated potable water standards are achieved.

A system of fire hydrants has been set up on the site, supplied by water pumped from the dam alongside the site.

7.1.2 Sewage system

There are three independent foul sewer disposal systems. All accommodation units including the mess tent are connected to a water-borne piped system that discharges into a Kingspan Bio-Disk sewage disposal unit. Each unit is connected to a 110mm diameter uPVC sewer main that flows under gravity flow to the Kingspan Bio-disk unit. The Bio-disk system treats sewage to General Limits,

The BioDisc domestic sewage treatment plant is based on a Rotational Biological Contactor. This allows for waste water to go through two stages of treatment, followed by two stages of settlement. Water is rotated and moved through the system with an electric motor. The chemical constituents of the effluent are shown in Table 7.1. While most of the constituents in the effluent are at low levels, the nitrates are higher than the levels required for General Limits, as contained in Schedule 2 of Government Notice 665 of 2013. The receiving environment, i.e. Stream 1, flows into the Berg River below its confluence with the Dwars River, so General Limits are acceptable, however, the nitrates are a concern.

It is recommended that the treated effluent be discharged to a soakaway below each treatment Unit. This will allow for additional treatment of the effluent before it is allowed to seep into the soil and, finally, the watercourse. The soakaway should be located outside of the ecological buffer around the riparian area. It is not recommended that the effluent be discharged directly into the watercourse, riparian area or the dam.

Figure 7.2 Sewer reticulation system at the Tented Camp site.

Figure 7.3 **Above ground component of the BioDisc domestic sewage treatment plant (BA model), located at the Tented Camp site.**

Table 7.1 **Chemical parameters of the treated effluent discharged to ground or a watercourse from the BioDisc treatment unit.**

Parameter	BioDisc effluent levels	General Limits (GN 665, September 2013)
pH	7.74	5.5 – 9.5
Conductivity	48.8 mS/m	70 mS/m above background receiving water, to a maximum of 150 mS/m
Nitrate as N	24 mg/litre	15 mg/litre
Phosphate	< 0.02 mg/litre	< 10 mg/litre
Ammonia as N	3.8 mg/litre	< 6 mg/litre
Suspended Solids	15 mg/litre	< 25 mg/litre
Chemical Oxygen Demand	59 mg/litre	75 mg/litre

7.1.3 Stormwater

There is no formal stormwater system for the Tented Camp site, and runoff from the tents, roads and hardened surface is to the ground, where it will filter into the soil.

7.2 Methods

The following impact assessment criteria were used to describe and assess the probable impacts associated with the Tented Camp development:

	Description
Impact	A description of the impact and/or risk to the water resource
Status of impact	Negative, positive or neutral
Extent of impact	Extent can be localised within the site boundary (**low**), widespread impact beyond the site boundary (**medium**), or widespread far beyond the site boundary and/or of regional or national importance (**high**).
Duration of impact	Impacts can be short-term and quickly reversible, i.e. 0 to 5 years (**low**), medium-term, i.e. 5 – 15 years, and reversible over time (**medium**) or long-term, causing permanent impact (**high**).
Probability of occurrence	Probability can be infrequent, or of low likelihood, with no known risk or vulnerability to natural or induced hazards (**low**), frequent, or possible, with low to medium risk (**medium**), or definite/highly likely (regardless of intervention measures), with a high risk or vulnerability to natural or induced hazards (**high**),
Intensity of the impact	Impact can cause minor change in species/habitat/ diversity or resource, no or very little quality deterioration (**low negative**), or partial loss of habitat/biodiversity/resource or slight alteration (**medium negative**), or loss of habitat/diversity or resource, severe alteration or disturbance of important processes (**high negative**). Positive impacts can range from minor improvement or restoration (**low positive**), to moderate improvement (**medium positive**) or substantial improvement (**high positive**).
Degree to which the impact may cause irreplaceable loss of resources	Project will destroy unique resources that cannot be replaced (High irreplaceability of resources) or the affected resource is easy to replace/rehabilitate.
Degree to which the impact can be reversed	Impacts are reversible at the end of the project life; or impacts are permanent and non-reversible.
Cumulative impact prior to mitigation	Impact resulting from the addition of impacts resulting from proposed development to the existing environmental state of the proposed site (existing and future resources' state, and/or impacts of other developments in the area). Can include direct and indirect impacts, as well as impacts ranging in various duration or geographical extent.
Significance rating of impact prior to mitigation	Product of duration, extent and intensity (see Table 7.2)
Degree to which the impact can be mitigated	Extent to which an impact can be mitigated on site.
Proposed mitigation	Mitigation measures proposed to reduce negative impacts, and enhance positive impacts.
Cumulative impact post mitigation	Cumulative impacts taking into account mitigation proposed above.
Significance rating of impact after mitigation	Product of duration, extent and intensity (see Table 7.2)

Table 7.2 Impact significance rating matrix, using impact duration, intensity and extent to assess significance.

Intensity = Low				
Duration	High			
	Medium			
	Low			
Intensity = Medium				
Duration	High			
	Medium			
	Low			
Intensity = High				
Duration	High			
	Medium			
	Low			
		Low	Medium	High
		Extent		

7.3 Description of probable impacts and mitigation measures

The following sections describe the impacts that are expected to affect the biodiversity and/or ecosystem functioning of Stream 1.

7.3.1 Construction (and demolition) phase

The following section describes the likely impacts associated with the construction and removal (or demolition) of the Tented Camp site.

Activity and *Impact*	**Mitigation measures**
Storage of building or demolition materials (sand, soil, bricks etc) in sensitive areas – this would *damage the soil structure, and would destroy or shade out plants growing in and around these ecosystems*. Dump areas frequently lead to the *compaction of soils*, which can influence re-growth of plants after construction.	• Ensure that all building and demolition materials and rubble are stored at least 50m away from the edge of the riparian area of Stream 1, **as demarcated prior to the activity.** Storage areas should be bunded adequately to prevent contaminated runoff from entering the watercourse. • Materials should be stored in piles that do not exceed 1.5m in height and should be protected from the wind (such as using shade-cloth), to prevent spread of fine materials across the site. • All natural areas that are to remain untransformed but that are impacted by the dumping of materials must be ripped and re-planted after construction is complete, to the satisfaction of the Environmental Control Officer (ECO).
Leakage of fuels, oils, etc. from construction machinery – this	• No mixing of concrete may occur close to (less than

Activity and *Impact*	Mitigation measures
would lead to *pollution of the watercourse or riparian area*.	50m from the riparian area) the stream. • Machinery prone to oil or fuel leakage must be located at least 50m away from the edge of the riparian area, and the area adequately bunded in order to contain leakages. • Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly. • Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities. These service areas must be maintained, and toilets emptied on at least a weekly basis.
Foot and vehicular traffic across the site, leading to *destruction or deterioration of aquatic habitat.* Access to the stream during construction or demolition will lead to *damage of soils, substrate (in the stream) and vegetatio*n. Regular use of a particular area for pathways will lead to the *compaction of soils*.	• Pathways and access roads for construction or demolition must avoid the stream and its riparian area. • The edge of the riparian area must be clearly demarcated and fenced off (using temporary fencing and danger tape) before any work or site preparation begins. These are no-go areas during the construction/demolition phase. • All impacted natural areas must be ripped and re-planted after the activity, to the satisfaction of the ECO.
Presence of construction/demolition teams and their machinery on site – this may lead to *noise and light pollution* in the area, which will *disturb aquatic and terrestrial fauna and flora*.	• If lights are used, these must be directed away from all sensitive areas. • The boundary of the riparian area must be clearly demarcated and fenced off (using temporary fencing and danger tape) before any work or site preparation begins. These are no-go areas during the construction/demolition phase.
Top soil or sand brought onto the site, for filling and landscaping can lead to the *introduction of alien or invasive seedbanks*.	• Top soil and sand brought onto the site should be inspected for seedlings throughout construction. Seedlings must be removed regularly. • Constant monitoring of the construction/demolition site by the Site Engineer and ECO must occur, and all alien plant species removed from or destroyed on the site.
Disturbance of soils and vegetation as a result of removal of tents and infrastructure This may lead to a loss of biodiversity and invasion by IAPs 9In disturbed soils), and possibly erosion of bare areas.	• All impacted areas on the Tented Camp site and areas impacted by the associated infrastructure must be rehabilitated once the Camp has been removed. • A rehabilitation plan must be compiled with input from a terrestrial and freshwater ecologist.

7.3.2 Operational phase

The activities (underlined), impacts (in italics) and mitigation measures associated with the operational phase are detailed in the table below.

Activity and *Impact*	Mitigation measures
Stormwater discharge into natural areas – water quality impacts A *decrease in water quality* can follow from discharge of residential *stormwater runoff* into natural areas. Residential	• New hardened surfaces (impermeable) must be limited to the developable area outside the stream's riparian area (i.e. outside the ecological buffer). • Pathways through the stream's riparian area must

Activity and *Impact*	Mitigation measures
stormwater is unlikely to be heavily polluted on the Tented Camp site, but can contain oil and petrol from vehicles, and of nutrients such as nitrates and phosphates from soaps, cleaning agents or fertilizers. These nutrients can lead to the proliferation of algae in aquatic ecosystems, which can be problematic and unsightly. This impact is likely to impact both the site area and any downstream areas should this polluted water leave the property.	be permeable. • No fertilizer may be used on the site. • Soaps and cleaning agents must be environmentally friendly brands. • All hardened areas within the site should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bio-retention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and entering the stormwater system.
<u>Stormwater discharge into natural areas – water quantity impacts</u> Any hardened surfaces on the Tented camp site will lead to *changes in water inputs and flow patterns*, as there will be an *increase in the quantity* of stormwater runoff exiting the developed footprint as opposed to filtering into the ground. Flow patterns will also be impacted, as *flood peaks will be increased in volume as well as frequency*. Discharge of stormwater into the seasonal stream may lead to a *loss of habitat quality*, as the stream will be inundated for longer and will *lose its seasonal character*.	• Effort should be made to minimise the hardening of surfaces across the whole site. Natural areas, gardens and road verges are areas where water can filter into the ground. • New hardened surfaces (impermeable) must be limited to the developable area outside the ecological buffers. • Stormwater should not be conveyed directly (e.g. by pipe or drain) into the stream but must flow along unlined swales, permeable areas, and bioswales. • Parking areas should preferably be constructed using permeable materials to allow for infiltration of water. • As a principle, hardened areas should be associated (where possible) with vegetated filter strips (broad, sloped vegetated areas that accept shallow runoff from hardened surfaces), bioswales (landscaped areas that are designed to remove silt and a number of pollutants from runoff, through ensuring that water flows slowly along these gently sloping (<6% slope) features, often planted with grass or other plant species, mulch or riprap), and / or bio-retention systems (vegetated areas where runoff is filtered through a filter media layer, e.g. sand, as it percolates downwards), all of which are designed to reduce the quantity of runoff leaving a hardened surface and entering the stormwater system.
<u>On-site treatment and/or storage of waste water.</u> The risks associated with this approach are: *contamination of soils, groundwater and the stream* from leaks or overflow from pipelines, and the BioDisc domestic sewage treatment plant; or contamination from discharge of treated effluent directly into the watercourse, or use of treated waste water for irrigation. The parameter of concern is **nitrates**, which would be discharged from the Unit at higher concentration than is acceptable for discharge to the watercourse (General Limit).	• Waste water conveyance, storage or treatment infrastructure must be placed outside of the delineated ecological buffers. • All sewage storage facilities must be regularly checked for leaks and overflow. • Nitrate levels must be monitored regularly (every 2-3 months) and the recycle stages adapted to ensure that levels are within General Limits. • The area immediately around the treatment Units should be protected with a berm, which would catch surface water flowing out of any of the

Activity and *Impact*	Mitigation measures
	components. • Treated waste water should be directed to a soakaway downslope of each Unit, and not discharged to the stream, or used for irrigation on the site.
Proximity of tents and human activity to the stream. This may lead to local *disturbance of fauna and flora*, through noise, light, trampling, etc. Fauna may move away from the site.	• Lighting should face away from the stream. • Visitors should be discouraged from walking on the bed and banks of the stream, and into the wetter areas, through construction of walkways and benches, guiding visitors to use specific pathways and areas. • Bicycle paths through the riparian area around the stream must be limited, and no new paths constructed. • All pathways must be regularly checked for signs of erosion, and stabilised or re-routed should this occur.
Clearing of vegetation and disturbance of soils for maintenance/landscaping/gardening *Clearing of indigenous vegetation* would lead to a loss of plant and animal diversity. *Alien or invasive seeds and seedlings may be transported onto site* during ongoing landscaping/gardening. Alien vegetation is well adapted to establishing on previously disturbed soils and road verges. This may lead to a further loss of habitat quality, and increase in water uptake through transpiration.	• No additional clearing of indigenous vegetation (i.e. post construction) should be permitted. • Eco-logs should be placed in areas that are bare of vegetation or that are being rehabilitated, in order to trap sediment, water and seeds. • Landscaping requiring ongoing maintenance around the tents must be kept to a minimum, especially within the ecological buffers. • No kikuyu grass is allowed anywhere on site. • The spread of alien plant species into all natural areas must be prevented and monitored. • Road verges must be monitored for alien species, especially grasses.

7.3.3 Cumulative impacts

The cumulative impacts of most concern in this area are:

- Loss of open space, through catchment hardening;
- Loss or fragmentation of riverine or wetland habitat, as a result of encroachment into ecosystems and/or their ecological buffers;
- Deterioration in water quality, from discharge of stormwater or treated waste water into natural areas and ecosystems.

The following activities could impact negatively on the resource quality of the watercourses on Boschendal Estate, and downstream:

- Discharge of treated waste water from package units, and untreated stormwater runoff into the riparian areas, wetlands or watercourses;
- Clearing of vegetation for preparation of construction sites, and for landscaping, and for operational maintenance of infrastructure;
- Maintenance of gravel roads, tracks and boardwalks;
- Proximity of developments to sensitive areas, resulting in the disturbance of fauna and flora through noise and light pollution, and trampling / cycling.

7.4 Assessment of impacts

7.4.1 Construction (and demolition) phase

Although the Tented Camp site has already been constructed, the following impacts are assumed to have been likely to occur. This section also deals with the impacts associated with removal of the camp. There are no construction or demolition impacts associated with the No-go alternative.

	Tented Camp
Potential impact and risk	Storage of building or demolition materials (sand, soil, bricks etc) in or close to sensitive areas – this would damage the soil structure, and would destroy or shade out plants growing in and around these ecosystems. Dump areas frequently lead to the compaction of soils, which can influence re-growth of plants.
Status of impact	Negative
Extent of impact	Site (low)
Duration of impact	Short-term
Consequence of impact or risk	This would lead to deterioration in ecological condition, or possibly permanent loss of natural habitat.
Probability of occurrence	Improbable
Intensity of the impact	Medium negative
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss
Degree to which the impact can be reversed	Fully reversible
Cumulative impact prior to mitigation	Low
Significance rating of impact prior to mitigation	Low negative
Degree to which the impact can be avoided	High
Degree to which the impact can be managed	High
Degree to which the impact can be mitigated	High
Proposed mitigation:	Store materials at least 50 m away from any sensitive areas in bunded areas. Protect piles (must be less than 1.5m high) of soil and other fine material, such as using shade-cloth. Rehabilitate sensitive areas that are impacted by this activity.
Cumulative impact post mitigation	No impact
Significance rating of impact after mitigation	No impact

	Tented Camp
Potential impact and risk	Leakage or spillage of fuels, oils, etc. from construction / demolition machinery – this would lead to pollution of the stream.
Status of impact	Negative
Extent of impact	Downstream (medium)
Duration of impact	Short-term
Consequence of impact or risk	This would lead to deterioration in ecological condition.
Probability of occurrence	Probable
Intensity of the impact	Medium negative
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss
Degree to which the impact can be reversed	Partly reversible

	Tented Camp
Cumulative impact prior to mitigation	Medium negative
Significance rating of impact prior to mitigation	Medium negative
Degree to which the impact can be avoided	High
Degree to which the impact can be managed	High
Degree to which the impact can be mitigated	High
Proposed mitigation	No mixing of concrete may occur close to (less than 50m from the riparian area) the stream. Machinery prone to oil or fuel leakage must be located at least 50m away from the edge of the riparian area, and the area adequately bunded in order to contain leakages. Water pumps and cement mixers shall have drip trays to contain oil and fuel leaks – these must be cleaned regularly. Suitable toilet and wash facilities must be provided to avoid the use of sensitive areas for these activities. These service areas must be maintained, and toilets emptied on at least a weekly basis.
Cumulative impact post mitigation	Low negative
Significance rating of impact after mitigation	Low negative

	Tented Camp
Potential impact and risk	Foot and vehicular traffic across the site, leading to destruction or deterioration of freshwater habitat.
Status of impact	Negative
Extent of impact	Site (low)
Duration of impact	Short -term
Consequence of impact or risk	This would lead to deterioration in ecological condition or possible loss of wetland or river habitat.
Probability of occurrence	Improbable
Intensity of the impact	Low
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss
Degree to which the impact can be reversed	Fully reversible
Cumulative impact prior to mitigation	Low negative
Significance rating of impact prior to mitigation	Low negative
Degree to which the impact can be avoided	High
Degree to which the impact can be managed	High
Degree to which the impact can be mitigated	High
Proposed mitigation	Pathways and access roads for construction or demolition must avoid the stream and its riparian area. The edge of the riparian area must be clearly demarcated and fenced off (using temporary fencing and danger tape) before any work or site preparation begins. These are no-go areas during the construction/demolition phase. All impacted natural areas must be ripped and re-planted after the activity, to the satisfaction of the ECO.
Cumulative impact post mitigation	No impact
Significance rating of impact after mitigation	No impact

	Tented Camp
Potential impact and risk	Presence of construction / demolition teams and their machinery on site –

	Tented Camp
	this may lead to noise and light pollution in the area, which will disturb aquatic and terrestrial fauna and flora.
Status of impact	Negative
Extent of impact	Site (low)
Duration of impact	Short -term
Consequence of impact or risk	This would lead to the deterioration in condition of aquatic habitat and the consequent movement of flora and fauna away from the site.
Probability of occurrence	Probable
Intensity of the impact	Medium
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss
Degree to which the impact can be reversed	Partly reversible
Cumulative impact prior to mitigation	Medium negative
Significance rating of impact prior to mitigation	Low negative
Degree to which the impact can be avoided	Medium
Degree to which the impact can be managed	Medium
Degree to which the impact can be mitigated	Medium
Proposed mitigation	If lights are used, these must be directed away from all sensitive areas. The boundary of the riparian area must be clearly demarcated and fenced off (using temporary fencing and danger tape) before any work or site preparation begins. These are no-go areas during the construction/demolition phase.
Cumulative impact post mitigation	Low negative
Significance rating of impact after mitigation	Low negative

	Tented Camp
Potential impact and risk	Top soil or sand brought onto the site, for filling and landscaping can lead to the introduction of alien or invasive seedbanks.
Status of impact	Negative
Extent of impact	Whole Estate and downstream (medium)
Duration of impact	Medium-term
Consequence of impact or risk	This would lead to the deterioration in condition of aquatic habitat and loss of water through higher transpiration rates of IAPs, compared to most fynbos species.
Probability of occurrence	Probable
Intensity of the impact	Medium
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss
Degree to which the impact can be reversed	Fully reversible
Cumulative impact prior to mitigation	Medium negative
Significance rating of impact prior to mitigation	Medium negative
Degree to which the impact can be avoided	Medium
Degree to which the impact can be managed	High
Degree to which the impact can be mitigated	High
Proposed mitigation	Top soil and sand brought onto the site should be inspected for seedlings throughout construction. Seedlings must be removed regularly. Constant

	Tented Camp
	monitoring of the construction/demolition site by the Site Engineer and ECO must occur, and all alien plant species removed from or destroyed on the site.
Cumulative impact post mitigation	Low negative
Significance rating of impact after mitigation	Low negative (possibly even low positive, if IAPs are consistently removed from the site)

	Tented Camp
Potential impact and risk	Disturbance of soils and vegetation as a result of removal of tents and infrastructure
Status of impact	Negative
Extent of impact	Site
Duration of impact	Short- to medium-term
Consequence of impact or risk	Loss of biodiversity and invasion by IAPs, and possibly erosion of bare areas.
Probability of occurrence	Definite
Intensity of the impact	Medium
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss
Degree to which the impact can be reversed	Medium to high
Cumulative impact prior to mitigation	Medium negative
Significance rating of impact prior to mitigation	Medium negative
Degree to which the impact can be avoided	Low
Degree to which the impact can be managed	High
Degree to which the impact can be mitigated	High
Proposed mitigation	All impacted areas on the Tented Camp site and areas impacted by the associated infrastructure must be rehabilitated once the Camp has been removed. **A rehabilitation plan must be compiled with input from a terrestrial and freshwater ecologist**.
Cumulative impact post mitigation	No impact
Significance rating of impact after mitigation	No impact, to low positive significance (depending on the success of rehabilitation)

7.4.2 Operational phase

	Tented Camp	No go
Potential impact and risk	Stormwater discharge into natural areas – water quality impacts.	
Status of impact	Negative	Negative
Extent of impact	Site and downstream (medium)	Site and downstream (medium)
Duration of impact	Long-term	Long-term
Consequence of impact or risk	May lead to pollution of soil, rivers and groundwater.	
Probability of occurrence	Probable	Highly improbable
Intensity of the impact	Low	Low

	Tented Camp	No go
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss	Marginal loss
Degree to which the impact can be reversed	Partly reversible	Partly reversible
Cumulative impact prior to mitigation	Medium negative	No impact
Significance rating of impact prior to mitigation	Medium negative	No impact
Degree to which the impact can be avoided	Medium to high	n/a
Degree to which the impact can be managed	High	n/a
Degree to which the impact can be mitigated	High	n/a
Proposed mitigation	New hardened surfaces (impermeable) must be limited to the developable area outside the stream's riparian area (i.e. outside the ecological buffer). Pathways through the stream's riparian area must be permeable. No fertilizer may be used on the site. Soaps and cleaning agents must be environmentally friendly brands. Runoff from hardened surfaces must be allowed to filter into the soil.	n/a
Cumulative impact post mitigation	Low negative	No impact
Significance rating of impact after mitigation	Low negative	No impact

	Tented Camp	No go
Potential impact and risk	Stormwater discharge into natural areas – water quantity impacts.	
Status of impact	Negative	Negative
Extent of impact	Site and downstream (medium)	Site and downstream (medium)
Duration of impact	Long-term	Long-term
Consequence of impact or risk	May lead to change in hydrological patterns in the watercourse and groundwater.	
Probability of occurrence	Probable	Highly improbable
Intensity of the impact	Low	Low
Degree to which the impact may cause irreplaceable loss of resources	Marginal loss	Marginal loss
Degree to which the impact can be reversed	Partly reversible	Partly reversible
Cumulative impact	Medium negative	No impact

	Tented Camp	No go
prior to mitigation		
Significance rating of impact prior to mitigation	Medium negative	No impact
Degree to which the impact can be avoided	Medium to high	n/a
Degree to which the impact can be managed	High	n/a
Degree to which the impact can be mitigated	High	n/a
Proposed mitigation	Effort should be made to minimise the hardening of surfaces across the whole site. Natural areas, gardens and road verges are areas where water can filter into the ground. New hardened surfaces (impermeable) must be limited to the developable area outside the ecological buffers. Stormwater should not be conveyed directly (e.g. by pipe or drain) into the stream but must flow along unlined swales, permeable areas, and bioswales. Parking areas should preferably be constructed using permeable materials to allow for infiltration of water.	n/a
Cumulative impact post mitigation	Low negative	No impact
Significance rating of impact after mitigation	Low negative	No impact

	Tented Camp	No go
Potential impact and risk	On-site treatment and/or storage of waste water – impacts on water quality	
Status of impact	Negative	n/a
Extent of impact	Site and downstream (medium)	n/a
Duration of impact	Long-term	n/a
Consequence of impact or risk	May lead to contamination of soils, groundwater and aquatic ecosystems.	
Probability of occurrence	Probable	n/a
Intensity of the impact	Medium	n/a
Degree to which the impact may cause irreplaceable loss of resources	Significant loss	n/a
Degree to which the impact can be reversed	Partly reversible	n/a
Cumulative impact prior to mitigation	Medium negative	n/a
Significance rating of impact prior to mitigation	Medium negative	n/a
Degree to which the impact can be avoided	Medium to high	n/a
Degree to which the impact can be	High	n/a

	Tented Camp	No go
managed		
Degree to which the impact can be mitigated	Medium	n/a
Proposed mitigation	Waste water conveyance, storage or treatment infrastructure must be placed outside of the delineated ecological buffers. All sewage storage facilities must be regularly checked for leaks and overflow. Nitrate levels must be monitored regularly (every 2- 3 months) and the recycle stages adapted to ensure that levels are within General Limits.The area immediately around the treatment Units should be protected with a berm, which would catch surface water flowing out of any of the components. Treated waste water should be directed to a soakaway downslope of each Unit, and not discharged to the stream, or used for irrigation on the site.	n/a
Cumulative impact post mitigation	Low negative	No impact
Significance rating of impact after mitigation	Low negative	No impact

	Tented Camp	No go
Potential impact and risk	Proximity of tents and human activity to the stream.	Proximity of bike paths to the stream.
Status of impact	Negative	Negative
Extent of impact	Site (low)	Site (low)
Duration of impact	Long-term	Long-term
Consequence of impact or risk	This may lead to local disturbance of fauna and flora, through noise, light, trampling, etc. Fauna may move away from the site.	
Probability of occurrence	Probable	Probable
Intensity of the impact	Low	Low
Degree to which the impact may cause irreplaceable loss of resources	Significant loss	Significant loss
Degree to which the impact can be reversed	Fully reversible	Fully reversible
Cumulative impact prior to mitigation	Medium negative	Low negative
Significance rating of impact prior to mitigation	Medium negative	Low negative
Degree to which the impact can be avoided	Medium to high	High
Degree to which the impact can be managed	High	High
Degree to which the impact can be mitigated	High	High
Proposed mitigation	Lighting should face away from the stream. Visitors should be discouraged from walking on the bed and banks of the stream, and into the wetter areas, through construction of	Bicycle paths through the riparian area around the stream must be limited, and no new paths

	Tented Camp	No go
	walkways and benches, guiding visitors to use specific pathways and areas. Bicycle paths through the riparian area around the stream must be limited, and no new paths constructed. All pathways must be regularly checked for signs of erosion, and stabilised or re-routed should this occur.	constructed. All pathways must be regularly checked for signs of erosion, and stabilised or re-routed should this occur.
Cumulative impact post mitigation	Low negative	No impact
Significance rating of impact after mitigation	Low negative	No impact

	Tented Camp	No go
Potential impact and risk	Clearing of vegetation and disturbance of soils for maintenance/landscaping/gardening and disturbance of soils for landscaping/gardening	
Status of impact	Negative	n/a
Extent of impact	Site and downstream (medium)	n/a
Duration of impact	Long-term	n/a
Consequence of impact or risk	Loss of biodiversity. Alien or invasive seeds and seedlings may be transported onto site during ongoing landscaping/gardening. This may lead to a loss of habitat quality, and increase in water uptake through transpiration.	
Probability of occurrence	Probable	n/a
Intensity of the impact	Medium	n/a
Degree to which the impact may cause irreplaceable loss of resources	Significant loss	n/a
Degree to which the impact can be reversed	Fully reversible	n/a
Cumulative impact prior to mitigation	Medium negative	n/a
Significance rating of impact prior to mitigation	Medium negative	n/a
Degree to which the impact can be avoided	Medium to high	n/a
Degree to which the impact can be managed	High	n/a
Degree to which the impact can be mitigated	High	n/a
Proposed mitigation	Clearing of indigenous vegetation should not be permitted. Eco-logs should be placed in areas that are bare of vegetation or that are being rehabilitated, in order to trap sediment, water and seeds. Landscaping requiring ongoing maintenance around the tents must be kept to a minimum, especially within the ecological buffers. No kikuyu grass is allowed anywhere on site. The spread of alien plant species into all natural areas must be prevented and monitored. Road verges must be monitored for alien species, especially grasses.	n/a
Cumulative impact post mitigation	Low negative	n/a
Significance rating of impact after mitigation	Low negative	n/a

8 Water use authorisation

8.1 Water uses

The construction and operation of the Tented Camp and the associated infrastructure may have an impact on the bed and banks of and flow in Stream 1, thus triggering non-consumptive water uses in terms of Section 21 of the National Water Act (NWA, 1998). Such water uses apply within the NWA regulatory zone, as discussed in Section 6.1.

Non-consumptive water uses include:

a. Taking water from a water resource;

b. Storing water;

c. Impeding or diverting the flow of water in a watercourse;

d. Engaging in a stream flow reduction activity;

e. Engaging in a controlled activity identified and declared as such in terms of the Act;

f. Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

g. Disposing of waste in a manner which may detrimentally impact on a water resource;

h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

i. Altering the bed, banks, course or characteristics of a watercourse;

j. Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

k. Using water for recreational purposes.

The process to be followed to obtain authorisation for these categories of water use is different for each water use, and relates to the **risk** associated with the water use. The General Authorisation (GA) in terms of Section 39 of the Water Act (1998) provided in Notice 509 of 2016 (GN 40229 of 26th August 2016) provides guidance and the conditions of authorisation regarding impeding and diverting the flow in a watercourse (Section 21 (c)), or altering the bed, banks, course and characteristics of a watercourse (Section 21 (i)). The recent amendment of the Section 21 (c) and (i) GA introduced a risk assessment matrix that allows for the determination of the level of risk associated with any given activity. Low risk water uses are **generally authorised**, requiring registration of the water use only, while activities with a moderate to high level of risk to the water resource require a full water use licence application.

8.2 Risk assessment matrix

The risk assessment matrix introduced in August 2016 adopts an approach similar to the EIA regulations, where each impact is assessed in terms of severity, likelihood and consequence. The matrix requires the assessment of each activity associated with the construction and operation of any development project in terms of the impacts expected to affect resource quality characteristics (flow regime, water quality, geomorphology, and habitat/biota) of watercourses and wetlands. Each impact is scored in terms of the

severity of its effect on each of the resource quality characteristics, and the scores are then averaged to give a total for severity. Each impact is then scored in terms of its:

- **Consequence**, which is the product of the severity of the impact, the spatial scale or extent, and the duration of the impact; and
- **Likelihood**, which is the sum of the frequency of the activity, frequency of the impact, existence of legislation governing the activity and ecosystem; and the *ease of detection* of the impact.

The significance of the impact is calculated as the product of its consequence and likelihood. The final score is used to assign a risk rating to the impact (see Table 8.1), **assuming implementation of effective mitigation measures as outlined in the Appendix**.

Table 8.1 Rating Classes for the Risk Assessment.

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 notably 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.

8.3 Results of risk assessment

The full risk assessment matrix is provided in the Appendix, along with the mitigation measures required to reduce the risks to the levels assessed. All risks can be reduced to low, **assuming all recommended mitigation measures are implemented**.

9 CONCLUSIONS

The Boschendal Estate comprises a network of watercourses and wetlands, ranging from pristine systems, to canalised drainage lines. The closer these ecosystems are to the unimpacted mountain slopes, the more pristine their condition. All of these ecosystems are important to the biota inhabiting this area, as they provide fresh water, habitat, food, nesting sites and protection to aquatic and semi-aquatic animals and plants. In addition, these ecosystems provide unique opportunities for developers of the Estate to combine natural, healthy areas with tourism facilities.

The Tented Camp site is located adjacent to a seasonal stream, named "Stream 1" in an earlier study (Snaddon, 2019). Stream 1 flows into the Werda River and then, ultimately, the Berg River, in quaternary catchment G10C. The sub-quaternary sub-catchment in which the Tented Camp site lies is not a freshwater priority area, while the riparian area around Stream 1 has been identified as an Ecological Support Area. Stream 1 itself was assessed as being in pristine condition above the farm dam adjacent to the site, deteriorating to moderate condition below the dam. In terms of ecological importance and sensitivity, the quality of the habitat is such that the stream will support populations of unique species that are sensitive to changes in water quantity and quality. The stream is an important refuge for species, and provides essential ecological corridors in a highly transformed, cultivated landscape.

The Tented Camp development is considered to be a temporary development, as the structures and services will be dismantled in the near future. The tents are placed on pre-cast concrete blocks that have been placed on top of the ground surface, for easy removal. All services are buried in shallow trenches and covered with rock and loose material, and will also be removed.

Services to and on the site include:

- Potable water from the farm reticulation system;
- Fire water from the farm system;
- Foul sewer reticulation to a set of Bio-Disks;
- Stormwater-surface discharge;
- Telecommunications;
- Electrical supply from the current Boschendal overhead reticulation system.

Only one layout was assessed – the existing layout – which was compared against the no development option. The assessment included impacts associated with construction and removal / demolition of the Camp, and the operational phase.

Impacts relating to the construction and eventual removal of the Tented Camp infrastructure were all assessed as being, at worst, of low negative significance, if the mitigation measures recommended in this report are implemented. Due to the fact that most of the infrastructure has been put in place, it was possible to visit the site and assess whether site construction has had an unexpectedly high impact on Stream 1 and its riparian area. It was noted on a site visit on 23 September 2021 that there are few residual impacts post-construction. It is important that the mitigation measures recommended for the demolition / removal phase are implemented, in order to maintain this low level of negative impact on the site.

The removal of the Camp must be guided by a rehabilitation plan for the site, compiled with input from a terrestrial and freshwater ecologist. All impacted areas on the site, and areas impacted by infrastructure, must be rehabilitated – at the very least, ripped and re-vegetated – in order to ensure that the site is not invaded by pioneer IAPs, with possible erosion of bare areas.

With regards to the operational phase, the impacts of concern are the discharge of treated waste from the BioDisc Treatment Units, and the possible introduction of invasive alien plants (IAPs) into disturbed areas of

the site through landscaping, gardening or clearing of vegetation during maintenance activities. The effluent discharged from the BioDisc Treatment Units are expected to be of acceptable quality (i.e. within General Limits), with the exception of nitrate levels. Nitrate levels must be regularly monitored (every 2 – 3 months) and the recycling stages adapted to ensure that the nitrate levels are within acceptable limits. In order to avoid any negative impacts on Stream 1, it is recommended that soakaways be installed downslope of each Unit, to encourage local filtration of treated effluent into the soil rather than allowing it to flow into the stream.

No new cycle paths should be located in the riparian area of Stream 1. Bare areas around the site should be stabilised with eco-logs, and re-vegetated with appropriate plant species.

Assuming that all mitigation measures are implemented, all operational phase impacts are, at most, of low negative significance, and the development is acceptable from a freshwater ecological perspective. The development poses only a low risk to Stream 1 and thus, the water use authorisation for the development should be generally authorised.

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Appendix: Risk assessment matrix for Stream 1 adjacent to the Tented Camp site

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

NAME and REGISTRATION No of SACNASP Professional member: …Kate Snaddon…….. Reg no. …… 400225/06……

Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

No.	Phases	Activity	Aspect	Impact	Severity				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
					Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota														
1	Construction	Construction activities in or close to the watercourse and riparian area	Storage or dumping of building / landscaping materials in close proximity to the	Compaction of soils; movement of building materials (sand, rubble, etc) into the riparian area	1	1	1	1	1	1	2	4	2	1	5	1	9	**36**	L	80	Ensure that materials are stored at least 50m away from the edge of the riparian area	PES is **Category A**; EIS is **high.**
			Leakage of fuels, oils, etc. from construction machinery.	Pollution of sensitive areas, deterioration in water quality	0	1	1	1	0.75	1	2	3.75	1	1	1	2	5	**18.75**	L	80	Ensure that machinery is bunded, and located at least 50m away from the riparian area.	
			Pedestrian access onto and around the construction site	Trampling of sensitive habitat; noise and light pollution; introduction and spread of alien invasive species	1	0	1	0	0.5	1	2	3.5	2	1	5	2	10	**35**	L	80	Demarcate the ecological buffer and ensure that construction activities remain outside of this area. The construction site must be monitored for the spread of IAPs.	
				Pollution of sensitive areas from human waste, deterioration in water quality	0	1	0	1	0.5	1	2	3.5	4	2	1	3	10	**35**	L	80	Ensure that toilets are provided and used by construction workers. If waste is found, it must be removed immediately and disposed of.	
2	Operational	Stormwater management	Discharge of stormwater runoff into riparian area and watercourse	Altered hydrology and water quality	1	1	0	1	0.75	2	3	5.75	2	1	1	3	7	**40.25**	L	50	A stable berm should be constructed, directing all stormwater runoff that runs towards the river, away from the riparian area and watercourse. Due to the lack of hardened surfaces across the site, it is unlikely that volumes will be substantial. Stormwater runoff should be allowed to flow as diffuse flow over the vegetation lying downslope of the tents, and well away from the waste water treatment unit.	
		Proximity of development to sensitive areas	Disturbance (noise, light) of fauna and flora	Loss of biodiversity	0	0	1	1	0.5	1	3	4.5	4	1	1	4	10	**45**	L	50	Ensure that lighting is directed away from the river, and that access into the riverine corridor is limited to existing pathways and tracks.	
		Clearing of vegetation (site/road maintenance, bike tracks, etc)	Damage or removal of vegetation	Loss of biodiversity; compaction of soils; loss of covering vegetation	0	0	1	1	0.5	1	3	4.5	2	1	5	3	11	**49.5**	L	50	Clearing of indigenous vegetation shouold not be permitted. Eco-logs should be placed in areas that are bare of vegetation or that are being rehabilitated, in order to trap sediment, water and seeds. The bike track in the riparian vegetation should be removed and rehabilitated.	
		Waste water management	Discharge of treated waste water into the riparian area or watercourse, or groundwater	Pollution of sensitive areas, deterioration in water quality	1	1	0	1	0.75	2	3	5.75	4	1	1	3	9	**51.75**	L	50	All waste water infrastructure must be placed outside of the delineated ecological buffers. All sewage storage facilities must be regularly checked for leaks and overflow. Nitrate levels must be monitored regularly (every 2- 3 months) and the recycle stages adapted to ensure that levels are within General Limits. The area immediately around the treatment Units should be protected with a berm, which would catch surface water flowing out of any of the components. Treated waste water should be directed to a soakaway downslope of each Unit, and not discharged to the stream, or used for irrigation on the site.	