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# Proposed Sheep Feedlot on Portion 1/177 Vrolykheid, Prince Albert, Western Cape.

## Aquatic Biodiversity Impact Assessment Report



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## GLOSSARY

<b>Buffer</b>	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted to reduce the impact of adjacent land uses on the wetland or riparian area. Buffers are land use specific and are calculated for the specific environmental context and proposed land use.
<b>Characteristics of a watercourse</b>	Means the resource quality of watercourse within the extent of a watercourse.
<b>Construction</b>	Means any works undertaken to initiate or establish activities, site preparation including vegetation removal and ground levelling that may result in impeding or diverting or modifying resource quality.
<b>Delineation of a wetland or riparian habitat</b>	Means delineation of wetlands and riparian habitat according to the methodology as contained in the Department of Water Affairs and Forestry, 2008 publication: A Practical Field Procedure for Delineation of Wetlands and Riparian Areas or amended version.
<b>Diverting</b>	Means to, in any manner, cause the instream flow of water to be rerouted temporarily or permanently.
<b>Flow-altering</b>	Means to, in any manner, alter the instream flow route, speed or quantity of water temporarily or permanently.
<b>Impeding</b>	Means to, in any manner, hinder or obstruct the instream flow of water temporarily or permanently.
<b>Regulated area of a watercourse</b>	<ul style="list-style-type: none"> <li>a) The outer edge of the 1 in 100-year flood line or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, dams and lakes.</li> <li>b) In the absence of a determined 1 in 100-year flood line or riparian area as contemplated in (a) above the area within 100m of distance from the edge of a watercourse where the edge of the watercourse (excluding floodplains) is the first identifiable annual bank fill flood bench.</li> <li>c) In respect of a wetland: a 500m radius around the delineated boundary (extent) of any wetland (including pans).</li> </ul>
<b>Rehabilitation</b>	Means the process of reinstating natural ecological driving forces within part or whole of a degraded watercourse to recover former or desired ecosystem structure, function, biotic composition and associated ecosystem services.
<b>Resource quality</b>	Of a watercourse means the quality of all the aspects of a water resource including: <ul style="list-style-type: none"> <li>(a) The quantity, pattern, timing, water level and assurance of instream flow;</li> <li>(b) The water quality, including the physical, chemical and biological characteristics of the water;</li> <li>(c) The character and condition of the instream and riparian habitat, and;</li> <li>(d) The characteristics, condition and distribution of the aquatic biota.</li> </ul>
<b>Site Assessment</b>	Comprehensive evaluation of the proposed development site, including the identification of wetlands, watercourses, and soil characteristics.
<b>Topography</b>	The physical features of the land surface, considered for its potential influence on drainage and ecological features.
<b>Vadose Zone</b>	Extends from the top of the ground surface to the water table. Also known as the unsaturated zone.

## ABBREVIATIONS

<b>CBA:</b>	Critical Biodiversity Area
<b>CD:NGI:</b>	Chief Directorate: National Geo-spatial Information
<b>CR:</b>	Critical Endangered
<b>DFFE:</b>	Department of Environment, Forestry and Fisheries
<b>DWAF:</b>	Department of Water Affairs and Forestry
<b>DWS:</b>	Department of Water & Sanitation
<b>EIS:</b>	Ecological Importance and Sensitivity
<b>ESA:</b>	Ecological Support Area
<b>FEPA:</b>	Freshwater Ecosystem Priority Area
<b>GA:</b>	General Authorisation
<b>GPS:</b>	Global Positioning System
<b>NEMA:</b>	National Environmental Management Act
<b>NFEPA:</b>	National Freshwater Ecosystem Priority Areas
<b>NWA:</b>	National Water Act
<b>NWM5:</b>	National Wetland Map 5
<b>PES:</b>	Present Ecological State
<b>SACNASP:</b>	South African Council for Natural Scientific Professions
<b>SWSA:</b>	Strategic Water Source Areas
<b>WCBSP:</b>	Western Cape Biodiversity Spatial Plan
<b>WUL:</b>	Water Use License

## 1. INTRODUCTION

Confluent Environmental (Pty) Ltd was appointed by Cape EAPrac to compile an aquatic specialist impact assessment report as part of the Basic Assessment for a proposed sheep feedlot and irrigation of fields with wastewater on farm portion 1/177 Vrolykheid, Prince Albert. The farm is located approximately 6km east of the settlement of Klaarstroom north of the Swartberg Mountain range (Figure 1).

The area currently farmed on the property is used for grazing free-ranging sheep and irrigating various crops in existing fields. Various fields are irrigated to produce lucerne, teff and oats which is cut, baled and sold. Other fields are used to produce onion seed. The Jan Rolms River flows in a westerly direction through the farming area and is the main water source for irrigation both at present and in the future. Although groundwater is also abstracted from boreholes for livestock watering and domestic use and when surface water is in short supply. The majority of the farm portion is untransformed while farming activities are concentrated around the Jan Rolms River.

Located in the Klein Karoo, the farm is covered in a network of non-perennial drainage lines which generally only flow following rainfall which creates surface runoff (Figure 1).

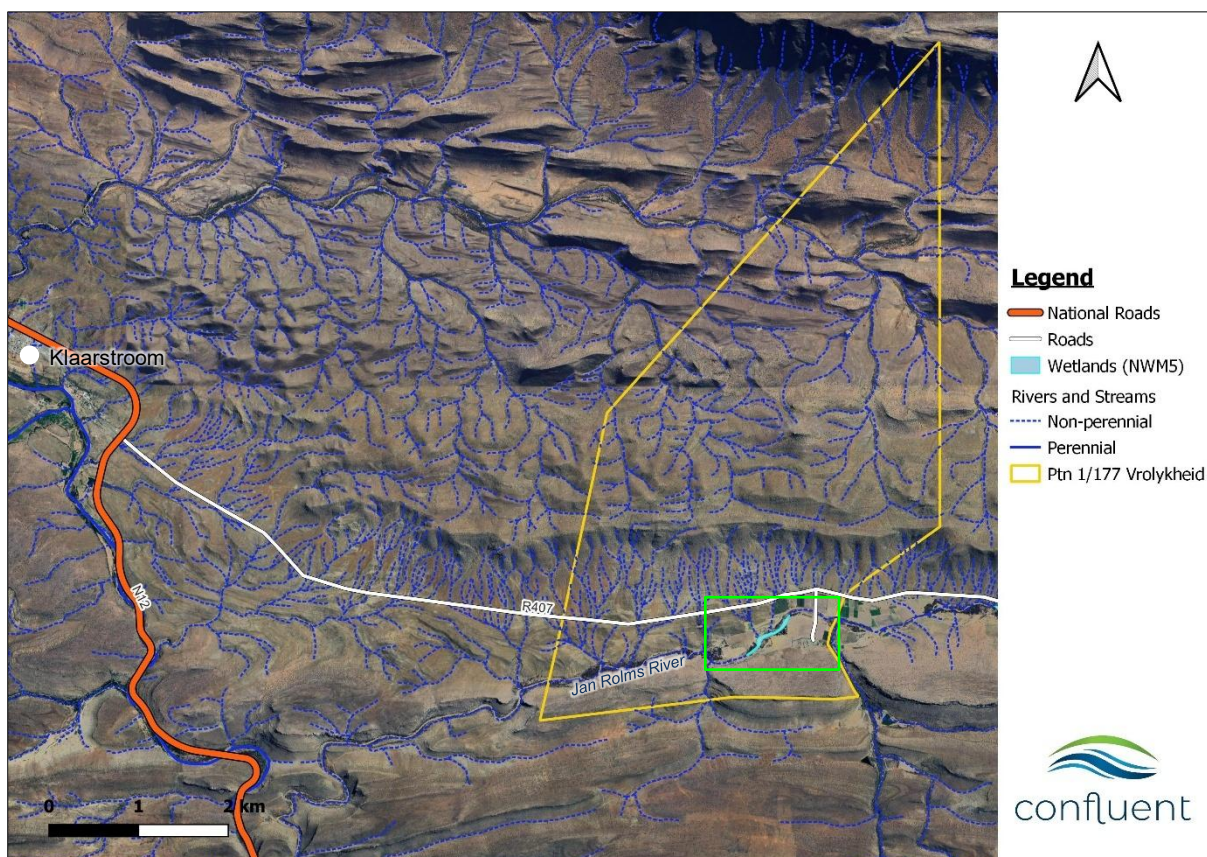


Figure 1. General location of the farm property in relation to mapped water resources, towns and roads. The current farmed area earmarked for the sheep feedlot is indicated in the green rectangle.

## 1.1 Description of Relevant Developments

### 1.1.1 Irrigation With Wastewater

The landowner proposes to change the land use to a sheep feedlot. Two areas of old fields will be used for concentration of animals in the feedlot pens, and fields that are currently used for crop and pasture production will be irrigated with wastewater from the feedlot to provide food for the sheep as well as produce for sale (Figure 2). Wastewater is proposed to be transferred from the animal pens via an earth furrow to an existing off-channel dam, from where it will be periodically irrigated on fields (Figure 2).



Figure 2. Layout of the existing fields where periodic irrigation with feedlot-generated wastewater is proposed (in red). Yellow dotted area consists of buildings and animal pens associated with the feedlot; river crossing upgrade is indicated by the green dotted line.

The proposed feedlot operation will focus on the existing developed area of the farm. Existing buildings will be used, with the addition of structures for new sheep arrivals, a wool bale and bakkie store, and a feedmix store. The feedlot pens are on sloping ground and will be protected from runoff during rainfall by a soil berm along the southern edge of fields which will divert runoff to the left and right (Figure 3). A description of the development proposal for the feedlots is provided:

- Fencing of small kraals (pens) will be of wooden poles and wire;
- Each kraal will have a feeding trough on one side, and a water trough on the other side. Troughs are made of steel with a rubber lining, and they are free standing;
- A shade port (shade cloth on a steel frame) will be erected in the middle of the two troughs to provide shade for animals;
- A small concrete slab may be required to provide a level surface on which the troughs can stand; and,
- Water containing waste from pens and animal holding areas will gravitate through an earth furrow to an existing off-channel irrigation dam which will be lined.
- Most of the solid faeces will be removed from the feedlot so the runoff should contain minimal solid waste but be fairly diluted with rainwater. No further dilution will take place.

- Solid waste will be spread over fields using a manure spreader.

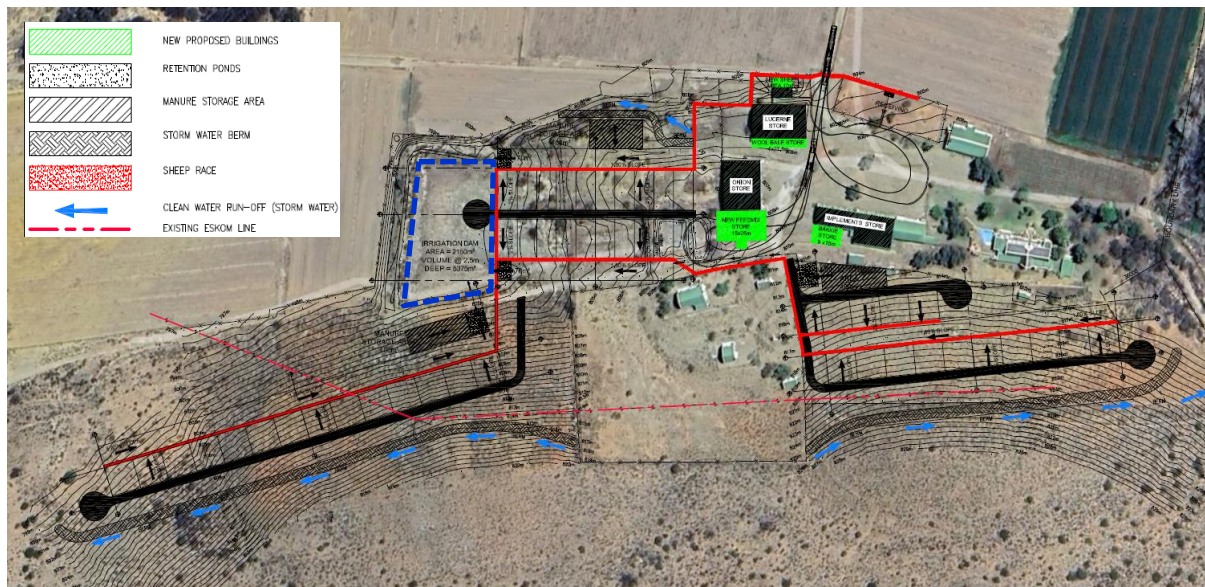


Figure 3. Proposed layout of the feedlot area showing animal pens in old fields to the south. Off-channel dam for storing wastewater for irrigation is indicated by the blue dotted line.

### 1.1.2 River Crossing Upgrade

The main access road to the farm must be upgraded at the crossing over the Jan Rolms River (See Figure 2 for location). At present, it consists of a gravel road over gabions which allow seepage of the river under base flow conditions, but no continuous flow paths (Figure 4). The road is overtopped when there is flooding limiting access to the farm, which is why the upgrade is proposed.



Figure 4. Photo of the existing road crossing the Jan Rolms River on gabions.

The original proposed engineering design for the upgraded road crossing is provided in Figure 5. Construction of this crossing will involve the removal of some sediment upstream and construction of a 3m wide cutoff wall. Downstream will require some infilling to reach the same height which will be stabilised with a 5m wide cutoff wall. At the base of the downstream wall

is a 2m Reno mattress to protect the stream bed when the river flows. Flows are proposed to be channelled through 6 piped culverts of 600mm diameter.

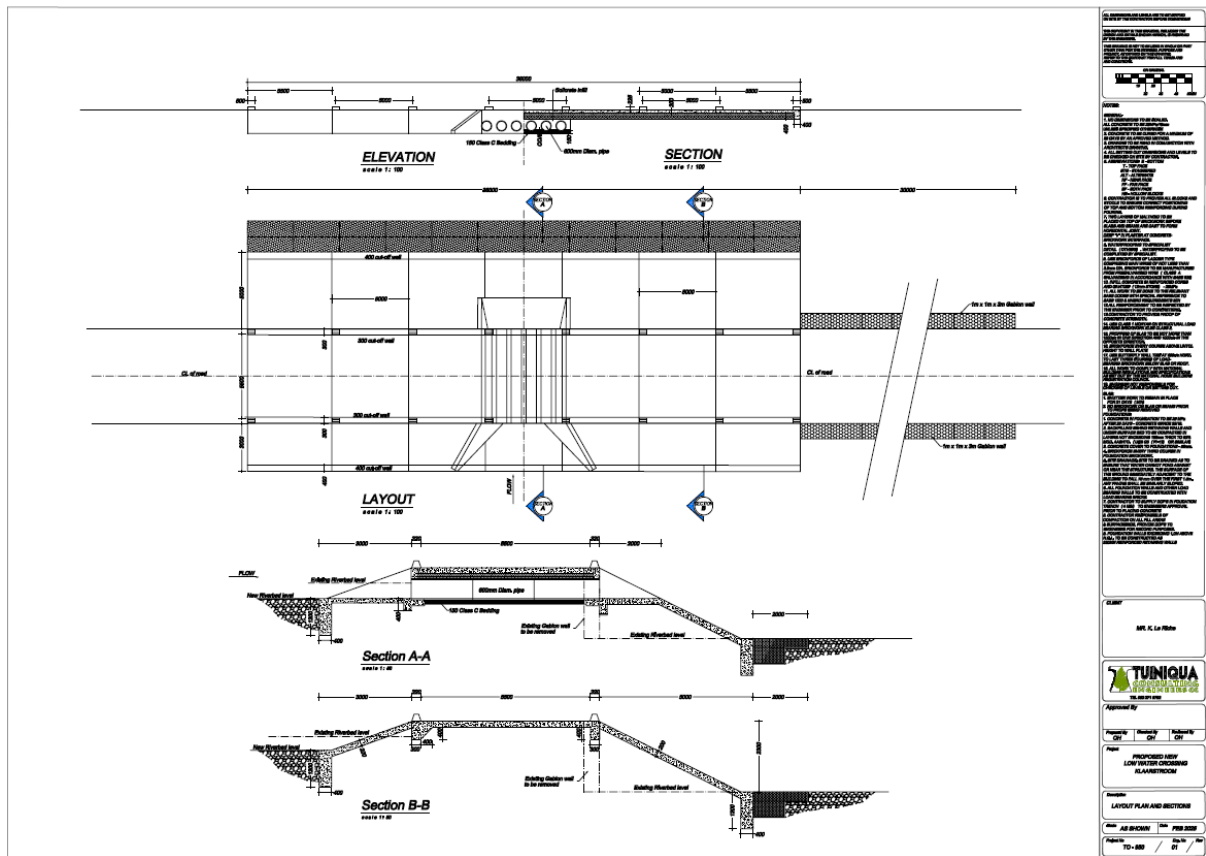


Figure 5. Original proposed design for the upgraded access road crossing over the Jan Rolms River (Tuiniqua Consulting Engineers).

### 1.1.3 Preferred River Crossing Upgrade

Following the site assessment and further engagement with the engineer, an improved design for the upgraded river crossing was developed which is very similar to the original, except it replaces the piped culverts with 6 portal culverts (similar to box culverts) measuring 1 200mm x 600 mm each (Figure 6). This effectively increases the area of flow through the under the road to around 7.2 m instead of the original plan which was approximately 3.6 m wide. This design is an improvement in terms of reducing the likelihood of ongoing blockage with debris and sediment requiring maintenance, and for improved connectivity of flows through the road crossing.

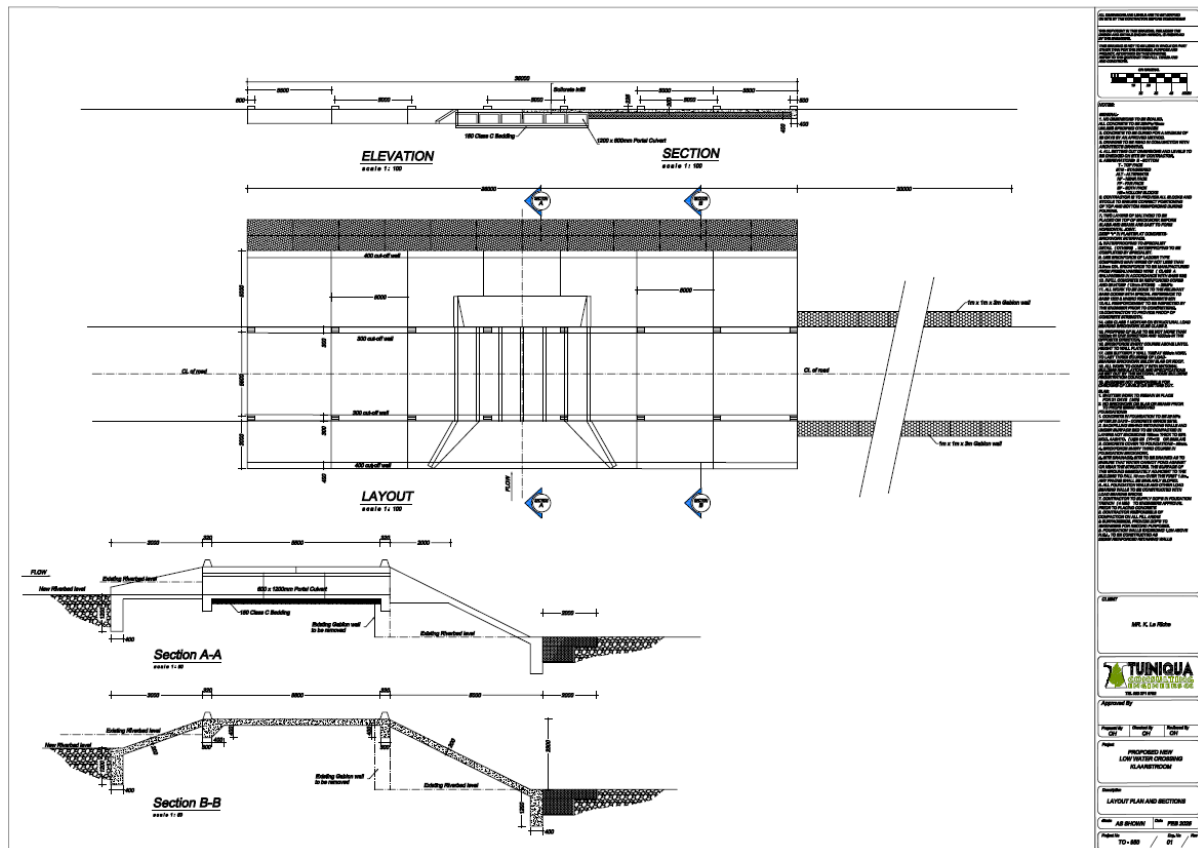


Figure 6. Preferred proposed design for the upgraded access road crossing over the Jan Rolms River (Tuiniqua Consulting Engineers).

## 1.2 Key Legislative Requirements & Scope of Work

### 1.2.1 DFFE Screening Tool Results

According to the Department of Environment, Forestry and Fisheries (DFFE) screening tool, aquatic biodiversity at the site has a **Very High** sensitivity (Figure 7). The sensitivity features upon which this rating is based are:

- Critical Biodiversity Area 1: Aquatic
- Ecological Support Area 1: Aquatic
- FEPA Sub-catchment
- Rivers AB (Very good condition)
- Wetlands

The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA; Act No 36 of 1998).

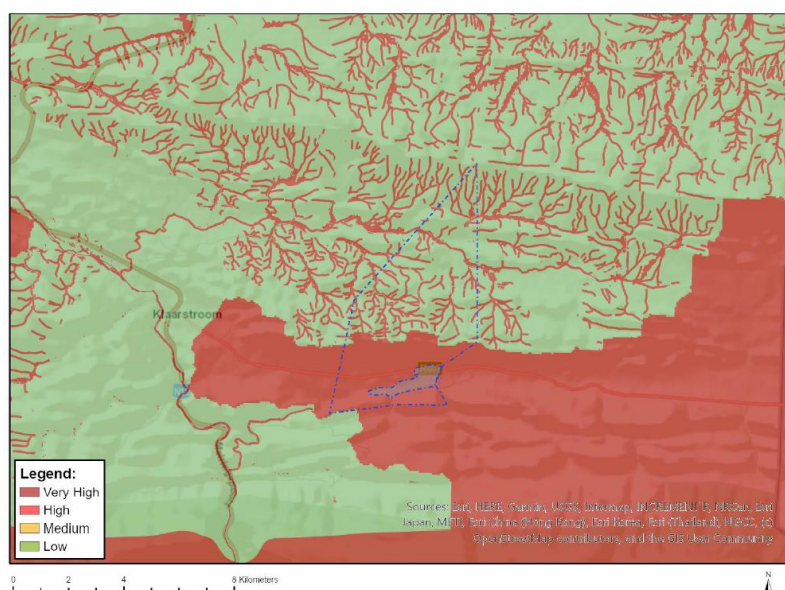


Figure 7. Results of the DFFE Screening Tool which indicate Very High Sensitivity of the Aquatic Biodiversity theme for Portion 1/177 Vrolykheid.

### 1.2.2 National Environmental Management Act

According to the protocols specified in GN 320 (Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity) of the National Environmental Management Act (NEMA; Act No. 107 of 1998), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool (screening tool). An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being of:

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

The screening tool classified the site as being of **Very High** aquatic biodiversity. According to the protocol, a site sensitivity verification must be undertaken to confirm the sensitivity of the site as indicated by the screening tool. This includes an assessment of the following:

Interrogation of available desktop resources including:

- DWS spatial layers (1:50 000 rivers)
- National Freshwater Ecosystem Priority Areas (NFEPA) spatial layers (Nel *et al.*, 2011)
- National Wetland Map 5 and Confidence Map (CSIR, 2018)
- Western Cape Biodiversity Spatial Plan (WCBSP, 2023).

Conduct a site visit to determine the site sensitivity:

- Identification and classification of watercourses within and adjacent to the site according to methods detailed by Ollis *et al.* (2013);

- Determine the watercourse Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) using an appropriate method (if watercourses are present).
- Delineate wetland / riparian areas following methods prescribed by DWAF (2015).
- Determine an appropriate buffer for wetland areas using the site-specific buffer tool developed by Macfarlane and Bredin (2016).

### 1.2.3 National Water Act

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

A watercourse means:

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

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

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

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

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

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

- a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
- b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance with section 144 of the Act); or
- c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

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

In this case, Section 21 (g) may trigger the requirement for a WUL due to the storage and irrigation with wastewater. This water use is defined as “Disposing of waste in a manner which may detrimentally impact on a water resource”.

## 2. CATCHMENT CONTEXT

### 2.1 Catchment Features

A summary of relevant environmental and conservation features of the catchment is provided in Table 1. Located in the semi-arid Klein Karoo, the mean annual rainfall is relatively low and has a moderate level of rainfall intensity. However, the inherent erosion potential of soils at the site is classified as High, which means that management of surface runoff on sloping areas is essential to prevent soil erosion and sedimentation in receiving watercourses. The Jan Rolms River and farming area of Portion 1/177 are location in quaternary catchment J33D (Figure 8). The southern portion of the farm drains to this river, while quaternary catchment J33C drains to the northern section of the farm.

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

Feature	Description
<b>Quaternary catchment</b>	J33D
<b>Rainfall Intensity</b>	Zone 2, 40.3, Moderate
<b>Mean Annual Precipitation</b>	200-264 mm
<b>Inherent erosion potential of soils (K-factor)</b>	0.55, High
<b>Soil type</b>	Soils with limited pedological development, usually shallow on hard or weathering rock. Lime present in part of most of the landscape. Rocky areas present.
<b>Vegetation type</b>	Prince Albert Succulent Karoo (Least Concern; SKv13)
<b>Geomorphological Zone</b>	D, Upper foothills
<b>NFEPA area</b>	None defined
<b>Conservation</b>	Critical Biodiversity Areas – Aquatic (Jan Rolms River) Ecological Support Areas - Aquatic (Restore)

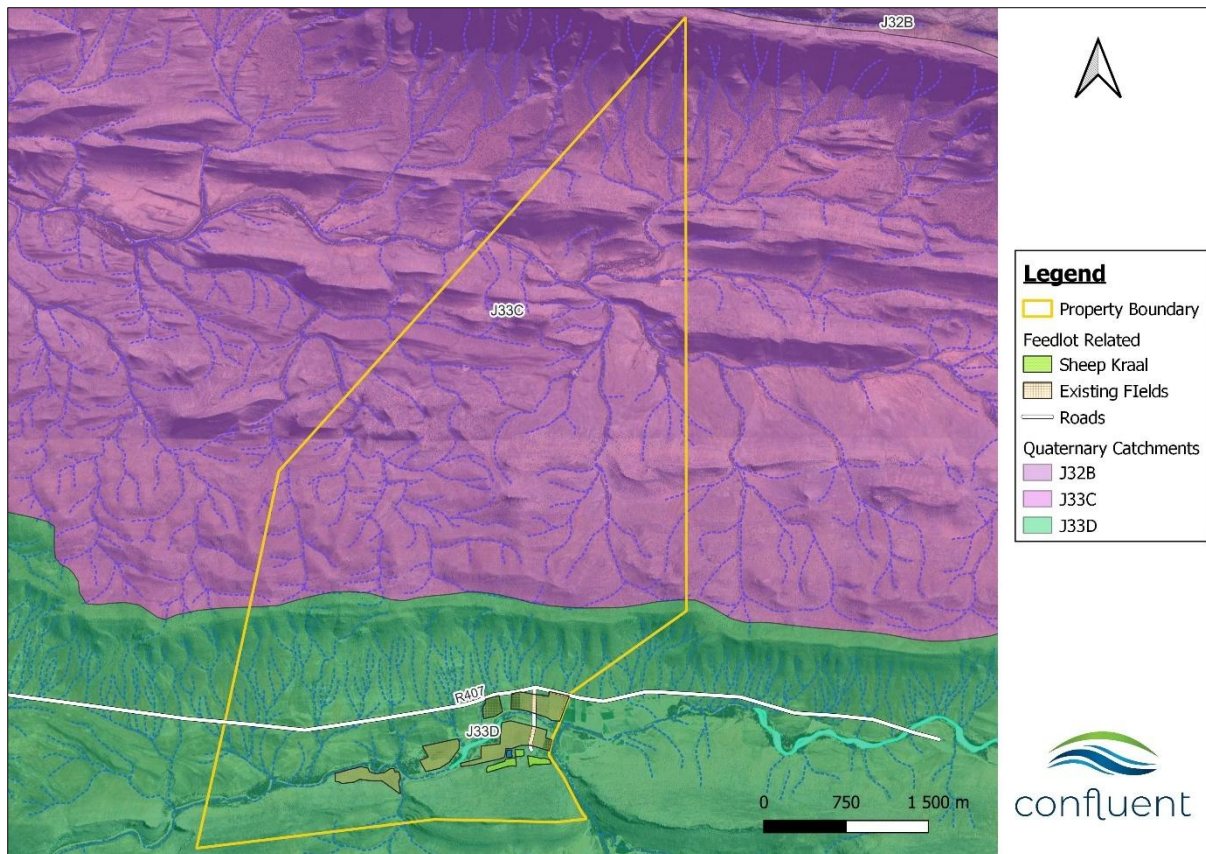


Figure 8. Mapped quaternary catchments in relation to the existing and proposed farming operation.

## 2.2 Mapped Watercourses

Mapped watercourses according to the National Wetland Map (V5) and DWS 1:50 000 drainage lines are indicated in Figure 9. The Jan Rolms River flows in a westerly direction and collects runoff from hills to the north and south. A narrow band of riparian vegetation exists along the river, the extent of which has been reduced through the establishment and ongoing farming of existing agricultural fields. A valley-bottom wetland is indicated downstream of the farm access road (Figure 9). The edge of existing fields is between 15m and 50m from the edge of the channel. Conversion of old fields to sheep kraals is located approximately 400m from the Jan Rolms River, but the eastern sheep kraal is 35m from a northern flowing tributary.

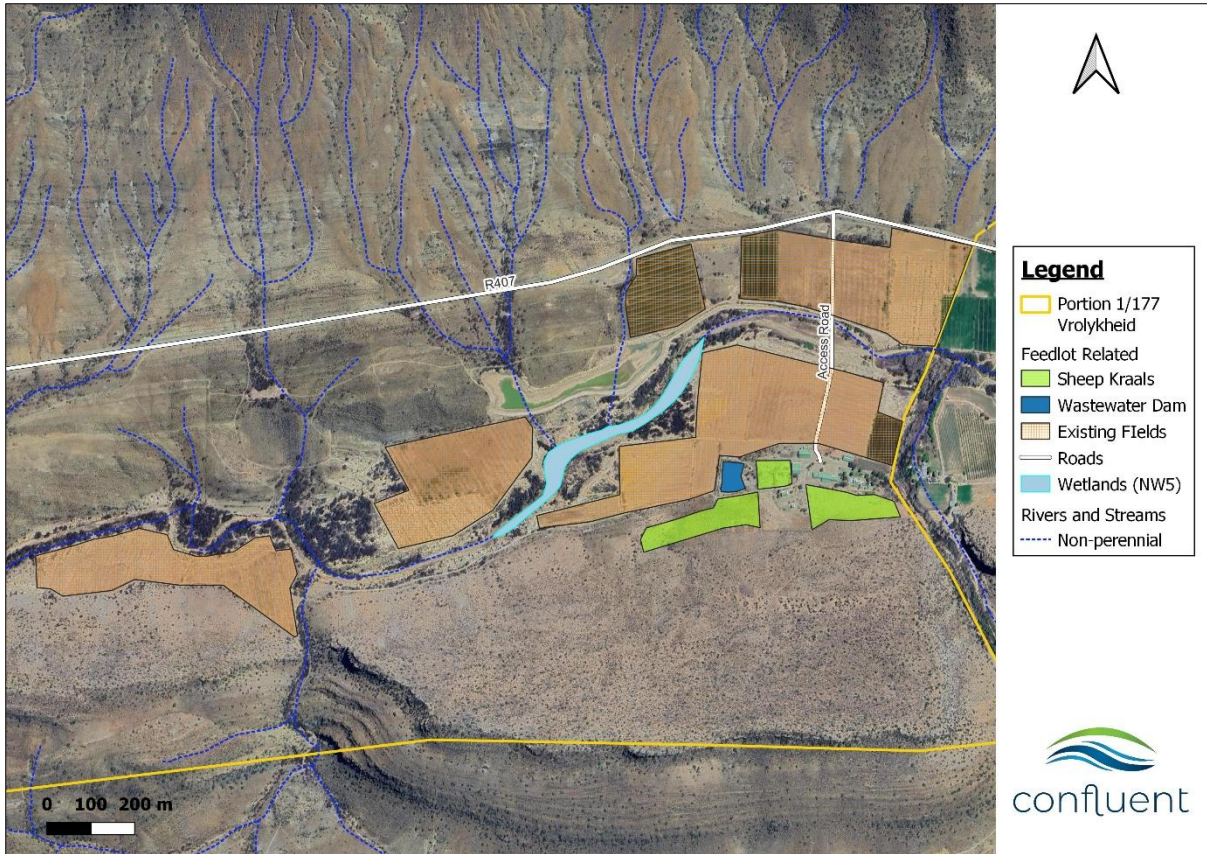


Figure 9. Mapped watercourses according to the National Wetland Map 5 (NWM5) and 1:50 000 flow paths (DWS).

### 2.3 Site Topography

The existing fields south of the Jan Rolms River are on mostly flat areas of land, mostly likely in the floodplain of the river (Figure 10). The area of proposed sheep pens is located on moderately sloping ground which drains in a northerly direction, mostly towards areas of existing fields and buildings.



Figure 10. 5m site contours and mapped watercourses overlaid with feedlot areas and existing fields (from Cape Farm Mapper).

## 2.4 Vegetation

The mapped vegetation type for the farming area and Jan Rolms River is Prince Albert Succulent Karoo which is classified as Least Threatened. No distinct vegetation type or plant species associated with watercourses are identified or discussed for this vegetation type.

A detailed description of vegetation and plant species of conservation concern for the proposed feedlot is provided in the botanical specialist assessment compiled by B. Fouche (Confluent Environmental).

## 2.5 Conservation and Catchment Management

### 2.5.1 Western Cape Biodiversity Spatial Plan

A map of the conservation classification areas the Western Cape Biodiversity Spatial Plan (WCBSP; 2024) is presented in Figure 11. The Jan Rolms River is classified as an aquatic Critical Biodiversity Area Level 1, (**CBA1; Aquatic**). The area adjacent to the river is classified as CBA 2 (Degraded), and within the footprint of the proposed sheep pens is mostly classified as Other Natural Area (ONA).

The definitions and management objectives for CBA 1 and CBA 2 are relevant for the Jan Rolms River and associated tributaries. These are provided in Table 2. Necessary actions in relation to the WCBSP are to ensure that development on the site does not result in negative impacts to the ecological structure and function of the Jan Rolms River and associated tributaries.

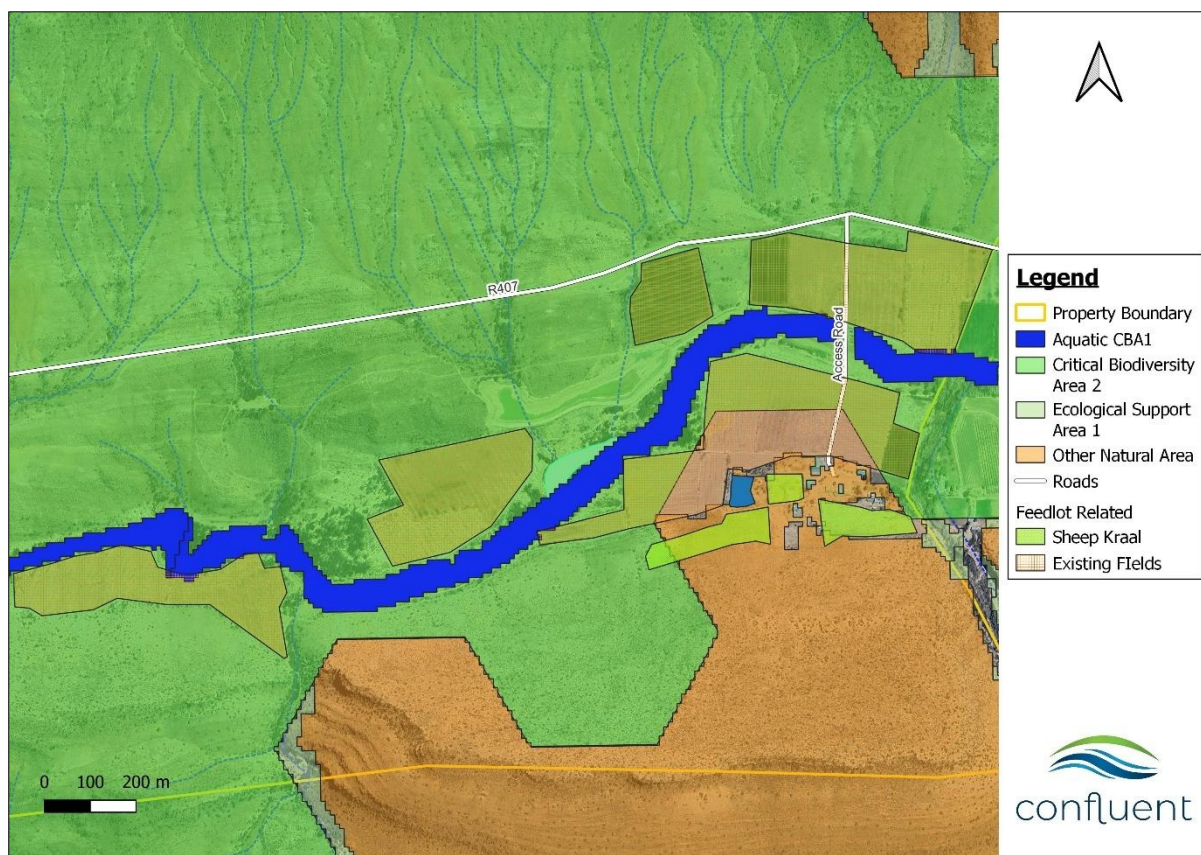


Figure 11. The proposed feedlot area in relation to mapped biodiversity priority areas of the Western Cape Biodiversity Spatial Plan (2024).

Table 2. Definitions and objectives for conservation categories identified in the Western Cape Biodiversity Spatial Plan (WCBSP, 2024).

Area Classification	Definition	Management Objective
Critical Biodiversity Area 1 (CBA1)	“Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.”	“Maintain in a natural or near-natural state, with no further loss of natural habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land uses are appropriate.”
Critical Biodiversity Area 2 (CBA2; Degraded)	“Areas in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.”	“Maintain in a natural or near-natural state, with no further loss of habitat. Degraded areas should be rehabilitated. Only low-impact, biodiversity-sensitive land-uses are appropriate.”

### 2.5.2 National Freshwater Ecosystem Priority Areas

The sub-quaternary catchment of the project area is located in a Freshwater Ecosystem Priority Area (FEPA; NFEPA; Nel *et al.*, 2011), number 8525. A FEPA is an area prioritised for conserving freshwater ecosystems and associated biodiversity. The selection of FEPAs is determined through a process of systematic biodiversity planning using data on freshwater ecosystem types, species and ecological processes. FEPAs should be maintained in a good condition to manage and conserve freshwater ecosystems and to protect water resources for human users. This does not mean that FEPAs should be fenced off from humans, but they should be supported by good planning, decision-making and management. The recommended condition for all river FEPAs is an A or B ecological category (Nel *et al.*, 2011).

### 2.5.3 Resource Quality Objectives

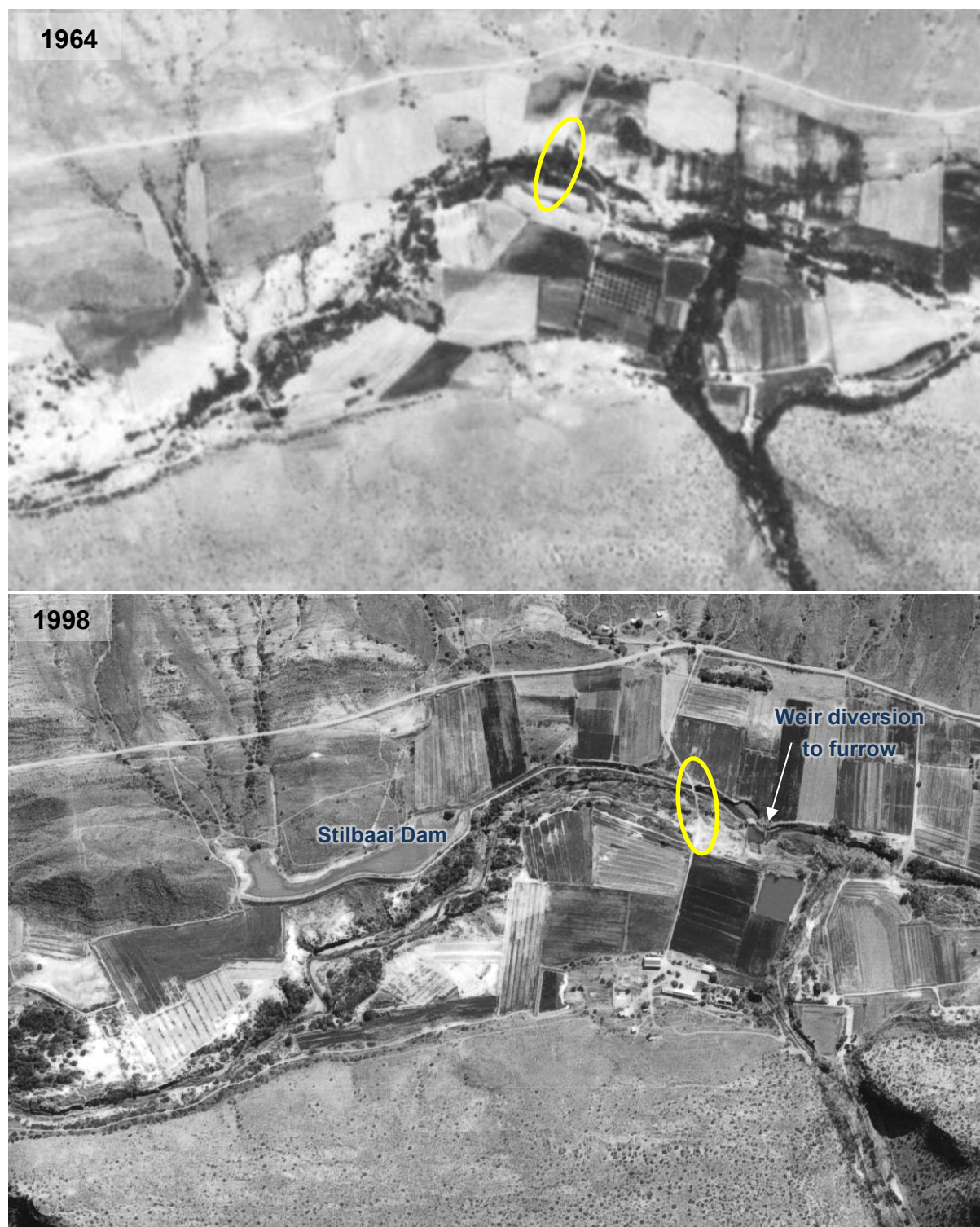
Resource Quality Objectives (RQOs) are defined as clear goals (numerical or descriptive statements) relating to the quality of a water resource and are set in accordance to the management class for the resource to ensure the water resource is protected. The purpose of RQOs is to set clear objectives for the resource against which water use licenses and the related impacts can be evaluated and managed to achieve a balance between the need to protect and utilise the resource. The Breede-Olifants Catchment Management Agency (BOCMA) concluded an assessment of major rivers in the Water Management Area (DWS, 2018). The Jan Rolms River was not included in the RQOs assessment.

## 2.6 Historical Assessment

Historical imagery of the farming area indicates that it has been actively farmed since at least the 1960s. The present extent of fields south of the Jan Rolms River is quite similar to the historical fields, and expansion of fields has mostly taken place north of the river. The proposed location of sheep pens is located on terrestrial areas that appeared to have been disturbed in terms of their natural vegetation. The tributary of the Jan Rolms River east of the proposed sheep pens had a

large, well established riparian zone, which appears to have reduced in density and extent in recent years. Likewise, riparian vegetation along the Jan Rolms River has also diminished since 1964. This is particularly evident in the vicinity of the road crossing.

In 1998, the largest of several farm dams had been constructed on the northern side of the river, which is named Stilbaai Dam. While located very close to the riparian zone of the river, it functions as an off-channel dam which receives water from an earth furrow that diverts water from an instream weir upstream from the road crossing.



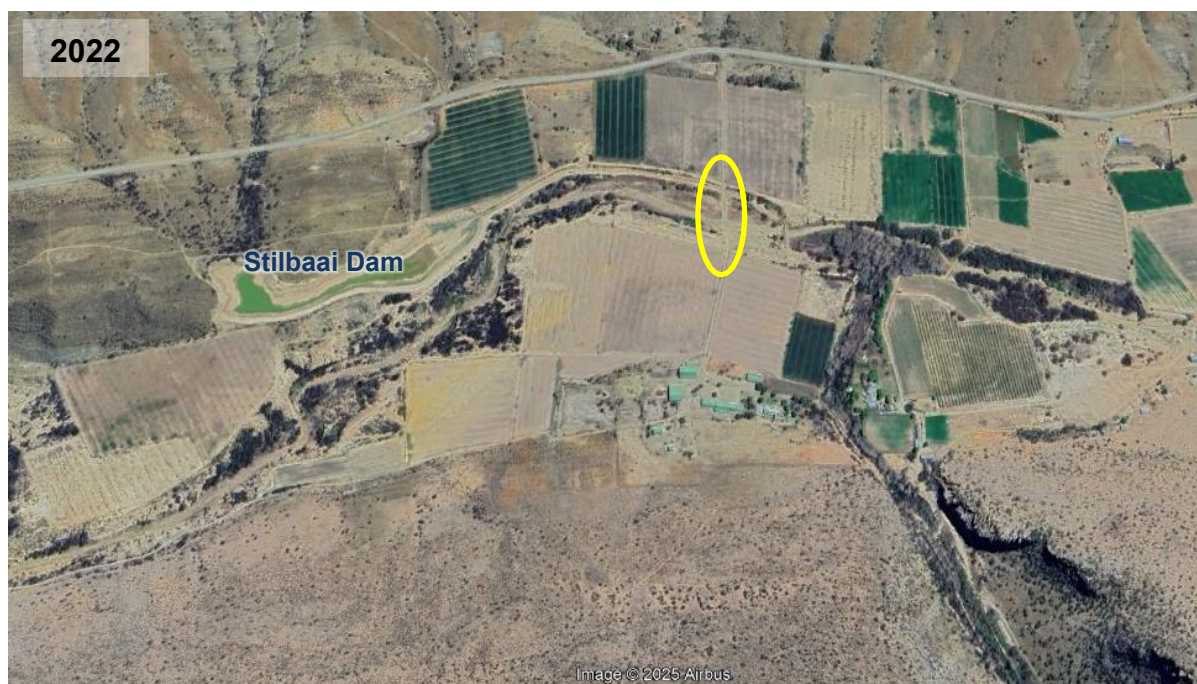


Figure 12: Historical photos showing the farming and proposed feedlot area in 1964 and recently in 2022 (CD:NGI & Google Earth imagery). The Jan Rolms River crossing is encircled in yellow.

### 3. SITE ASSESSMENT

#### 3.1 Site Visit

The site was visited on 20 March 2025 which is considered autumn. Weather during the site visit was very hot, dry and clear. The general veld conditions indicated that little rainfall had occurred in the area in recent weeks or months. The site was assessed by meandering through areas potentially impacted by the proposed feedlot (with a focus on watercourses) and was undertaken along with a botanical and a faunal specialist (Figure 13).

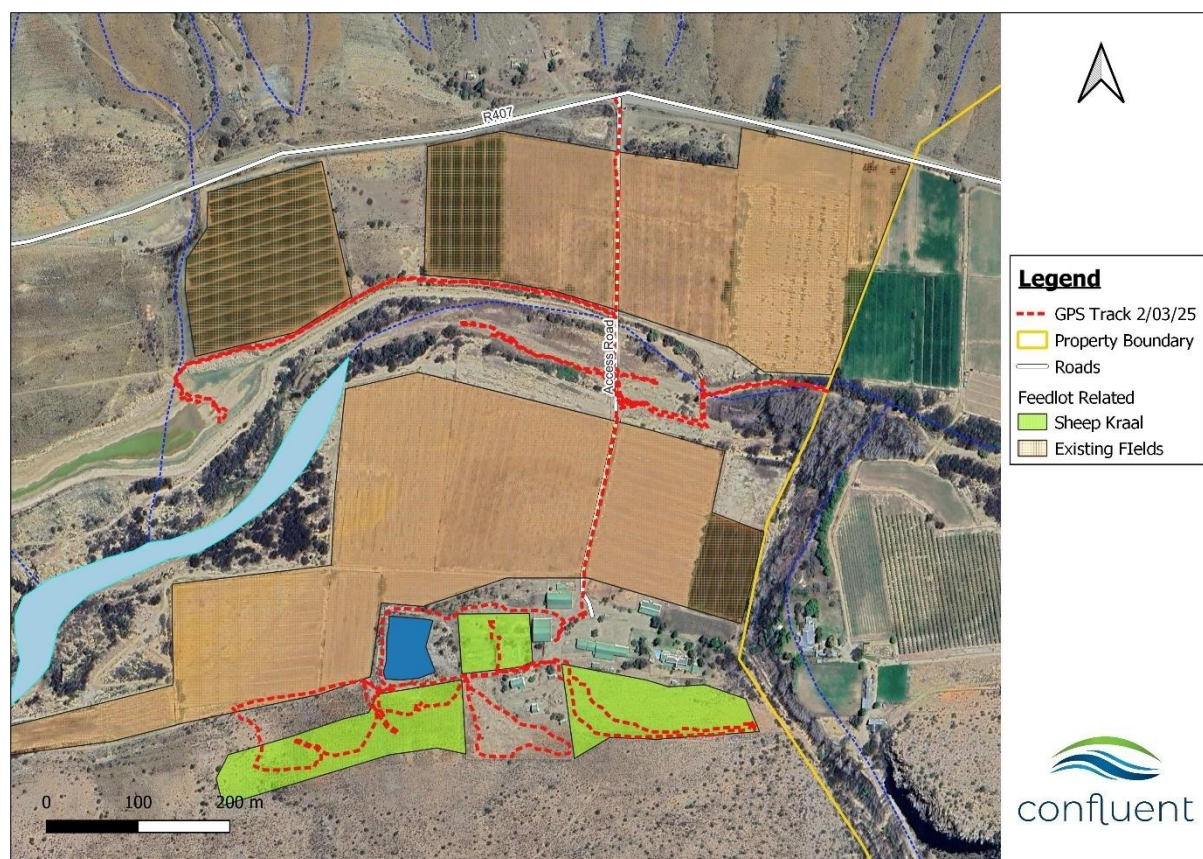


Figure 13. Property boundary showing GPS track walked during the site visit.

### 3.1.1 General Site Observations

A drone was used to take general pictures of different potential impact areas on the farm. Various photos presenting relevant observations are provided in this section.

The existing road across the Jan Rolms River is constructed on gabions which allow seepage through the structure, but no continuous flow. A trickle flow was present in the river at the time of the site visit. The existing road crossing creates a barrier to flow which has created an impact in the form of large quantities of sediment which have accumulated upstream, altering the profile of the riverbed, which is now approximately 1.5m higher upstream (Figure 4), than downstream (Figure 14 & Figure 15).

The riparian zone in the region of the road crossing was invaded by stands of the alien *Arundo donax* (Spanish reed (mainly downstream) which are indicated in Figure 14. These can look quite like the indigenous *Phragmites australis* (Fluitiesriet), which grow alongside them and can also be somewhat invasive in some settings but are very typical of vegetated riverbeds in the Klein Karoo region. Dense growth of *A. donax* can exacerbate riverbank erosion as it impedes flow, directing it elsewhere.

Free-ranging sheep were observed in the riverbed, along with numerous spoor including faeces and footprints. Evidence of widespread grazing on instream sedges and rushes was evident, with most plants heavily grazed in the area assessed. Common plant species in the riverbed include *Cyperus longis*,



Figure 14. The existing river crossing to be upgraded showing: White = unrestricted sheep access; Orange = Stands of invasive Spanish reed (*Arundo donax*); Blue arrow = flow direction.



Figure 15. Photos showing the riverbed upstream (sandy) and downstream (rocky) of the road crossing.



Figure 16. Bank erosion downstream of the road crossing indicating high levels of soil mottling consistent with wetland conditions.

Upstream of the road crossing is another instream barrier in the form of a vertical concrete weir which was historically constructed to divert water via a furrow to the Stilbaai dam (Figure 12). As in the case of the road crossing, a large volume of sediment has accumulated upstream of the weir, while the downstream section is sediment starved and rocky. An invasion of alien invasive Poplar trees (*Populus* sp.) is present about 70m upstream of the weir and is spread between Portion 1/177 and the neighbouring property (Figure 17). This stand of trees has been present for a few decades with what appears to have been minimal attempts at control or management.



Figure 17. Weir approximately 90m upstream of the road crossing which diverts water via a furrow (blue arrow) to the Stilbaai Dam. Orange = dense invasion of *Populus* sp.

Existing fields where future irrigation with wastewater is proposed are located very close to the Jan Rolms River (Figure 18). Although gradients are mostly flat which would potentially reduce the amount of surface runoff from fields towards the watercourse.



Figure 18. The Jan Rolms River downstream of the road crossing flowing between existing fields (in yellow) where proposed irrigation with wastewater from the sheep feedlot would take place.

The eastern edge of the proposed sheep pens is located near the riparian vegetation associated with the unnamed tributary of the Jan Rolms River (Figure 19).



Figure 19. Proposed sheep pen area (green) closest to the unnamed tributary (blue) of the Jan Rolms River.

### 3.1.2 Vegetation

Diverse wetland plant species were present in sandy sections of the riverbed, some of which are shown in the figure below. Clumps of alien invasive *Arundo donax* (Spanish reed) were present among indigenous *Phragmites australis* reeds. The picture below highlights the difference between the two species in terms of height.

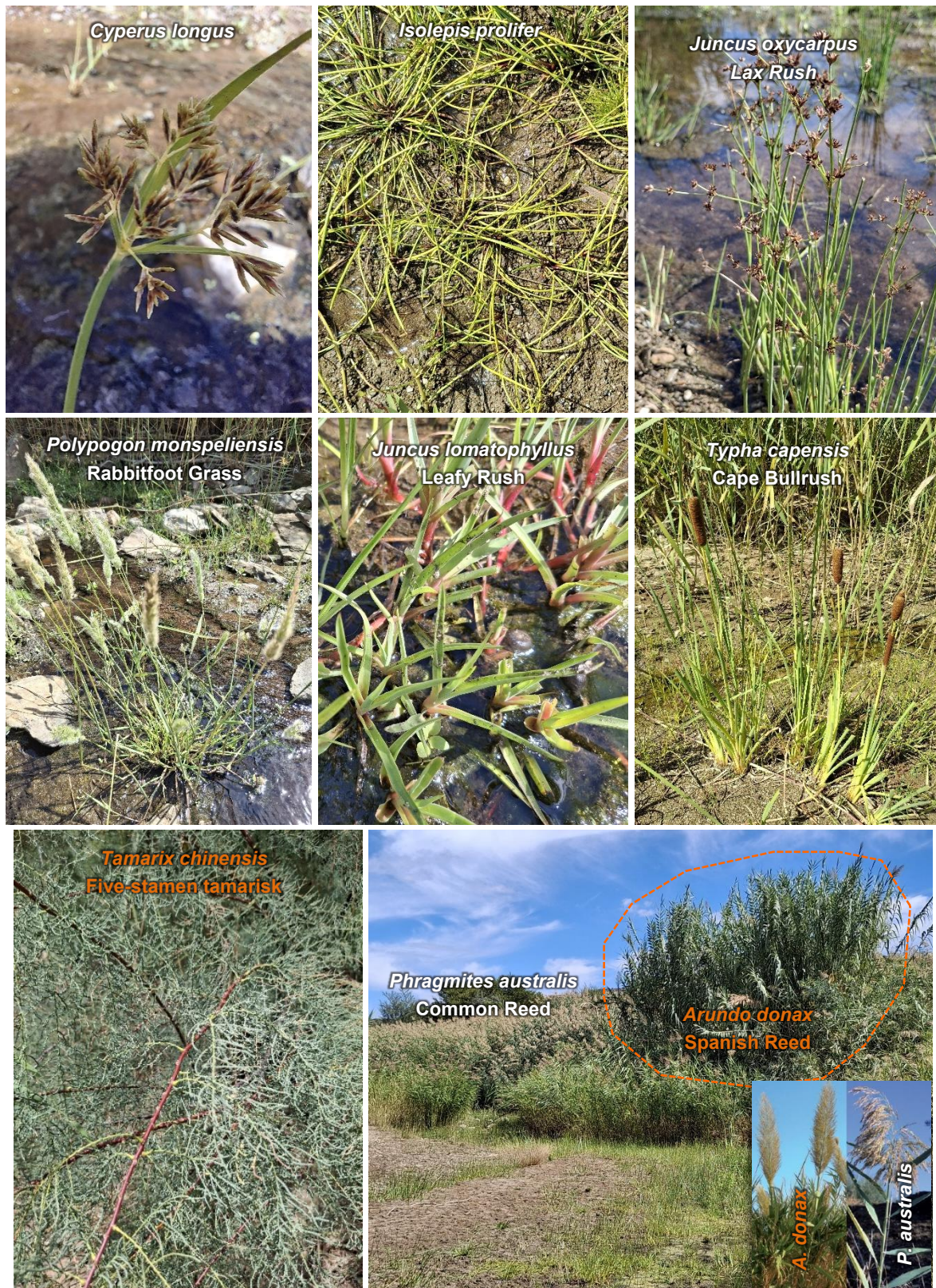


Figure 20. Typical wetland plant species in the bed of the Jan Rolms River. Indigenous species = white; Invasive alien species = orange. Inset shows the difference between flower heads of *Arundo donax* and *Phragmites australis*.

Riparian vegetation formed a relatively dense thicket beyond the river channel was dominated by *Vachellia karroo* which is typically associated with floodplains and riparian vegetation in the Klein Karoo (Vlok, 2015) and creates a dense riverine thicket. Sweetthorn mistletoe (*Viscum continuum*) was often observed growing in *V. karroo*. Associated riparian plant species include *Melianthus comosus* (Crown honeyflower), *Gymnosporia buxifolia* (Common spikethorn), *Nidorella ivifolia* (Ovenbush), *Searsia burchelli* (Karoo kunirhus) and *S. pyroides* (Common wild currant).

### 3.2 Watercourse Classification

The Jan Rolms River has a distinct active channel, banks and riparian zone. Larger river channels of the Klein Karoo are often vegetated as the riverbed frequently provides sustained moisture levels when not in flow (Ollis et al, 2013). This is the case with the river channel at this site where the bed contains areas of extensive wetland vegetation and a distinct riparian zone which is associated with the riverbanks. The watercourse is in the valley bottom in a fairly incised channel (Figure 21). Eroded soils exposed on the riverbanks show extensive mottling indicative of periodic saturation and drying of the soil along the riverbed. This is consistent with the non-perennial, intermittent flow regime of the river.

The watercourse has features and characteristics of both a channelled valley-bottom wetland and a river with riparian zone, typical of the Klein Karoo region. The Level 4 hydrogeomorphic unit is confirmed as a **River**, which is defined as linear, with discernible bed and banks, which periodically carries a concentrated flow of water (Ollis et al., 2013). The extent of the river includes the riparian vegetation.

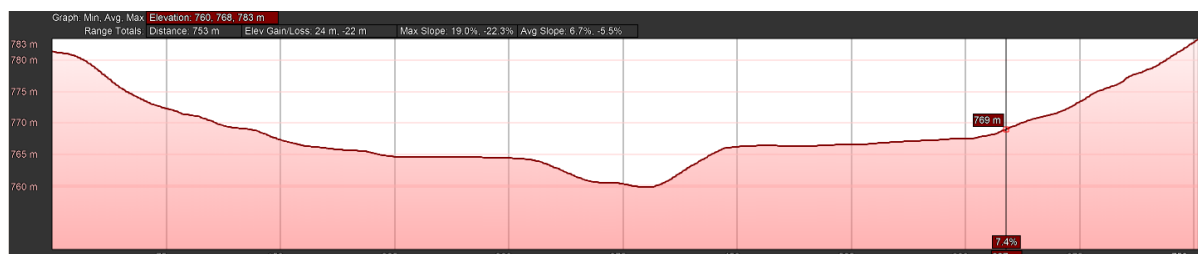


Figure 21. Cross section elevation profile of the river and valley sides approximately 500m either side. Note the generally flat floodplain areas where farming occurs on both sides of the river channel.

### 3.3 Watercourse Delineation

Delineation of the watercourse followed standard methods (DWAF, 2005) and mostly followed the riparian zone using both present and historical imagery as a guide. Elevation profiles at numerous points across the river were also used to get a sense of the riparian zone extent, as well as reference sections of the river downstream where the riparian zone is relatively intact (Figure 22). One difficulty when delineating the riparian zone is that the existing fields have been in place for many decades and have certainly intruded into the riparian zone in some areas. But it is not possible to determine exactly where that point would have been given the gaps in historical images. Therefore, an estimate based on the width of the riparian zone in areas with higher confidence was utilised.



*Figure 22. Comparison of a relatively undisturbed section of the Jan Rolms River riparian zone downstream (above) of the farmed area on Portion 1/177 (below) for comparison.*

The riparian zone and river channel delineation are provided in Figure 23. This shows that for the most part the existing fields are located outside of the estimated historical extent of the riparian zone. There are a few fields which have extended into what was probably riparian vegetation historically. The is most notable on the westernmost field on the southern side of the river.



Figure 23. Delineated river channel and riparian zone of the Jan Rolms River proximal to existing fields and proposed feedlot areas.

## 4. WATERCOURSE ASSESSMENT

### 4.1 Water Quality

Basic water chemistry values were obtained from the Jan Rolms River at two locations, immediately upstream and downstream of the existing access road across the river. This provides a very basic understanding of current water quality and a baseline to which any further monitoring can be compared. Results in Table 3 show a distinct difference in most measured parameters upstream and downstream of the road crossing. The pH and dissolved oxygens values differed but were both within the range acceptable for aquatic life. Electrical conductivity was fairly elevated as unimpacted waters are typically in the range of 100 – 250 uS/cm (personal observations). This could be related to agricultural return flows and concentration of ions due to high evaporation rates. Sheep were standing in an around the area upstream from the road crossing, and there is evidence that they frequently utilise this area as the southern bank in the area is devoid of vegetation and a feeding trough is present next to the river (Figure 24).

Table 3. Water quality parameters measured upstream and downstream of the existing road crossing.

Water Quality Parameter	Upstream Crossing	Downstream Crossing
pH	8.20	7.60
Electrical Conductivity (uS/cm)	746	687
Dissolved Oxygen (mg/L)	8.22	6.56
Temperature (°C)	22.72	20.20



Figure 24. Water quality testing (left) and sheep droppings in feeding area adjacent to the river upstream of the crossing (right).

## 4.2 Present Ecological State (PES)

### 4.2.1 Methods

Rivers and drainage lines are natural channels in which water flows permanently or intermittently following rainfall. The Jan Rolms River is classified as a river at the point of the proposed upgraded road crossing, and adjacent to the fields associated with the proposed feedlot. The assessment used the Index of Habitat Integrity (IHI; Kleynhans, 1996) which measures the impact of human disturbance on riparian and instream habitats. The IHI is a rapid assessment of the severity of impacts affecting habitat integrity within a defined segment of a watercourse. The method can be applied to both perennial and non-perennial watercourses. The instream impacts considered were: water abstraction; flow modification; bed modification; channel modification; physico-chemical modification; inundation; alien macrophytes; and rubbish dumping. The riparian impacts assessed were: vegetation removal; exotic vegetation; bank erosion; channel modification; water abstraction; inundation; flow modification; physico-chemistry. Each of the impacts were given a score based on their degree of modification (1-25; Table 4), along with a confidence rating based on the level of confidence in the score.

Table 4. Descriptive classes for assessment of habitat modifications (Kleynhans, 1996)

Impact Class	Description	Score
None	No discernible impact or the modification is located in a way that has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability are also very small.	1-5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability is limited.	6-10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11-15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not affected.	16-20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21-25

An IHI class is then determined based on the resulting score which is shown in Table 5.

Table 5 Index of habitat integrity (IHI) classes and descriptions

Integrity Class	Description	IHI Score (%)
<b>A</b>	Natural	> 90
<b>B</b>	Largely Natural	80 – 90
<b>C</b>	Moderately Modified	60 – 79
<b>D</b>	Largely Modified	40 – 59
<b>E</b>	Seriously Modified	20 – 39
<b>F</b>	Critically Modified	0 – 19

#### 4.2.2 PES Results

The Present Ecological State of the Jan Rolms River along the extent of the farming areas on Portion 1/177 Vrolykheid was rated as a D, Largely Modified. The final score of 56 and 58 for instream and riparian habitat respectively was close to category C which is one level better. The main impacts affecting river habitat relate to the invasion of riparian vegetation by alien invasive plants, and the presence of instream barriers (weir and road crossing) and abstraction for irrigation (Table 6).

Table 6. Results of the Index of Habitat Integrity for the Jan Rolms River.

Aspect	Impact Score	Notes
<b>Instream Habitat (PES D)</b>		
<b>Water Abstraction</b>	15	Moderate farming activities along extensive reaches of the river including abstraction via furrows and off-channel dams.
<b>Flow Modification</b>	18	Flood-related impacts (plunge pools and rocks exposed below structures) and sedimentation due to lower base flows.
<b>Bed Modification</b>	10	Alternate exposure of bedrock with high levels of sedimentation due to flow alteration and instream structures.
<b>Channel Modification</b>	10	Erosion of the channel in sections due to flow alterations and instream structures.
<b>Physico-chemical Modification</b>	8	Moderate alterations to water chemistry due to the presence of livestock and agricultural lands adjacent to the river.

<b>Inundation</b>	5	Minor impact of inundation upstream of instream barriers resulting in sedimentation.
<b>Alien Macrophytes</b>	0	No alien plant species observed instream.
<b>Introduced Aquatic Fauna</b>	0	None observed or expected.
<b>Rubbish Dumping</b>	0	None observed instream.
<b>Riparian Habitat (PES C/D)</b>		
<b>Vegetation Removal</b>	18	Some historical areas of riparian zone have been removed for agricultural fields, excavation of irrigation furrow, structures across the river and road crossings.
<b>Exotic Vegetation</b>	10	Most problematic are isolated stands of <i>Arundo donax</i> , the extensive group of Poplar trees (eastern boundary),
<b>Bank Erosion</b>	10	Considered a natural process in some areas, but definitely exacerbated by instream structures altering sediment budgets and flow regimes.
<b>Channel Modification</b>	10	Mainly associated with channel modification where riparian vegetation has collapsed with eroded soils or replaced with structures.
<b>Water Abstraction</b>	5	While abstraction is present and significantly impacts base flow of the river, the impact on riparian vegetation appears to be minor.
<b>Inundation</b>	0	No evidence of inundation impacting on riparian vegetation in the reach assessed.
<b>Flow Modification</b>	5	Altered flows due to instream barriers and abstraction have had a minor impact on riparian vegetation in isolated areas.
<b>Physico-Chemistry</b>	0	No impacts observed or expected.

### 4.3 Ecological Importance and Sensitivity (EIS);

The ecological importance of the Jan Rolms River and associated riparian zone is acknowledged at the conservation planning level by the designation of the river as a Critical Biodiversity Area 1 (Aquatic; *Figure 11*) and riparian zone (plus terrestrial areas beyond) as a Critical Biodiversity Area 2. The vegetation type within which the river is embedded, however, is classified as Least Threatened. Although there is no well described river or wetland vegetation type associated with Prince Albert Succulent Karoo.

#### 4.3.1 EIS Methods

The Ecological Importance and Sensitivity (EIS) for the Jan Rolms River was derived using the methods developed by Department of Water Affairs and Forestry (DWA; 1999). Ecological Importance of a system is defined as the expression of its importance to the maintenance of ecological diversity and functioning on local as well as broader scales. Ecological sensitivity relates to the system's resilience to disturbance, or its ability to recover from disturbance that has occurred. For the assessment both biotic and abiotic factors are considered as follows:

- The presence of rare, endangered or unique aquatic species. This includes species of conservation concern, endemic or isolated species populations, intolerant species and overall species richness;
- Diversity and refuge value of habitat types;
- Sensitivity of the system to changes in flow and related water quality changes;
- Importance of providing functional connectivity between related systems;
- Biological connectivity in the form of migration routes / corridors instream and along riparian zones;
- Protection level of the area where the system is located (e.g. National Park).

These parameters are scored individually and the median score of all variables is calculated to derive an EI and ES category as defined in (Table 7).

*Table 7 Ecological Importance and Sensitivity Categories. Section in bold applies to the river reach assessed.*

Ecological Importance and Sensitivity Categories	General Description
Very High	Quaternaries/delineations 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 flow modifications and have no or only a small capacity for use
High	Quaternaries/delineations 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 flow modifications but in some cases, may have a substantial capacity for use.
<b>Moderate</b>	<b>Quaternaries/delineations that are 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 flow modifications and often have a substantial capacity for use.</b>
Low/Marginal	Quaternaries/delineations that are not unique at any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have a substantial capacity for use.

#### 4.3.2 EIS Results

The reach of the Jan Rolms River associated with existing and proposed agricultural land use was assessed (Table 8 **Error! Reference source not found.**). Of primary importance is the value of the river as a habitat corridor through the landscape which provides important refuge for feeding, breeding and movement of a wide range of species, although no endangered or particularly rare species are expected to be dependent on the local reach.

The EIS was rated as Moderate, with an explanation of this category provided in Table 7.

*Table 8. Ecological Importance and Sensitivity of the Jan Rolms River.*

Determinant	Drainage lines assessed collectively
<b>Presence of Rare &amp; Endangered Species</b>	0 – No rare or endangered species at any scale
<b>Populations of Unique Species</b>	0 – No population or taxon judged to be unique at any scale
<b>Intolerant Biota</b>	1 – A small population of the biota is expected to be dependent on permanently flowing water during some phase of their life cycle.
<b>Species/Taxon Richness</b>	2 – Rated on a local scale due to the presence of flowing water even during a very dry, late summer. Diversity of plant species in the riverbed is high.
<b>Diversity of Habitat Types or Features</b>	2 – Rated on a local scale. The presence of more perennial water with alternate bed materials of rock and sand create a locally important habitat diversity.
<b>Refuge value of habitat types</b>	2 – Rated on a local scale. The riverbed and riparian zone are densely vegetated compared to the sparse vegetation cover of surrounding, terrestrial areas. This

Determinant	Drainage lines assessed collectively
	creates a locally important habitat and corridor for movement, feeding and breeding of wildlife.
<b>Sensitivity of habitat to flow changes</b>	3 – The stream flow under natural conditions is expected to be relatively dependable, and geomorphology of the river strongly influenced by instream barriers (dams and weirs).
<b>Sensitivity to flow related water quality changes</b>	3 – Smaller, slow-flowing water streams have a higher sensitivity to organic pollution loads than larger streams of fast-flowing water. The former situation is typical of this river reach, increasing the sensitivity of the stream to water quality related impacts, especially under low or base flow conditions.
<b>Migration route for instream and riparian biota</b>	3 – The Jan Rolms River and associated drainage lines are well connected at a landscape level providing an important migratory corridor to biota through a patchwork of agricultural land uses.
<b>Protection Status</b>	1 – The conservation of instream and riparian habitat is important at the local scale but does not occur within a formally protected area.
<b>EIS Score</b>	<b>2 - MODERATE</b>

#### 4.4 Aquatic Impact Buffer Zones

Riparian means where the land meets a watercourse, and refers to the interface between these two habitats. Buffer areas are linear zones adjacent to wetland and riparian areas managed with the intention of protecting water resources from diffuse pollution associated with adjacent land uses. In addition, they provide habitat for wildlife and aid movement through increasingly fragmented landscapes. Some well established benefits of buffer zones include:

- ✓ Maintain channel stability
- ✓ Control microclimate and temperature
- ✓ Flood attenuation
- ✓ Maintain wildlife habitat
- ✓ Sediment removal from diffuse runoff
- ✓ Nutrient removal from diffuse runoff
- ✓ Improve habitat connectivity
- ✓ Screening adjacent disturbance
- ✓ Enhance visual quality
- ✓ Control noise levels
- ✓ Improve air quality
- ✓ Create recreational opportunities

Many of these benefits would be realised by including adequate aquatic impact buffer zones throughout the existing and proposed farming and feedlot areas.

Buffer zone widths were determined using the site-based Riparian Buffer model for rivers developed by Macfarlane & Bredin (2017) which is the more comprehensive of the two available models. The model incorporates locally determined environmental factors such as soil type, slope, annual rainfall, soil erodibility and inherent runoff potential at the site. Based on the proposed land use selected (Agriculture: Concentrated livestock operations) the buffers were determined as follows:

#### **Aquatic Impact Buffer Zone: 46 m**

The delineated watercourses and associated aquatic impact buffers are provided in Figure 25. From a management perspective, future activities associated with the feedlot (irrigation of fields with wastewater and sheep kraals) should be excluded from either the riparian zone or the 46m buffer, whichever is the greatest.

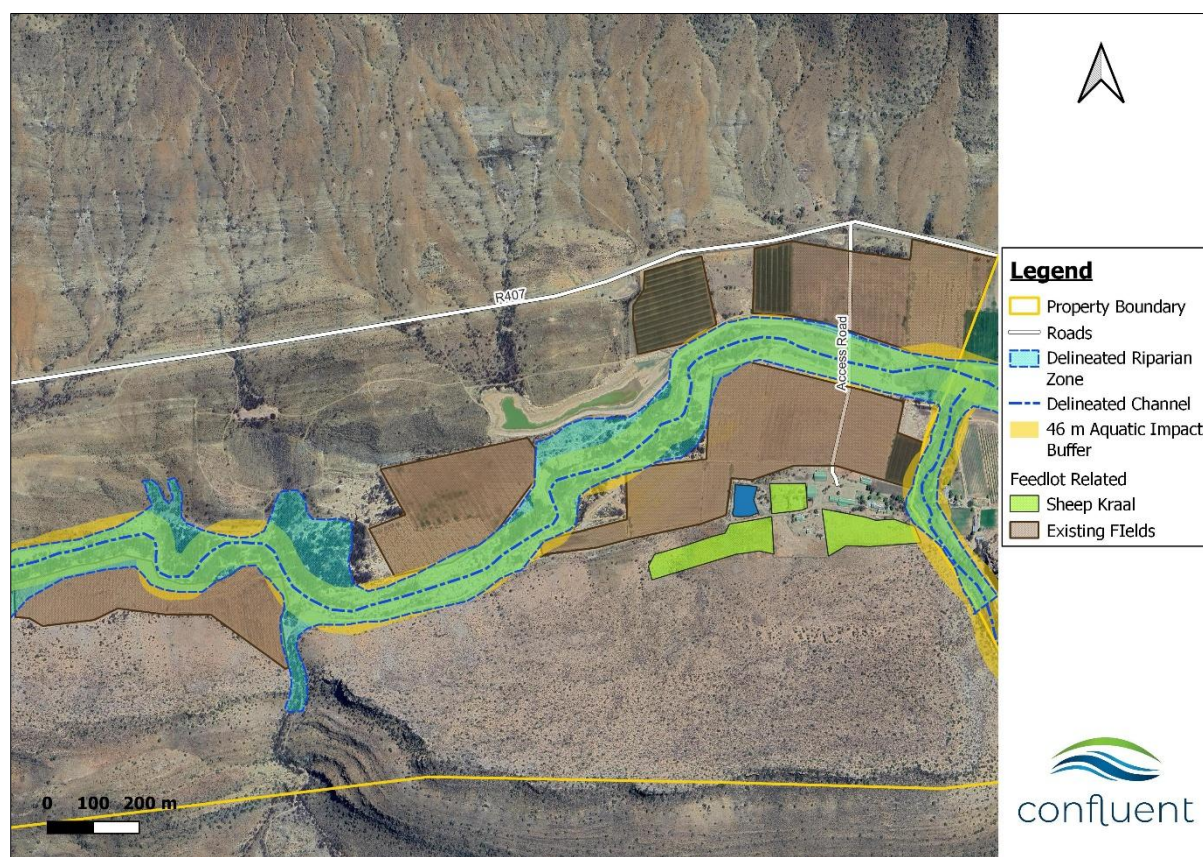


Figure 25. Agricultural area indicating full extent of the recommended aquatic impact buffer of 46m.

## 5. SITE SENSITIVITY VERIFICATION

The site sensitivity verification for this site is confirmed as **Very High** due to the presence of the Jan Rolms River and associated tributary which will be directly and indirectly affected by the proposed change in land use and road crossing upgrade. The proposed farming operations therefore require an Aquatic Specialist Impact Assessment.

## 6. IMPACT ASSESSMENT

The impact assessment is fundamentally guided by the mitigation hierarchy which seeks to avoid and minimise impacts as the first priority (Figure 26). Every effort must be made to avoid and minimise impacts and rehabilitate affected areas. Offsets are the final option in the mitigation hierarchy. The impact assessment includes not only direct and indirect impacts, but also cumulative impacts which are additive. Cumulative impacts in this instance must not cause irreversible decline to the conservation value of the river and the presence of special habitats or cause a significant loss in ecosystem services. Residual impacts are negative impacts that remain after all reasonable and practical changes have been made to location, siting, scale, layout, technology, and design of the proposed farming operation. Provided the residual impacts are Very Low or Low, no offset is required. However, if the residual impacts are Medium or High, then an offset is required. Very High residual impacts cannot be offset and are unlikely to be authorised.

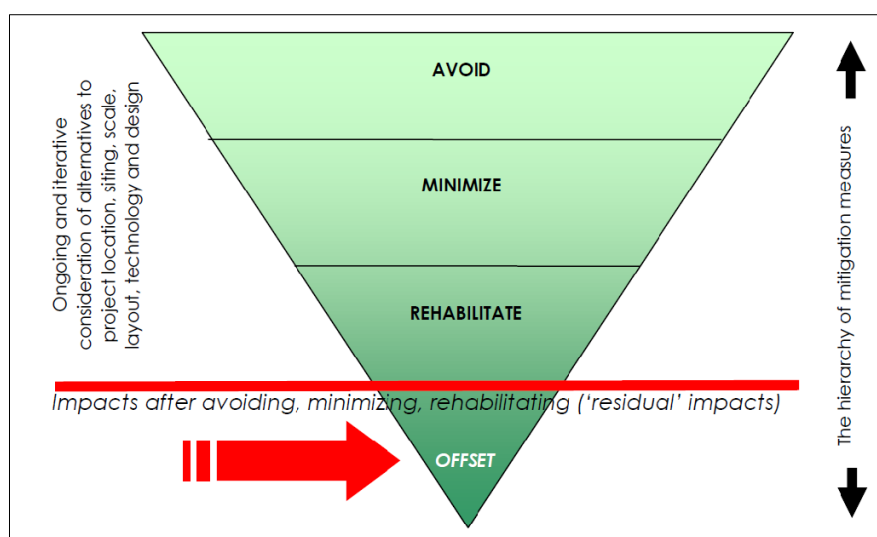


Figure 26. Mitigation hierarchy applied in the assessment of impacts.

## 6.1 No Go Option

Assessment of the No Go option assumes that current activities will continue as they are currently practiced. That is free-ranging sheep farming, production of a range of irrigated crops on the existing fields (irrigated using surface water from various sources), and the access road maintained in its present condition.

Several existing impacts have been identified during the assessment of the Present Ecological State (PES) of the Jan Rolms River, which was rated as being in a D, Largely Modified condition. Some of the current impact such as water abstraction, alien plant invasions, and instream barriers are applicable to general agricultural land use upstream, as well as at Portion 1/177 Vrolykheid. The No Go option would see this condition maintained.

However, if the No Go option were to be improved (ie. Mitigation measures recommended) then a number of recommendations would be made regardless of future development:

- Upgrade the road crossing to allow better water flow and sediment movement instead of the solid barrier which is currently in use.
- Manage and maintain riparian vegetation clear of alien invasive plant species.
- Ensure livestock are prevented from entering the riparian zone and watercourse. Provide designated drinking water and feeding areas elsewhere on the farm that are not located in the watercourse.

These recommendations form both part of the proposed feedlot development (road upgrade) and will be included in mitigation measures recommended to reduce impacts of the agricultural operation in general. If these mitigation measures were fully implemented, the PES of the Jan Rolms River could be locally improved by at least one category to a C, Moderately Modified.

## 6.2 Layout and Design

### 6.2.1 Fields Receiving Feedlot Waste

The layout of the fields is existing, and it therefore makes sense to utilise existing fields so as not to disturb more natural areas for the expansion of field areas. However, portions of the

existing fields are situated closer to the channel than the recommended buffer of 46 m, and in some cases extend into the historical riparian area. Of the fields proposed for irrigation and with wastewater and spreading of manure, four of them are laid out too close to the watercourse at present (Figure 27). Two possible options for mitigation would be either to:

- A) Adjust the extent of the four fields in areas where they extend into the recommended buffer, or
- B) Do not irrigate/spread waste on the five fields indicated with wastewater or solids. Irrigation should be maintained with current sources from clean surface water. This may be complex to achieve in practicality but may be considered a viable option.

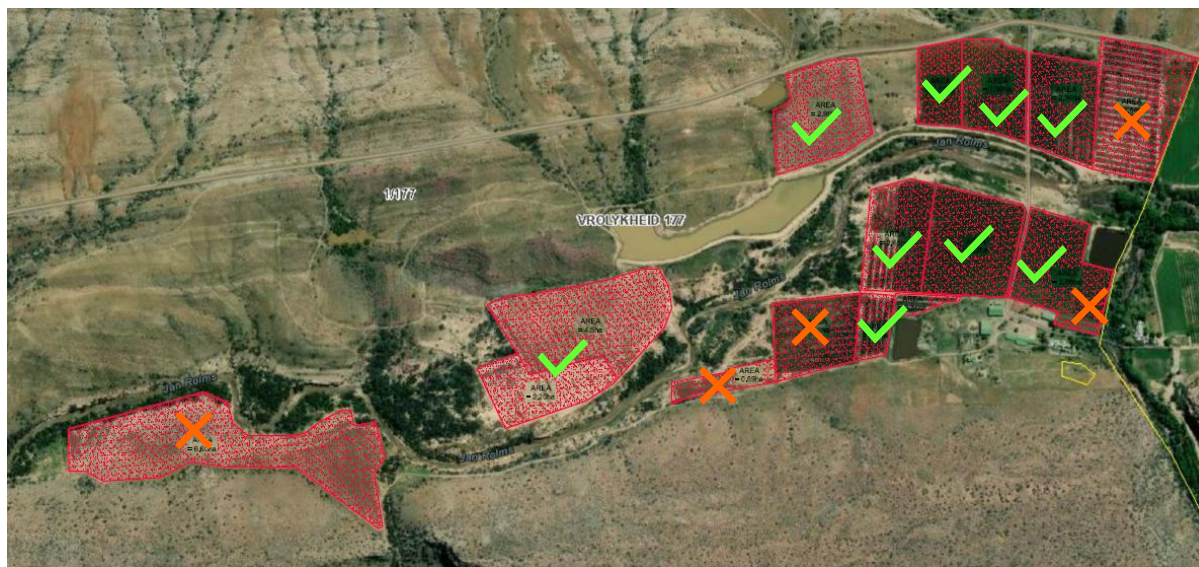


Figure 27. Proposed fields for irrigation and spreading of feedlot waste indicating those where the 46m buffer is upheld (ticked), and four fields where the boundary is considered too close to the watercourse for these practices (crossed).

In the case of Option A, the requirement would be to re-align fencing to the adjusted extent of the field and allow the area beyond to regenerate as natural riparian vegetation to be excluded from any agricultural impacts.

In the case of Option B, the fields would remain in their present extent (as they are currently operational) and the irrigation system would need to be set up to ensure that no waste was ever irrigated or spread on the four fields of concern. The landowner has indicated that Option B would be the preferred option.

Both mitigation methods were considered equal in the impact assessment table provided in Table 9.

It is noted that an inherent risk mitigating factor is that the furrow diverting water from the Jan Rolms River to Stilbaai Dam will act as a cutoff drain below at least four fields on the northern side of the river, preventing runoff from entering the Jan Rolms River.

### 6.2.2 Establishment of the Sheep Kraal

One of the two areas indicated for concentration of high numbers of sheep is located adjacent to the tributary of the Jan Rolms River. The eastern edge of this area extends approximately 13 m into the 46 m buffer (Figure 28). It is therefore recommended that the extent of the field

be adjusted away from the buffer to protect this watercourse. If this area was essential to recover from elsewhere, then the western edge of the field could be extended towards the west into an old field with no impact to aquatic ecosystems.



Figure 28. The overlap (encircled) between the eastern extent of the proposed sheep kraal and the 46 m buffer. Refer to Figure 29 for more detail.

An enlargement of the eastern sheep kraal planned layout is provided in Figure 29. This shows that a soil berm will be established along the southern extent of the sheep kraal to intercept surface runoff from the upslope area and divert it towards the Jan Rolms tributary. It also shows that the approximate location of the 46 m buffer is almost entirely outside of the footprint of the sheep kraal. It should therefore be relatively straightforward to ensure the footprint of this section be kept out of the buffer.

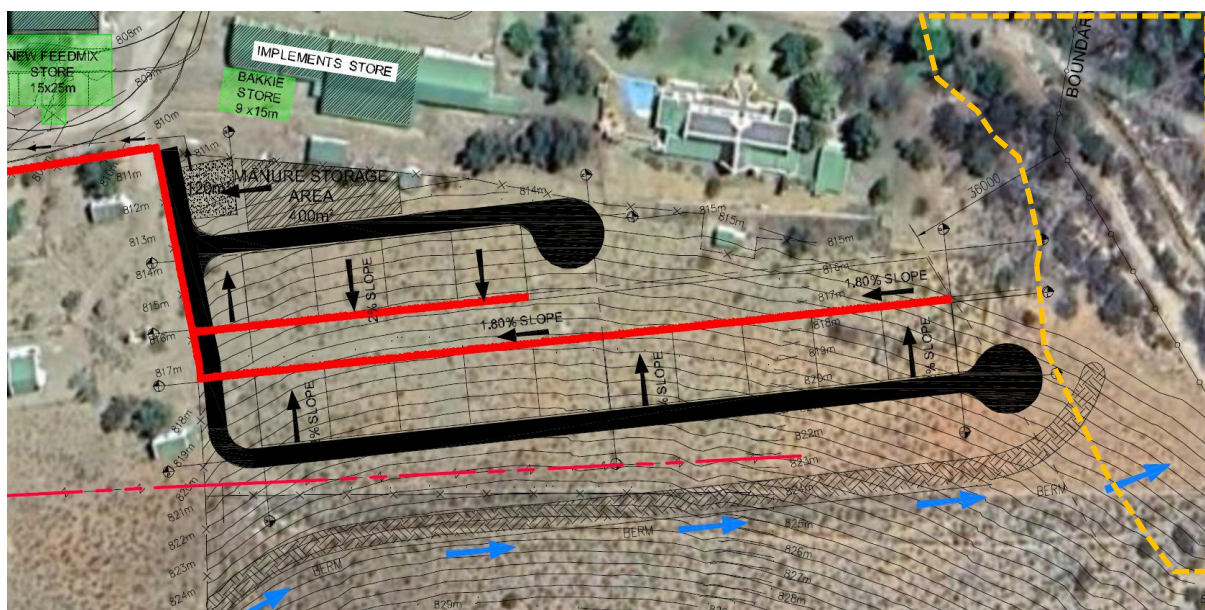


Figure 29. Proposed detail of the eastern sheep kraal layout annotated to show the approximate line of the 46 m buffer.

The recommended mitigation measure would be to ensure the entire area of the Eastern sheep kraal is fenced off outside of the 46 m buffer. Given that the kraal only encroaches a

small amount into the buffer, the 'with' and 'without mitigation' impacts are considered similar and were rated as a Minor Negative (Table 9).

### 6.2.3 River Crossing Upgrade

The location of the river crossing at the same location as the existing crossing is ideal, as no additional disturbance will be created, and the footprint will be relatively similar.

The initial design provided by the engineer was reviewed from the perspective of important processes that are currently disrupted by the existing crossing.

#### **Mitigation Measure: Revised Preferred Design for the River Crossing**

An improved design was discussed with the engineer which includes box culverts of a greater height beneath the road instead of piped culverts which are more likely to block. This would mean that the road would need to be constructed higher than the present design, but that water and sediment would have an easier passage through the culverts. The additional material for construction of the road could be sourced from the abundant accumulation of sand upstream of the current crossing in the riverbed. This must be lowered in any event to try and re-establish a uniform level of the riverbed. The improved design has a reduced likelihood of blockage and reduced disturbance due to ongoing maintenance (Figure 6).

The revised design of the road crossing is considered 'with mitigation' alternative and is an improvement on the original design.

Table 9. Layout & Design Impact: Establishment of the Eastern sheep kraal.

Impact	Intensity	Duration	Extent	Probability	Significance	Significance Rating	Reversibility	Irreplaceability	Confidence
<b>Layout and Design Phase Impact Assessment for Proposed Feedlot Development</b>									
<b>Impact 1: Irrigation of existing fields with wastewater</b>									
<b>Without Mitigation</b>	Moderate	Ongoing	Local	Almost certain	-78	Moderate	Low	Medium	High
<b>With Mitigation</b>	Low	Ongoing	Limited	Probably	-44	Minor	Medium	Medium	High
<b>Impact 2: Establishment of the Eastern sheep kraal</b>									
<b>Without Mitigation</b>	Moderate	Ongoing	Limited	Likely	-60	Minor	Medium	Medium	Medium
<b>With Mitigation</b>	Low	Ongoing	Very limited	Probably	-40	Minor	Medium	Medium	Medium
<b>Impact 3: Design of the road crossing upgrade to ensure free flow of water and sediment</b>									
<b>Without Mitigation</b>	Moderate	Ongoing	Limited	Probably	-48	Minor	Medium	Low	High
<b>With Mitigation</b>	Low	Short term	Very limited	Unlikely	-21	Negligible	High	Low	High

### 6.3 Construction Phase Impacts

An Environmental Control Officer (ECO) should be appointed at the start and conclusion of the feedlot establishment to provide feedback on compliance with authorisation conditions to various regulatory departments. The ECO should check in and report back on progress once a month until the project concludes. The ECO should ensure that photos are taken of all areas where work will be carried out before, during and after completion. These should be submitted as part of a report for commencement and completion of the work to be supplied to both DEA&DP and BOCMA.

#### 6.3.1 Fields Receiving Feedlot Waste

The fields to be irrigated with wastewater are already established and therefore do not require any further construction as such. The only anticipated construction phase activities for this aspect are listed here:

- a) Pipelines might need to be installed across the river to irrigate fields on the other side of the feedlot. Pipelines may require physical disturbance such as digging and vegetation removal, and could potentially leak during their operation, requiring maintenance and repeated disturbance.
- b) The wastewater storage dam which receives manure runoff from the sheep kraals could pollute groundwater.
- c) If the extent of the four fields in the 46 m buffer is going to be adjusted (Layout phase impact), then removal / replacement of fencing around these fields may be necessary.

#### **Mitigation Measures: Pipeline Installation and Maintenance**

The following mitigation measures are recommended to address impacts associated with these activities:

- Discuss the requirements for any new pipelines to be installed with the ECO, and agree on the best routing where river crossings are involved, following the recommendations below.
- If any pipelines must cross the river, these should be installed adjacent to existing infrastructure such as the road crossing, or furrow diversion weir. This is meant to avoid disturbance of new areas of the river that might require maintenance in the future.
- If the pipeline will be carrying feedlot wastewater across the river, then the longest length of pipeline should be used to minimise the number of joins that can potentially leak into the river. Pipe joints should be sealed very well to prevent leakage as far as possible.
- If carrying wastewater, try to install the pipeline above ground if possible so that any leaks can be easily detected and repaired.
- Installation and maintenance of pipelines should be done by hand using spades and wheelbarrows as far as possible. If heavy machinery is deemed necessary, then this should be operated from a position of existing disturbance such as the road crossing.

The installation and maintenance of irrigation pipelines is expected to have a Negligible negative impact if the recommended mitigation measures are followed (Table 10).

### **Mitigation Measures: Pollution of Water Resources from Wastewater Storage Dam**

Minimal mitigation measures are required to mitigate this impact:

- The wastewater storage dam must be suitably lined to prevent seepage to groundwater. The liner can consist of welded plastic or clay, with the decision partially informed by the ease with which periodic maintenance to clean solids out of the dam can take place.
- Water levels in the dam must be monitored to ensure it doesn't get too full and potentially overflow. Irrigation must be undertaken to reduce dam water levels prior to periods of high rainfall predictions.

Provided these mitigation measures are implemented, the negative impact of this aspect is likely to be Negligible (Table 10).

### **Mitigation Measures: Possible Refencing of Fields along the 46 m Buffer**

- Any vehicles or machinery required to remove / install fencing must be operated along the inside of the field area to minimise disturbance in the 46 m buffer.
- Remove any fencing necessary and repurpose this for adjusted fence lines along the buffer where feasible.
- No fences must run across the river at any point. Fencelines must not cross into the riparian zone or 46 m buffer at any point as this would restrict the movement of wildlife and potentially create a barrier during high flow / flood events.
- All fencing waste materials must be removed from the riparian zone and buffer and disposed of at a suitable waste disposal site.

Should fencing need to be moved, the potential impacts are considered Negligible both with and without mitigation (Table 10).

### **6.3.2 Establishment of the Sheep Kraal**

The establishment of the sheep kraal area is unlikely to have many direct impacts on the Jan Rolms River or tributary because work with a low rate of disturbance and earth-moving is anticipated. The installation of fences, shadeports, and concrete slab for feeding troughs, along with construction of the soil berm to divert clean water is all that is anticipated. General mitigation measures are provided which primarily relate to the eastern sheep kraal near the Jan Rolms tributary.

### **Mitigation Measures: Establishment of the Sheep Kraal**

- Survey and mark out the boundary of the 46 m buffer adjacent to the eastern sheep kraal using danger tape or similar.
- No workers, machinery or materials may be placed, stored, or operated in the buffer as the aim is to maintain a healthy undisturbed vegetation cover. Use signage to indicate this as a 'No-Go' area during establishment of the sheep kraal.
- The soil berm used to divert clean water away from the sheep kraal should conclude at a point where diverted water will not easily form an erosion cut.

- Work to establish the soil berm should be undertaken during dry weather and should aim to retain as much of the natural vegetation cover as possible to avoid erosion in future.

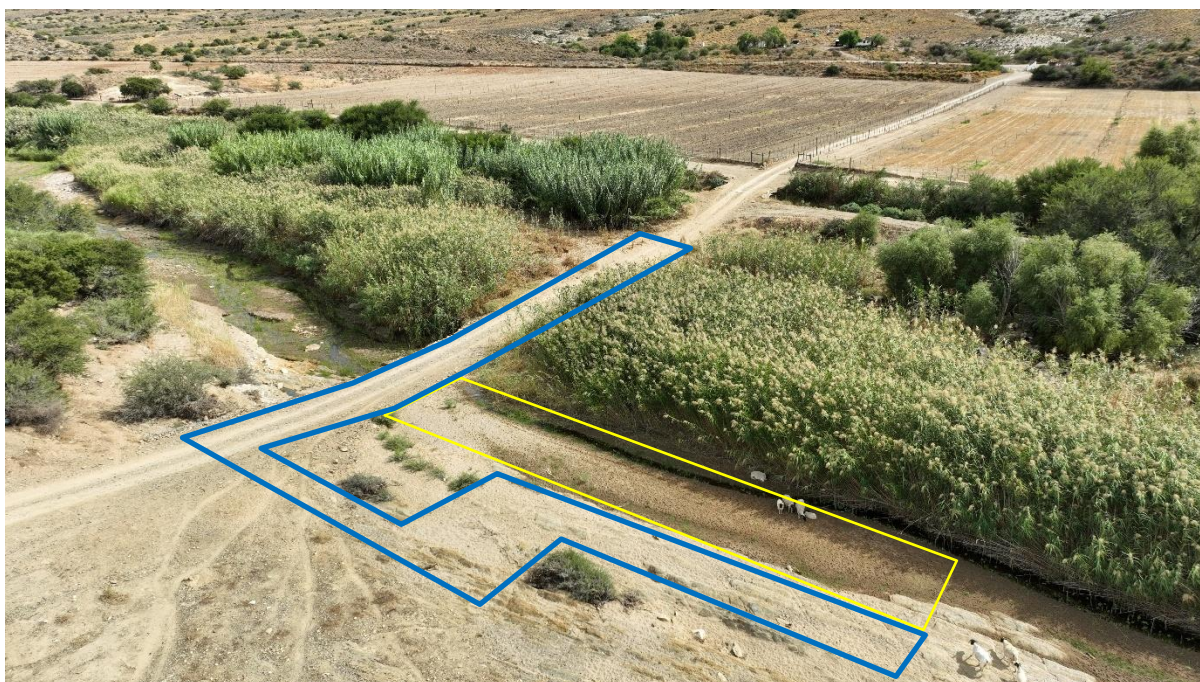
Provided the mitigation measures provided can be implemented, the expected impact with mitigation is Negligible (Table 10).

### 6.3.3 River Crossing Upgrade

Construction of the upgraded river crossing will require the use of heavy machinery such as a TLB, storage of materials such as sand and cement, and the use of labour and various contractors to implement the work. Impacts to the Jan Rolms River would best be avoided by working when the river is dry. Under ideal conditions, this would naturally be the case at the time the work is undertaken; however, this cannot be guaranteed, and mitigation measures are provided to ensure water quality and habitat are impacted to a minimal degree during the construction phase.

#### **Mitigation Measures: Construction of the River Crossing Upgrade**

- Together with the ECO delineate and mark out (using danger tape) the minimum disturbance footprint which allows access to the crossing area and prevents excessive disturbance of both instream and riparian vegetation. An area of 5m either side of the construction footprint is considered the maximum required area of disturbance.
- It is proposed that sand that has accumulated upstream of the road crossing be used to partially / fully meet the requirements of the fill necessary to rebuild the road crossing. As the sand is recently deposited without much vegetation, this impact is acceptable. However, the area that sand may be collected is limited to the annotated image shown in Figure 30. This is 30 m in length upstream of the bridge and 5 m in width across the sandy section (not into reeds), and 0.5 m deep on average. The depth should be graded so a gentle, even slope is formed along the riverbed profile to the road crossing.
- For effective waste management, hire a skip for disposal of waste during the construction phase and provide portable toilet(s) for construction workers.
- Materials cannot be stockpiled, and concrete cannot be mixed in the watercourse or riparian zone. Stockpiles should be located >100 m from the river. Concrete mixing for small applications must be done on a board and the waste material discarded in a skip for removal from the site.
- All dirty water from materials mixing and cleaning cannot be discarded anywhere in the natural environment. A skip must be kept on site and small volumes of dirty water can be thrown into this.
- Create dry working conditions. If the stream is flowing, consider diverting as much flow as possible to Stilbaai Dam via the existing weir and furrow diversion structure. Alternatively create a small instream dam using sandbags upstream of the working area in the sandy riverbed and pump the water around the road crossing site from the hole. Dry conditions at the crossing point should be maintained for as short a time as possible.



*Figure 30. Area of sand that may be excavated to provide material for the new road crossing (yellow). Measures approximately 30 m long x 5 m wide x 0.5 m depth on average. Heavy vehicle access points (blue).*

- Remove the existing crossing materials using a suitable machine (e.g. TLB) working from the road structure backwards. As far as possible, the machine must not drive in the riverbed or on the banks and should stick to the road footprint as far as possible.
- Remove all materials from the old crossing from the river. No material to be spread or discarded in the river or riparian zone. The reuse of materials is acceptable. For instance, rocks in the existing gabions can be reused in any gabion / reno mattress structures associated with the new crossing.
- At the conclusion of construction, ensure that all waste materials are removed from the river and riparian zone.
- Remove any instream flow barriers that were used to create dry working conditions.

Provided all the mitigation measures recommended are fully implemented, the impacts to the Jan Rolms River of upgrading the river crossing is rated as a Negligible Negative (Table 10).

Table 10. Construction phase impact assessment for establishment of the proposed feedlot.

Impact	Intensity	Duration	Extent	Probability	Significance	Significance Rating	Reversibility	Irreplaceability	Confidence
<b>Construction Phase Impact Assessment for Proposed Feedlot Development</b>									
<b>Impact 1: Installation and Maintenance of Pipelines for Irrigation of Fields</b>									
<b>Without Mitigation</b>	Moderate	Short term	Limited	Probably	-36	Minor	High	Low	High
<b>With Mitigation</b>	Very low	Brief	Very limited	Unlikely	-15	Negligible	High	Low	High
<b>Impact 2: Pollution of Water Resources from Wastewater Storage Dam</b>									
<b>Without Mitigation</b>	Low	Short term	Limited	Probably	-32	Minor	Medium	Medium	High
<b>With Mitigation</b>	Very low	Brief	Limited	Unlikely	-18	Negligible	High	Low	High
<b>Impact 3: Possible Refencing of Fields Along the 46m Buffer</b>									
<b>Without Mitigation</b>	Low	Medium term	Very limited	Unlikely	-24	Negligible	High	Low	High
<b>With Mitigation</b>	Very low	Brief	Very limited	Rare	-10	Negligible	High	Low	High
<b>Impact 4: Establishment of the Sheep Kraal</b>									
<b>Without Mitigation</b>	Moderate	Medium term	Limited	Probably	-40	Minor	High	Low	High
<b>With Mitigation</b>	Very low	Short term	Very limited	Unlikely	-18	Negligible	High	Low	High
<b>Impact 5: Construction of the Upgraded River Crossing</b>									
<b>Without Mitigation</b>	High	Medium term	Limited	Likely	-55	Minor	Medium	Medium	High
<b>With Mitigation</b>	Moderate	Short term	Very limited	Probably	-32	Negligible	High	Low	High

## 6.4 Operational Phase Impacts

### 6.4.1 Management of 46 m Buffer Area

The aim of the 46 m buffer is to protect water resources from contamination with organic and pathogenic pollutants that originate from spreading waste on the adjacent fields. For buffers to function effectively for this purpose vegetation must be managed in optimal conditions. This means that vegetation cover and diversity should be maintained at a high level, as vegetation acts as a biofilter for waste runoff before it enters the watercourse. The following mitigation measures are recommended for maintenance and management of the buffer area.

### **Mitigation Measures: Management of the 46 m Buffer Area**

- Ensure that free-roaming sheep cannot enter the buffer area. This may require some basic fencing to exclude sheep from the buffer areas but should not result in a fence that in any way inhibits the movement of wildlife through the buffer.
- Undertake invasive alien plant clearing and follow-ups. Alien plants should be identified and cleared at least twice per year along the full length of the Jan Rolms River in the farmed area.
- Poplars represent a special case for alien clearing, as the trees at this location are large, growing in a dense stand, and exhibit aggressive coppicing and regeneration from root suckers when cut. Large trees should be ring barked or can be felled for commercial timber use. Regrowth from root suckers must be controlled. Ideally roots must be removed physically, or ongoing control in the form of goats restricted to feeding on young root suckers can be effective.
- Bare areas where sheep have been feeding and grazing near the river crossing should be allowed to revegetate passively over time. No active planting in the area is considered necessary, as once the grazing pressure is removed, vegetation can regenerate from the existing seedbank.

With implementation of these mitigation measures the expected impact is rated as a Negligible Negative (Table 11).

#### **6.4.2 Fields Receiving Feedlot Waste**

Operational phase impacts are largely dependent on which of the layout phase options are selected. If the 4 fields earmarked for exclusion of feedlot waste are simply meant to be left out of the waste spreading routine, then this must be clearly communicated to all staff, and operationalised through separate pipelines. If the extent of the fields is adjusted to align with the 46 m buffer then no further mitigation measures are required.

#### **6.4.3 Establishment of the Sheep Kraal**

Once the feedlot is operational, large numbers of sheep will occupy the sheep kraals where they will be feeding, drinking and defecating. The planned layout of the kraal areas directs all liquid and solid waste into holding areas located away from the 46 m buffer. Given that runoff from the feedlot area aims to capture as much of the waste as possible for use as fertiliser, the impact of organic pollution on the adjacent tributary of the Jan Rolms River is unlikely to occur.

#### **6.4.4 River Crossing Upgrade**

The operational phase aspects for the river crossing primarily relate to ensuring no erosion associated with the new structure occurs, and that water and sediment flow through the new structure are improved. The revised design of the crossing aims to ensure these aspects are effectively addressed and **the impact of the upgraded road crossing is envisaged to be positive for the Jan Rolms River** compared to the existing crossing, particularly regarding geomorphology processes. The primary consideration for the upgraded river crossing is monitoring that it is operating as intended and creating no additional, unforeseen impacts.

### **Mitigation Measures: Monitoring and Maintenance of the River Crossing**

- The landowner must inspect the crossing after heavy rainfall events to check for blockages and debris that could restrict flow through the culverts.
- Any material blocking culverts must be cleared preferably by hand. If significant debris is present following floods, then an excavator working from the road may remove debris from within 2m of the structure.

Provided the mitigation measures recommended in terms of managing and monitoring are implemented, the impacts to the Jan Rolms River and tributary are rated as a Negligible Negative.

Table 11. Operational phase impact assessment for the proposed feedlot.

Impact	Intensity	Duration	Extent	Probability	Significance	Significance Rating	Reversibility	Irreplaceability	Confidence
<b>Operational Phase Impact Assessment for Proposed Feedlot Development</b>									
<b>Impact 1: Management of the 46 m Buffer Area</b>									
<b>Without Mitigation</b>	Moderate	Long term	Limited	Almost certain	-66	Minor	Medium	Low	High
<b>With Mitigation</b>	Very low	Medium term	Limited	Probably	-32	Negligible	High	Low	High
<b>Impact 2: Monitoring and Maintenance of the River Crossing Upgrade</b>									
<b>Without Mitigation</b>	Low	Medium term	Limited	Probably	-36	Minor	Low	Medium	High
<b>With Mitigation</b>	Very low	Brief	Very limited	Unlikely	-15	Negligible	Medium	Medium	High

## **7. CONCLUSIONS**

The proposed establishment of a sheep feedlot is consistent with the zoning and current land use of the farm operation on Portion 1/177 Vrolykheid Farm. The Jan Rolms River and tributary are the primary aquatic ecosystems that could be negatively impacted by the intensification of agriculture in the farmed area. Existing impacts are present and could potentially be reduced through implementation of the proposed mitigation measures. In the other words the present *status quo* could be improved despite the development of the feedlot. The Jan Rolms River PES was categorised as D, Largely Modified. This could potentially be improved to a C, Moderately Modified, if all the mitigations measures are diligently implemented. Most impacts assessed were rated as Negligible Negative provided the recommended mitigation measures are implemented.

Feedlot operations can potentially create significant sources of waste and pollution to surrounding natural environments, and water resources in particular. Therefore, compliance with any conditions of approval should be closely monitored to ensure the operation is well managed and compliant with any stipulated conditions.

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