Proposed Upgrade of Sewerage Infrastructure in Woodlands, Eastern Cape.

Aquatic Biodiversity Impact Assessment

Prepared For:	Blue Pebble (Pty) Ltd
Author:	Jackie Dabrowski (PhD) Confluent Environmental Pty (Ltd) 7 St. Johns Street, Dormehls Drift, George, 6529
Report Ref:	CENV10
SACNASP:	Pr. Sci. Nat. (Aquatic & Ecological Science – 115166)
Date:	July 2025
Version:	Draft

DECLARATION OF SPECIALIST INDEPENDENCE

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I undertake to disclose all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant;
- have the necessary qualifications and guidance from professional experts in conducting specialist reports relevant to this application, including knowledge of the relevant Act, regulations and any guidelines that have relevance to the proposed activity;
- This document and all information contained herein is and will remain the intellectual property of Confluent Environmental. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigators.
- All the particulars furnished by me in this document are true and correct.

Jackie Dabrowski (Ph.D., Pr.Sci.Nat. Aquatic Science)
SACNASP Registration Number 115166
Co-director: Confluent Environmental (Pty) Ltd

Qualifications: BSc, BSc Honours (Entomology), MSc & PhD (Veterinary Science)

Expertise: > 13 years' experience working on aquatic ecosystems across South Africa, with a focus on the Southern Cape in the last 7 years. Includes research and consulting expertise, having published > 10 water-related research articles and compiled > 450 aquatic specialist reports. Research and consulting have been in a range of sectors including agriculture, urban developments, linear structures, renewable energy, conservation, and mining.

TABLE OF CONTENTS

DECLARATION OF SPECIALIST INDEPENDENCE .... **II**
LIST OF TABLES .... **IV**
LIST OF FIGURES .... **IV**
GLOSSARY .... **VI**
ABBREVIATIONS .... **VII**
1. INTRODUCTION **8**
1.1 KEY LEGISLATIVE REQUIREMENTS 8
1.1.1 National Environmental Management Act 8
1.1.2 National Water Act 9
1.2 DFFE SCREENING TOOL RESULTS 10
1.3 ASSUMPTIONS AND LIMITATIONS 11
1.4 THE PROPOSED SEWERAGE UPGRADES 11
2. CATCHMENT CONTEXT **13**
2.1 CATCHMENT FEATURES 13
2.2 VEGETATION 14
2.3 CONSERVATION AND CATCHMENT MANAGEMENT 15
2.3.1 Eastern Cape Biodiversity Conservation Plan 15
2.3.2 National Freshwater Ecosystem Priority Areas 16
2.4 FISH SUPPORT AREA 16
2.5 MAPPED WATERCOURSES 18
2.6 HISTORICAL ASSESSMENT 19
3. SITE ASSESSMENT **20**
3.1 WATERCOURSE CLASSIFICATION 22
3.2 WATER QUALITY ANALYSIS 23
3.3 PRESENT ECOLOGICAL STATE (PES) 25
3.3.1 Wetland PES 25
3.3.2 Drainage Line PES 25
4. LEGISLATIVE IMPLICATIONS **26**
4.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT 26
4.2 NATIONAL WATER ACT 26
5. IMPACT ASSESSMENT **26**
5.1 NO-GO DEVELOPMENT OPTION 28
5.2 DESIGN AND LAYOUT PHASE IMPACT ASSESSMENT 28
5.2.1 Impact 1: Bulk Sewer Line Route 28
5.2.2 Impact 2: The Upgraded WWTW and Associated Outlets 29

5.3 CONSTRUCTION PHASE IMPACT ASSESSMENT ... 30
5.3.1 Impact 1: Non-compliance with Conditions of the Environmental Authorisations ... 30
5.3.2 Impact 2: Delineating a Minimal Footprint of Disturbance and No-Go Areas ... 31
5.3.3 Impact 3: Construction Workers in and Around Sensitive Aquatic Habitat ... 32
5.3.4 Impact 4: Stormwater Runoff Causing Erosion, Sedimentation and Pollution During Construction ... 33
5.3.5 Impact 5: Working in and Adjacent to Wetlands for Construction of the Bulk Sewer Line ... 34
5.3.6 Impact 6: Working in and Adjacent to the Drainage Line for Construction of the WWTW and Associated Outlets ... 35
5.4 OPERATIONAL PHASE IMPACT ASSESSMENT ... 36
5.4.1 Impact 1: Pipeline Blockages, Sewage Spills, and Operational Issues ... 36
5.4.2 Impact 2: Risk of Increased Access to Aquatic Habitats for Dumping ... 37
5.5 MONITORING RECOMMENDATIONS ... 38
6. CONCLUSIONS ... 39
7. REFERENCES ... 39
8. APPENDICES ... 40
8.1 METHODS FOR INDEX OF HABITAT INTEGRITY ... 40

LIST OF TABLES

Table 1. Summary of relevant catchment features for Woodlands. ... 13
Table 2. Definitions and objectives for conservation categories identified in the Western Cape Biodiversity Spatial Plan (WCBSP, 2017). ... 16
Table 3: Water quality results ... 24
Table 4. WET-Health assessment of the wetland to be crossed by the sewer line. ... 25
Table 5. Design and Layout Phase Impact Assessment ... 30
Table 6. Construction phase impact assessment. ... 36
Table 7. Operational Phase Impact Assessment ... 38
Table 8. Descriptive classes for assessment of habitat modifications (Kleynhans, 1996) ... 40
Table 9. Index of habitat integrity (IHI) classes and descriptions ... 40

LIST OF FIGURES

Figure 1. Location of the WWTW and bulk sewer line to be upgraded near Woodlands in the Eastern Cape. ... 8
Figure 2: Results of the DFFE Screening Tool which indicate Very High Sensitivity of the Aquatic Biodiversity theme for the preferred development pipeline. ... 10

Figure 3. Map showing the progression of sewer line layout options and the proposed WWTW upgrade site at Woodlands (SMEC Engineering). Inset indicates enlargement of the WWTW. 12

Figure 4. Approximate area of the new WWTW footprint adjacent to the existing landfill site in Woodlands. 12

Figure 5. Location of the WWTW and proposed new bulk sewer line in the quaternary catchment K80D. 14

Figure 6. Area-averaged monthly rainfall for the coastal Southern Cape indicating peaks in Mar-Apr, Aug, and Oct. Data averaged between 1979 and 2011 (Engelbrecht et al., 2015). 14

Figure 7. The WWTW and proposed new bulk sewer line (Option 2 shown) in relation to mapped conservation features of the Eastern Cape Biodiversity Conservation Plan (ECBCP,2019) 15

Figure 8: Map indicating the Proposed New Bulk Sewer Line and WWTW location in relation to mapped Freshwater Ecosystem Priority Areas 17

Figure 9: Distribution of the Eastern Cape redfin, Pseudobarbus afer (Chakona and Skelton 2017) 18

Figure 10: The WWTW and proposed new bulk sewer line (showing Option 2) in relation to mapped watercourses. 19

Figure 11. Historical photos showing WWTW and proposed new bulk sewer line's location from 2003 until 2024 (Google Earth imagery). Arrows indicate the location of an impact when it is first observed. 20

Figure 12. Photos taken of various features during the site visit. 21

Figure 13. GPS track walked and driven during the site assessment and delineated wetland and stream. Sewer line route shown is Option 2. 22

Figure 14: Map of the WWTW and proposed new bulk sewer line (Option 2 shown) in relation to water quality sampling points. 23

Figure 15. Successive steps shown in the mitigation hierarchy which can only be considered once the previous step has been exhausted (EWT, 2023). 27

Figure 16. Layout of the proposed WWTW and pipeline options in relation to delineated watercourses and the 1:100 year floodline (determined by SMEC). Inset shows enlargement of the WWTW area for greater visibility of the two outlets proposed to the watercourse. 28

Figure 17. Example of mixing cement (dagha) on a wooden board to prevent wash off to watercourses during rainfall. 32

Figure 18. Examples of silt fences with soil saver matting (left) and coir logs (right) used to trap sediment mobilised from steep slopes during the construction phase. 33

Figure 19. Examples of a haybale check dam in a concentrated flow path (left) and sandbags surrounding a stormwater drain which leads to a wetland. This prevents silt laden water from entering the wetland where it would be difficult to remove. 34

GLOSSARY

Aquatic Biodiversity	The variety of plant and animal life in water ecosystems, relevant to the study due to the site's proximity to potential water bodies.
Desktop Review	Preliminary assessment based on existing data and information, conducted prior to on-site investigations.
Erosion Control Methods	Techniques employed to prevent or minimize soil erosion, such as haybale check dams or silt fencing, crucial in areas with high inherent erosion potential.
Freshwater Ecosystem Priority Area (FEPA)	Designated areas of high importance for freshwater ecosystem conservation, identified as a sensitivity feature in the DFFE screening tool.
Site Assessment	Comprehensive evaluation of the proposed development site, including the identification of wetlands, watercourses, and soil characteristics.
Sensitivity	The degree to which a particular area or ecosystem is susceptible to disturbance or impact, crucial in determining potential environmental consequences.
Topography	The physical features of the land surface, considered for its potential influence on drainage and ecological features.
Wetland	An area where water covers the soil, or is present either at or near the surface, contributing to biodiversity and ecological significance.
Eastern Cape Biodiversity Conservation Plan	A plan indicating categorized areas based on their ecological importance in the Eastern Cape region.

ABBREVIATIONS

CD:NGI:	Chief Directorate: National Geo-spatial Information
DFFE:	Department of Environment, Forestry and Fisheries
DWAF:	Department of Water Affairs and Forestry
DWS:	Department of Water & Sanitation
EIS:	Ecological Importance and Sensitivity
ESA:	Ecological Support Area
FEPA:	Freshwater Ecosystem Priority Area
GA:	General Authorisation
GPS:	Global Positioning System
NEMA:	National Environmental Management Act
NFEPA:	National Freshwater Ecosystem Priority Areas
NWA:	National Water Act
NWM5:	National Wetland Map 5
SACNASP:	South African Council for Natural Scientific Professions
ECBCP:	Eastern Cape Biodiversity Conservation Plan
WUL:	Water Use License

1. INTRODUCTION

Confluent Environmental Pty (Ltd) was appointed to provide aquatic specialist inputs for the proposed upgrade of the Wastewater Treatment Works (WWTW) and the replacement of the main sewer line in Woodlands, Easten Cape. The Woodlands settlement is located 15 km southwest of the town of Kareedouw and approximately 1 km south of the N2 Highway. The existing and non-operational WWTW is situated approximately 200 m south of the Woodlands settlement, adjacent to the Woodlands landfill site. The closest perennial river is the Groot River, approximately 900 m south of the WWTW.

According to the Department of Forestry, Fisheries and Environment (DFFE) Screening Tool, the area in which the WWTW upgrade is proposed has a 'Very High' aquatic biodiversity sensitivity (Figure 2).

The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA) as well as the National Water Act (NWA).

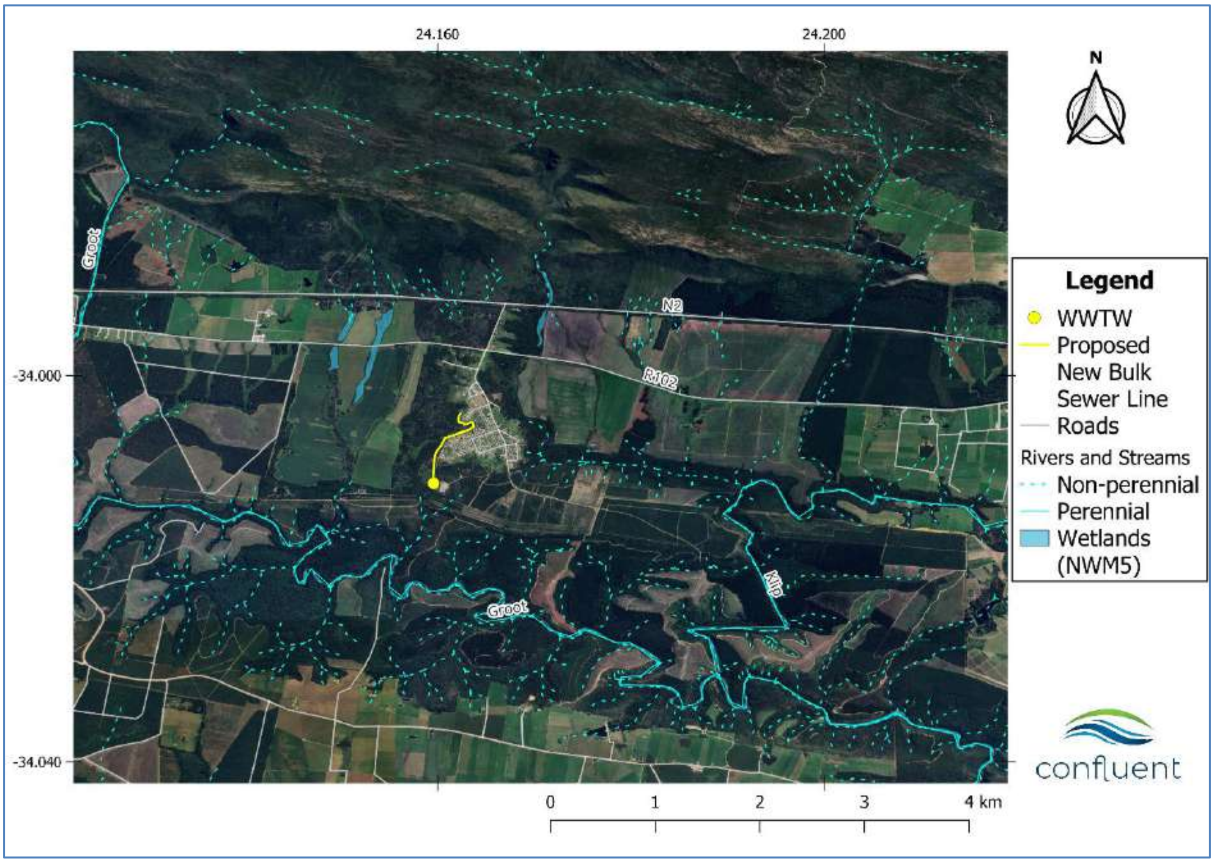

Figure 1. Location of the WWTW and bulk sewer line to be upgraded near Woodlands in the Eastern Cape.

1.1 Key Legislative Requirements

1.1.1 National Environmental Management Act

According to the protocols specified in GN 1540 (Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in Terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when

Applying for Environmental Authorisation), assessment and reporting requirements for aquatic biodiversity are associated with a level of environmental sensitivity identified by the national web-based environmental screening tool. 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:

- Where the information gathered from the site sensitivity verification differs from the screening tool designation of **Very High** aquatic biodiversity sensitivity, and it is found to be of a **Low** sensitivity, an Aquatic Biodiversity Compliance Statement must be submitted.

1.1.2 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, 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

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

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

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

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

- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

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

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

According to Section 21 (c) and (i) of the NWA, any water use activities that do occur within the regulated area of a watercourse must be assessed using the DWS Risk Assessment Matrix (GN4167) to determine the impact of construction and operational activities on the flow, water quality, habitat and biotic characteristics of the watercourse. Low-Risk activities require a General Authorisation (GA), while Medium or High-Risk activities require a Water Use License (WUL).

1.2 DFFE Screening Tool Results

According to the DFFE screening tool, aquatic biodiversity at the site has a **Very High** sensitivity (Figure 2). The sensitivity features that triggered this classification are:

- Ecological Support Area 1 (ESA 1)
- Strategic Water Source Area (SWSA) for surface water in the Tsitsikamma

Figure 2: Results of the DFFE Screening Tool which indicate Very High Sensitivity of the Aquatic Biodiversity theme for the preferred development pipeline.

1.3 Assumptions and Limitations

- It was not possible to access the entire pipeline route for various reasons including that some of the access roads are informal and have eroded and been used for dumping, vegetation was very dense in some areas including steep embankments. Therefore, several more accessible areas along the length of the proposed pipeline route were accessed and assessed.
- The area in the vicinity of Woodlands township has extensive wetlands and dense vegetation. Only the proposed sewer line route and vicinity of the proposed WWTW upgrade were investigated for wetland features. Areas to the east and south-east of Woodlands were not assessed and therefore no wetland features are identified here. However, this does not mean that no wetland features are present in these areas in reality.

1.4 The Proposed Sewerage Upgrades

The upgrade is needed because the existing WWTW has exceeded its operational capacity due to growing residential development and the associated increase in wastewater volumes generated. In fact, the plant was not operating at all at the time of the site visit and new infrastructure is desperately needed to improve access to sanitation for the residents of Woodlands and to prevent serious pollution of the environment due to present practice of dumping sewage (described in more detail in the section about the site visit).

The aim of the proposed upgrade is to increase the treatment capacity of the WWTW to accommodate existing and projected future flows and loads, ensuring compliance with the national wastewater effluent standards and supporting residential expansion. The proposed upgrade would increase treatment volumes from 250 kL/day to 500 kL/day and would increase the footprint of the existing site (Figure 3). The footprint of the WWTW would increase to approximately 1.42 ha.

The bulk sewer line which drains from Woodlands to the WWTW is to be upgraded to a 160mm diameter class 34 uPVC pipe with a 200mm diameter class 34 uPVC pipe for the final 900 meters before connecting to the WWTW. This pipeline will allow for stormwater ingress. Manholes will be placed every 60 m. The entire bulk sewer line will be rerouted, while the old sewer line will be blanked off as soon as the new WWTW is commissioned. During construction, the anticipated disturbance footprint of for a manhole is 5m x 5m and along the pipeline a 5m area would be necessary for placement of a TLB, materials, equipment and to stockpile soil.

During the course of this project, the engineering team proposed an initial sewer line route (Option 1) which was refined based on the presence of wetlands delineated during this assessment (Option 2) and further improved to minimise the impact on wetlands (Option 3; all options shown in Figure 3). Option 3 for the proposed sewer line route is considered the preferred option for this assessment given that the other two options have a higher footprint of disturbance through wetland habitat.

While specific engineering designs are still being finalised, the upgrade is expected to include the expansion of treatment units, improved sludge handling processes, and potentially the incorporation of energy-efficient and environmentally friendly technologies, with the preferred option being option two (Rotating Biological Contactors) in the engineering report from SMEC South Africa Pty Ltd.

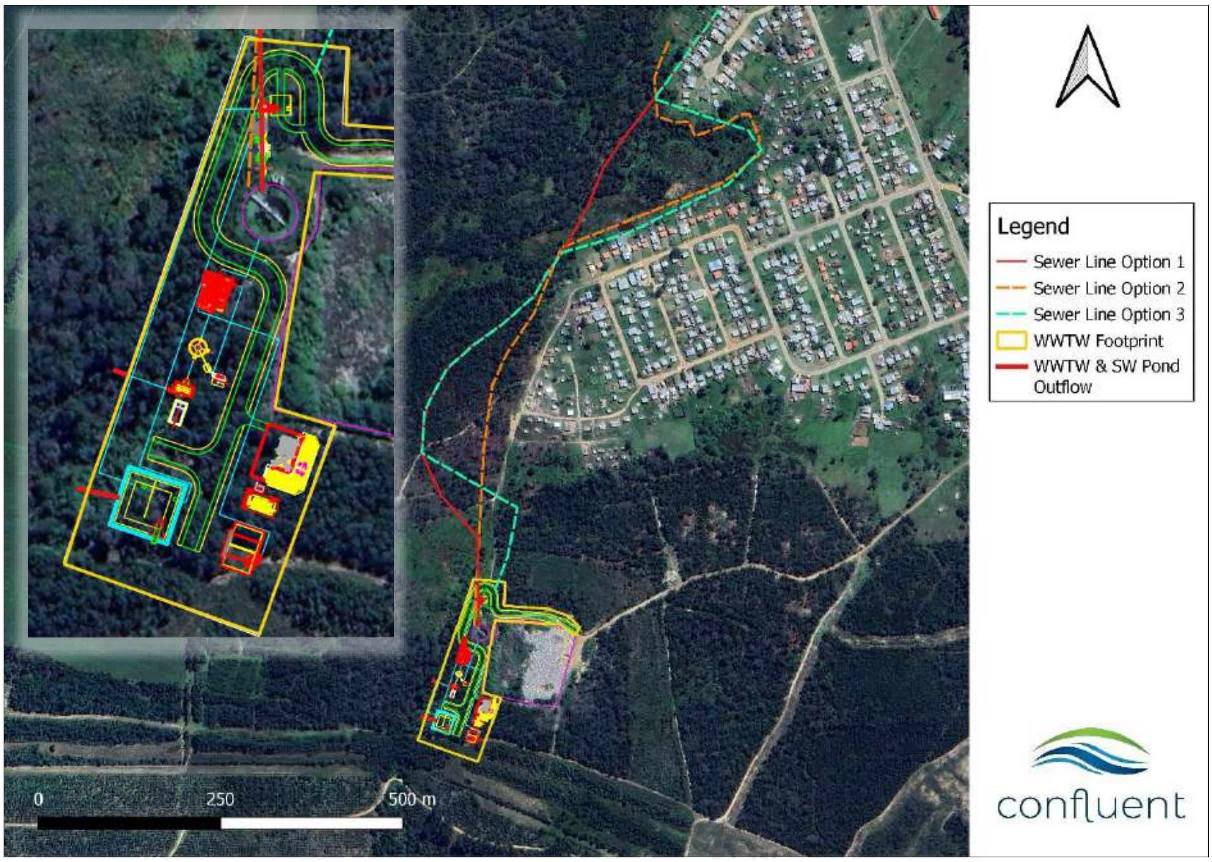

Figure 3. Map showing the progression of sewer line layout options and the proposed WWTW upgrade site at Woodlands (SMEC Engineering). Inset indicates enlargement of the WWTW.

Figure 4. Approximate area of the new WWTW footprint adjacent to the existing landfill site in Woodlands.

2. CATCHMENT CONTEXT

2.1 Catchment features

The proposed upgrade of the WWTW and associated infrastructure is in the quaternary catchment K80D (Figure 5). Five non-perennial rivers are mapped within 50 to 300 m around the proposed upgrade area, 2 flowing in a southern direction and 3 in an eastern direction. The area receives a substantial amount of rainfall on average, and as the rainfall intensity in the area is classified as Very High and the inherent erosion potential of soils also as Very High, erosion of soils and stormwater management are factors that must be carefully considered during the upgrade of the WWTW and the associated sewer infrastructure, especially considering the large amounts of stormwater runoff that associated with increasing urbanisation of the surrounding area. This is further exacerbated by areas of fairly steep slopes leading to watercourses which are vulnerable to erosion (Table 1; Figure 5 and Figure 10).

Table 1. Summary of relevant catchment features for Woodlands.

Feature	Description
Quaternary catchment	K80D
Mean Annual Runoff	414.98 mm
Mean Annual Precipitation	1 067 mm
Inherent erosion potential of soils (K-factor)	0. 72, Very High
Rainfall intensity	Very High
Ecoregion Level II	20.02, Southeastern coastal belt
Geomorphological Zone	None
NFEPA area	Sub-quaternary reaches 9124 and 9138, Fish FEPA.
Mapped Vegetation Type	FFs20: Tsitsikamma Sandstone Fynbos (LT)
Conservation	ESA1: Aquatic, ECBCP (2019).

Figure 5. Location of the WWTW and proposed new bulk sewer line in the quaternary catchment K80D.

Rainfall occurs year-round with seasonal peaks in spring and autumn (Figure 6).

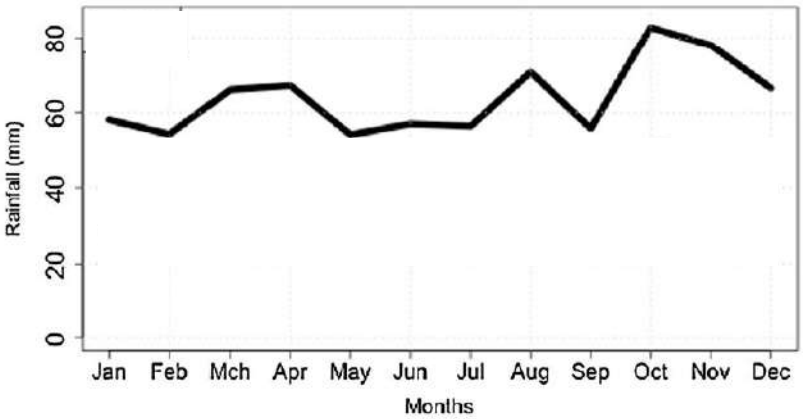

Figure 6. Area-averaged monthly rainfall for the coastal Southern Cape indicating peaks in Mar-Apr, Aug, and Oct. Data averaged between 1979 and 2011 (Engelbrecht et al., 2015).

The project area is located within the southeastern coastal belt (Ecoregion Level 2:20.02). The terrain is described as closed hills of moderate and high relief and moderately undulating plains. Altitude ranges between 0 – 1 300 m.a.m.s.l.

2.2 Vegetation

The vegetation type at the site is mapped as Tsitsikamma Sandstone Fynbos (FFs20: Least Threatened).

Tsitsikamma Sandstone Fynbos, occurs along the Tsitsikamma Mountains in both the Western and Eastern Cape provinces, extending from Uniondale to Cape St Francis. This vegetation type is associated with a relatively low mountain range featuring gentle to steep slopes on both the northern and southern aspects, and is characterised by a moderately undulating landscape. The vegetation consists predominantly of medium-dense, tall proteoid shrubland overlaying a dense, moderately tall ericoid-leaved shrubland. It is composed primarily of proteoid, restioid, and ericoid fynbos elements, with fynbos-thicket vegetation occurring in wetter areas.

2.3 Conservation and Catchment Management

2.3.1 Eastern Cape Biodiversity Conservation Plan

The Eastern Cape Biodiversity Conservation Plan (ECBCP,2019) indicated the following categorised areas in the area of the WWTW and the new bulk sewer line;

- An aquatic Ecological Support Area 1 (ESA1),

The ECBCP,2019 categorise the entire extent of the surrounding area as an Aquatic ESA1.

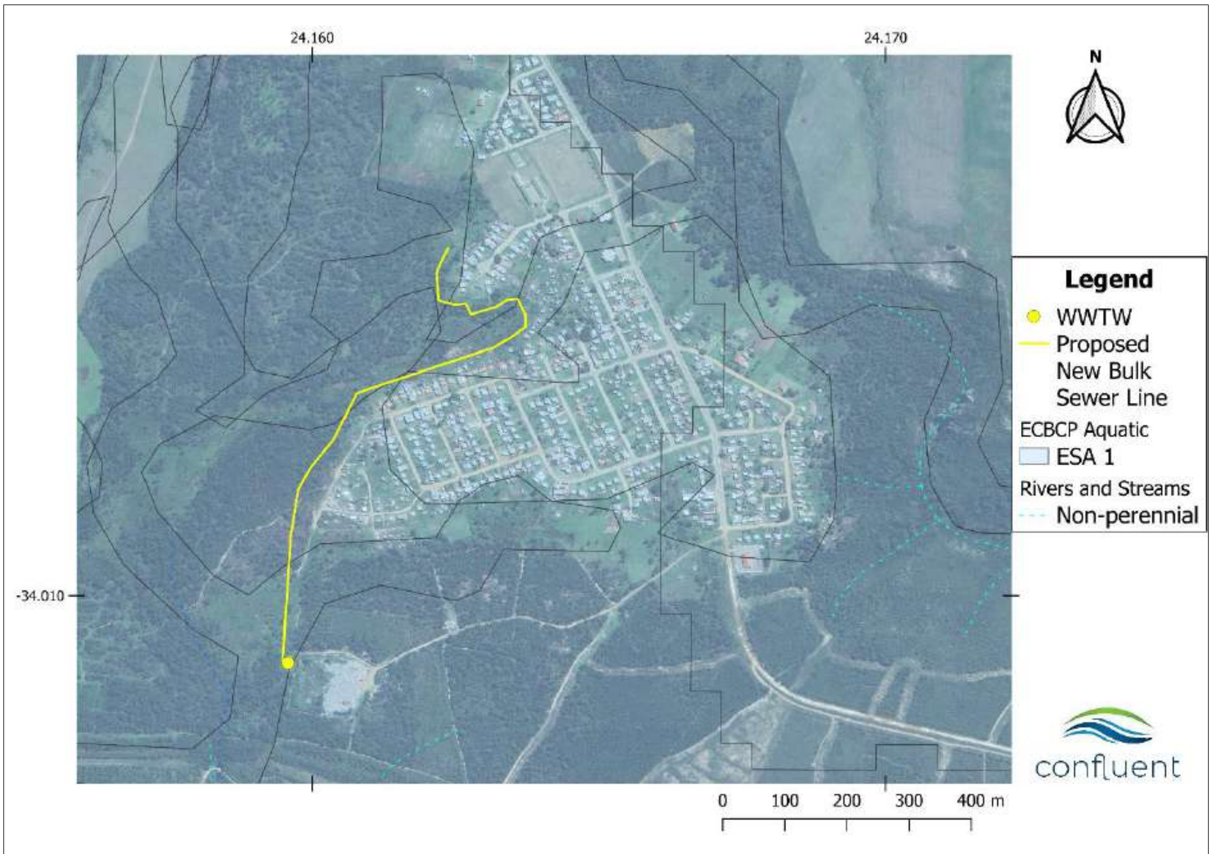

Figure 7. The WWTW and proposed new bulk sewer line (Option 2 shown) in relation to mapped conservation features of the Eastern Cape Biodiversity Conservation Plan (ECBCP,2019)

Necessary actions in relation to the ECBCP are to ensure that the proposed WWTW upgrade and bulk sewer line do not result in significant negative impacts to the ecological structure and function of watercourses adjacent to and on to the site (Table 2). However, it must be acknowledged that the present condition (the status quo) where sewerage infrastructure is poorly functioning is definitely not desirable, and the upgraded infrastructure is fully supported, even if some impacts are unavoidable.

Table 2. Definitions and objectives for conservation categories identified in the Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

WCBSP Category	Definition	Management Objective
Ecological Support Area 1 (ESA1)	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.	Maintain in a functional, near-natural state. Some habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.

2.3.2 National Freshwater Ecosystem Priority Areas

2.4 Fish Support Area

According to the National Freshwater Ecosystem Priority Atlas (NFEPA; Nel *et al*., 2011), the sub-quaternary reach in which the WWTW and associated infrastructure are to be upgraded (SQR 9124), is classified as a Fish Support Area, (FSA; Figure 8). The management objective for fish support areas is as follows:

"Sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened fish species indigenous to South Africa. Fish support areas also include SQRs that are important for the migration of threatened and near-threatened fish species. River reaches in Fish Support Areas need to be maintained in a condition that supports the associated populations of threatened fish species."

Fish Support Areas are designated in SQRs where endangered fish species occur, but the condition of rivers is lower than an A or B ecological category.

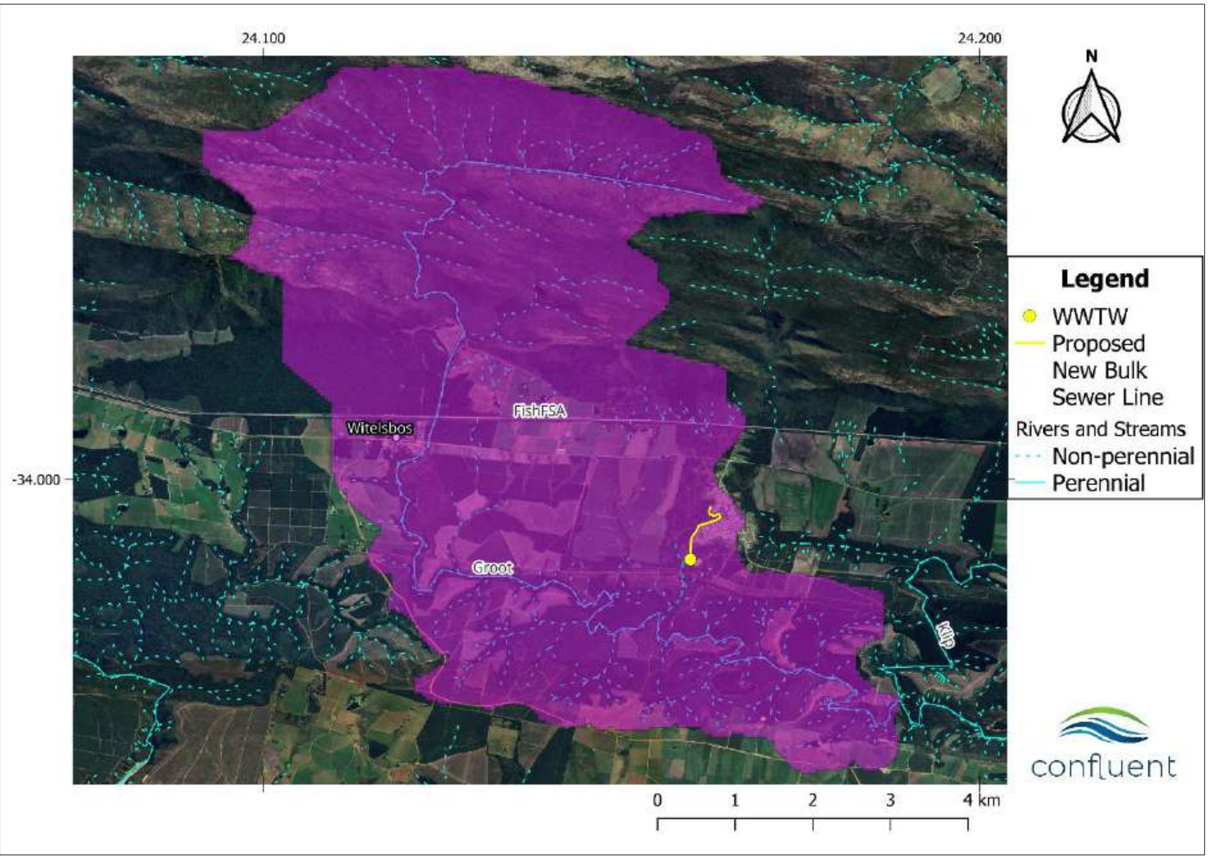

Figure 8: Map indicating the Proposed New Bulk Sewer Line and WWTW location in relation to mapped Freshwater Ecosystem Priority Areas

Important fish species potentially present within these systems include *Pseudobarbus afer (*Eastern Cape redfin*), Pseudobarbus tenuis* (slender redfin), and *Galaxias zebratus* (Cape galaxias), all of which are endemic to the Cape Floristic Region and are typically associated with clean, well-oxygenated, perennial to intermittent streams (Skelton, 2001). Although no site-specific fish sampling was undertaken as part of this assessment, previous samples have been taken and indicate that at least one of the species (*Pseudobarbus afer*) has been recorded in the Groot River (Chakona and Skelton, 2017), into which streams from SQR 9124 ultimately flow. The map provided by Chakona and Skelton (2017) indicates that a sample was taken downstream of the confluence of the Klip and Groot Rivers in 1982 (Figure 9).

Regardless of the latter, given this hydrological connectivity, the discharge of treated wastewater into or near these systems could pose a risk to downstream aquatic biodiversity, particularly if water quality, flow regime, or habitat structure is altered. The designation of these catchments as Fish Support Areas under NFEPA highlights the need for stringent water quality management and careful ecological consideration during the planning and operation of wastewater infrastructure.

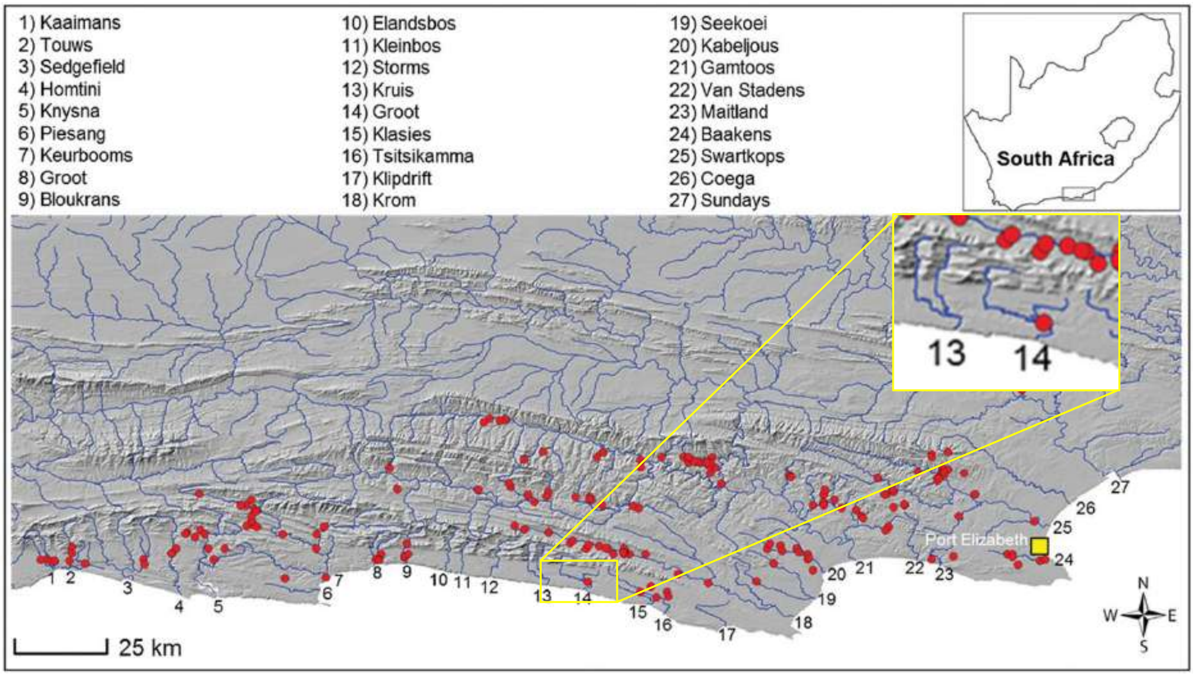

Figure 9: Distribution of the Eastern Cape redfin, Pseudobarbus afer (Chakona and Skelton 2017)

2.5 Mapped Watercourses

The mapped watercourses along the extent of the proposed sewer line are five non-perennial rivers, two of the rivers are flowing in a southern direction and three flowing in an easterly direction (Figure 10). None of the mapped non-perennial rivers are to be crossed by the new bulk sewer line. All of the non-perennial rivers are mapped to flow into the Groot River approximately 900 m south of the WWTW. The three non-perennial rivers flowing east flow into the Klip River, which joins the Groot River 3.5 km southeast of the WWTW (Figure 1). No wetlands are mapped to occur in the immediate vicinity of the WWTW and associated infrastructure, however, four possible wetlands were identified by the Environmental Assessment Practitioner EAP (Figure 10).

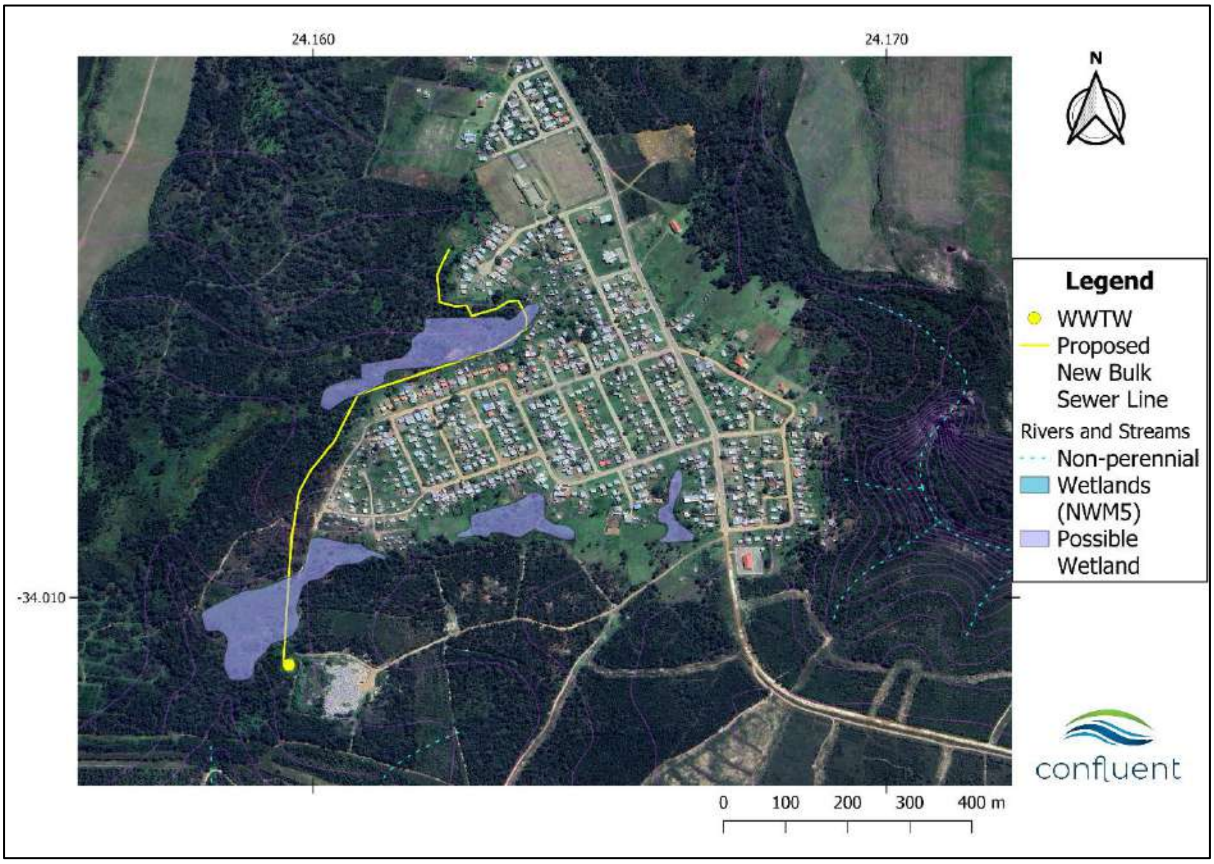

Figure 10: The WWTW and proposed new bulk sewer line (showing Option 2) in relation to mapped watercourses.

2.6 Historical Assessment

Historically, the environment surrounding the WWTW and sewer infrastructure proposed to be upgraded has undergone minimal noticeable changes in the past 22 years from 2003 to 2025. The surrounding area in the immediate vicinity of the WWTW and sewer infrastructure remained disturbed by the Woodllands settlement throughout the 22 years. Notable changes are listed below and can be seen in Figure 11.

- Extensive vegetation clearing in bushy areas to the west of Woodlands which is observable in 2003, but revegetates during the decades thereafter.
- Significant increase in vehicle tracks between Woodlands and the landfill site between 2003 and 2017.
- Continuous expansion of the landfill site between 2003 and the present.
- Increase in more recent years of informal houses / shacks along the periphery of Woodlands.
- Extensive clearing of vegetation East of Woodlands between 2018 and 2024.

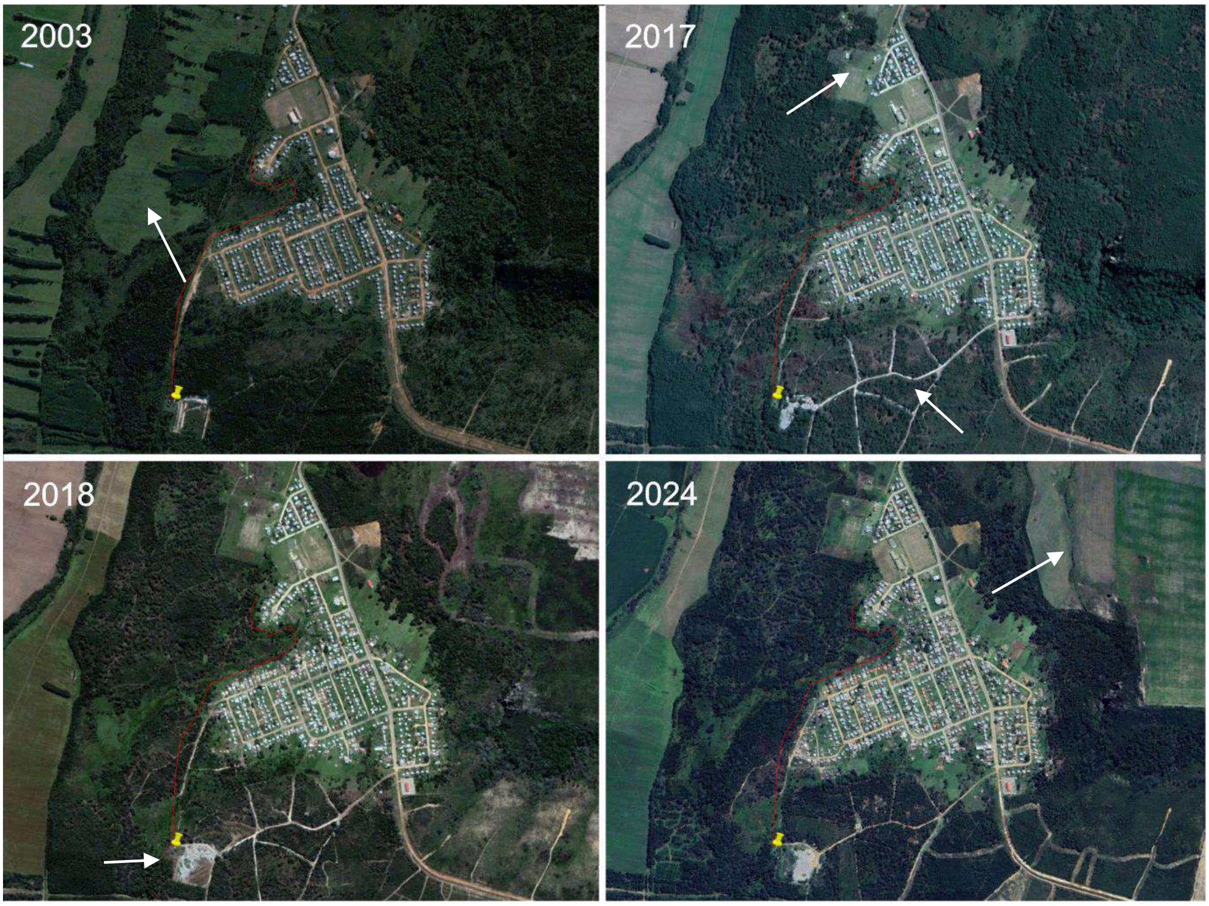

Figure 11. Historical photos showing WWTW and proposed new bulk sewer line's location from 2003 until 2024 (Google Earth imagery). Arrows indicate the location of an impact when it is first observed.

3. SITE ASSESSMENT

The site visit was conducted on 13 May 2025. Weather conditions were fine and sunny, and no significant rainfall had occurred in the preceding 48 hrs. Parts of the proposed sewer line route and the WWTW site were accessed by vehicle and on foot (GPS track in Figure 13). A water sample was collected from the watercourse downstream from the existing WWTW and upstream of the Woodlands Township near the main access road (Figure 14).

The following series of photos illustrate key points regarding the present condition and impacts affecting the pipeline route and WWTW site (Figure 12).

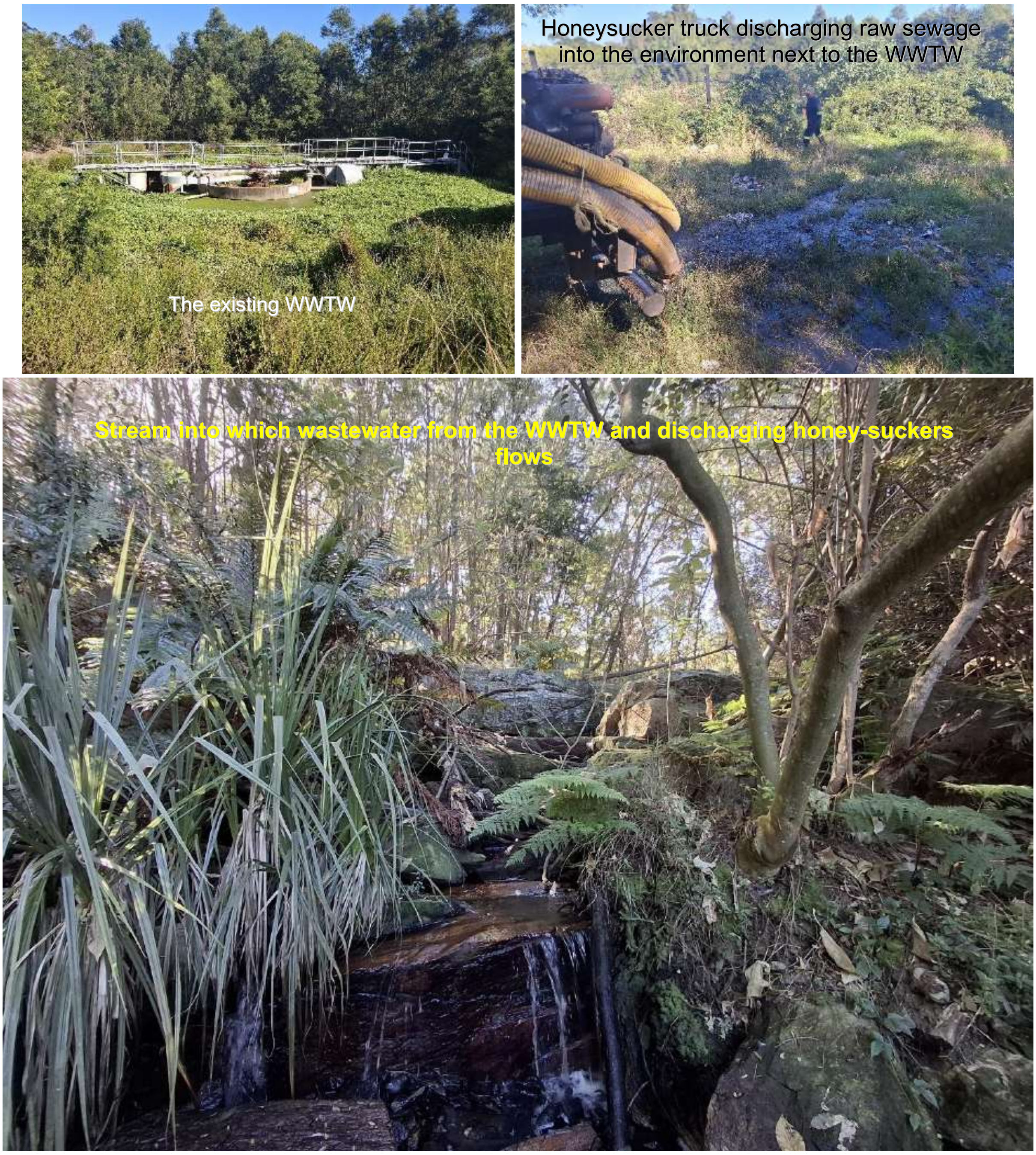

Figure 12. Photos taken of various features during the site visit.

Extensive wetland habitat is present to the west and south of Woodlands in an unconfined (broad) valley bottom. As the gradient steepens to the south, the wetland gives way to a flowing stream with riparian forest (Figure 12). It is this stream that receives the wastewater outflow at present, and the proposed outflow for the upgraded WWTW.

In some parts of Woodlands the residents have created large areas of rubbish dumping approximately 20 – 30m from houses. Dumping areas frequently overlap with wetland habitat which was observed almost continuously along the western boundary of Woodlands. In addition, informal livestock enclosures containing pigs were also constructed adjacent to wetland areas. Free-ranging grazing cattle have created grass lawns adjacent to wetland areas.

The Wastewater Treatment Plant itself is overgrown with vegetation which has covered the area outside as well as inside infrastructure. It was completely non-operational at the time of the site visit. A honey sucker truck contracted by the municipality to collect sewer from parts of Woodlands was directly observed discharging the raw waste down a vegetated slope leading directly to the wetland area (Figure 12). The truck driver cited the WWTW as inoperative and stated that even driving the truck into the plant was a hazard.

Environmental impacts occurring in and around Woodlands are largely related to poor service delivery. During the site visit, several residents expressed frustration and disappointment in the condition of their local environment. Therefore, the proposal to upgrade bulk sewerage infrastructure is fully supported.

The WWTW in its current condition is also considered a safety hazard both for people and animals. The site has open access, and the edge of the old pond is indistinct with overgrown vegetation, while the pond is full of (likely) sludge, water and vegetation. Animals or people could fall into it, and therefore maintenance at the site such as cutting vegetation around the pond and fencing it off should be undertaken as soon as possible.

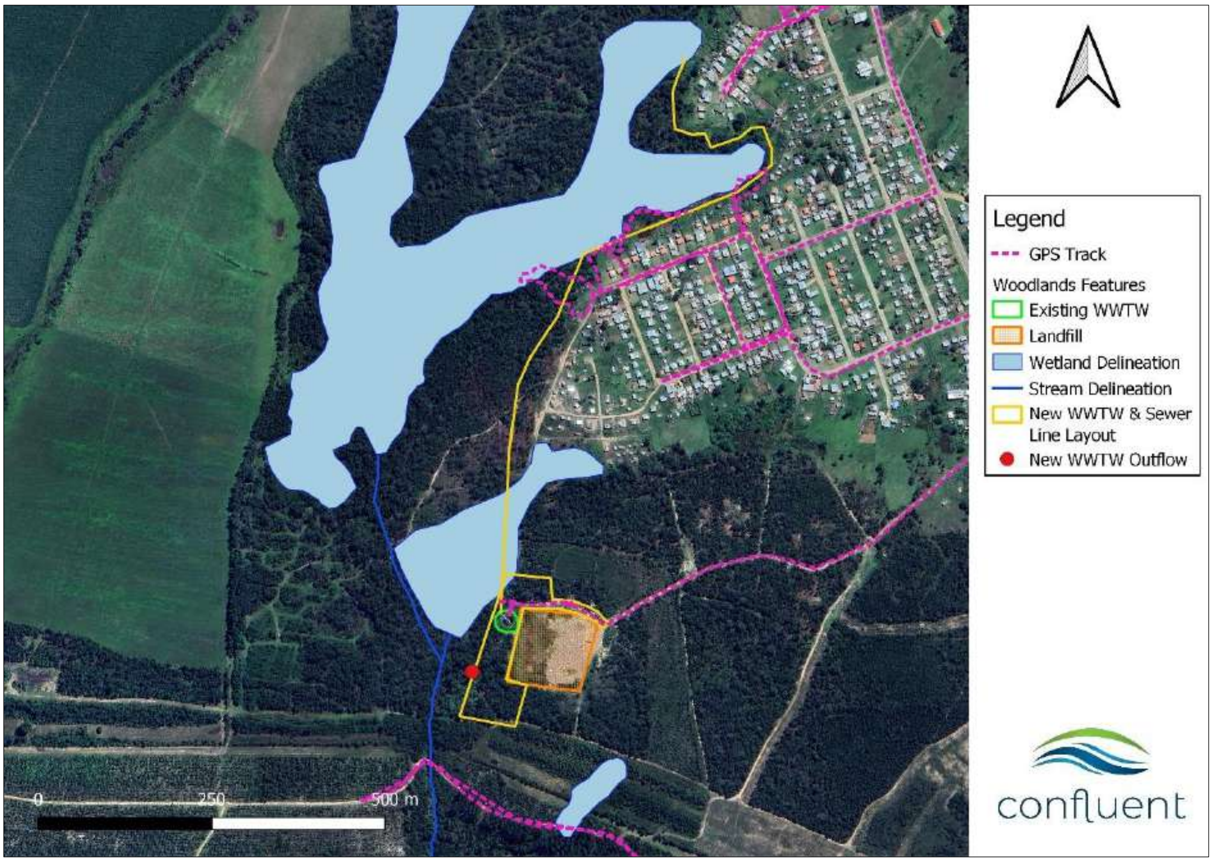

Figure 13. GPS track walked and driven during the site assessment and delineated wetland and stream. Sewer line route shown is Option 2.

3.1 Watercourse Classification

A broad **unchanneled valley-bottom wetland** is located west of Woodlands and was delineated using a combination of field-based (vegetation and soil) and desktop (aerial and drone images and contours) methods. The delineated wetland is indicated in Figure 13. Adjacent to the WWTW is a smaller **seep wetland** which feeds into the mainstem watercourse in the valley below. The gradient increases to the west and south of the of the existing WWTW and the wetland develops a channelled flow more typical of a **forested stream** (Figure 12).

3.2 Water Quality Analysis

A 1 Litre water sample was collected from the wetland area upstream of Woodlands and a second sample was collected from the stream downstream of the WWTW and discharge point for honey-suckers. The upstream site provides a reference point for the impact associated with the discharge of sewage and current operation (if any) of the WWTW (Figure 14).

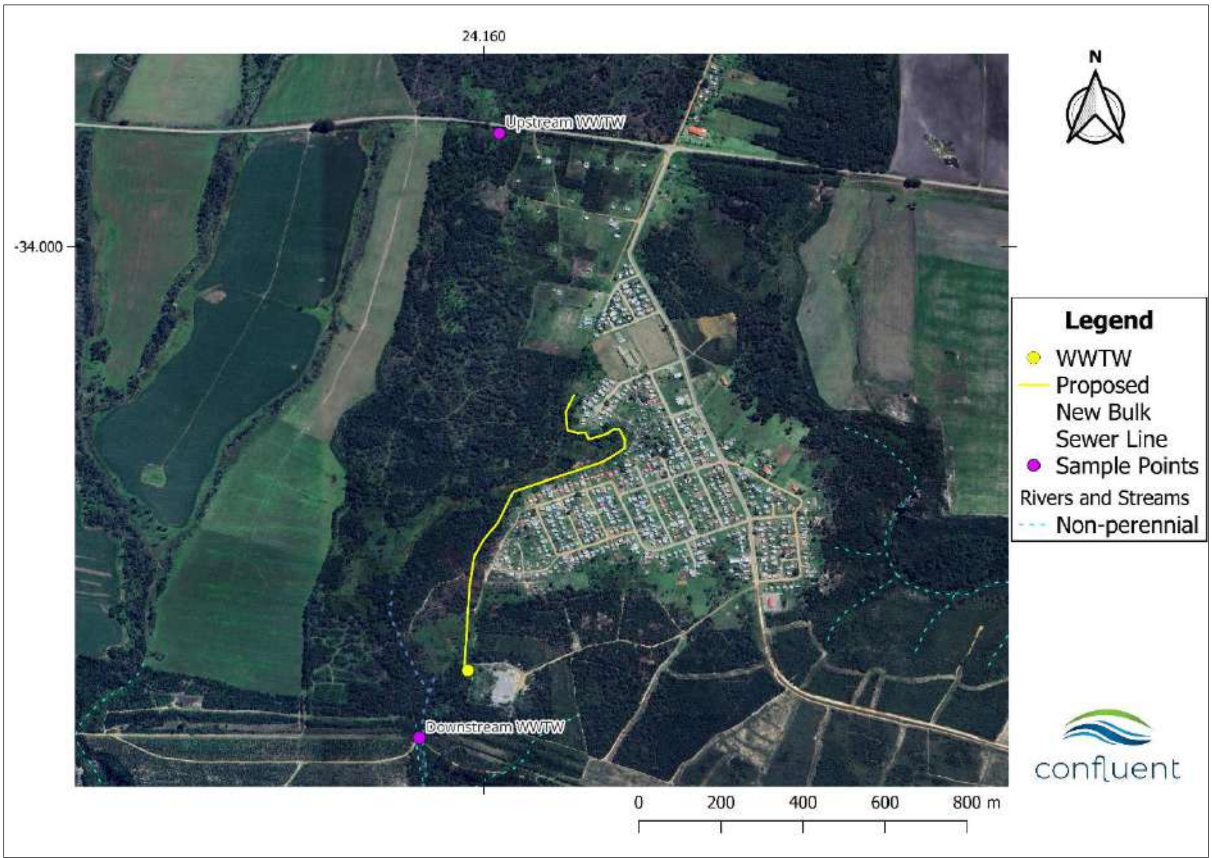

Figure 14: Map of the WWTW and proposed new bulk sewer line (Option 2 shown) in relation to water quality sampling points.

Water samples were collected in clean 1 L plastic containers pre-rinsed in water from the site. Samples were kept cool with ice blocks in a cooler bag during the field trip and refrigerated for 24 hrs before being couriered to AL Abbott Labs in Cape Town overnight from George. Couriered samples were sealed in a polystyrene cooler box with frozen ice blocks. The results are provided in Table 3.

Results indicate a <u>major impact</u> associated with the discharge of sewage which is affecting water quality in ways typically associated with pollution with wastewater. Almost all measured parameters were elevated downstream of the WWTW compared to the reference site. Nutrient levels of inorganic and organic N and P were very high and will contribute to eutrophication of downstream water resources. Microbial counts of *E. coli* were high (maximum measurable limit) downstream of the WWTW. While *E. coli* was detected in the upstream sample, the count was low, and could be reflective of occasional grazing / drinking in the wetland by cattle, as their dung was observed in places. High levels of E. coli in the stream downstream of the WWTW indicate a human health risk.

While practices such as keeping pigs immediately adjacent to the wetland, and other activities associated with poor sanitation delivery such as the use of bucket toilets or disposal of waste in the wetland would contribute to this result from the township itself, the discharge of raw sewage from trucks adjacent to the WWTW would play a highly significant role in this very poor water quality.

Environmental impacts of this water quality for aquatic biota are considered very high. Note the pH elevated from the reference value of 4.08 to 6.5, an increase in almost 2.5 units. Natural waters of the southern Cape are well-known for their acidic pH associated with fynbos-dominated catchments and unique podzol soils. Aquatic biota such as macro-invertebrates and all the unique fish species mentioned in this report are adapted to the low pH conditions, as well as low nutrients, high oxygen, and low conductivity. The water quality downstream of the WWTW is the opposite of conditions to which these unique biota are adapted.

Table 3: Water quality results.

Parameter	Sample Points	
	Upstream WTWW	Downstream WTWW
Conductivity (mS/m) (at 25 ºC)	24.9	68.6
Total Dissolved Solids (mg/l)	166	448
pH (at 25 ºC)	4.08	6.50
Nitrate Nitrogen. (mg/l as N)	<0.20	3.3
Nitrite Nitrogen (mg/l as N)	<0.20	1.2
Nitrite/Nitrate Nitrogen	0.40	4.5
Sulphate (mg/l as SO4)	<2.0	17.1
Fluoride (mg/l as F)	<0.50	0.92
Ammonia Nitrogen (mg/l as N)	0.13	16.4
Chloride (mg/l as Cl)	62.6	125
Sodium (mg/l as Na)	31.5	71.2
Zinc (mg/l as Zn)	0.01	0.02
Total Alkalinity (mg/l as CaCO3)	<11.0	73.7
Total Hardness (mg/l as CaCO3)	18.3	55.4
Magnesium Hardness (mg/l as CaCO3)	15.6	35.7
Calcium Hardness (mg/l as CaCO3)	2.8	19.8
Total Kjeldahl Nitrogen (mg/l as N)	0.78	16.9
Total Phosphate (mg/l as P)	<0.20	2.9
Ortho Phosphate (mg/l as P)	<0.20	1.8
Calcium (mg/l as Ca)	1.1	7.9
Magnesium (mg/l as Mg)	3.8	8.7
E. coli (count per 100ml)	56	> 2 419

3.3 Present Ecological State (PES)

3.3.1 Wetland PES

The wetland to be crossed by the sewer line was assessed to determine the PES using WET-Health Level 1 (Macfarlane *et al.*; 2020). The results indicate the wetland is in a Category C, Moderately Modified condition. As can be seen in the assessment summary (Table 4) the greatest impact is to water quality which results from the inflow of dumped raw sewage to the wetland area, which subsequently drains to the flowing stream.

Vegetation in the wetland is currently in a near natural condition (rated B) and would likely be the element most impacted by the sewer line crossing. It is therefore important that the footprint of disturbance to wetland vegetation be minimised, which will form part of the mitigation measures recommended in the impact assessment in this report.

Table 4. WET-Health assessment of the wetland to be crossed by the sewer line.

WET-Health Level 1B assessment: PES Summary				
	Final (adjusted) Scores			
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	1,5	0,8	5,0	1,0
PES Score (%)	85%	92%	50%	90%
Ecological Category	B	A	D	B
Trajectory of change	↓	→	↓↓	↓
Confidence (revised results)	Medium	Medium	High	Medium
Combined Impact Score	2,0			
Combined PES Score (%)	80%			
Combined Ecological Category	C			
Hectare Equivalents	2,4 Ha			

3.3.2 Drainage Line PES

The lower section of the watercourse into which the treated wastewater will be discharged is classified as a drainage line with perennial flowing water and a well-developed riparian zone. The method for assessment of the PES was the Index of Habitat Integrity (IHI; Kleynhans, 1996). Methods are provided in Appendix 1.

The results indicate:

Instream PES: **C, Moderately Modified**

Riparian PES: **B, Largely Natural**

The primary impact affecting the instream PES is the serious impact of sewage on water quality reported in Table 3. Were it not for the impacted water quality, the instream PES would have been rated A/B. While it is understood that some impacts upstream associated with poor sanitation in the Woodlands settlement contribute to poor water quality, the wetland has the capacity to remediate some of this impact to a large extent through bioattenuation of nutrients and other pollutants. However, the direct dumping of raw sewage onto the slope above this stream, and its location adjacent to the dysfunctional WWTW point strongly to these two impacts.

The riparian zone is currently in good condition, impacted mainly by some minor alien vegetation which has somewhat modified the channel in places. But this impact could be rehabilitated, and future works (e.g. construction of the two outlets) must attempt to maintain the riparian zone in good condition.

4. LEGISLATIVE IMPLICATIONS

4.1 National Environmental Management Act

According to the Screening Tool, aquatic biodiversity at the site is rated as **Very High**. This finding is upheld and confirmed for the following reasons:

- Construction phase impacts could directly impact on areas of wetland habitat;
- Decommissioning of some existing parts of the sewerage system may result in pollution of the local environment;
- Operation of the sewerage infrastructure could result in periodic or chronic leaks of wastewater, causing pollution.

Where a Very High sensitivity is confirmed for a site the proposed development must be subjected to an impact assessment.

4.2 National Water Act

Given that the bulk sewerline will be crossing part of the wetland, and this appears to be unavoidable, it is necessary to apply for a **Water Use License** as this activity is explicitly excluded from the General Authorisation.

5. IMPACT ASSESSMENT

The impact assessment is fundamentally guided by the mitigation hierarchy, which seeks to avoid and minimise impacts as the first priority (Figure 15). 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.

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 development. 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.

Cumulative impacts in this instance must not cause irreversible decline to the conservation status of species and the presence of special habitats or cause a significant loss in ecosystem services.

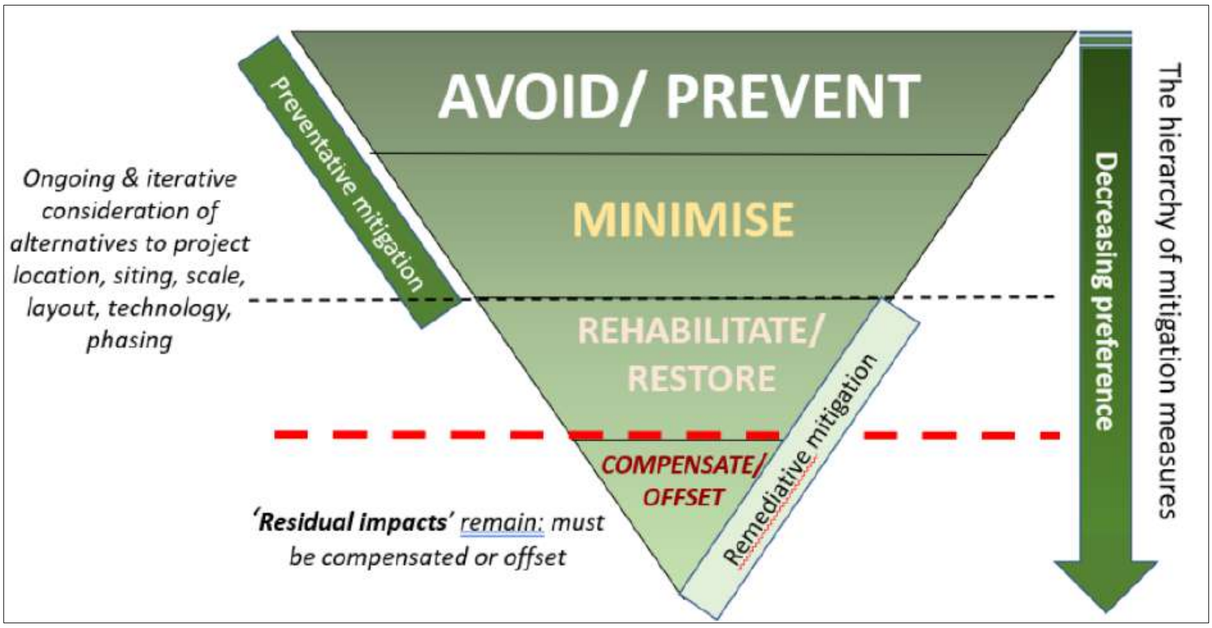

Figure 15. Successive steps shown in the mitigation hierarchy which can only be considered once the previous step has been exhausted (EWT, 2023).

The layout for assessment is shown in as much detail as was provided at the time of writing (Figure 16). The mapped 1:100 year floodline does not appear well aligned with the wetland delineation. In the case of the wetland delineation, this could be due to low confidence in the delineation of the edge given the difficulties of access previously mentioned. However, the areas of delineated wetland were correlated directly with wetland habitat observed in the field and using drone imagery. As unchanneled valley-bottom wetlands, these systems are unlikely to carry high volumes of channelled flows associated with a conventional flood line. If that were the case, then channels would have formed through the wetland, and vegetation would have been washed away in these areas. Rather, it is expected that water would spread out and fully saturate the wetland area; moving downslope mostly in the form of interflow.

Two outlets from the WWTW to the stream along the western boundary are necessary. The first is the discharge of treated wastewater from the chlorine contact tank around mid-way along the western extent of the WWTW (Figure 16). The second overflow structure will be constructed to discharge any overflowing stormwater from the stormwater pond to the drainage line (southwest corner of the WWTW; Figure 16). This would only be necessary during flooding conditions because under ordinary circumstances the stormwater overflow captured in the stormwater pond would be recirculated back to the WWTW head of works. No detailed designs for these outlets were provided at the time of writing, but mitigation measures to minimise impacts on the watercourse through all phases of development are still provided here, and were discussed with the engineers.

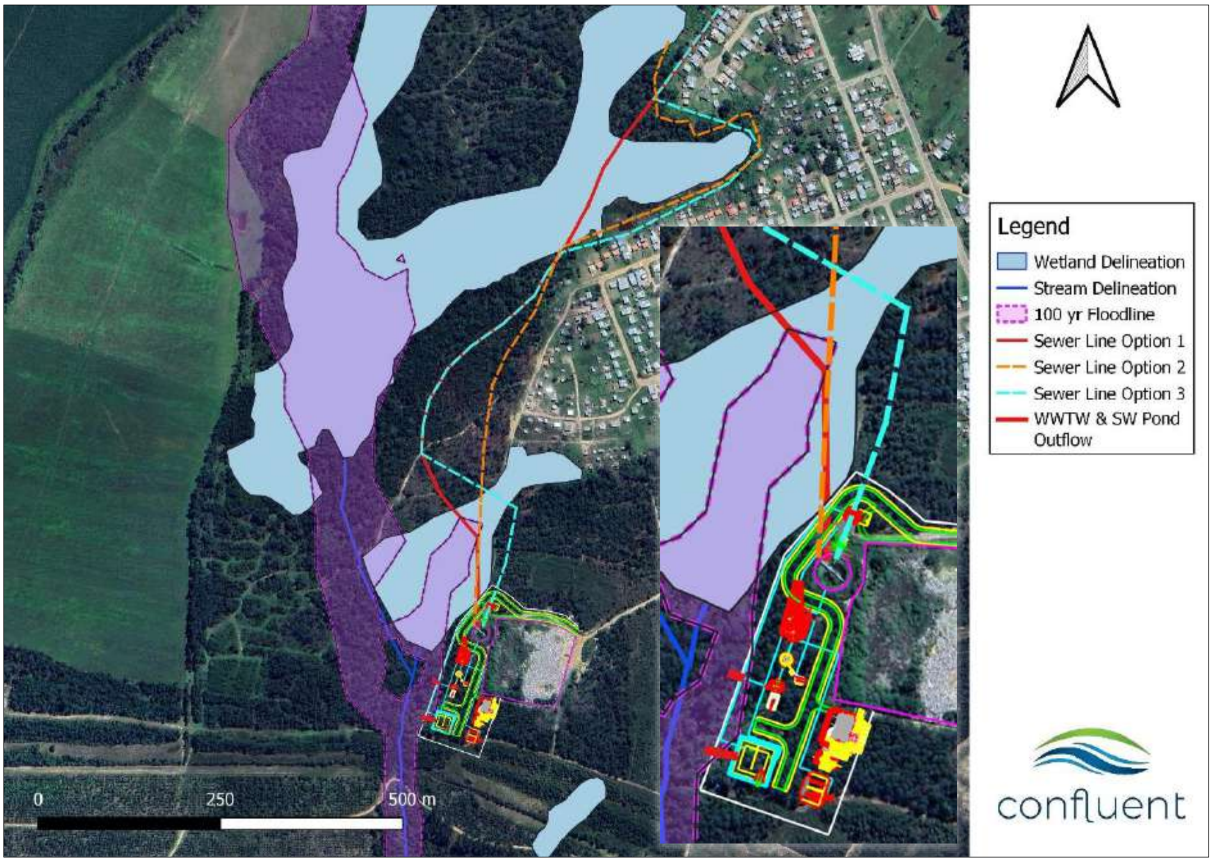

Figure 16. Layout of the proposed WWTW and pipeline options in relation to delineated watercourses and the 1:100 year floodline (determined by SMEC). Inset shows enlargement of the WWTW area for greater visibility of the two outlets proposed to the watercourse.

5.1 No-Go Development Option

In the event that the upgrades proposed for the bulk sewer line and the WWTW are not approved, domestic wastewater generated by the Woodlands township will continue to discharge into the natural environment degrading water quality, habitat and reducing biodiversity. Human and environmental health would be negatively affected by the No-Go development option, which is not supported for the above-mentioned reasons.

5.2 Design and Layout Phase Impact Assessment

5.2.1 Impact 1: Bulk Sewer Line Route

While the design of the WWTW and pipeline are fields of engineering expertise, the layout of infrastructure proposed (mainly the bulk sewer line route) was assessed in the event that any anticipated impacts could be avoided or minimised. Joint meetings and communication between the environmental and engineering team facilitated further refinement of the layout. From these engagements, the 3rd sewer line layout was proposed by the engineers (Figure 16) and is supported as the preferred layout option for this application for the following reasons:

- There is only one short wetland crossing instead of one longer one (Option 2) or two crossings (Option 1).

- The wetland crossing for Option 3 is across the narrowest section of the wetland, crossing approximately 37 m, and the proposal is that the pipeline should daylight across the wetland on concrete supports.
- The above points will result in reduced impacts to wetland habitat in both the construction and operational phase of upgrading the bulk sewer line.
- Very minimal loss of wetland habitat will occur in the long-term due to section of wetland that must be crossed.

Due to contours of the area and the need for sewage to drain via gravity to the WWTW, there were no alternative options to route the sewer line without crossing some part of the delineated wetland areas.

Mitigation Measures

- Option 3 pipeline route is preferred and should be implemented.
- The pipeline should daylight across the wetland crossing with as few supports in the wetland as is possible. Exposure of the pipeline would reduce impacts to the wetland for maintenance and improve the detection of leaks.
- Pipeline supports should be designed and constructed to minimise the footprint of disturbance, both during the construction and the operational phase.
- Pipeline joints should be minimised over and adjacent to the wetland as far as possible to reduce the likelihood of leaks directly into the wetland.
- Specify the use of lockable polymer concrete manhole covers to reduce the risk of vandalism to the sewer line.

The layout phase impact of the bulk sewer line with the above mitigation measures is rated as Minor (Table 5) compared to the non-mitigated scenario where Option 1 or 2 sewer line routes were considered.

5.2.2 Impact 2: The Upgraded WWTW and Associated Outlets

The main design and layout aspects considered for the upgrade to the WWTW itself relate to mitigation of potential sewage overflow events for a variety of reasons (e.g. very high rainfall events). The engineers provided several solutions in this regard.

Mitigation Measures

- Design of the WWTW has allowed for additional flows due to stormwater ingress during high rainfall events. Stormwater will be diverted to the stormwater pond southwest of the site from where it will be recirculated to the head of works for treatment. The stormwater pond is supported and recommended to mitigate the impact of stormwater ingress.
- In case of very high inflows of stormwater, an emergency overflow from the stormwater pond must be constructed in such a way the water is delivered to the watercourse downslope without causing erosion to the slope, stream banks, or stream bed. A stepped gabion structure with stilling basin is recommended.
- The outflow of treated wastewater must be constructed to ensure flows (anticipated at 0.6-1m/s) will not cause erosion of the slope, stream bank or stream bed into

- which it flows. Like the above a stepped gabion structure with stilling basin is recommended.
- Outlets into the stream from the chlorine contact tank and the stormwater pond should not have a perpendicular entry to the stream that could cause erosion on the opposite bank.
- The design should include bund walls around the biological reactor.
- A pipeline should be installed between the outlet of the chlorine contact tank and the stormwater pond. This should be an emergency outlet that could utilise the storage provided by the stormwater pond on a temporary basis and to recirculate the sewage for treatment in the event of equipment failure in the WWTW. This would only function if capacity in the stormwater pond was available and would reduce or prevent serious pollution of the watercourse due to the discharge of partially treated or untreated sewage (in the event of an equipment failure).

The impacts to the receiving stream both with and without the above mitigation measures were both rated as Moderate, although the rating was much higher for the impact without mitigation (Table 5). This is because the probability that impacts will occur in terms of stormwater damage, erosion, and additional stormwater capacity is still likely.

Table 5. Design and Layout Phase Impact Assessment

Impact	Intensity	Duration	Extent	Probability	Significance	Significane Rating	Reversibility	Irreplaceibility	Confidence
Layout and Design Phase Impact Assessment for Proposed Upgrade to Woodlands WWTW									
Impact 1: Layout of the upgraded bulk sewer line to the route identified as Option 3									
Without Mitigation	High	Long term	Local	Certain	-91	Moderate	Low	Medium	High
With Mitigation	Moderate	Long term	Limited	Likely	-55	Minor	Medium	Medium	High
Impact 2: Design of the upgraded WWTW and potential impacts to the receiving watercourse									
Without Mitigation	Very high	Ongoing	Local	Certain	-105	Moderate	Medium	Medium	High
With Mitigation	High	Long term	Local	Almost certain	-78	Moderate	Medium	Medium	High

5.3 Construction Phase Impact Assessment

The construction phase impact assessment considers construction of the pipeline separately to that of the WWTW upgrade, although some general mitigation measures during the construction phase are applicable for both aspects.

5.3.1 Impact 1: Non-compliance with Conditions of the Environmental Authorisations

Monitoring must be undertaken by an appointed ECO and should commence prior to construction of the works so there is a clear understanding of baseline conditions to which comparisons can be made at a later point.

Mitigation Measures

- An Environmental Control Officer (ECO) should be appointed at the start and conclusion of the WWTW upgrade to provide feedback on compliance with authorisation conditions to various regulatory departments.
- The ECO must ensure that all conditions of environmental authorisations are discussed and fully explained to the construction team. The construction team must have copies of the EAs on file in their site office.
- The ECO should check in and report back on progress at a minimum 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 the Department of Environmental Affairs and Water Affairs.
- The ECO must use a clarity tube (available from GroundTruth) to measure water clarity at the downstream site indicated in Figure 14 prior to commencement of construction. Thereafter, measurements should be taken and recorded (in cm) at this point each time the ECO is on site. Natural variation in water clarity is acceptable within 10% of the baseline value. Anything higher may be reflective of high levels of disturbance which requires mitigation.

5.3.2 Impact 2: Delineating a Minimal Footprint of Disturbance and No-Go Areas

By their nature, construction projects involving large numbers of workers using heavy machinery, with movement of materials over a large area are likely to create more disturbance to the natural environment (and watercourses) than necessary. This impact is considered and the following mitigation measures provided.

Mitigation Measures

- Prior to commencement of construction, during the site establishment phase, the ECO must work closely with the construction team, resident engineer and site surveyor to establish and demarcate areas that workers, vehicles and materials cannot disturb or enter.
- No-go areas must especially focus on wetland or stream habitat that is beyond **5m** from the construction footprint of the infrastructure. These areas must be delineated using suitable temporary fencing that is not prone to theft (e.g. construction mesh fencing on wooden stakes) and must be clearly sign-posted as No-go areas.
- The importance of No-go areas must be clearly communicated to site workers and contractors through a site induction, which is required each time new workers enter the site. Implementation of fines for gross negligence and ignoring No-go areas may serve as a good deterrent.
- Together with the ECO and construction team, identify suitable access, parking and turning areas for vehicles for each phase of the construction work. As far as possible, existing areas of disturbance, and existing tracks should be used for vehicle access. This must be clearly communicated to all drivers and demarcated using danger tape, reflectors or similar.

- Identify materials and equipment laydown areas away from wetlands and other watercourses as far as is practical. Consider that materials, temporary toilets, leaked fuel and litter can wash downslope during heavy rainfall and must therefore be bunded, secured, covered or surrounded by sandbags to prevent impacts to aquatic habitats. The ECO must inspect these areas for compliance.
- Check weather reports for rainfall predictions on a weekly and daily basis. Postpone work during rainfall and ensure the site has been prepared to prevent wash off of materials etc.
- As far as possible, work should be undertaken by hand using spades, pickaxes etc. However, it is acknowledged that work on this scale will require the use of heavy vehicles in some areas such as TLBs.

5.3.3 Impact 3: Construction Workers in and Around Sensitive Aquatic Habitat

This impact mainly concerns the proper management of human-generated waste and containment thereof.

Mitigation Measures

- Through each phase of construction have a designated area which is marked out for eating, resting, rubbish disposal, and sanitation (cleaning drinking, washing water and toilets).
- Provide adequate bins for disposal of personal waste (e.g. lunch wrappers) as well as a waste area for larger waste materials (e.g. concrete rubble).
- Provide an appropriate number of temporary toilets and ensure they are cleaned by a registered company on a regular basis.
- All workers must be made aware that no rubbish may be disposed of in aquatic habitats under any circumstance.
- Concrete mixing (dagha) should be done on boards, trays or strong plastic sheeting, away from the watercourse (Figure 17) as cement is a pollutant that must not be allowed to flow into the watercourse. Any waste cement should be allowed to dry and be disposed of in skips at the site. No waste cement should be discarded in aquatic habitats under any circumstance.

Figure 17. Example of mixing cement (dagha) on a wooden board to prevent wash off to watercourses during rainfall.

5.3.4 Impact 4: Stormwater Runoff Causing Erosion, Sedimentation and Pollution During Construction

Large areas of exposed soil, stockpiled mobile materials, and compacted soil without vegetation are susceptible to erosion, which could result in sedimentation and pollution of water in aquatic habitats. The aim for mitigating this impact are to ensure that no sediment-laden runoff enters watercourses. Cleaning up sedimentation through a wetland or stream is very difficult and time consuming, so preventing such incidents should be the primary focus. Stormwater generated on-site should be managed according to Sustainable Drainage System (SuDS) principles even during the construction phase. This means that infiltration of low velocity flows should be encouraged as far as possible. High velocity, concentrated flows of water must be avoided.

Mitigation Measures

- Clearly demarcate the construction area and ensure that heavy machinery does not compact soil or disturb vegetation outside of these demarcated areas (Also refer to Impact 2).
- Ensure stockpiled materials such as topsoil, subsoils, or any other mobile materials are bunded with sandbags to prevent their loss during rainfall. Topsoil must always be kept separate from other materials and protected from loss and contamination at all times.
- Ensure that construction activities do not cause any preferential flow paths and concentrated surface runoff during rainfall events.
- Ensure that vegetation clearing is conducted in parallel with the construction progress to minimise erosion and runoff.
- Rainwater that must be pumped out of excavations (holes, trenches, foundations) after heavy rainfall cannot be discharged to stormwater drains or into a watercourse. A **temporary coffer dam** must be established using sandbags as the walls and bidim geotextile fabric as the liner. Water must be pumped into this and will seep through the bidim, leaving the majority of fine sediment behind in the fabric.
- Reduce transport of sediment down slopes through use of structures such as silt fences, biodegradable coir logs and soilsaver biodegradable matting (Figure 18).

Figure 18. Examples of silt fences with soil saver matting (left) and coir logs (right) used to trap sediment mobilised from steep slopes during the construction phase.

- Construct haybale check dams within concentrated flow paths to encourage water pooling and seepage through the haybale, while sediment remains in drains (Figure 19).
- Protect stormwater drains which lead to aquatic habitats with sandbags to prevent silt-laden water from entering drains (Figure 19).

Figure 19. Examples of a haybale check dam in a concentrated flow path (left) and sandbags surrounding a stormwater drain which leads to a wetland. This prevents silt laden water from entering the wetland where it would be difficult to remove.

- Revegetate exposed areas once construction has been completed with grass. In terrestrial areas, a mixture of oats (*Avena sativa*), buffalo grass (*Stenotaphrum secondatum*) and kweek (*Cynodon dactylon*) is preferable. The use of **kikuyu grass is not supported** as this is a classified alien plant and considered highly invasive in wetlands.

Provided the recommended mitigation measures are fully implemented, this impact is rated as Negligible. However, implementation is dependent on having the correct materials available on site (as these are not always immediately available), and proactive preparation in anticipation of, during, and following rainfall is critical.

5.3.5 Impact 5: Working in and Adjacent to Wetlands for Construction of the Bulk Sewer Line

This impact concerns the preferred layout route indicated as Option 3 and construction of the bulk sewer line.

Mitigation Measures

- Construction disturbance to be kept to the 'settlement side' of the sewer line route as opposed to the wetland side. Disturbance includes vehicles, workers, excavated soil from the trench and stockpiled materials. This would mean that the wetland would be protected from construction works for the most part by the pipeline trench itself.
- Practice **'first out, last in' for soil** excavated in trenches. Topsoil is highly valuable and it is imperative that all topsoil is replaced as the uppermost soil layer. Subsoils should not be mixed with topsoil. Topsoil has a valuable seedbank and organic matter which will greatly promote rapid regrowth of vegetation once the trench is refilled.

- *Where possible*, excavated sods of earth containing intact plants should be saved for replacement to preserve vegetation and fast-track revegetation at conclusion of the works.
- Excavations by hand and other access required in the wetland should be done using wooden boards placed over vegetation to give workers an easier footing in wet soils and minimise soil disturbance.
- Excavations for pipe supports in the wetland will likely require pumping of water out of the excavation given that the soil is fully saturated. The water is likely to have very low oxygen levels and high redox values which represent very different water quality to any surface water in the wetland. This water should therefore be spread over adjacent terrestrial areas where it can flow back to the wetland slowly, instead of being directed straight into the wetland where it could impact aquatic fauna.
- When constructing the crossing through the wetland area, work from both sides of the wetland towards the middle point *if possible*, to avoid disturbing habitat through back-and-forth movements.

5.3.6 Impact 6: Working in and Adjacent to the Drainage Line for Construction of the WWTW and Associated Outlets

Impacts 1 – 4 cover the impacts anticipated for construction of the upgraded WWTW. For while the footprint of the WWTW itself is not within a watercourse, it’s location adjacent to slopes leading to the stream to the West provide a potential source of disturbance and impacts to water quality.

Additional specific impacts are considered here that relate to construction of the two outlets from the WWTW which discharge treated sewage from the chlorine contact tank and stormwater pond respectively.

Mitigation Measures

- If the outlet location is flexible within a few metres, then the route selection should strongly consider avoiding the removal of large, indigenous trees as far as possible. The reason is the significant role trees play in stabilising slopes and soil.
- Work down steep slopes must be undertaken by hand with the minimal footprint of disturbance as far as possible.
- No vegetation, soil or rocks may be discarded into the stream. All material removed from the site should be carried up the slope. Topsoil must be retained for reuse following conclusion of the works.
- Consider (in discussion with the ECO) whether an instream silt fence will be required to minimise siltation during construction (only works in very low flows). Alternatively, place haybales or silt fencing along the base of any earthworks to minimise sedimentation of the stream.
- The use of gabions must follow best practice for installation including the use of bidim geotextile to prevent erosion behind gabions, the correct sizing of stones, and levelling of areas for gabions.
- Gabion boxes should be constructed of poly-coated wire to reduce the likelihood of vandalism through cutting and theft.

- Construction of any fencing along the western boundary of the WWTW should be positioned along the top of the slope and as far away from the watercourse and 1:100-year floodline as possible. Pedestrian gates should be included to allow for inspection and maintenance of the two outflows from the WWTW. The fence must not restrict movement of wildlife along the drainage line in any way.

Table 6. Construction phase impact assessment.

Impact	Intensity	Duration	Extent	Probability	Significance	Significance Rating	Reversibility	Irreplaceibility	Confidence
Construction Phase Impact Assessment for Proposed Upgrade to Woodlands WWTW									
Impact 1: Non-compliance with conditions of the environmental authorisations									
Without Mitigation	Moderate	Short term	Limited	Almost certain	-54	Minor	High	Low	High
With Mitigation	Low	Short term	Limited	Probably	-32	Negligible	High	Low	High
Impact 2: Delineating a minimal footprint of disturbance and No-Go areas									
Without Mitigation	Very high	Medium term	Local	Almost certain	-78	Moderate	High	Low	High
With Mitigation	Moderate	Short term	Limited	Likely	-45	Minor	High	Low	High
Impact 3: Construction workers in and around sensitive aquatic habitat									
Without Mitigation	Moderate	Short term	Limited	Almost certain	-54	Minor	High	Low	High
With Mitigation	Low	Short term	Very limited	Probably	-28	Negligible	High	Low	High
Impact 4: Stormwater runoff causing erosion, sedimentation and pollution during construction									
Without Mitigation	High	Short term	Local	Probably	-44	Minor	Medium	Low	High
With Mitigation	Moderate	Brief	Limited	Probably	-32	Negligible	High	Low	High
Impact 5: Working in and adjacent to wetlands for construction of the bulk sewer line									
Without Mitigation	Very high	Medium term	Local	Almost certain	-78	Moderate	High	Low	High
With Mitigation	High	Short term	Limited	Likely	-50	Minor	High	Low	High
Impact 6: Working in and adjacent to the drainage line for construction of the WWTW and associated outlets									
Without Mitigation	High	Medium term	Limited	Almost certain	-66	Minor	Medium	Low	High
With Mitigation	High	Short term	Limited	Probably	-40	Minor	High	Low	High

5.4 Operational Phase Impact Assessment

5.4.1 Impact 1: Pipeline Blockages, Sewage Spills, and Operational Issues

During the operational phase of the upgraded sewer line and WWTW, the greatest risk to watercourses is from leaking sewage which both affects water quality and necessitates maintenance. While short-term spills are likely on an occasional basis, it is chronic leakage or discharge of poorly treated or untreated sewage that causes long-term damage to aquatic ecosystem health (as is the case at present). Mitigation to prevent leakage and the appropriate response are essential.

Mitigation Measures

- Ensure the ongoing use of lockable polymer concrete manhole covers to minimise acts of vandalism and dumping in sewer lines.
- Add signage to manholes and pipelines informing passersby of the manhole ID and telephone number to call and report leaks. This should ideally be in isiXhosa and can be spray painted onto infrastructure to prevent theft of signs.
- 6-8 months post-construction, an aquatic specialist must inspect all impacted aquatic habitats (sewer line crossing wetland and two outlets from WWTW) to ensure that:
    - Indigenous revegetation has occurred and at least 70% vegetation cover has been achieved through passive regrowth.
    - Check disturbed areas for evidence of dumping.
    - Assess the level of alien plant invasion. If substantial alien vegetation is present, then the municipality must provide staff or appoint a contractor to remove alien plants from disturbed areas of the wetland and / or stream.
    - Check outlets from the WWTW for erosion or signs that gabions may be slumping.
    - Repeat water sampling undertaken for this project at two sampling points testing for the same parameters. There should be a significant improvement in water quality downstream of the WWTW.
    - The aquatic specialist should provide a short report including recommendations to the municipality and Department of Water and Sanitation on this monitoring.

5.4.2 Impact 2: Risk of Increased Access to Aquatic Habitats for Dumping

Solid waste disposal is a serious issue in Woodlands. Although some sort of waste disposal facility is present to the east of the WWTW, there is extensive dumping in and around the settlement, especially in wetland areas. Residents explained that this is because the rubbish truck seldom collects their rubbish and as most residents do not own vehicles, they end up dumping and burning it in the bush nearby. The creation of a new servitude for the pipeline will result in easier access to certain areas of the wetland, which may increase the incidence of dumping in these sensitive areas.

Mitigation Measures

- While beyond the scope of this project, the municipality is encouraged to improve service delivery for the disposal of solid waste in a formalised facility. Disposal of solid waste is currently an environmental and human health concern. Furthermore, existing areas of dumping should be cleaned up as a priority.
- Certainty regarding the disposal for sludge and screenings must be provided by the municipality. Under no circumstances can either of the above be dumped in any watercourse.
- Encourage the regeneration of thick indigenous vegetation along disturbed areas which will create a physical barrier to dumping (to be monitored by a suitably qualified ecologist – Impact 1).

- Vehicle access to wetland areas can be restricted with installation of wooden poles or lockable bollards. However, this would not restrict access by people on foot or using wheelbarrows.

It is not easy to mitigate this impact given the situation of residents in Woodlands and the proximity of the settlement to wetland habitats. Mitigation of this impact is very much dependent on improved service delivery for the settlement going forward, and an effort to clean up existing dumping areas affected at present. Therefore, the impact is rated as Minor both with and without mitigation measures (Table 7).

Table 7. Operational Phase Impact Assessment

Impact	Intensity	Duration	Extent	Probability	Significance	Significane Rating	Reversibility	Irreplaceibility	Confidence
Operational Phase Impact Assessment for Proposed Upgrade to Woodlands WWTW									
Impact 1: Pipeline blockages, sewage spills and operational issues									
Without Mitigation	High	Ongoing	Local	Almost certain	-84	Moderate	Medium	Low	Medium
With Mitigation	High	Short term	Limited	Probably	-40	Minor	Medium	Low	Medium
Impact 2: Risk of increased access to aquatic habitats for dumping									
Without Mitigation	Moderate	Ongoing	Limited	Likely	-60	Minor	Medium	Low	High
With Mitigation	Moderate	Ongoing	Very limited	Likely	-55	Minor	Medium	Low	High

5.5 Monitoring Recommendations

Conditions of the Water Use License (WUL) usually include monitoring requirements to determine impacts of the WWTW to receiving watercourses. Over and above the typical requirements for monitoring the quality of discharge water, the following stream monitoring measures are recommended:

- Utilise the upstream and downstream WWTW monitoring sites in this report for ongoing water quality monitoring. It may be necessary to select an alternative upstream site closer to the WWTW in order to isolate the impacts more clearly.
- Water samples should be collected on a 6-monthly basis by a suitably qualified ecologist. Samples must be sent to a SANS accredited laboratory and analysed for all the parameters listed in Table 3. The interpretation of results in a short report should be compiled by a suitably qualified ecologist with a background and understanding of environmental water quality and aquatic ecosystem health.
- Additional monitoring of stream health could be achieved using diatoms as these are indicative of general water quality conditions on an ongoing basis, as opposed to the 'snapshot' provided by a water sample. Diatoms can be collected and compared both upstream and downstream of the WWTW.
- SASS5 may be an applicable biomonitoring method but it must be noted that it is not designed for use in wetlands and would only be applicable if the site had flowing water in a stream, such as the site downstream of the WWTW.

- Reporting must be provided to DWS on a 6-monthly basis with feedback provided to the municipality. The report should include water quality and biomonitoring (if required) results conducted by the specialist, as well as a summary of data provided by staff at the plant regarding the quality of water at the 'end of pipe'.

It is understood and expected that detailed and specific monitoring of the WWTW would be undertaken as part of the Green Drop Reporting structure by the DWS. This would highlight any further issues that require attention from time to time during operation of the plant.

6. CONCLUSIONS

The proposed sewer line and WWTW upgrade at Woodlands settlement in Tsitsikamma was assessed from the perspective of impacts (current and future) to aquatic ecosystems.

The present impacts to wetlands which grades to a drainage line downstream, are mostly related to the current practice of discharging raw sewage from a honey-sucker truck downslope and into the receiving watercourse. The PES of the wetland was rated C, Moderately Modified, while the drainage line was rated B/C. The current state of the WWTW is considered non-functional and the proposed upgrades are urgently needed to address both environmental and potential human health risks.

Significant engagement with the project team (engineering and environmental) resulted in an improved layout of the sewer line which minimises impacts to wetlands as far as possible. Several mitigation measures have been recommended through all phases of the proposed upgrade / development and should ideally form part of the conditions of an approved water use license.

Approval of the proposed upgrade is strongly supported as the present situation in terms of wastewater management is highly detrimental to the receiving environment.

7. REFERENCES

Council for Scientific and Industrial Research (CSIR). (2018). National Wetland Map 5 and Confidence Map [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 30 September 2020.

Chakona, Albert & Skelton, Paul. (2017). A review of the Pseudobarbus afer (Peters, 1864) species complex (Teleostei, Cyprinidae) in the eastern Cape Fold Ecoregion of South Africa. ZooKeys. 657. 109-140.

Department of Water Affairs and Forestry (DWAF) (2005). Final Draft: A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas.

Le Maitre, D.C., Walsdorff, A., Cape, L., Seyler, H., Audouin, M, Smith-Adao, L., Nel, J.A., Holland, M. and Witthüser. K. (2018). Strategic Water Source Areas: Management Framework and Implementation Guidelines for Planners and Managers. WRC Report No. TT 754/2/18, Water Research Commission, Pretoria.

Mucina, L., Adams, J. B., Knevel, I. C., Rutherford, M. C., Powrie, L. W., Bolton, J. J., van der Merwe, J. H., Anderson, R. J., Bornman, T. G., le Roux, A., Janssen, J. A. (2006). Fynbos Biome. In L. Mucina, & M. C. Rutherford, The vegetation of South Africa, Lesotho and Swaziland 19 (pp. 660-690). Pretoria: South African National Biodiversity Institute.

Skelton, P.H., 2001. A complete guide to the freshwater fishes of southern Africa. Cape Town: Struik.

8. APPENDICES

8.1 Methods for Index of Habitat Integrity

Rivers and drainage lines are natural channels in which water flows permanently or intermittently following rainfall. The stream into which the WWTW will discharge is classified as a stream with perennial flows. 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;**Error! Reference source not found.** Table 8), along with a confidence rating based on the level of confidence in the score.

Table 8. 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 9.

Table 9. Index of habitat integrity (IHI) classes and descriptions

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

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS & TOURISM

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST IN TERMS OF REGULATIONS 12 AND 13 OF THE AMENDMENTS TO THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 AS AMENDED.

(For official use only)

File Reference Number:	
NEAS Reference Number:	
Date Received:	

Application for environmental authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Amendments to the Environmental Impact Assessment Regulations, 2014. This form is valid as of 6 January 2021.

PROJECT TITLE

UPGRADE OF A WASTEWATER TREATMENT WORKS AND INSTALLATION OF SMALL-BORE SEWAGE RETICULATION SYSTEM IN WOODLANDS, KOUKAMMA LOCAL MUNICIPALITY, SARAH BAARTMAN DISTRICT MUNICIPALITY , EASTERN CAPE

SPECIALIST [1]			
Contact person:	Dr Jackie Dabrowski		
Postal address:	7 St Johns St. Dormehls Drift George		
Postal code:	6529	Cell:	083 256 3159
Telephone:		Fax:	
E-mail:	jackie@confluent.co.za		
Professional affiliation(s) (if any)	SACNASP 115166 Aquatic + Ecological Science		

Project Consultant:	Dr Jackie Dabrowski, Confluent Environmental		
Contact person:	Above		
Postal address:	7 St Johns Street, Dormehls Drift, George		
		Cell:	083 256 3159
Postal code:			
Telephone:		Fax:	
E-mail:	jackie@confluent.co.za		

4.2 The SPECIALIST

I, Jackie Dabrowski, declare that –

General declaration:

- I act as the independent Specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation **8** of the regulations when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;

- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended.
- I have a vested interest in the proposed activity proceeding, such vested interest being:

____

____

Signature of the environmental assessment practitioner:

Confluent Environmental (Pty) Ltd

Name of company:

4/09/2025

Date:

Signature of the Commissioner of Oaths:

2025/09/04

Date:

Designation:

[1] Curriculum Vitae (CV) attached

Official stamp (below).

Friedel Louise Botha
8 St John's Street, St John's Place
Dormehlsdrift, George
044 873 3539
Commissioner of Oaths / Kommissaris van Ede
R.S.A