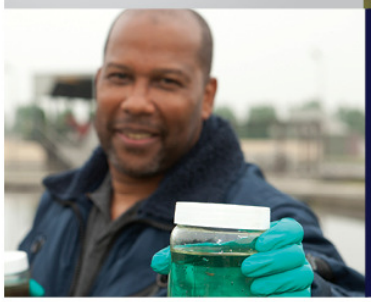
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WETLAND DELINEATION AND ASSESSMENT REPORT FOR THE PROPOSED ADAMAYVIEW OUTFALL SEWER PIPELINE UPGRADE FOR THE CITY OF MATLOSANA MUNICIPALITY, NORTH WEST PROVINCE

24 JULY 2017 Version 2





TITLE:	**WETLAND DELINEATION AND ASSESSMENT REPORT FOR THE ADAMAYVIEW OUTFALL SEWER PIPELINE UPGRADE FOR THE CITY OF MATLOSANA MUNICIPALITY, NORTH WEST**
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Date: July 2017

Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as information available at the time of study. Therefore the author reserves the right to modify aspects of the report, including the recommendations, if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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EXECUTIVE SUMMARY

1. Introduction

SAZI Environmental Consulting cc was appointed by City of Matlosana Municipality to undertake a wetland delineation and assessment for the proposed upgrade of a sewer outfall pipeline in Adamayview in the North West Province. The study was undertaken in May 2017.

2. Approach and Methodology

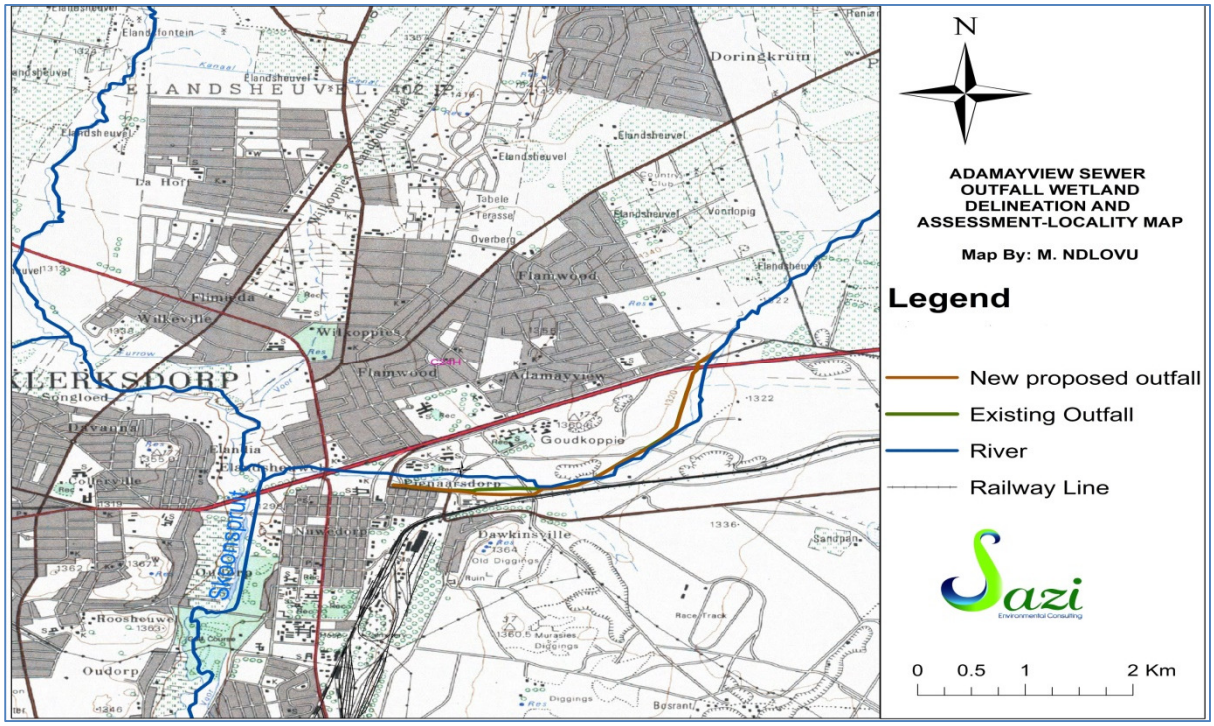
The activities for this assessment include the following:

- Desktop assessment of the site;
- A site visit to confirm the presence or absence of wetland areas within the proposed project site area as well as verification of wetland boundaries;
- Assessment of the catchment;
- Assessment of the Present Ecological Status of wetlands on site (Level 1, Wet-Health);
- Assessment of Ecological Importance and Sensitivity of wetlands on site ;
- Impact assessment of the proposed activities on the wetlands.

3. Wetland Assessment Results

The Study area falls within the C24H quaternary catchment of the Middle Vaal Water Management Area (WMA), which is sub-catchment of the Vaal Major WMA (DWS 2012, https://www.dwa.gov.za/). Major rivers in this catchment include the Wilge, Liebenbergsvlei, Mooi, Renoster, Vals, Sand, Vet, Harts, Molopo and Vaal. The main river that flows within the study area is the Palmietspruit River, which is a first order stream.

The wetland identified on site was a channelled Valley bottom wetland that was associated with the Palmietspruit River. The Palmietspruit CVB wetland was approximately 400 ha in size, extending from Elandsheuwel till just before Dawkinsville (close to Keurhof School).



4. WETLAND HEALTH ASSESSMENT

Wetland health status was assessed by considering impacts to wetland hydrology, geomorphology and vegetation in accordance with the Wet-Health modules. Individual modules are discussed in the sections below, for each wetland assessed. The impact scores are summarised on the tables below.

PES impact score

	Hydrology	Geomorphology	Vegetation
	Impact Score	Impact Score	Impact Score
Area weighted impact scores	3.5	2.8	4.0
PES Category	C	C	D
OVERALL IMPACT SCORES	3		
PES SCORE	C (Moderately Modified)		

5. WETLAND ECOLOGICAL IMPORTANCE AND SENSITIVITY

The Palmietspruit wetland was assessed to have Moderate ecological importance and sensitivity. The table below gives a summary and explanation of the EIS Scores for the CVB wetland.

EIS Scores for CVB wetland

SUMMARY	Score (0-4)	Confidence (1-5)
Ecological Importance and Sensitivity	**2.7**	**3.3**
Hydro-Functional Importance	**1.4**	**2.9**
Direct Human Benefits	**0.0**	**0.3**
Overall EIS Category	**1.3**	**2.2**

Explanation of EIS scores for CVB Wetland

ECOLOGICAL IMPORTANCE & SENSITIVITY	**1.3**
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2

6. ASSESSMENT OF IMPACT

An impact assessment was undertaken and mitigation measures prescribed for the proposed Adamayview sewer outfall pipeline.

7. CONCLUSION

A channeled valley bottom wetland was identified within the sewer outfall pipeline study area. The CVB wetland was associated with the Palmietspruit River of the North West Province. The CVB wetland is ranked as **Moderately Modified** both based on PES and EIS undertaken. This infers that the wetland has not experienced major impacts both due to natural or anthropogenic activities. The proposed sewer outfall upgrade will run along the

existing pipeline but further away from the river. The sewer pipeline is located adjacent the CVB wetland with portions of it cutting through the wetland. The construction of the sewer pipeline will undoubtedly have a negative impact on the current state of the CVB wetland, however with proper mitigation measures put in place, impacts might be left at a minimum and the integrity of the wetland may be restored after construction. In addition, the proposed activity is a linear activity which has less detrimental impacts on water courses than other developments such as mining.

It is also recommended that any construction activities of the sewer outfall should be undertaken during dry season of the year (March-August). In conclusion, the current wetland study approves the development of the sewer pipeline, with consideration of all recommended mitigation measures.

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LIST OF TERMS AND ABBREVIATIONS

Delineation – the technique of establishing the boundary of an aquatic resource such as a wetland or riparian area.

Drain – In the context of wetlands, refers to a natural or artificial feature such as a ditch or trench created for the purpose of removing surface and sub-surface water from an area (commonly used in agriculture).

Ecological Importance – An expression of the importance of an environmental resource for the maintenance of biological diversity and ecological functioning on local and wider scales.

Ecological Sensitivity – A system's ability to resist disturbance and its capability to recover from disturbance once it has occurred.

EIS – Ecological Importance & Sensitivity.

GIS – Geographical Information Systems.

GPS – Global Positioning System.

Gulley (or erosion gulley) - A gully (commonly called a "donga") is an erosion landform or feature, created by running water eroding sharply into soil. Gullies generally resemble small ditches that can be several meters in depth and width. Gullying or gully erosion is the process by which gullies are formed.

HGM – Hydro-Geomorphic.

NFEPA – National Freshwater Ecosystem Priority Areas, identified to meet national freshwater conservation targets (CSIR, 2010).

PES – Present Ecological State, referring to the current state or condition of an environmental resource in terms of its characteristics and reflecting change from its reference condition.

RESERVE - The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

1 INTRODUCTION

The City of Matlosana has since experienced blockages/overflow of sewage, where the outfall sewer line reduces the size from 600Ø to 375Ø then 1000Ø for approximately 3.7km. The proposed project (sewer outfall pipeline upgrade) is aimed at providing intergraded social development in the City of Matlosana. The current outfall sewer line is discharging 225 litres per second. The existing outfall sewer line runs parallel with the existing stream. The proposed sewer outfall upgrade will run along the existing pipeline but further away from the river. The existing pipe sizes are detailed below:

- The pipe size at highest point of the site starts at 600mm and reduces to 375mm, then 1050mm at the lowest side; and
- For approximately 3.7km, the pipe size remains at 375mm then enlarges to 1000mm.

SAZI Environmental Consulting cc was appointed to undertake an assessment of fauna and flora species for the proposed upgrade of a sewer outfall pipeline by the City of Matlosana in Adamayview, North West Province. The study was undertaken in May 2017.

According to the NWA Section 21 (c) and (i) guidelines, any development that takes place within 500m of a watercourse constitutes a water use, which requires a Water Use Licence before development can commence. This wetland delineation and assessment study was undertaken to supplement the (WUL) application process.

1.1 TERMS OF REFERENCE

The terms of reference applicable to the specialist study include:

- Desktop assessment of the project site (identify wetlands within the site by examining existing national and provincial wetland databases, 1: 50 000 topographical maps, and ortho/ aerial photographs, if available).
- Identify riparian areas where they occur;
- A site visit to confirm the presence or absence of wetland areas within the proposed project site area as well as verify wetland boundaries;
- Where wetlands occur on or near the site alternatives identified on site only, delineation is to be performed (according to the DWAF proposed methodology of the delineation of wetlands) and classification of the wetland hydrogeomorphic types

using the hydrogeomorphic method (as specified within Wet-Ecoservices) will be undertaken;

- Assessment of the catchment;
- Assessment of the Present Ecological Status of wetlands on site (Level 1, Wet-Health);
- Assessment of Ecological Importance and Sensitivity of wetlands on site; and
- Impact assessment of the proposed activities on the wetlands.

1.2 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are applicable to this report:

- The current information received from the client and existing data is correct.
- The maps available are still relevant and can be used as representation of site conditions.

- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies, due to the use of handheld GPS instrumentation, may occur. If more accurate assessments are required the wetlands will need to be surveyed and pegged according to surveying principles.
- Aquatic, wetland and riparian ecosystems are dynamic and complex. The effects of natural seasonal and long-term variation in the ecological conditions are therefore largely unknown.
- Fauna and flora assessments undertaken were mainly for the purposes of supporting the Present Ecological Status and Ecological Importance and Sensitivity that is required as part of the wetland assessment. Extensive fauna and flora assessment outside of the wetland system did not form part of this report.

1.3 DEFINITIONS AND LEGAL FRAMEWORK

In a South African legal context, the term watercourse is often used rather than the terms wetland, or river. The NWA includes wetlands and rivers into the definition of the term watercourse (DWAF, 2005).

The NWA, defines a riparian habitat as follows: “Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.”

The NWA defines a wetland 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.”

The assessment of the Palmietspruit wetland was undertaken within the context of the definitions as mentioned above. The figure below (Figure 1-1) illustrates the location of the project site.

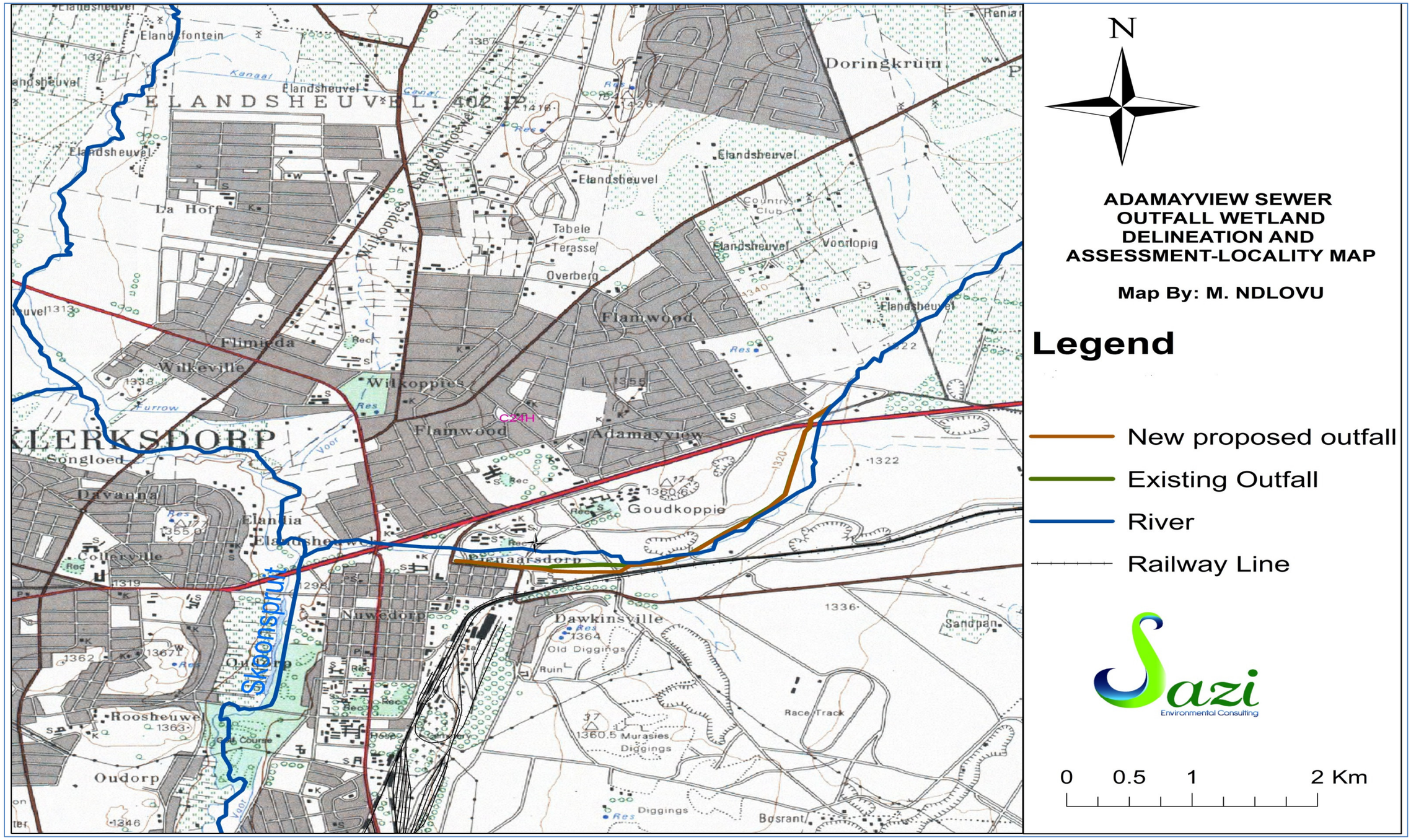


Figure 1-1 Location of the sewer outfall pipeline assessment site

2 METHODOLOGY FOLLOWED

2.1 DESKTOP ASSESSMENT

The following data sources were used to inform the desktop assessment:

- National Freshwater Ecosystem Priority Areas (NFEPA) wetland coverage, which shows location of FEPA wetland sites;
- 1:50,000 imagery as well as latest Google Map Imagery for desktop assessment of the site;
- Biodiversity GIS (BGIS) to obtain conservation areas;
- Wet-Health tool for the assessment of the present ecological status or health of the wetland;
- Department of Water and Sanitation (DWS) Wetland Reserve tool for the assessment of ecological importance and sensitivity of the wetland;
- DWS website;
- The topography data was obtained from the Surveyor General's 1:50 000 top sheet data for the region; and
- Background information from client.

2.2 WETLAND DELINEATION AND CLASSIFICATION

Verification of wetland boundaries was undertaken on site according to the DWS, previously known as the Department of Water Affairs and Forestry - DWAF) guideline, 2013: A practical guideline procedure for the identification and delineation of wetlands and riparian zones.
The guidelines indicate that wetlands must have one or more of the following attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and
- A high water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 60 centimetres of the soil.

Wetland indicators that were identified on site included the terrain unit indicator, and soil wetness. These were used to confirm the boundary of the Palmietspruit wetland.

The Hydro-Geomorphic types (HGM) classification was based on geomorphic wetland setting (e.g. hillslope or valley bottom), water source (surface water dominated or sub-surface water dominated) and how water flows through the wetland unit (diffusely or channelled).

Figure 2-1 below indicates the wetland hydro-geomorphic setting of inland wetlands in South Africa as well as wetland classification applied on wetlands for assessment.

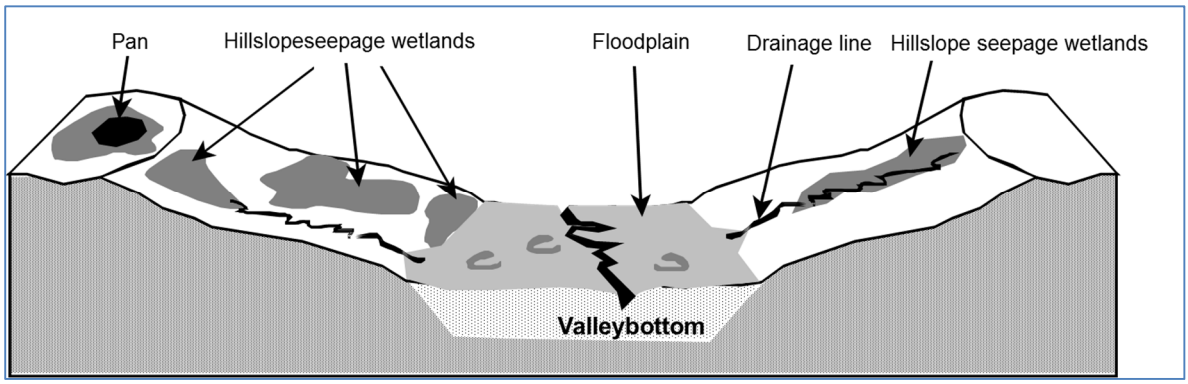


Figure 2-1 Hydro-geomorphic setting

2.3 EXISTING IMPACTS AND CATCHMENT CONTEXT

Using available information, existing impacts to the wetlands and within the delineated micro-catchment were mapped and described.

2.4 WETLAND HEALTH ASSESSMENT

This assessment was made in accordance with the level 1 Wet-Health method to describe the Present Ecological Status (PES) (Macfarlane, *et al*. 2008). The method utilises geomorphology, hydrology and vegetation to determine the health of a wetland.

The hydrology module assesses the land use descriptors (irrigation, level of reduction or increase in flows, hydro-geomorphic setting of the wetland and extent of canalisation and gully formations). The vegetation module assesses the level of vegetation transformation, which is indicated by level of alien species invasion, terrestrial species encroachment and encroachment by indigenous invasive species. The geomorphology module captures

deviations in the sedimentary inputs and outputs to and from wetlands that are consequence of human activities.

Values range from Class A (largely natural) to Class F (critically modified). Table 2-1 below describes the overall HGM health categories and their scores. **This is calculated as 10 - Impact scores to get the overall impact score.**

Table 2-1Health categories used by WET-Health for describing the integrity of wetlands

HEALTH CATEGORY	DESCRIPTION	Min Score
A	Unmodified, natural.	0 – 0.9
B	Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1 – 1.9
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2 – 3.9
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9
E	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9
F	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10

An overall wetland health score was calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula:
Overall health rating = [(Hydrology*3) + (Geomorphology*2) + (Vegetation*2)] / 7
This overall score assists in providing an indication of wetland health/condition which can in turn be used for recommending appropriate management measures.

2.5 WETLAND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

An assessment of the importance and sensitivity of wetland systems using the DWS Reserve tool. Data input was populated using the outcomes of the WET-Health assessment

and other valuable information gathered in the field as well as available desktop information. Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits.

The maximum score for these components was taken as the importance rating for the wetland which is rated using Table 2-2 below.

Table 2-2 Ecological Importance and Sensitivity rating table

ECOLOGICAL IMPORTANCE AND SENSITIVITY CATEGORIES	RANGE OF EIS SCORE
Very high: Wetlands that are considered ecologically important and sensitive on a **national or even international** level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4
High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2
Low/marginal: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in	>0 and <=1

moderating the quantity and quality of water of major rivers.	

2.6 IMPACT ASSESSMENT

The information gained from the functional integrity and EIS assessments was used to inform an assessment of the likelihood and significance of potential impacts associated with the proposed sewer outfall pipeline activities. The following methodology (Table 2-3) has been adopted from the DWS's Operational Guideline, 2010 entitled "Operational Guideline: Integrated Water and Waste Management Plan'.

Table 2-3 Ranking scales for impact assessment

DURATION (D)	**MAGNITUDE (M)**
5 - Permanent 4 - Long term (ceases with operational life) 3 - Medium term (5-15 years) 2 - Short term (0-5 years) 1 – Immediate	10 - Very high/do not know 8 - High 6 - Moderate 4 - Low 2 – Minor
SCALE (S)	**PROBABILITY (P)**
5 – International 4 - National 3 - Regional 2 - Local 1 - Site 0 – None	5 - Definite/do not know 4 - Highly probable 3 - Medium probability 2 - low probability 1- Improbable 0 – None
SIGNIFICANCE POINTS (SP) = (D+M+S) X P	
HIGH (H) = >60 POINTS	
MODERATE (M) = 30-60 POINTS	
LOW (L) = <30 POINTS	
NO SIGNIFICANCE = 0	
POSITIVE IMPACT	

The maximum value of significance points is 100. Environmental effects could therefore be rated as either high (H), moderate (M), or low (L) significance, as seen above.

3 WETLAND ASSESSMENT RESULTS

This section provides the findings of the wetland assessment. It gives a description of the water resources found within the study area and surrounds; the wetland types (HGM units) assessed and also describes the wetland delineation process. Thereafter, the wetland Present Ecological Status (PES) and Ecological Importance and Sensitivity (EIS) are presented and discussed in relation to the impacts on the wetlands identified on site.

3.1 DESCRIPTION OF WATER RESOURCES

The Study area falls within the C24H quaternary catchment of the Middle Vaal Water Management Area (WMA), which is sub-catchment of the Vaal Major WMA (DWS 2012, https://www.dwa.gov.za/). Major rivers in this catchment include the Wilge, Liebenbergsvlei, Mooi, Renoster, Vals, Sand, Vet, Harts, Molopo and Vaal. The main river that flows within the study area is the Palmietspruit River, which is a first order stream **(Figure 3-1)**.

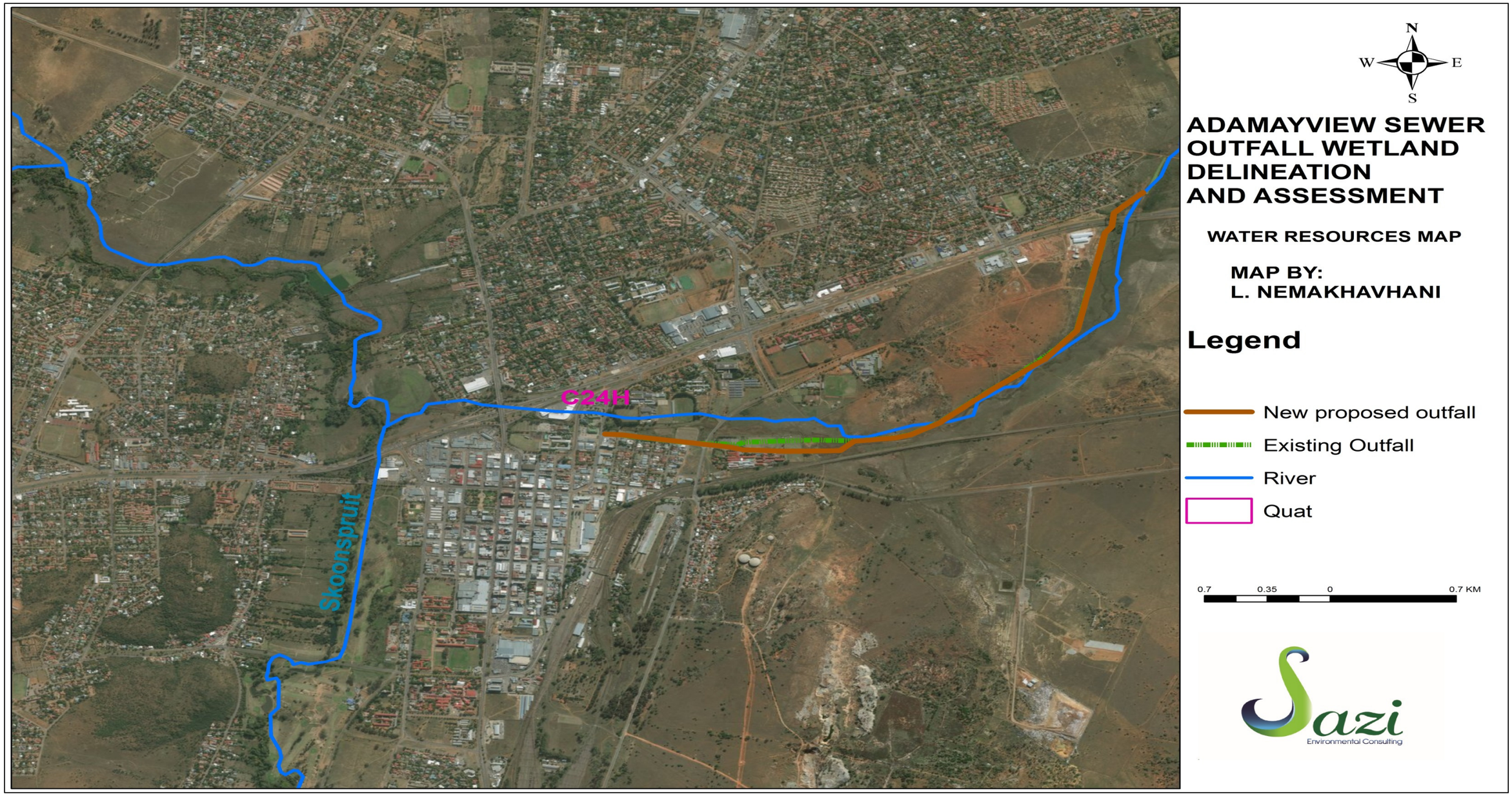


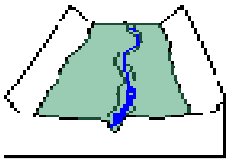
Figure 3-1 Map indicating the water resources within the study area

3.2 CLASSIFICATION OF WETLANDS

Wetland classification was based on the Hydro-geomorphic (HGM) classification, which is based on the geomorphology wetland setting, water source and how water flows through the wetland unit. Based on the classification mentioned above, the wetland identified on site was a channelled valley bottom wetland that was associated with the Palmietspruit River. The Palmietspruit CVB wetland was approximately 400 ha in size, extending from Elandsheuwel to just before Dawkinsville (close to Keurhof School). The CVB wetland is known for its function in flood attenuation and potential for water quality enhancement and erosion. The CVB is furthermore maintained by surface and sub-surface water.

Table 3-2 below gives a description of the CVB Wetland type observed on site and provides a picture showing a segment of the CVB thereafter.

Table 3-2 Description of the wetland identified on site

WETLAND TYPE	DESCRIPTION
Valley bottom with a channel 	Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes. 

4 WETLAND DELINEATION

Wetland indicators that were identified on site included the terrain unit indicator, hydrophytes and soil wetness. These indicators were used in identifying and confirming the boundary of the wetland during the filed assessment. The CVB wetland was identified as per the DWAF guidelines 2005 and was delineated from the outer edges of the wetland boundaries; furthermore a 30 m buffer was created for this wetland. The 30 m buffer is a recommended buffer for wetlands within urban environments (Gauteng Department of Agriculture and Rural Development, 2014). **However, for this particular development, the 32 m buffer will not hold for the entire wetland as the proposed pipeline will at some points be constructed on the buffer zone and wetland area. The point of emphasis here should be on the mitigation measures suggested after construction on the buffer and wetland zone. Should these recommendations be implemented, it is believed that the wetland will be minimally impacted and will be able to recover.**

Figure 4-1 below is a map illustrating the wetland delineation. Following that is a map (Figure 4-2) showing the wetland buffer of the delineated wetland type.

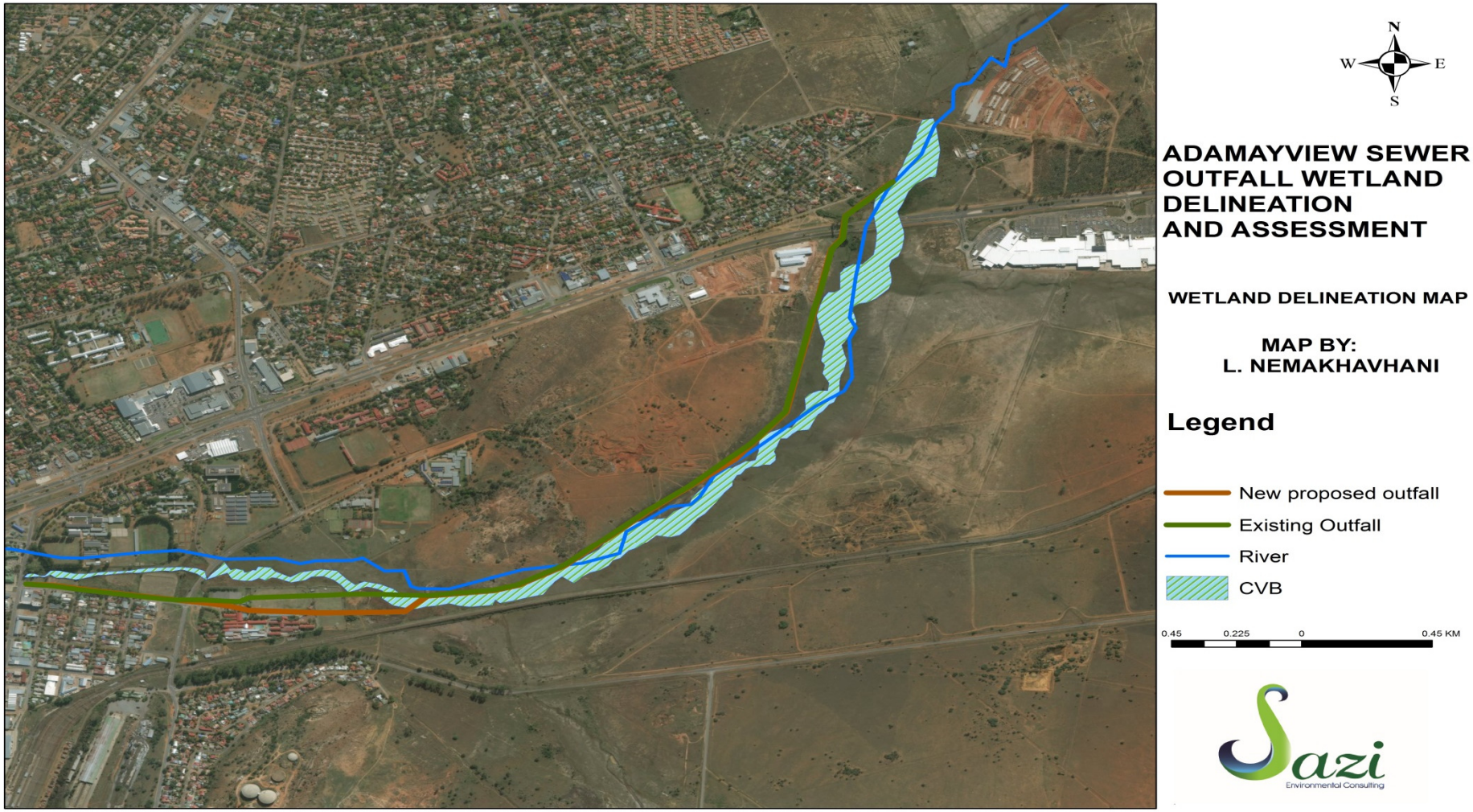


Figure 4-1 Delineated wetland boundary

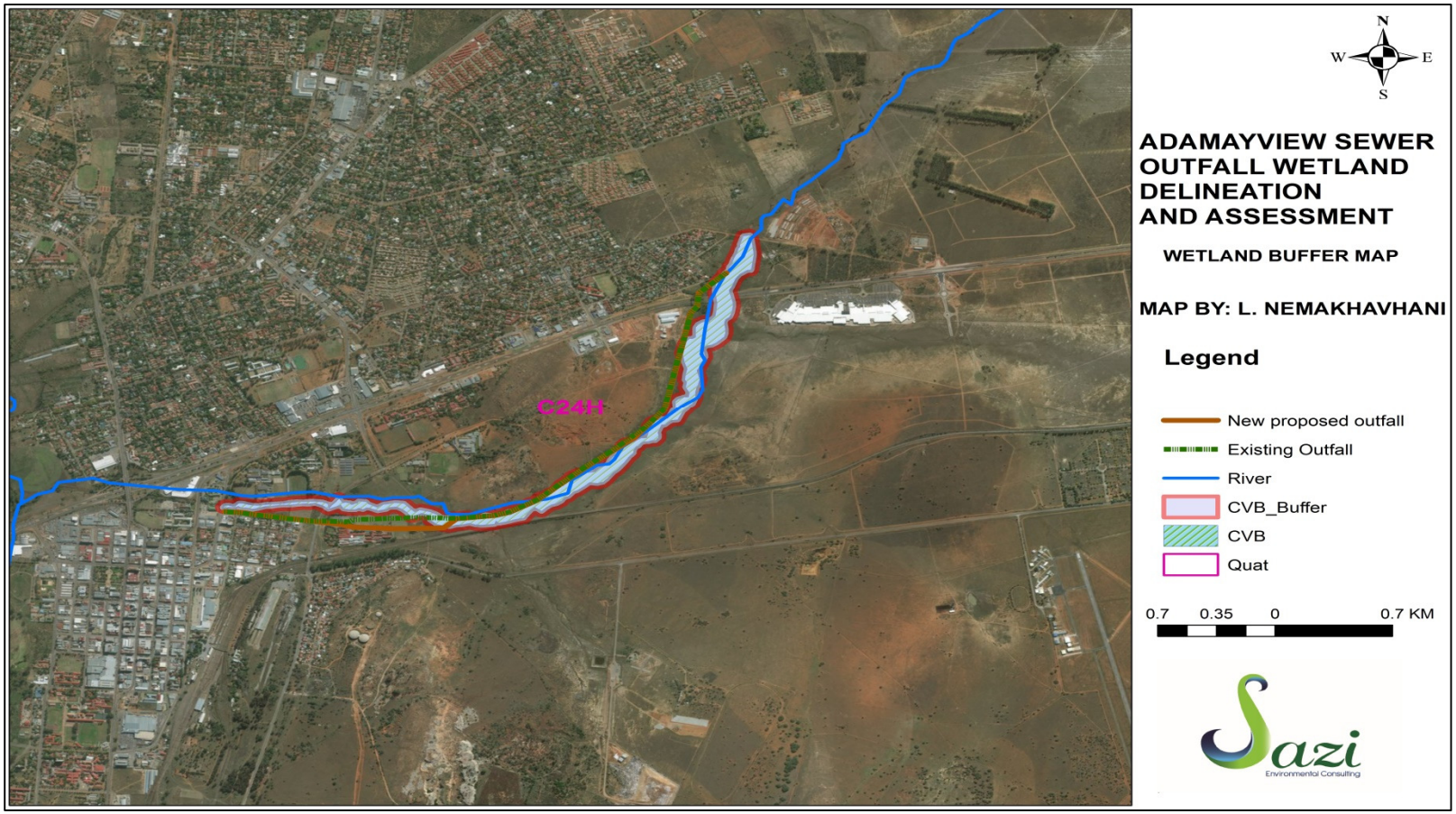


Figure 4-2 Wetland buffer zone

5 PRESENT ECOLOGICAL CATEGORY OF THE CVB WETLAND

Wetland health status was assessed by considering impacts to wetland hydrology, geomorphology and vegetation in accordance with the Wet-Health modules. Individual modules are discussed in the sections below, for each wetland assessed.

5.1 HYDROLOGICAL CHANGES

The formation, persistence, size, and function of wetlands are controlled by hydrologic processes. Seasonal changes in water levels and the effect of recent precipitation events must be considered when evaluating an area's hydrology, particularly outside of the growing season or during the dry summer months. Hence, wetlands are characterised by movement of water through or within them, water quality, and the degree of natural or human-induced disturbance.

The hydrology of the CVB wetland is mainly from surface and sub-surface input. Another input source of water for these type of wetlands is also from flooding or outflow of water from the associated stream.

Hydrological Impacts associated with the channelled valley bottom wetland identified on site included; associated stream modification, reduced roughness due to burning of vegetation within the wetland, impeding features and sediment deposition. Based on current impacts observed on site and the PES undertaken for this wetland, the hydrological state of the wetland was at present regarded as moderately modified. The table below provides a description of the impacts on the CVB wetland's hydrology.

Table 5-1 Hydrological impacts on the CVB wetland

 Paved road on a wetland, reducing associated channel stream flow and impacting on water quality	 Impeeding feature on a wetland (fencing)
 Water quality impacts on associated stream,	 External water input

5.2 GEOMORPHOLOGICAL CHANGES

The Geomorphology module evaluates the effects of changed sediment and erosion distribution and retention patterns on a wetland. Evidence of this would relate to accelerated erosion in the catchment and in the wetland.

The Palmietspruit CVB wetland geomorphological impacts were largely due to the wetland being located within an urban settlement area, and thus experienced a lot of road and housing development (Impervious surfaces). Fewer impacts such as gully creation, erosion and sedimentation were also identified. Table 5-2 below summaries these impacts.

Table 5-2 Geomorphological impacts on the CVB wetland

 Bridge construction and erosion on the associated stream	 gully creation
 Sediment deposition	

5.3 VEGETATION CHANGES

This module has an important contribution to the composition, structure and function of a wetland, and is also important in terms of the habitat. A robust vegetation cover assists in holding soil particles therefore minimising soil erosion intensity. This is also important for water retention, which aids in water quality improvement.

The vegetation type that exists in an area can serve as an indication of the type of landscape features that area may host. Some vegetation types do not have the capacity to host permanent wetlands and/or perennial rivers. Using vegetation as a wetland indicator is considered one of the indicator tools; however, the use of vegetation as an indicator may bring along confusion based on the fact that, vegetation differs with season, especially when working with seasonal wetlands that are not permanently inundated to hold hydrophytes.

Vegetation indicator during rainy season is ideal; however during dry season it may not be easy to identify certain vegetation species.

5.3.1 CVB VEGETATION CHANGES

The CVB wetland did not have a high amount of alien species that pose a threat to wetland vegetation. The wetland had minor natural impacts with regards to vegetation. However, the wetland experienced, to some degree, human interference. Evidence of burning and camping out was observed in this wetland vicinity, which has resulted in the removal of vegetation.

The wetland housed some wetland vegetation and this resulted in an increased biodiversity around this wetland area. The vegetation assessment undertaken for the wetland was regarded as largely modified. Impacts associated with wetland vegetation are presented in the table below. Thereafter, a list of vegetation observed in the wetland is presented in Table 5-4.

Table 5-3: Vegetation impacts on the CVB wetland

	
Littering on vegetation	alien vegetation encroachment

Table 5-4 Vegetation observed on CVB Wetland

Vegetation type	Identification	Extent (%)
Grasses	*Aristida congesta, Eragrostis curvula, Themeda triandra, Hyparrhenia hirta, Eragrostis superba*	40
Sedges	*Cyperus marginatus*	15
Trees and shrubs	*Acacia sp, Salix babylonica, Eucalyptus camaldulensis, Arundo donax*	15
Aquatic plants	*Typha capensis*	30

6 SUMMARY OF THE IMPACT SCORES

The impacts that were observed on site largely informed the hydrological, geomorphological and vegetation impact scores. The overall score of the Palmietspruit wetland was C which infers moderately modified. The impact scores are summarised on the table below.

Table 6-1 Summary of impact scores for Palmietspruit CVB wetland

	Hydrology	Geomorphology	Vegetation
	Impact Score	**Impact Score**	**Impact Score**
Area weighted impact scores	**3.5**	**2.8**	**4.0**
PES Category	**C**	**C**	**D**
OVERALL IMPACT SCORES	**3**		
PES SCORE	**C (Moderately Modified)**		

7 WETLAND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

According to Kotze, *et al*, (2008), wetlands perform certain functions based on their HGM unit type and the importance of a wetland unit is linked to its ecosystem services. According to Davies and Day, (1998), some of the wetland functions include the following:

- streamflow regulation;
- flood attenuation;
- groundwater recharge;
- water purification;
- sediment trapping;
- harvesting of natural resources;
- tourism and recreation;
- Livestock, and crop farming.

Some of the functions in addition to Davies and Day (2008) include: Provision of water for human use, cultural significance, erosion control, and biodiversity maintenance.

7.1 ECOLOGICAL IMPORTANCE

The Palmietspruit wetland was assessed to have Moderate ecological importance and sensitivity. The tables below give a summary (Table 7-1) and explanation (Table 7-2) of the EIS Score for the Palmietspruit wetland.

7.1.1 PALMIETSPRUIT WETLAND ECOLOGICAL IMPORTANCE AND SENSITIVITY

The wetland was assessed to be at a **moderately** modified state, which infers a moderate change in ecosystem processes and loss of natural habitats and biota has taken place but the natural habitat remains predominantly intact which makes the wetland suitable for hosting a diversity of biota;

- The wetland contributes towards maintaining biodiversity;
- The wetland contributes towards maintaining water quality;
- The associated Palmietspruit river is of order one, feeding into other downstream rivers; and

- The associated river is a perennial river.

However, the following considerations were made about the wetland:

- The associated Palmietspruit river experienced stream reduction and diversions;
- The Palmietspruit river is not located in a protected area and is not a RAMSAR site;
- The wetland type is not considered rare; and
- The wetland and the associated stream are located within urban settlement.

The table below gives a summary and explanation of the EIS Scores for the CVB wetland.

Table 7-1 Summary of EIS Scores for CVB wetland

SUMMARY	**Score (0-4)**	**Confidence (1-5)**
Ecological Importance and Sensitivity	**2.7**	**3.3**
Hydro-Functional Importance	**1.4**	**2.9**
Direct Human Benefits	**0.0**	**0.3**
Overall EIS Category	**1.3**	**2.2**

Table 7-2 Explanation of EIS scores for CVB wetland

ECOLOGICAL IMPORTANCE & SENSITIVITY	**1.3**
Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2

8 HYDROLOGICAL FUNCTION OF THE WETLAND

The hydrological function of the Palmietspruit CVB is described on the table below. The wetland on site is important as it is likely to perform some nitrate and toxicant removal functions.

Table 8-1 Generic hydrological functions performed by the Palmietspruit wetland

WETLAND HYDRO-GEOMORPHIC TYPE	Source of water maintaining the wetland[1]		HYDROLOGICAL FUNCTIONS POTENTIALLY PERFORMED BY THE WETLAND								
			Flood attenuation		Stream flow augmentation		Erosion control	Potential for water quality enhancement			
	Surface	Sub-surface	Early wet season	Late wet season	Early wet season	Late wet season		Sediment trapping	Phosphate removal	Nitrates	Toxicants[2]
1. Valley bottom - channelled	*	*	+	0	0	0	++	+	+	+	+

Water source:
0 Contribution usually small
* Important contribution

Rating:
0 Function unlikely to be performed to any significant extent
+ Function likely to be present at least to some degree
++ Function very likely to be present (and often performed to a high level)

8.1 DIRECT HUMAN BENEFITS

The Palmietspruit wetland did not have any significant human benefits. The wetland was however impacted on by human activities such burning of vegetation within the wetland.

8.2 NFEPA WETLANDS

The National Freshwater Ecosystem Priority Areas (NFEPA) strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources were considered for this wetland assessment. **The identification of wetland and aquatic NFEPA's takes place on a large scale and as a result, not all wetland units present on a site are always identified nor are all wetlands identified by NFEPA available on site.** During the desktop assessment of the NFEPA atlas, various wetland types (HGM Units) were identified. The figure below depicts the wetland types identified on site by the NFEPA database in relation to the wetland identified in this report.

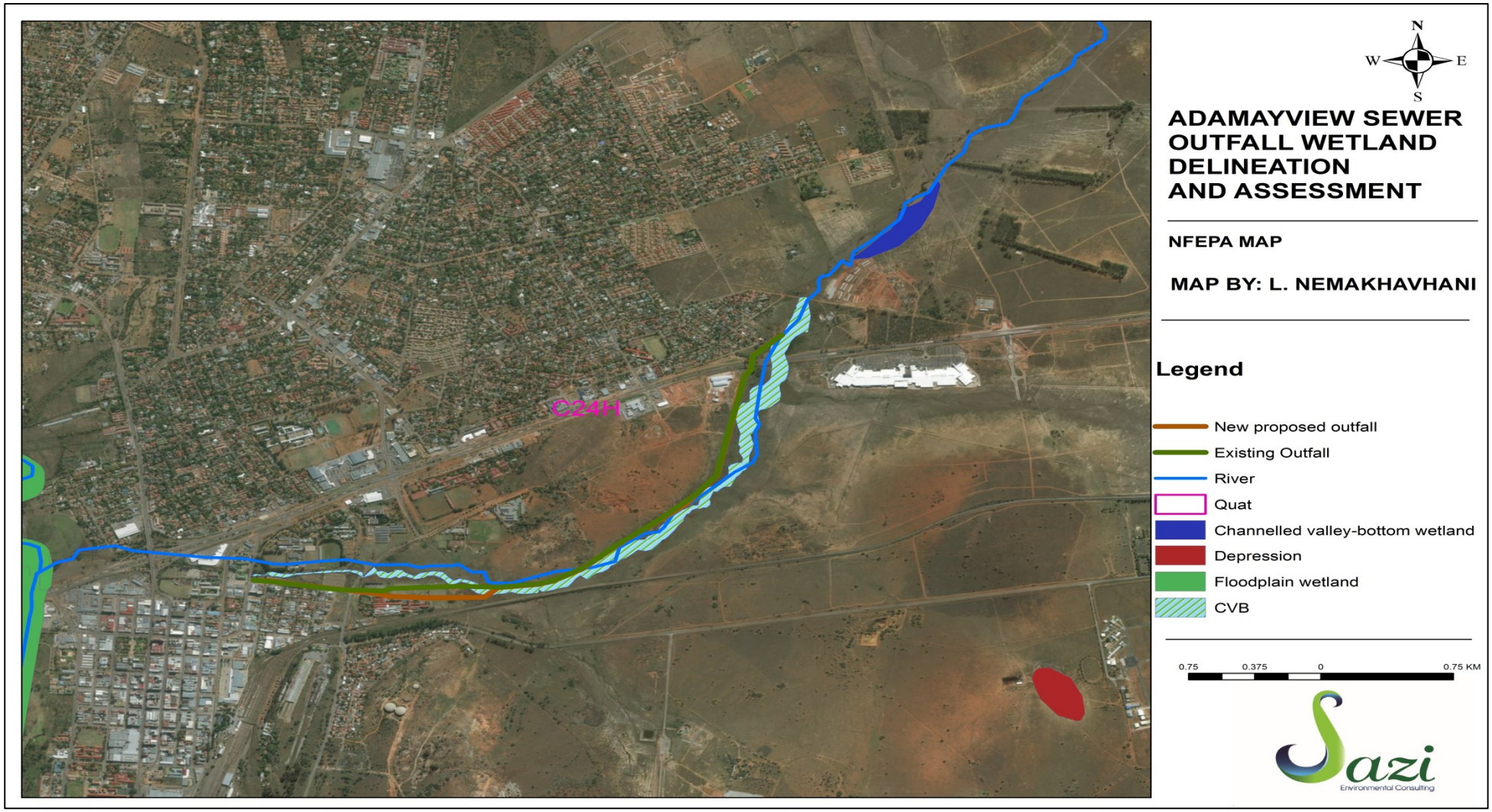


Figure 8-1 NFEPA Wetlands around study area

9 ASSESSMENT OF POTENTIAL IMPACT

An impact assessment was undertaken and mitigation measures prescribed for the proposed sewer outfall pipeline. The expected impacts associated with the Palmietspruit CVB due to the sewer outfall are summarised below

9.1 Loss and disturbance of wetland habitat

Mitigation:

- Avoid additional wetland loss by limiting construction/excavation activities to as small an area as possible.
- Clearly demarcate the required servitudes in the field and limit all activities to the demarcated areas.
- Include environmental awareness aspects into the site induction program to ensure all staff are aware of the location and importance of wetland habitats on site.
- Establish emergency response measures and a clearly defined chain of communication to rapidly deal with any unforeseen impacts to wetland, e.g. spills.
- No stockpiling of material may take place within the wetland areas and buffer zones.
- Temporary construction camps and infrastructure should be located away from the wetland edge and its buffer zone.
- Regular cleaning up of the wetland areas should be undertaken to remove litter.

9.2 Increased sediment transport into wetland

Mitigation:

- Design and implement a stormwater management plan that aims to minimise the concentration of flow and increase in flow velocity, as well as minimising sediment transport off site.
- Phase vegetation clearing activities as far as possible to limit the area exposed at any one time.
- Where practically possible, the major earthworks should be undertaken during the dry season (roughly from April to August) to limit erosion due to rainfall runoff.

9.3 Altered flow characteristics within wetland

Mitigation:

Design and implement a stormwater management plan that aims to minimise the concentration of flow and increase in flow velocity, as well as minimising sediment transport off site.

9.4 Water quality deterioration within wetland and associated stream

Mitigation:

- Store and handle potentially polluting substances and waste in designated, bund wall facilities.
- Waste should be regularly removed from the construction site by suitably equipped and qualified operators and disposed of in approved facilities.
- Locate temporary waste and hazardous substance storage facilities a minimum of 100m from any wetland edge.
- Keep sufficient quantities of spill clean-up materials on site.

Table 9-1 Summary of wetland impact assessment

ASPECT	IMPACT	POSITIVE/NEGATIVE IMPACT	PROBABILITY	DURATION	SCALE	MAGNITUDE	SIGNIFICANCE/RISK	SIGNIFICANCE RATING BEFORE MITIGATION	MITIGATION MEASURE	SIGNIFICANCE RATING AFTER MITIGATION
CONSTRUCTION PHASE IMPACTS										
Construction trenches and excavations on wetland and associated river	Water quality deterioration (Pollution from suspended material)	Negative	3	4	2	4	30	Low	An appropriate water management system should be used during the construction period, including, for example, efficient land drainage and the use of constructed ponds for receiving site runoff to reduce the impact of runoff on nearby watercourses.	Low
Land clearing	Biodiversity loss	Negative	4	3	1	3	28	Low	Avoid stockpiling of removed soils on wetland.	Low
Land clearing	Soil loss	Negative	3	4	1	5	30	Low	Construct low level water deflection berms, reduce clearing to a minimum to maintain vegetation cover. Avoid stockpiling of removed soils on wetland as this will promote erosion of soil into wetlands and further deteriorating the wetland.	Low
Oil spillages	Water quality contamination	Negative	3	3	2	4	27	Low	Servicing of machinery procedures; maintenance. This should also be done far away from the wetlands. No washing of equipment's (after spill or with oil) within the wetland.	Low
Human dispersal of alien seeds/sapling by construction vehicles, shoes, clothes	Alien invasion of native species habitat	Negative	3	3	2	3	24	Low	A list of all possible alien vegetation that is probable to occur within site and as a result of construction activities within wetland should be compiled and eradicated as soon as they occur.	Low
OPERATIONAL PHASE IMPACTS										

Excavation processes during maintenance of pipeline that may lead to more sediment being deposited into the wetland	Gully formations	Negative	2	4	2	4	20	Low	During the operational phase, the use of a detailed EMP should be encouraged. Storm water management measures should be followed.	Low
Human dispersal of alien seeds/sapling by maintenance vehicles, shoes, clothes during maintenance of pipeline	Alien invasion of native species habitat	Negative	3	3	2	3	24	Low	Alien species (including their seedlings and saplings) identified within the proposed site should be removed (manually preferably) to prevent their spreading; Alien species removal programme must be developed and implemented	Low

10 CONCLUSION

A channeled valley bottom wetland was identified within the sewer outfall pipeline study area. The CVB wetland was associated with the Palmietspruit River of the North West Province. The CVB wetland is ranked as **Moderately Modified** both based on PES and EIS undertaken. This infers that the wetland has not experienced major impacts both due to natural or anthropogenic activities. The proposed sewer outfall upgrade will run along the existing pipeline but further away from the river. The sewer pipeline is located adjacent the CVB wetland with portions of it cutting through the wetland. The construction of the sewer pipeline will undoubtedly have a negative impact on the current state of the CVB wetland, however with proper mitigation measures put in place, impacts might be left at a minimum and the integrity of the wetland will be restored after construction. In addition, the proposed activity is a linear activity which has less impacts than other developments such as mining.

It is also recommended that any construction activities of the sewer outfall should be undertaken during dry season of the year (March-August). In conclusion, the current wetland study approves the development of the sewer pipeline, with consideration of all recommended mitigation measures.

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