PROPOSED UPGRADE AND EXPANSION OF THE KAMEELMOND WASTEWATER TREATMENT WORKS IN UPINGTON, NORTHERN CAPE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT IN SUPPORT OF A WASTE MANAGEMENT LICENCE

DFFE REF. NO.: 12/9/11/L210929132741/8/N

DRAFT

FEBRUARY 2022

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TITLE AND APPROVAL PAGE

Project Name:	Proposed Upgrade and Expansion of the Kameelmond Wastewater Treatment Works in Upington, Northern Cape
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Applicant:	Dawid Kruiper Municipality

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EXECUTIVE SUMMARY

A. PROJECT BACKGROUND AND MOTIVATION

The Dawid Kruiper Municipality (DKM) (the "Applicant") has proposed the upgrading and expansion of the Kameelmond Wastewater Treatment Works (K-WWTW), which is located on the south-western side of Upington in the Northern Cape (the "Project").

The K-WWTW is under ever increasing pressure to enhance serviceability of new residential and, to a lesser extent, industrial runoff located within the Works' planned drainage area. Effluent quality standards specified by the Department of Water and Sanitation (DWS) are also likely to increase beyond the current treatment efficiency that the Works' is able to achieve. Potential reuse of the Works' effluent, together with the above mentioned culminates in the requirement of the upgrade and expansion of the K-WWTW. The aim of the Project is to increase the capacity of the K-WWTW from 16 Ml/d to 24 Ml/d.

B. ENVIRONMENTAL PROCESSES

Nemai Consulting (Pty) Ltd was appointed as the Environmental Assessment Practitioner (EAP) to undertake the following environmental processes to seek authorisation for the proposed Project:

- A Basic Assessment process in terms of the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended) to seek Environmental Authorisation for the Project in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA), where the mandated authority is the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARDLR);
- **A Scoping and Environmental Impact Reporting (S&EIR) process in terms of the EIA Regulations of 2014 (as amended) to seek a Waste Management Licence (WML) for the Project in terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA), where the mandated authority is the Department of Forestry, Fisheries and the Environment (DFFE).** The need for a WML is triggered by the waste management activities associated with the proposed Project; and
- A Water Use Licence Application (WULA) in terms of the National Water Act (Act No. 36 of 1998) (NWA) for water uses associated with the K-WWTW. The mandated authority for the WULA is the DWS.

This document serves as the **draft EIA Report** and forms part of the S&EIR process in support of the WML. The other environmental processes are being undertaken separately.

C. PROJECT LOCATION

The K-WWTW is situated north of the Orange River, on the south-western side of Upington (centre point coordinates for plant: 28°28'41"S; 21°12'12"E) on the N14 between Upington and Keimoes, in the Northern Cape (see figure to follow).

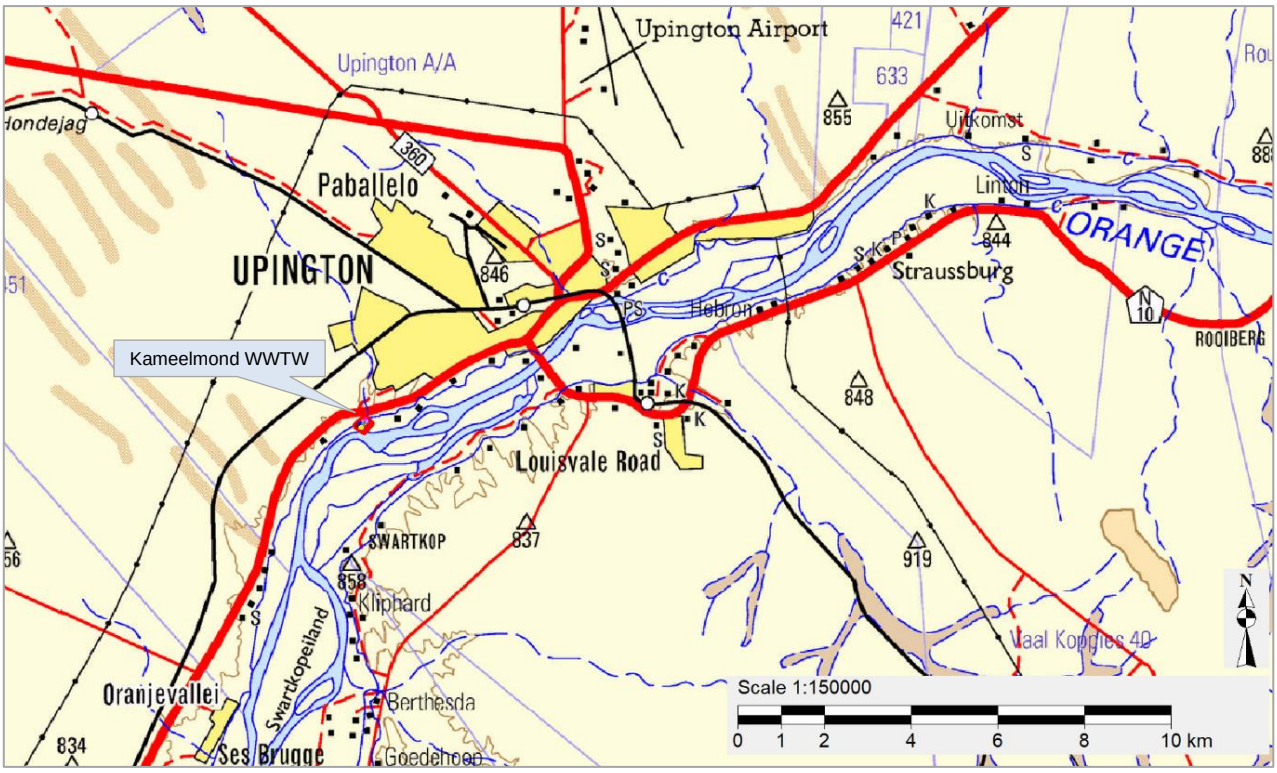

***Figure A:* Locality map**

The proposed upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence.

D. LEGISLATION AND GUIDELINES CONSIDERED

Pertinent legislation that has possible bearing on the Project from an environmental perspective is briefly discussed in the EIA Report.

The relationship between the Project and the following key pieces of environmental legislation is also explained:

- NEMA;
- NEM:WA;
- NWA;
- National Environmental Management Air Quality Act (Act No. 39 of 2004) (NEM:AQA);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA); and
- National Heritage Resources Act (Act No. 25 of 1999) (NHRA).

E. SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

As the Project triggers waste management activities listed in Categories A and B of Government Notice (GN) No. R. 921 of 29 November 2013 (as amended) (refer to the table to follow), a S&EIR process is being undertaken in terms of the EIA Regulations to seek a WML. As the waste type under consideration is classified as hazardous the mandated authority is the National DFFE.

***Table A:** Waste management activities triggered by the Project*

Activity Wording	Relevance to Project
Category A, Activity 13: The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.	The proposed upgrade and expansion of the K-WWTW by method of a new activated sludge module and sludge management facility.
Category B, Activity 4: The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment excluding the treatment of effluent, wastewater or sewage.	The proposed sludge handling facility, consisting of the following systems: ▪ Mechanical dewatering units; ▪ Poly electrolyte dosing system; ▪ Solar-drying/stockpiling slab with associated sludge handling equipment. The estimated maximum sludge production is 1 566 kg/day.
Category B, Activity 10: The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	The proposed construction of the new sludge dewatering facility to treat sludge in excess of 1 tonnes/day.

An outline of the S&EIR process is provided in the diagram to follow.

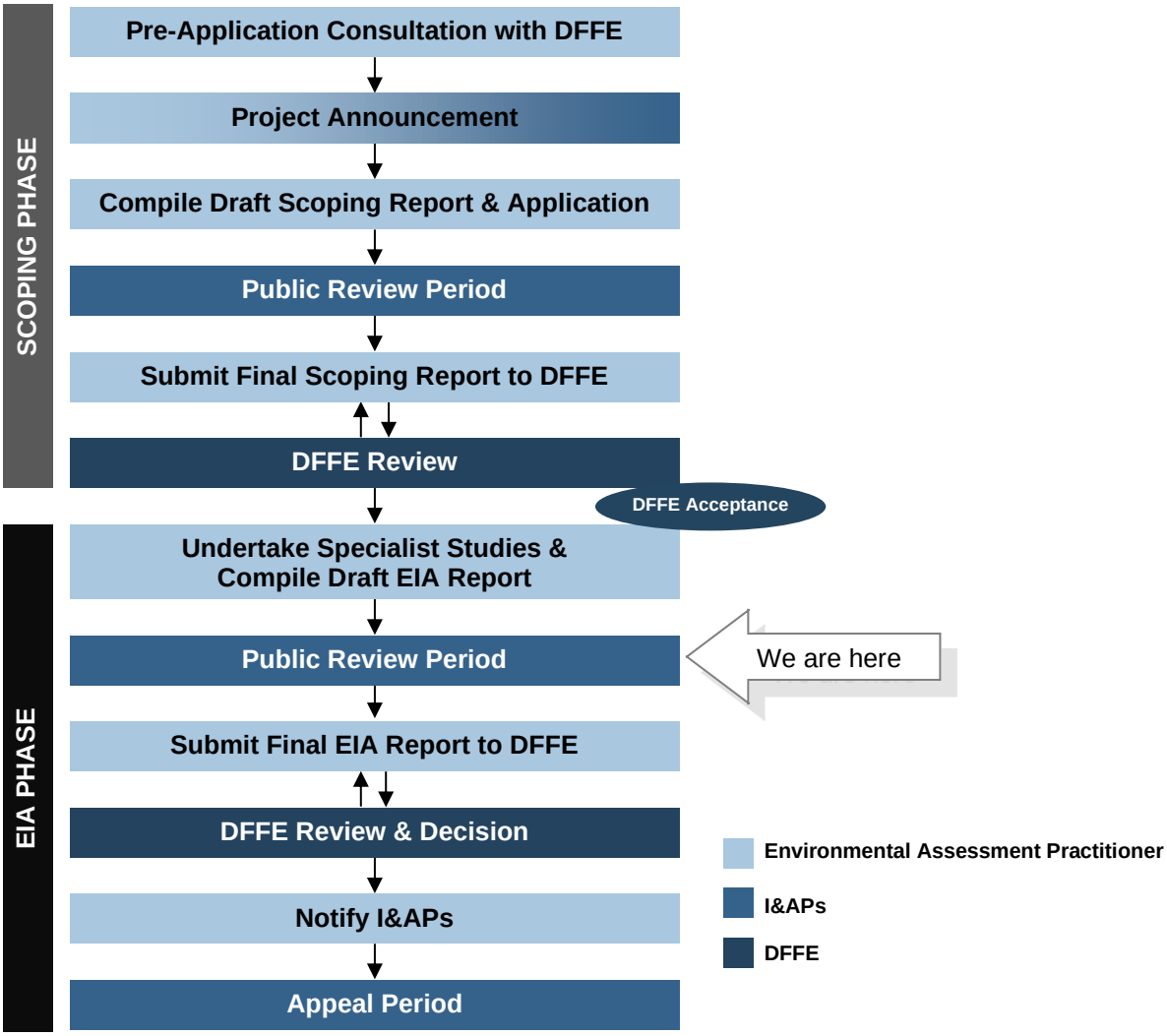

***Figure B:** Overview of Scoping and EIA Process*

F. PROJECT DESCRIPTION

The status quo treatment process requires major refurbishment as large sections of the K-WWTW have been in operation since the 1970s, with the last upgrade and expansion having taken place during the 1990s. It was therefore proposed that the overall scope of work for the K-WWTW be split into the following: (i) refurbishment of existing mechanical and electrical equipment; and (ii) upgrade and expansion of the K-WWTW. This Application focuses on the latter.

The upgrade and expansion of the K-WWTW will be by method of a new activated sludge module and sludge management facility. Key components of the K-WWTW associated with the Project are shown in the figure to follow.

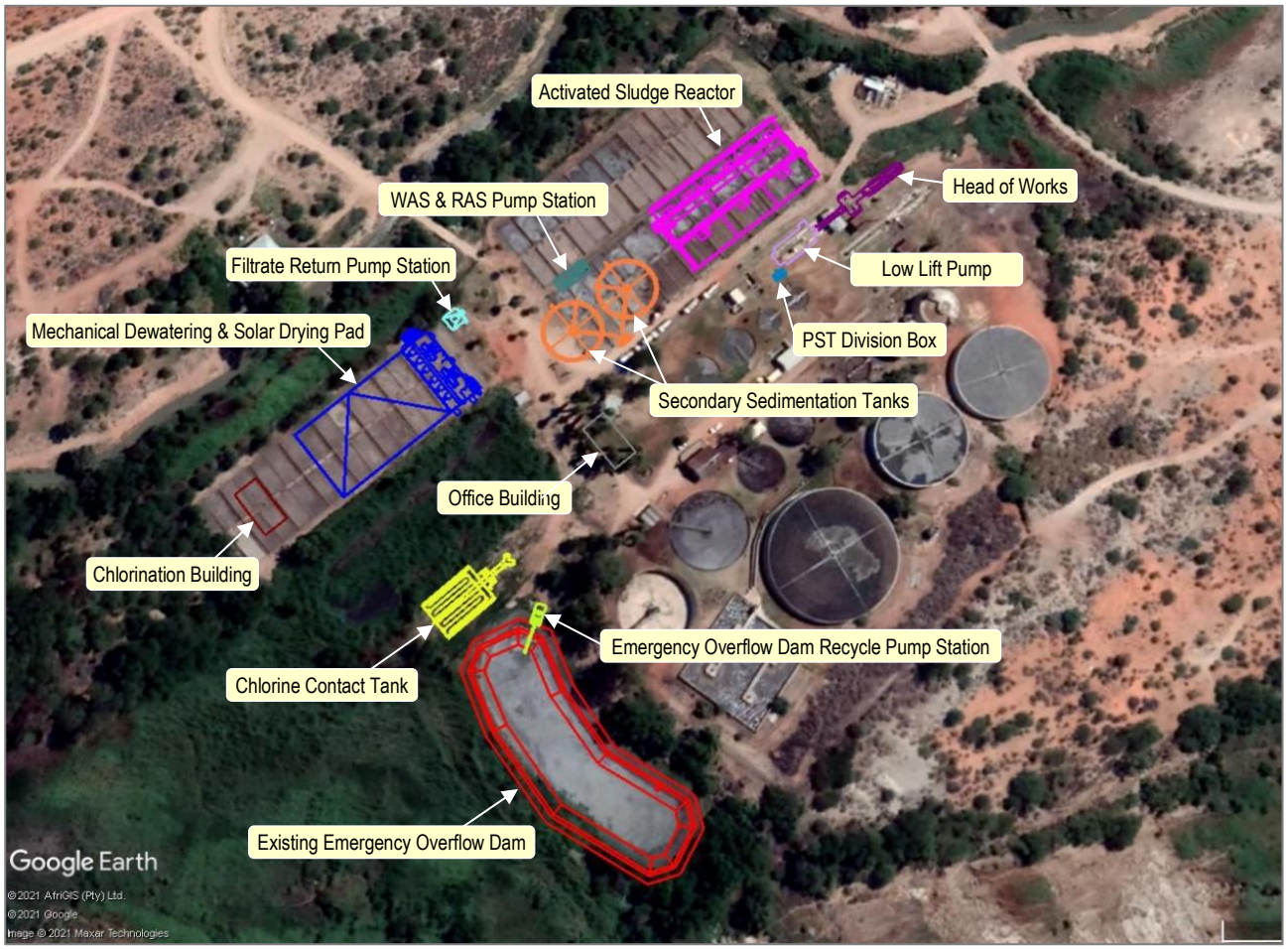

***Figure C:* K-WWTW upgrade and expansion works (Google Earth image)**

The key components of the K-WWTW associated with the upgrade and expansion works are discussed further in this EIA Report. In addition, an overview is also provided of the project life-cycle as well as resources and services required for construction and operational purposes.

G. PROFILE OF THE RECEIVING ENVIRONMENT

This EIA Report provides a general description of the status quo of the receiving environment in the Project area. This serves to provide the context within which the assessment was conducted.

The receiving environment is explained in terms of the following:

- Land Use and Land Cover;
- Climate;
- Geology;
- Soils;
- Hydrogeology;
- Topography;
- Surface Water;
- Terrestrial Ecology;
- Socio-Economic Environment;
- Planning;
- Transportation;
- Visual Quality;
- Air quality;
- Noise;
- Heritage; and
- Health.

H. SPECIALIST STUDIES

The specialist studies 'triggered' by the nature of the proposed development and its receiving environment, which aimed to address the key issues and to ensure compliance with legal obligations, included the following:

1. Freshwater Assessment;
2. Phase 1 Cultural Heritage Impact Assessment; and
3. Terrestrial Ecology Compliance Statement.

The information obtained from the respective specialist studies was incorporated into this EIA Report in the following manner:

- The information was used to complete the description of the receiving environment in a more detailed and site-specific manner;
- A summary of each specialist study is provided, focusing on the approach to each study, key findings and conclusions drawn
- The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment;
- Specialist input was obtained to address comments made by Interested and Affected Parties (I&APs) that related to specific environmental features pertaining to each specialist discipline; and
- Salient recommendations made by the specialists were taken forward to the final EIA conclusions.

I. IMPACT ASSESSMENT

This EIA Report assessed the pertinent environmental impacts that could potentially be caused during the pre-construction, construction and operational phases of the Project.

The potentially significant environmental impacts associated with the Project were identified through an appraisal of the following:

- The Project's legal and policy context;
- The scope of the proposed Project;
- The nature and profile of the receiving environment and potential sensitive environmental features and attributes;

- Findings from specialist studies;
- Activities and environmental aspects associated with the project life-cycle (i.e. pre-construction, construction and operational phases);
- Understanding of direct and indirect effects of the Project as a whole; and
- Comments received during public participation from authorities and I&APs.

The impacts are discussed on a qualitative level and thereafter quantitatively assessed to ultimately determine the significance of the impacts. The assessment considered impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

The proposed mitigation of the impacts associated with the Project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme (EMPr) provides a comprehensive list of mitigation measures for specific elements of the Project, which extends beyond the impacts evaluated in the body of this EIA Report.

The implications of the “no-go option” are also assessed. The “no-go option” was considered in light of the motivation as well as the need and desirability of the overall Project. In contrast, should the proposed Project not go ahead, any potentially significant environmental issues associated with the proposed upgrade and expansion works would be irrelevant and the status quo of the local receiving environment would not be affected by the Project-related activities. The objectives of the Project, including the benefits (such as improving the quality of the effluent and overall enhancement of the K-WWTW’s operations), will not materialise. The “no-go option” is thus not preferred.

Cumulative impacts were considered in light of the Project’s aim to upgrade and expand the current K-WWTW, which was already built in the 1970’s, to increase its capacity to allow for the efficient operation of the plant according to the relevant standards.

The following potential cumulative impacts were considered:

- Cumulative land use impacts;
- Cumulative soil impacts;
- Cumulative water resources impacts;
- Cumulative terrestrial biodiversity impacts;
- Cumulative heritage impacts;
- Cumulative transportation impacts;
- Cumulative air quality impacts;
- Cumulative noise impacts; and
- Cumulative services and utilities impacts.

J. ANALYSIS OF ALTERNATIVES

The alternatives considered for sludge treatment at the K-WWTW included sludge drying, belt presses and linear screens, and a sludge dewatering facility. Following a comparison of these

alternatives, the sludge dewatering facility prevailed as the Best Practicable Environmental Option (BPEO).

The sludge management options that were evaluated included using the sludge for agricultural purposes, as fertiliser product, or for commercial products. In addition, the disposal of sludge at a landfill site was also considered. At this stage, it is assumed that the option of disposing the sludge and screenings at a waste disposal site is the current preferred alternative.

K. PUBLIC PARTICIPATION

This EIA Report provides the details of the following tasks undertaken as part of the public participation process:

- Maintaining the database of I&APs;
- Notification of review of the draft EIA Report and the means of accessing copies of the report;
- Scheduling a public meeting to present the draft EIA, based on interest shown; and
- Commenting on the draft EIA Report.

L. CONCLUSIONS

The following key tasks were undertaken during the EIA phase for the Project:

- The specialist studies identified in the Plan of Study for the EIA were undertaken and the findings were incorporated into the EIA Report in terms of understanding the environmental status quo and sensitive features, as well as assessing the potential impacts and establishing concomitant mitigation measures;
- Issues raised during public participation to date were considered further;
- Potentially significant impacts pertaining to the pre-construction, construction and operational phases of the Project were identified and assessed, and mitigation measures were provided;
- Alternatives for achieving the objectives of the proposed activity were considered, and the BPEO was identified. The “no-go” option is not supported when considering the implications of not implementing the Project; and
- Authorities and I&APs were notified of the review of the draft EIA Report.

Attention is drawn to specific sensitive environmental features for which mitigation measures are included in this EIA Report and the accompanying EMPr. An Environmental Impact Statement is also provided, which highlights key findings from the EIA and provides recommendations which may influence the conditions of the Environmental Authorisation (if granted).

With the adoption of the mitigation measures and recommendations, as well as through the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this Project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the Project and that the WML can be issued, based on the findings of the specialists and the impact assessment and through the compliance with the identified environmental management provisions.

AMENDMENTS PAGE

Date	Nature of Amendment	Amendment No.
February 2022	Draft for Review by Authorities and the Public	0

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS & ABBREVIATIONS

ADWF	Average Dry Weather Flow
ADF	Annual Daily Flow
AEL	Atmospheric Emission Licence
AIDS	Acquired Immunodeficiency Syndrome
ASP	Activated Sludge Process
ASPT	Average Score Per Taxon
AWWF	Average Wet Weather Flow
BPEO	Best Practicable Environmental Option
BTF	Biological Trickling Filter
CBAs	Critical Biodiversity Areas
CGS	Council for Geoscience
CRR	Comments and Responses Report
DAEARDLR	Department of Agriculture, Environmental Affairs, Rural Development and Land Reform
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DENC	Department of Environment and Nature Conservation
DFFE	Department of Forestry, Fisheries and the Environment
DKM	Dawid Kruiper Municipality
DMRE	Department of Mineral Resources and Energy
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Environmental Importance and Sensitivity
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EMS	Environmental Management System
ESAs	Ecological Support Areas
GHG	Greenhouse Gas
GIS	Geographical Information System
GN	Government Notice
GUDWS	Guidelines for Utilisation and Disposal of Wastewater Sludge
HIV	Human Immunodeficiency Virus
HoW	Head of Works
HPF	Hourly Peak Flow
I&APs	Interested and Affected Parties
ISO	International Organization for Standardization
IDP	Integrated Development Plan
K-WWTW	Kameelmond Wastewater Treatment Works

KZN	KwaZulu-Natal
mamsl	meters above mean sea level
MIRAI	Macroinvertebrate Response Assessment Index
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEM:WA	National Environmental Management: Waste Act (Act No. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
NWMS	National Waste Management Strategy
OHS	Occupational Health and Safety
PES	Present Ecological Status
PPE	Personal Protective Equipment
PS	Primary Sludge
RAS	Return Activated Sludge
S&EIR	Scoping and Environmental Impact Reporting
SA	South Africa
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency
SANS	South African National Standard
SASS5	South African Scoring System version 5
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SOTER	Soil and Terrain Databases
SQR	Sub-Quaternary Reach
SST	Secondary Sedimentation Tanks
TDS	Total Dissolved Solids
TOC	Top of Concrete
TOPS	Threatened or Protected Species
TWL	Top Water Level
WAS	Waste Activated Sludge
WMA	Water Management Area
WML	Waste Management Licence
WRC	Water Research Commission
WUL	Water Use Licence
WULA	Water Use Licence Application
WWTW	Wastewater Treatment Works

UNITS OF MEASUREMENT

°C	Degrees Celsius
ha	Hectare
kg	Kilogram
kg/d	Kilogram/day
kl	Kilolitre
km	Kilometre
l/s	Litre Per Second
m	Metre
m^2	Square metre
m^3	Cubic metre
m^3/d	Cubic metres per day
m^3/hr	Cubic metre per hour
µS/cm	Microsiemens per centimeter
Ml/d	Megalitre per day
mg/l	Milligrams per litre
Ml/d	Megalitres per day
mm	Millimetre
mS/M	Milli Siemens per Metre
tonnes/d	Tonnes per day
%	Percentage

1 PURPOSE OF THIS DOCUMENT

Nemai Consulting was appointed by the Dawid Kruiper Municipality (DKM) (the "Applicant") to conduct the Environmental Impact Assessment (EIA) for the **proposed upgrade and expansion of the Kameelmond Wastewater Treatment Works (K-WWTW) in Upington, Northern Cape** (the "Project"). The EIA is being undertaken according to the process prescribed in the EIA Regulations of 2014, published under Government Notice (GN) No. 982 in Gazette No. 38282 of 4 December 2014 and amended by GN 326 of 7 April 2017 published in Gazette No. 40772 (the "EIA Regulations"). The EIA Regulations were promulgated in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA).

Various consents are required for the Project according to its environmental governance framework, one of which is a **Waste Management Licence** (WML) in terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA). The need for a WML is triggered by the **waste management activities** associated with the proposed Project.

To date, the Scoping phase of the overall environmental assessment for the Project has been completed. The Final Scoping Report and Plan of Study for the EIA were approved by the Department of Forestry, Fisheries and the Environment (DFFE), which is the competent authority to decide on the application, on 9 December 2021.

This document serves as the **draft EIA Report** in support of the WML. According to the EIA Regulations, the objectives of the EIA process are to undertake the following, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report;
- Identify the location of the development footprint within the approved site as contemplated in the accepted Scoping Report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the -
  - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - Degree to which these impacts -
    - Can be reversed;
    - May cause irreplaceable loss of resources; and
    - Can be avoided, managed or mitigated;

- Identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted Scoping Report based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted Scoping Report through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

The draft EIA Report will be made available to Interested and Affected Parties (I&APs) for a 30-day review period from **3 March until 4 April 2022**. All comments that are received will be addressed in the final EIA Report and will also be included in the Comments and Responses Report. The final EIA Report will then be submitted to the DFFE for review and decision-making.

2 DOCUMENT ROADMAP

As a minimum, this EIA Report aims to satisfy the requirements stipulated in Appendix 3 of the EIA Regulations. **Table 1** below presents the document's composition in terms of the aforementioned regulatory requirements.

Table 1: EIA Report Roadmap

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
1	Purpose of this Document	–	–
2	Document Roadmap	–	–
3	Introduction	–	–
4	Project Location	3(1)(b)	The location of the development footprint of the activity on the approved site as contemplated in the accepted Scoping Report, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.
		3(1)(c)	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is - (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; and (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.
5	Legislation and Guidelines Considered	3(1)(e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.
6	Scoping and EIA Process	3(1)(a)	Details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.
		3(1)(u)	An indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation.
		3(1)(v)	Any specific information that may be required by the competent authority.
7	Assumptions and Limitations	3(1)(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
8	Need and Desirability	3(1)(f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted Scoping Report.
9	Project Description	3(1)(d)	A description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.
		3(1)(g)	A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report.
		3(1)(h)(i)	A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: (i) details of the development footprint alternatives considered.
		3(1)(h)(ix)	If no alternative development footprints for the activity were investigated, the motivation for not considering such.
		3(1)(t)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.
10	Alternatives	3(1)(h)(i)	Details of the development footprint alternatives considered.
11	Profile of the Receiving Environment	3(1)(h)(iv)	The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.
12	Summary of Specialist Studies	3(1)(k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.
13	Impact Assessment	3(1)(h)(v)	The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (i) can be reversed; (ii) may cause irreplaceable loss of resources; and (iii) can be avoided, managed or mitigated.
		3(1)(h)(vi)	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.
		3(1)(h)(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.
		3(1)(h)(viii)	The possible mitigation measures that could be applied and level of residual risk.

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
		3(1)(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including - (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.
		3(1)(j)	An assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated.
		3(1)(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the Environmental Management Programme (EMPr) as well as for inclusion as conditions of authorisation.
14	Analysis of Alternatives	3(1)(h)(ix)	If no alternative development locations for the activity were investigated, the motivation for not considering such.
		3(1)(h)(x)	A concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted Scoping Report.
		3(1)(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.
15	Public Participation	3(1)(h)(ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.
16	EIA Conclusions	3(1)(l)	An environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report

Chapter	Title	Correlation with GN No. R. 982	GN No. R. 982 Description
			indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.
		3(1)(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.
		3(1)(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.
17	References	-	-
Appendix A	Maps	3(1)(c)	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale.
Appendix E	Specialists' Reports	R23(5)	Specialist Reports containing all information set out in Appendix 6 of GN No. R. 982 of 4 December 2014 (as amended).
Appendix G	EMPr	R23(4)	EMPr containing all information set out in Appendix 4 of GN No. R. 982 of 4 December 2014 (as amended).
Appendix H	Comments and Responses Report	3(1)(h)(ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.
		3(1)(h)(iii)	A summary of the issues raised by Interested and Affected Parties (I&APs), and an indication of the manner in which the issues were incorporated, or the reasons for not including them.
Appendix I	Oath of Environmental Assessment Practitioner	3(1)(s)	An undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to IAPs and any responses by the EAP to comments or inputs made by IAPs.
N/A		3(1)(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised**.**
N/A		3(1)(w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.

3 INTRODUCTION

3.1 Project Background and Motivation

The K-WWTW is located on the south-western side of Upington, in the Northern Cape (see **Figure 1** below).

According to the Department of Water and Sanitation (DWS) (2016), the existing Works was originally constructed during the 1970's as a biological filter plant with an average dry weather flow (ADWF) of 3,672 kl/d. The works was extended in 1984 to 8,000 kl/d ADWF. During 1990 the works was again extended to a capacity of 16,000 kl/d ADWF by the addition of an activated sludge process downstream of the biological filters.

According to the Preliminary Design Report (Bigen, 2021), the K-WWTW is under ever increasing pressure to enhance serviceability of new residential and, to a lesser extent, industrial runoff located within the Works' planned drainage area. Effluent quality standards specified by the DWS are also likely to increase beyond the current treatment efficiency that the facility is able to achieve. Potential reuse of the works' effluent, together with the abovementioned factors, necessitate the upgrading and expansion of the K-WWTW.

The aim of the Project is to increase the capacity of the K-WWTW from 16 Ml/d to 24 Ml/d. The upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence.

3.2 Environmental Processes

Nemai Consulting (Pty) Ltd (Nemai Consulting) was appointed as the Environmental Assessment Practitioner (EAP) to undertake the following environmental processes to seek authorisation for the proposed Project:

- A Basic Assessment process in terms of the EIA Regulations to seek Environmental Authorisation in terms of the NEMA, where the mandated authority is the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARDLR) (previously known as the Department of Environment and Nature Conservation [DENC]);
- **A Scoping and Environmental Impact Reporting (S&EIR) process in terms of the EIA Regulations to seek a WML in terms of NEM:WA, where the mandated authority is the DFFE**; and
- A Water Use Licence Application (WULA) in terms of the National Water Act (Act No. 36 of 1998) (NWA) for water uses associated with the K-WWTW. The mandated authority for the WULA is the DWS.

This EIA Report forms part of the S&EIR process in support of the WML. The other environmental processes are being undertaken separately.

3.3 The Project's Waste Management Activities

The following waste management activities are associated with the proposed Project, which are explained further in **Section 9.4.3** below:

1. Current WML Application (DFFE ref. no.: 12/9/11/L210929132741/8/N) –
   a. The primary sludge and Waste Activated Sludge (WAS) that is produced at the K-WWTW will be treated at the proposed dewatering facility, mixed, and stockpiled on a proposed concrete slab for solar drying.
2. Separate WML application for decommissioning activities (to be submitted) –
   a. It is proposed to decommission and demolish the K-WWTW's existing sludge drying beds to avail space for the new Activated Sludge Process (ASP) train; and
   b. It is proposed to decommission the existing diesel-fired incinerator at the K-WWTW, which is currently used for the disposal of screenings.

The proposed Project is associated with hazardous waste (refer to **Section 5.1.3** below). The Licensing Authority for a WML application related to hazardous waste is the DFFE.

4 PROJECT LOCATION

The K-WWTW is situated north of the Orange River, on the south-western side of Upington (centre point coordinates for plant: 28°28'41"S; 21°12'12"E) on the N14 between Upington and Keimoes, in the Northern Cape. The locality map is provided in **Figure 1** below, and is also contained in **Appendix A**.

The K-WWTW falls within Ward 11 of the DKM and is also located in the ZF Mgcawu District Municipality. The plant is located on Erf 18896, Upington (refer to the Surveyor General Diagram provided in **Figure 2** below).

As mentioned, the upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence. The coordinates of the corner points of the plant's operational area are listed in **Table 2** and shown in **Figure 3** below. It is noted that the cadastral boundary of the property extends beyond these four points.

Table 2: Coordinates of the K-WWTW's corner points

	Latitude (S)	Longitude (E)
North-eastern Point	28°28'34.86"S	21°12'12.84"E
South-eastern Point	28°28'38.67"S	21°12'17.90"E
North-western Point	28°28'41.04"S	21°12'05.55"E
South-western Point	28°28'45.62"S	21°12'11.95"E

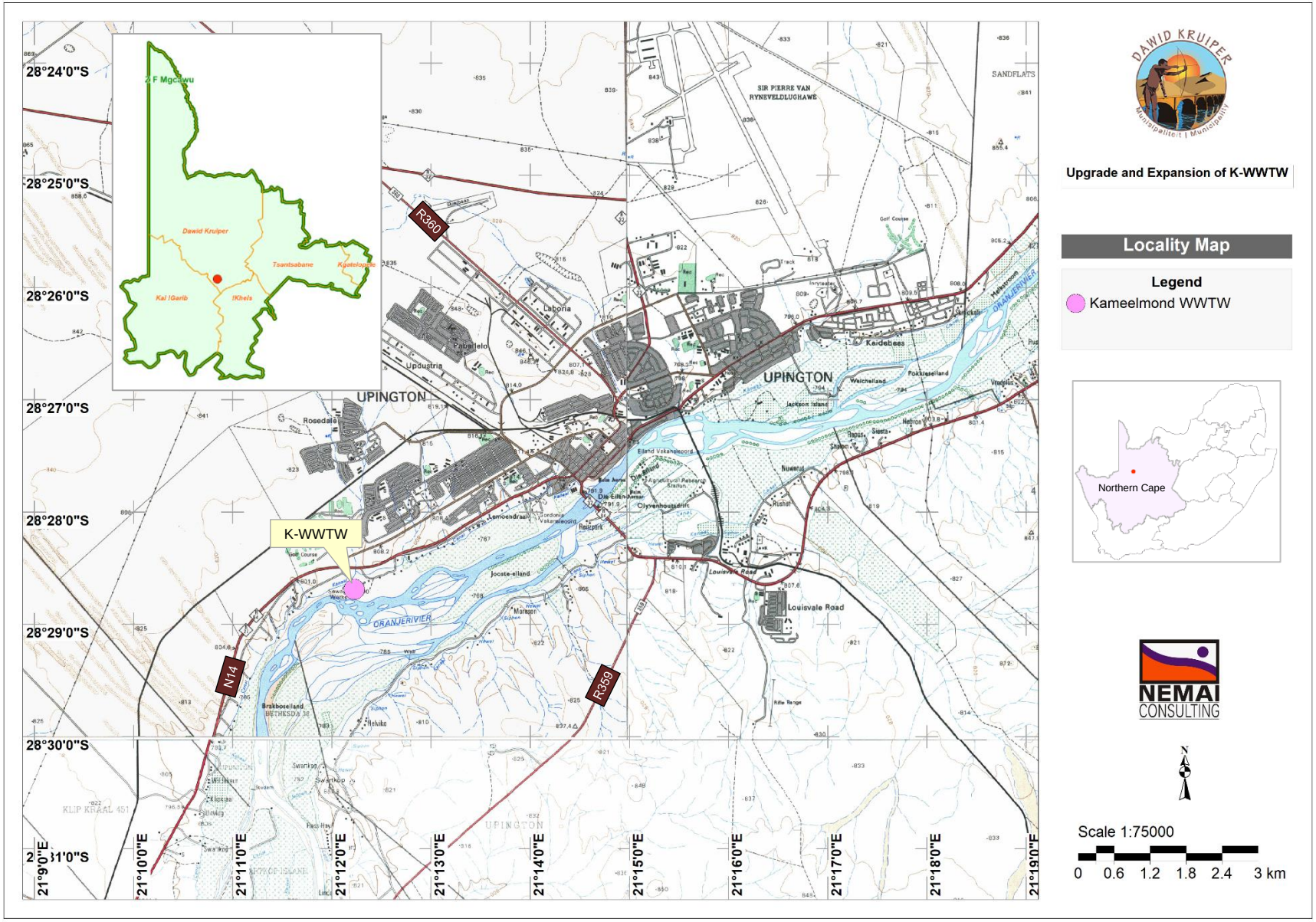

Figure 1: Locality map

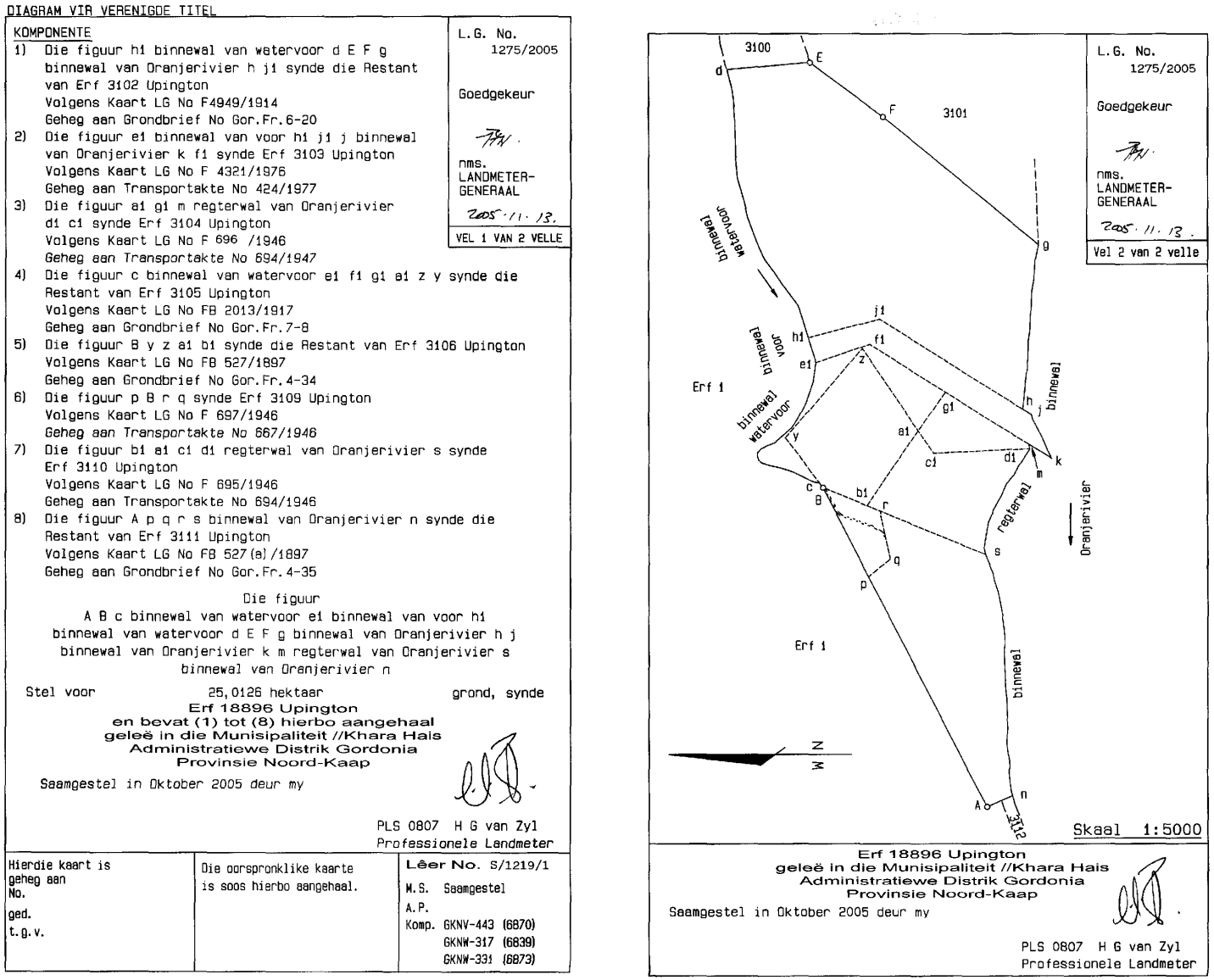

DIAGRAM VIR VERENIGDE TITEL

KOMPONENTE

1) Die figuur h1 binnewal van watervoor d E F g binnewal van Oranjerivier h j1 synde die Restant van Erf 3102 Upington
Volgens Kaart LG No F4949/1914
Geheg aan Grondbrief No Gor.Fr.6-20
2) Die figuur e1 binnewal van voor h1 j1 j binnewal van Oranjerivier k f1 synde Erf 3103 Upington
Volgens Kaart LG No F 4321/1976
Geheg aan Transportakte No 424/1977
3) Die figuur a1 g1 m regterwal van Oranjerivier d1 c1 synde Erf 3104 Upington
Volgens Kaart LG No F 696 /1946
Geheg aan Transportakte No 694/1947
4) Die figuur c binnewal van watervoor e1 f1 g1 a1 z y synde die Restant van Erf 3105 Upington
Volgens Kaart LG No FB 2013/1917
Geheg aan Grondbrief No Gor.Fr.7-8
5) Die figuur B y z a1 b1 synde die Restant van Erf 3106 Upington
Volgens Kaart LG No FB 527/1897
Geheg aan Grondbrief No Gor.Fr.4-34
6) Die figuur p B r q synde Erf 3109 Upington
Volgens Kaart LG No F 697/1946
Geheg aan Transportakte No 667/1946
7) Die figuur b1 a1 c1 d1 regterwal van Oranjerivier s synde Erf 3110 Upington
Volgens Kaart LG No F 695/1946
Geheg aan Transportakte No 694/1946
8) Die figuur A p q r s binnewal van Oranjerivier n synde die Restant van Erf 3111 Upington
Volgens Kaart LG No FB 527(a)/1897
Geheg aan Grondbrief No Gor.Fr.4-35

Die figuur
A B c binnewal van watervoor e1 binnewal van voor h1 binnewal van watervoor d E F g binnewal van Oranjerivier h j binnewal van Oranjerivier k m regterwal van Oranjerivier s binnewal van Oranjerivier n

Stel voor 25,0126 hektaar grond, synde
Erf 18896 Upington
en bevat (1) tot (8) hierbo aangehaal
geleë in die Munisipaliteit //Khara Hais
Administratiewe Distrik Gordonia
Provinsie Noord-Kaap

Saamgestel in Oktober 2005 deur my

PLS 0807 H G van Zyl
Professionele Landmeter

L.G. No. 1275/2005
Goedgekeur
nms. LANDMETER-GENERAAL
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VEL 1 VAN 2 VELLE

Hierdie kaart is geheg aan No.
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Die oorspronklike kaarte is soos hierbo aangehaal.

Lêer No. S/1219/1
M.S. Saamgestel
A.P.
Komp. GKNV-443 (6870)
GKNW-317 (6839)
GKNW-331 (6873)

2005-10-20 Barnard R230-00

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Goedgekeur
nms. LANDMETER-GENERAAL
2005. 11. 13.
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Erf 18896 Upington
geleë in die Munisipaliteit //Khara Hais
Administratiewe Distrik Gordonia
Provinsie Noord-Kaap

Saamgestel in Oktober 2005 deur my

PLS 0807 H G van Zyl
Professionele Landmeter

Figure 2: Surveyor General Diagram (Erf 18896, Upington)

Figure 3: **Coordinates of the K-WWTW's corner points (Google Earth image)**

5 LEGISLATION AND GUIDELINES CONSIDERED

5.1 Legislation

5.1.1 Environmental Statutory Framework

The legislation that has possible bearing on the Project from an environmental perspective is captured in **Table 3** below. ***Note:*** *this list does not attempt to provide an exhaustive explanation, but rather represents an identification of some of the most appropriate sections from pertinent pieces of legislation*.

Table 3: Environmental Statutory Framework

Legislation	Description and Relevance
Constitution of the Republic of South Africa, (No. 108 of 1996)	▪ Chapter 2 – Bill of Rights. ▪ Section 24 – Environmental Rights.
National Environmental Management Act (Act No. 107 of 1998)	▪ Key sections (amongst others): o Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). o Section 28 – Duty of care and remediation of environmental damage. ▪ Environmental management principles. ▪ Authorisation type – A separate process is being undertaken to apply for Environmental Authorisation under NEMA for the Project. ▪ Authorities – DFFE (national) and DAEARDLR (provincial).
National Environmental Management: Waste Act (Act No. 59 of 2008)	▪ Management of waste. ▪ Key sections (amongst others): o Section 16 – General duty in respect of waste management. o Chapter 5 – licensing of waste management activities (listed in GN No. R. 921 of 29 November 2013 (as amended)). ▪ Authorisation type – WML (*topic of this EIA Report*). ▪ Authority – DFFE (national) and DAEARDLR (provincial).
National Water Act (Act No. 36 of 1998)	▪ Sustainable and equitable management of water resources. ▪ Key sections (amongst others): o Chapter 3 – Protection of water resources. o Section 19 – Prevention and remedying effects of pollution. o Section 20 – Control of emergency incidents. o Chapter 4 – Water use. ▪ Authorisation type – A separate process is being undertaken to apply for a Water Use Licence for the Project. ▪ Authority – DWS.
National Environmental Management Air Quality Act (Act No. 39 of 2004)	▪ Air quality management. ▪ Key sections (amongst others): o Section 22A – Illegal emissions. o Section 29 – Pollution prevention plans. o Section 32 – Dust control. o Section 34 – Noise control. o Section 35 – Control of offensive odours. ▪ Authorisation type – Atmospheric Emission License. ▪ Authority – DFFE (national), DAEARDLR (provincial) and municipalities.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	▪ Management and conservation of the country's biodiversity. ▪ Protection of species and ecosystems. ▪ Authorisation type – Permit (*relevance to the Project to be confirmed*). ▪ Authority – DFFE (national) and DAEARDLR (provincial).

Legislation	Description and Relevance
National Forests Act (Act No. 84 of 1998)	▪ Supports sustainable forest management and the restructuring of the forestry sector, as well as protection of indigenous trees in general. ▪ Section 15 – Authorisation required for impacts to protected trees. ▪ Authorisation type – Licence (*relevance to the Project to be confirmed*). ▪ Authority – DFFE.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	▪ Equitable access to and sustainable development of the nation's mineral and petroleum resources and to provide for matters related thereto. ▪ Key sections (amongst others): o Section 22 – Application for mining right. o Section 27 – Application for, issuing and duration of mining permit. o Section 53 – Use of land surface rights contrary to objects of Act. ▪ Authorisation type – Mining Permit / Mining Right (*not required for the Project*). ▪ Authority – Department of Mineral Resources and Energy (DMRE).
Occupational Health & Safety Act (Act No. 85 of 1993)	▪ Provisions for Occupational Health & Safety. ▪ Authority – Department of Employment and Labour). ▪ Relevant regulations, such as Construction Regulations, etc.
National Heritage Resources Act (Act No. 25 of 1999)	▪ Key sections: o Section 34 – protection of structure older than 60 years. o Section 35 – protection of heritage resources. o Section 36 – protection of graves and burial grounds. o Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m^2 in extent, etc. ▪ Authorisation type – Permit (*relevance to the Project to be confirmed*). ▪ Authority – South African Heritage Resources Agency (SAHRA) and Northern Cape Provincial Heritage Resources Authority (Ngwao-Boswa Jwa Kapa Bokone).
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	▪ Control measures for erosion. ▪ Control measures for alien and invasive plant species. ▪ Authority – DAEARDLR.
Northern Cape Conservation Act (Act No. 9 of 2009)	▪ Protected and Specially Protected Species. ▪ Permit (*relevance to the Project to be confirmed*) ▪ Authority – DAEARDLR.

The relationship between the Project and certain key pieces of environmental legislation is discussed in **Section 5.1.2** to **Section 5.1.7** below.

5.1.2 National Environmental Management Act

NEMA is the framework legislation regulating the environment in South Africa (SA). According to Section 2(3) of NEMA, "*development must be socially, environmentally and economically sustainable*", which means the integration of these three factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

The Project requires Environmental Authorisation in terms of NEMA. It triggers activities under Listing Notices 1 and 3, and thus needs to be subjected to a Basic Assessment process. A separate process is being undertaken to seek Environmental Authorisation for the Project from DAEARDLR. This approach was confirmed during the separate pre-application meetings that were held with DAEARDLR (Basic Assessment) and DFFE (S&EIR process in support of the WML).

5.1.3 National Environmental Management: Waste Act

Amongst others, the purpose of NEM:WA includes the following:

1. To reform the law regulating waste management in the country by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development;
2. To provide for institutional arrangements and planning matters;
3. To provide for specific waste management measures;
4. To provide for the licensing and control of waste management activities;
5. To provide for the remediation of contaminated land; and
6. To provide for compliance and enforcement.

"Waste" is defined in NEM:WA as "*any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act*".

Schedule 3 of the NEM:WA groups waste into two categories, namely hazardous waste and general waste. The classification of waste determines the associated management and licencing requirements. ''Hazardous waste'' is defined as "*any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles*".

The following hazardous waste is associated with the Project:

- As shown in **Table 12** below, the sludge produced at the K-WWTW is classified as low hazardous material; and
- Screenings, which are nuisance items (typically non-degradable solids such as plastics, wood chips and rags) that are removed by the screens at the inlet works of K-WWTW, are classified as hazardous.

GN No. R. 921 of 29 November 2013 (as amended) contains a list of waste management activities that have, or are likely to have, a detrimental impact on the environment. If any of the waste management activities are triggered in Category A and Category B, a WML is required. Activities listed in Category C need to comply with the relevant National Norms and Standards.

Table 4 below lists the waste management activities triggered by the Project in terms of GN No. R. 921 of 29 November 2013 (as amended).

Table 4: Waste management activities triggered by the Project in terms of GN No. R. 921 of 29 November 2013 (as amended)

Category	Activity No.	Activity Wording	Relevance to Project	WML Application
A	14	The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.	The proposed decommissioning of the existing sludge drying beds and the diesel-fired incinerator (used for disposal of screenings) at K-WWTW.	**Separate WML Application to DFFE** (*to be submitted*)
A	13	The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.	The proposed upgrade and expansion of the K-WWTW by method of a new activated sludge module and sludge management facility.	Current WML Application (DFFE ref. no.: 12/9/11 /L210929132741/8/N)
B	4	The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment excluding the treatment of effluent, wastewater or sewage.	The proposed sludge handling facility, consisting of the following systems: ▪ Mechanical dewatering units; ▪ Poly electrolyte dosing system; ▪ Solar-drying/stockpiling slab with associated sludge handling equipment. The estimated maximum sludge production is 1 566 kg/day. Based on discussions held with DFFE during the pre-application meeting, the exclusion under this activity related to sewage does not apply to the Project.	
B	10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	The proposed construction of the new sludge dewatering facility to treat sludge in excess of 1 tonnes/day.	

As the Project triggers waste management activities listed in Category B of GN No. R. 921 of 29 November 2013 (as amended), a S&EIR process is being undertaken in terms of the EIA Regulations to seek a WML. As the waste type under consideration, which includes sludge and screenings, is classified as hazardous the mandated authority is the National DFFE.

5.1.4 National Water Act

The purpose of the NWA is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Redressing the results of past racial and gender discrimination;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Providing for growing demand for water use; protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations;
- Promoting dam safety; and
- Managing floods and droughts.

The DWS is the custodian of SA's water resources.

Some key definitions from this Act include:

- "Pollution" means the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it (a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or (b) harmful or potentially harmful;
- "Waste" includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted; and
- A "water resource" includes a watercourse, surface water, estuary, or aquifer.

The water uses that are associated with the Project, in terms of Section 21 of the NWA, are listed in **Table 5** below.

Table 5: Water uses associated with the Project in terms of Section 21 of the NWA

Water Use Type		Project-related Activities
Section 21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.	The discharge of effluent into the Orange River.
Section 21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	▪ This historical storage of sludge in the existing sludge drying beds. ▪ The existing maturation ponds. ▪ The existing emergency pond. ▪ The storage of wastewater at the K-WWTW for the purpose of disposal. ▪ The disposal of wastewater into a wastewater pond system.

Water Use Type		Project-related Activities
		▪ The proposed solar-drying / stockpiling slab.
Section 21(c)	Impeding or diverting the flow of water in a watercourse.	Encroachments of Project infrastructure and activities into the regulated areas of watercourses.
Section 21(i)	Altering the bed, banks, course or characteristics of a watercourse.	

5.1.5 National Environmental Management: Air Quality Act

The purpose of the National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA) is to reform the law regulating air quality by providing measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development. This Act aims to promote justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government, and for specific air quality measures.

Some key definitions from this Act include:

- "Air pollution" means any change in the composition of the air caused by smoke, soot, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances;
- "Atmospheric emission" or "emission" means any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution;
- A "non-point source" is a source of atmospheric emissions which cannot be identified as having emanated from a single identifiable source or fixed location, and includes veld, forest and open fires, mining activities, agricultural activities and stockpiles; and
- A "Point source" is a single identifiable source and fixed location of atmospheric emission, and includes smoke stacks and residential chimneys.

The NEM:AQA provides for the listing of activities which result in atmospheric emissions that pose a threat to health or the environment. No person may conduct any such listed activity without an Atmospheric Emission Licence (AEL).

It was confirmed, in consultation with DAEARDLR, that a Section 22A (consequences of unlawful conduct of listed activity resulting in atmospheric emission) is required for the K-WWTW in terms of the NEM:AQA. This is required for the diesel-fired incinerator which is used for the disposal of screenings at the plant. A separate process will need to be undertaken in this regard.

Section 35(2) of NEM:AQA places an obligation on the occupier of any premises to "*take all reasonable steps to prevent the emission of any offensive odour caused by any activity on such premises*". The Project will include measures to control odour at the K-WWTW, which are discussed further in **Section 13.16** below.

5.1.6 National Environmental Management: Biodiversity Act

The purpose of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA) is to provide for the management and conservation of SA's biodiversity within the framework of NEMA.

The Act allows for the publication of provincial and national lists of ecosystems that are threatened and in need of protection. The list should include:

- **Critically Endangered Ecosystems**, which are ecosystems that have undergone severe ecological degradation as a result of human activity and are at extremely high risk of irreversible transformation;
- **Endangered Ecosystems**, which are ecosystems that, although they are not critically endangered, have nevertheless undergone ecological degradation as a result of human activity;
- **Vulnerable Ecosystems**, which are ecosystems that have a high risk of undergoing significant ecological degradation; and
- **Protected Ecosystems**, which are ecosystems that are of a high conservation value or contain indigenous species at high risk of extinction in the wild in the near future.

Similarly, the NEM:BA allows for the listing of endangered species, including critically endangered species, endangered species, vulnerable species and protected species. A person may not carry out a restricted activity (including trade) involving listed threatened or protected species without a permit.

Some key definitions from this Act include:

- "Alien species" –
  - A species that is not an indigenous species; or
  - An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
- "Biological diversity" or "biodiversity" means the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
- An "indigenous species" is a species that occurs, or has historically occurred, naturally in a free state in nature within the borders of the Republic, but excludes a species that has been introduced in the Republic as a result of human activity.
- An "invasive species" is any species whose establishment and spread outside of its natural distribution range -
  - Threaten ecosystems, habitats or other species or have demonstrable potential; and
  - May result in economic or environmental harm or harm to human health.

- A “species” is a kind of animal, plant or other organism that does not normally interbreed with individuals of another kind, and includes any sub-species, cultivar, variety, geographic race, strain, hybrid or geographically separate population.

The Regulations on the management of Listed Alien and Invasive Species were promulgated on 1 August 2014. The Listed Invasive Species were also published on this date and were subsequently amended in GN 864 of 29 July 2016.

The implications of the NEM:BA for the Project *inter alia* include the requirements for managing invasive and alien species, protecting threatened ecosystems and species, as well as for rehabilitation.

The findings from the Freshwater Assessment and Terrestrial Ecology Compliance Statement that were undertaken for the Project are included in **Section 12.3** and **Section 12.5** below, respectively.

5.1.7 National Heritage Resources Act

The purpose of the National Heritage Resources Act (Act No. 25 of 1999) (NHRA) is to protect and promote good management of SA's heritage resources, and to encourage and enable communities to nurture and conserve their legacy so it is available to future generations.

In terms of Section 38 of the NHRA, certain listed activities require authorisation from provincial agencies, which include the following:

- The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- The construction of a bridge or similar structure exceeding 50 m in length;
- Any development or other activity which will change the character of a site -
  - Exceeding 5 000 m^2 in extent; or
  - Involving three or more existing erven or subdivisions thereof; and
- The re-zoning of a site exceeding 10 000 m^2 in extent.

The findings from the Phase 1 Cultural Heritage Impact Assessment that was undertaken for the Project are included in **Section 12.4** below.

5.2 Governance of Waste in SA

Some of the key policies, strategies, plans and programmes that govern and guide waste management in SA include:

- National Waste Management Strategy (NWMS), 2020;
- The Waste Act National Domestic Waste Collection Standards, 2009;
- Industry Waste Management Plans;

- The Regulations regarding the control of the import or export of waste, 2008;
- Norms and Standards for the assessment of waste for landfill disposal;
- Norms and Standards for the disposal of waste to landfill, 2013;
- National Standards for the extraction, flaring or recovery of landfill gas, 2013;
- Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste;
- National Waste Information Regulations, 2012;
- Waste Classification and Management Regulations, 2013;
- Regulations regarding the planning and management of residue stockpiles and residue deposits, 2015; and
- National Pricing Strategy for Waste Management, 2016.

5.3 EIA-related Guidelines

The following guidelines were considered during the preparation of the EIA Report:

- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP, 2010a);
- Guideline on Need and Desirability, EIA Guideline and Information Document Series (DEA&DP, 2010b);
- Integrated Environmental Management Guideline Series 7: Public Participation in the EIA Process (DEA, 2010); and
- Guidelines for Involving Specialists in the EIA Processes Series (Brownlie, 2005).

5.4 National and Regional Plans

The following regional plans were considered during the execution of the EIA Phase (amongst others):

- DKM's Spatial Development Framework (SDF);
- DKM's Integrated Development Plan (IDP);
- The Northern Cape Critical Biodiversity Areas Map, 2016;
- The Environmental Management Framework (EMF) for the previous Siyanda District Municipality, which is now known as the ZF Mgcawu District Municipality; and
- Relevant national, provincial, district and local policies, strategies, plans and programmes.

6 SCOPING AND EIA PROCESS

6.1 Environmental Assessment Authorities

The Licensing Authority for a WML application is determined by the classification of the waste type in question, which is either general or hazardous. In the case of the Project, where the waste management activities include hazardous waste, the DFFE is the Licensing Authority.

In terms of the geographic location of the K-WWTW, the DAEARDLR is regarded as one of the key commenting authorities in terms of NEM:WA during the execution of the EIA, and all documentation will thus be copied to this Department (amongst others).

Various other authorities with jurisdiction over elements of the receiving environment or project activities (refer to **Section 5.1** above) were consulted during the course of the S&EIR process. Refer to the database of I&APs contained in **Appendix F** for a list of the government departments that were notified of the Project.

6.2 Environmental Assessment Practitioner

Nemai Consulting was appointed as the independent EAP to undertake the S&EIR process for the proposed Project.

In accordance with Appendix 3, Section 3(1)(a) of the EIA Regulations, this section provides an overview of Nemai Consulting and the company's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team.

Nemai Consulting is an independent, specialist environmental, social and Occupational Health and Safety (OHS) consultancy, which was founded in December 1999. The company is a 100% black female owned company, with a level 1 BBBEE rating. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng) and Durban (KZN).

The core members of Nemai Consulting that are involved with the S&EIR process for the Project are captured in **Table 6** below, and their respective Curricula Vitae are contained in **Appendix C**. The oath of the EAP is contained in **Appendix I**.

Table 6: Scoping and EIA Core Team Members

Name	Qualifications	Experience
D. Henning	MSc (River Ecology)	• 20 years' experience. • EAP for various bulk sewer and WWTW projects, including: ○ Expansion of the Sunderland Ridge WWTW, Gauteng. ○ Zandspruit Pump Station and Bulk Sewer Rising Main, Gauteng. ○ Sewer inspection programme and the replacement of damaged sewer pipes, Gauteng. ○ Realignment of a sub-outfall sewer, Gauteng. ○ Remedial measures to eliminate sewer surcharging at Leeukop Prison, Gauteng. ○ Upgrade of undersize collector sewer in Bryanston, Gauteng. ○ Sewer upgrade in the Klipspruit Sewer Basin, Gauteng.
D. Naidoo	BSc Eng (Chem)	• 25 years' experience. • Project Manager for various bulk sewer and WWTW projects, including: ○ Development of a new 150 Mℓ/d WWTW in Lanseria, Gauteng. ○ Development of a new WWTW on the Hennops River, Gauteng. ○ Construction of Northern WWTW: Unit 5, Gauteng. ○ Empangeni Bulk Outfall Sewer, 40 km pipeline, KZN. ○ Replacement of the existing Anthea Nancefield Sewer Pipeline, Gauteng. ○ Increase in sludge treatment capacity including a new lime dosing plant at the Northern WWTW, Gauteng. ○ Construction of sludge thickeners at Goudkoppies WWTW, Gauteng.

6.3 Environmental Assessment Triggers

As indicated in **Section 5.1.3** above, the Project triggers waste management activities listed in Category B of GN No. R. 921 of 29 November 2013 (as amended) and a S&EIR process thus needs to be undertaken in terms of the EIA Regulations to seek a WML.

6.4 S&EIR Process

An outline of the S&EIR process for the proposed Project is provided in **Figure 4** below.

The following key milestones have been reached as part of the process to date:

1. A pre-application meeting was held with the former Department of Environment, Forestry and Fisheries (DEFF), which is now known as the DFFE, on 19 November 2019;
2. A draft Scoping Report, which conformed to Appendix 2 of the EIA Regulations, was compiled. This document included the following salient information (amongst others):
   a. A Scoping-level impact assessment to identify potentially significant environmental issues for detailed assessment during the EIA phase;
   b. Screening and investigation of feasible alternatives to the project for further appraisal during the EIA phase; and
   c. A Plan of Study, which explained the approach to be adopted to conduct the EIA for the proposed project.
3. The WML Application Form and the draft Scoping Report were submitted to DFFE on 17 September 2021.

4. The draft Scoping Report was lodged for public review from 21 September until 22 October 2021.
5. The final Scoping Report was submitted to DFFE on 2 November 2021.
6. DFFE accepted the Scoping Report and Plan of Study for the EIA on 9 December 2021 (refer to letter contained in **Appendix B**), which allowed the EIA phase to commence.

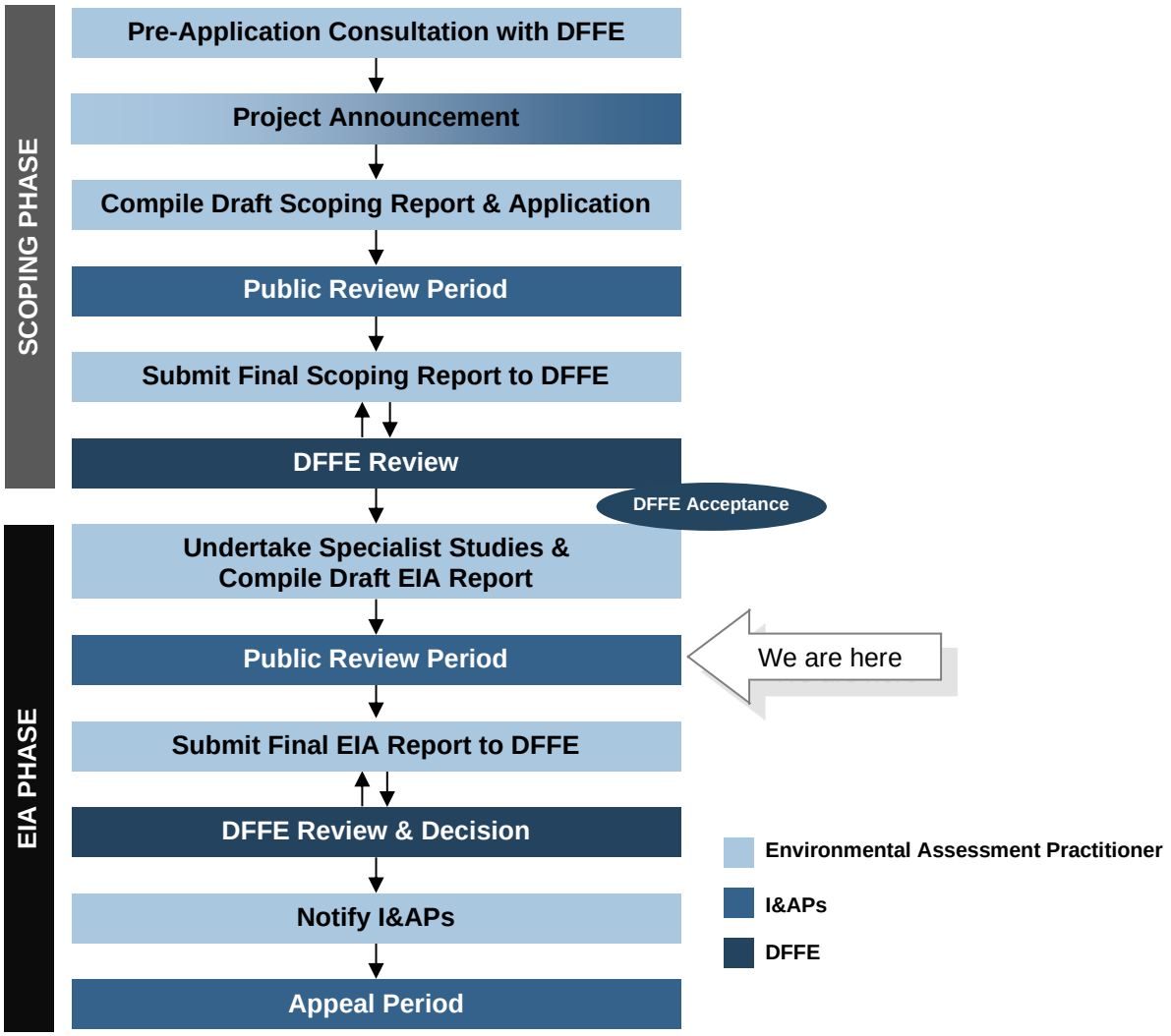

Figure 4: Outline of S&EIR Process

6.5 Objectives of the EIA Phase

The objectives of the EIA phase, based on the EIA Regulations, are captured in **Section 1** above.

6.6 Alignment with the Plan of Study

The Plan of Study, which was contained in the Scoping Report and was accepted by DFFE, explained the approach to be adopted to conduct the EIA for the proposed Project. The manner in which the EIA Report addresses the requirements of the Plan of Study is shown in **Table 7** below.

Table 7: Alignment of the EIA Report with the Plan of Study

No.	Plan of Study Requirement	EIA Report Reference
1.	Assess pertinent environmental issues identified during Scoping through: 1. Applying an appropriate impact assessment methodology. 2. Conducting specialist studies. 3. Identifying suitable mitigation measures.	• **Section 12** – Summary of specialist studies. • **Section 13** – Impact assessment.
2.	Assessment of feasible alternatives.	• **Section 14**
3.	Specialist studies to be completed in accordance with Terms of Reference.	• **Section 12**. • **Appendix E**
4.	Public participation to include the following: • Update the database of I&APs. • Allow for the review of the draft EIA Report. • Convene a public meeting. • Compile and maintain a Comments and Responses Report (CRR). • Notification of DFFE's decision.	**Section 15**
5.	The EIA Report is to satisfy the minimum requirements stipulated in Appendix 3 of the EIA Regulations.	**Section 2**
6.	Authority Consultation.	**Section 15**

6.7 Addressing DFFE's Requirements

The manner in which DFFE's specific requirements, as listed in the letter received from this Department for the acceptance of the Scoping Report (refer to the copy of the letter contained in **Appendix B**), were attended to are described in **Table 8** below.

Table 8: DFFE's Specific Requirements - Acceptance of the Scoping Report

No.	DFFE's Requirements	Response/Status
1.	Page 5 of the Scoping Report indicated that the sludge will be treated, mixed, and stockpiled on a proposed concrete slab for solar drying. It should be further explained on how the sludge will be able to dry while stockpiled and what is the proposed height of the stockpile?	Refer to **Section 9.4.3.6** below.
2.	Page 45 of the Scoping Report assessed the project alternatives. The alternatives for the proposed development must be assessed further in the EIA Report to include a detailed description of each alternative and should include the advantages, disadvantages, and motivation for the preferred alternative.	Refer to **Section 14** below.
3.	The EIA process must be undertaken in line with Appendix 3 of the EIA Regulations.	**Table 1** above shows the manner in which the EIA Report aims to satisfy the requirements stipulated in Appendix 3 of the EIA Regulations.
4.	A draft Environmental Management Programme (EMPr) complying with Appendix 4 of the EIA Regulations must be included in the draft EIA Report to be submitted to the National and Provincial Department for comment.	The EMPr is contained in **Appendix G**.
5.	The EMPr to be developed must include an emergency plan that deals with all potential hazardous circumstances which might	The EMPr (contained in **Appendix G**) makes provision for dealing with emergencies.

No.	DFFE's Requirements	Response/Status
	occur during all the project life cycle and must include the following; (a) Specific emergency centres identified and a list of emergency telephones numbers; (b) Identification of all potential emergencies that could arise (e.g. fire and injury); and (c) Description of the procedures to be followed in the event of each specific emergency (e.g. evacuation procedures).	
6.	A detailed stormwater management plan must form part of the study and it must consider the following; (a) It must be noted that no stormwater must be diverted through forms of stormwater retention facilities containing and releasing flood water in a way that simulate natural flow into the natural drainage systems, to moderate associated erosion and siltation problems that may arise. (b) A maintenance plan for the stormwater system.	The EMPr (contained in **Appendix G**) makes provision for managing stormwater.
7.	All environmental issues, potential impacts and mitigation measures that have been identified must be described in the draft EIA Report.	Refer to the Impact Assessment in **Section 13** below.

7 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations accompany the EIA process:

- As the design of the project components is still in feasibility stage, and due to the dynamic nature of the planning environment, the dimensions and layout of the infrastructure may change during the detailed design phase.
- Regardless of the analytical and predictive method employed to determine the potential impacts associated with the Project, the impacts are only predicted on a probability basis. The accuracy of the predictions is largely dependent on the availability of environmental data and the degree of understanding of the environmental features and their related attributes.
- The following assumptions, gaps and limitation were noted as part of the Specialist Studies –
  - Freshwater Assessment (Kindler, 2021):
    - Only a single season survey was conducted, which was a late summer wet season survey;
    - This assessment did not assess any temporal trends for the Project;
    - Sampling was limited to the wadeable margins of the river both upstream and downstream of the K-WWTW, which limited the sampling effort across available habitat, underestimating the full macroinvertebrate and fish assemblages present at the two sampling sites;
    - The non-perennial drainage line (running adjacent to the north-western perimeter fence) was based on DWS river shapefiles and was dry at the time of the survey. Access to this system was limited by dense alien vegetation that has overgrown the access gate located near the chlorine contact tank;
    - A basic layout and description of the proposed K-WWTW infrastructure were provided, assumptions were made on likely associated infrastructure;
    - The proposed activities listed are based on the assessment of several existing WWTW developments. Several assumptions were made through the compilation of the activity list; and
    - The impact assessments only considered the construction and operational phases of the Project, as per the details and shapefiles provided by the client.
  - Phase 1 Cultural Heritage Impact Assessment (van Schalkwyk, 2021):
    - It is assumed that the description of the Project, provided by the client, is accurate;
    - It is assumed that the public consultation process undertaken as part of the EIA is sufficient and that it does not have to be repeated as part of the Heritage Impact Assessment;
    - The unpredictability of buried archaeological remains;
    - No subsurface investigation (i.e. excavations or sampling) were undertaken, since a permit from SAHRA is required for such activities; and
    - The vegetation cover encountered during a site visit can have serious limitations on ground visibility, obscuring features (artefacts, structures) that might be an indication of human settlement.

- Terrestrial Ecology Compliance Statement (Erasmus, 2021):
  - Only a single season survey was conducted for the respective studies, this would constitute a wet season survey; and
  - This assessment did not assess any temporal trends for the Project.
- Groundwater Impact Assessment (van Staden, 2022):
  - Available data was sourced from relevant groundwater databases and sources. The aquifer vulnerability, yield and quality data are predominantly accurate albeit mapped at a regional scale; and
  - A further limitation was the temporal nature of the site visit. The field work was undertaken on a single day in February 2022 and does not account for the temporal variability of the weather conditions within the area. This is not expected to alter the risk assessment for the site.

8 NEED AND DESIRABILITY

This section serves to expand on the background and motivation to the Project, as provided in **Section 3.1** above.

The format contained in the Guideline on Need and Desirability (DEA&DP, 2010b) was used in **Table 9** below. Need (time) and desirability (place) relate to, amongst others, the nature, scale and location of development being proposed, as well as the prudent use of land.

Table 9: Need and Desirability

No.	Question	Response
NEED ('timing')		
1.	*Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).*	Yes. In terms of land use, the Project proposes the upgrade and expansion of the existing K-WWTW. The proposed activities associated with the Project will take place within the confines of the plant's existing perimeter fence. DKM's SDF of 2017 designates the area encompassed by the K-WWTW as a 'sewage plant'. The SDF further shows a 1000m risk zone around the plant. The DKM's IDP for 2020/2021 lists the upgrading of the K-WWTW as one of the capital projects. Refer to **Section 11.10** below for a discussion on the SDF and planning aspects.
2.	*Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?*	Yes. According to the Preliminary Design Report (Bigen, 2021), the K-WWTW is under ever increasing pressure to enhance serviceability of new residential and, to a lesser extent, industrial runoff located within the Works' planned drainage area. Effluent quality standards specified by the DWS are also likely to increase beyond the current treatment efficiency that the Works' is able to achieve. Potential reuse of the Works' effluent, together with the above mentioned culminates in the requirement of the upgrade and expansion of the K-WWTW.
3.	*Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate)*	Yes. The DKM is under great pressure from the downstream users of the water, to improve on the quality of the effluent. The users apply the water from the Orange River for the irrigation of agricultural products for local and international markets. Due to the poor quality of the effluent, these markets could be compromised. The standards imposed by the European Union are very strict regarding possible contact between edible products and treated sewage effluent. It is thus of importance that the DKM undertake concrete measures to improve on the existing situation.

No.	Question	Response
		The Project will also enhance the operation of the K-WWTW, which will manage impacts to surrounding land uses (such as odour control).
4.	*Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?*	Yes. Related factors were taken into consideration in the Preliminary Design Report (Bigen, 2021). The services required for the development are explained in **Section 9.7** below.
5.	*Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)?*	Yes. Refer to response to no. 1 above.
6.	*Is this project part of a national programme to address an issue of national concern or importance?*	Yes. The K-WWTW is scored against the Green Drop Programme.
DESIRABILITY ('placing')		
7.	*Is the development the Best Practicable Environmental Option (BPEO) for this land/site?*	The Project entails the upgrading and expansion of the existing K-WWTW. Refer to **Section 14** below for the selected BPEO for the Project alternatives.
8.	*Would the approval of this application compromise the integrity of the existing approved municipal IDP and SDF as agreed to by the relevant authorities?*	No. The Project does not contradict, nor is it in conflict, with the municipal IDP and SDF (refer to response to no. 1 above).
9.	*Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?*	No. The proposed upgrade and expansion aim to ensure that the K-WWTW will discharge effluent of suitable quality, which will benefit the receiving river and downstream water users. The compatibility of the Project with the Northern Cape Biodiversity Conservation Plan and Terrestrial Ecosystem Threat Status (amongst others) was considered as part of the Terrestrial Ecology Compliance Statement (refer to **Section 12.5** below).
10.	*Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).*	Yes. The Project entails the upgrading and expansion of the existing K-WWTW. The specialist studies further investigated the location based on sensitive environmental features and receptors. Refer to the findings of the specialist studies contained in **Section 12** below. Also refer to the response provided to item no. 2 above.
11.	*How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?*	▪ Refer to the findings of the specialist studies in **Section 12** below. ▪ See compilation of significant environmental issues associated with the Project contained in **Section 13.5** below. ▪ Refer to the assessment of potential impacts in **Section 13.8** to **Section 13.20** below.
12.	*How will the development impact on people's health and wellbeing (e.g. in*	

No.	Question	Response
	terms of noise, odours, visual character and sense of place, etc.)?	
13.	*Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?*	No. Opportunity costs are associated with the net benefits forgone for the development alternative. As the Project proposes the upgrade and expansion of the existing K-WWTW, it is not expected that there will be unacceptable opportunity costs.
14.	*Will the proposed land use result in unacceptable cumulative impacts?*	Cumulative impacts are considered in **Section 13.22** below.

9 PROJECT DESCRIPTION

The information presented in this section was primarily sourced from the following technical reports:

1. K-WWTW Implementation Readiness Study (Element Consulting Engineers, 2016);
2. Report on the Status Quo of the Works and the Refurbishment Requirements (Bigen, 2020); and
3. Preliminary Design Report (Bigen, 2021).

9.1 K-WWTW'S Status Quo Treatment Process

The K-WWTW consists of the following process elements:

- Night soil discharge and bucket washing system;
- Inlet works -
  - Screen;
  - Degritting;
  - Flow measurement;
- Incinerator;
- Screw pump station;
- Primary settling tank (PST);
- Raw sludge pumps (to thickener);
- Main pump station;
- Biological filters;
- Biological reactor;
- Return activated sludge pumps;
- Thickeners;
- Sludge pumps;
- Anaerobic digesters;
- Sludge drying beds;
- Maturation pond;
- Disinfection;
- Chlorination system;
- Chlorine contact tank;
- Emergency pond; and
- Return pump station.

The schematic process diagram showing the inter-relationship between the process units at the K-WWTW is provided in **Figure 5** below.

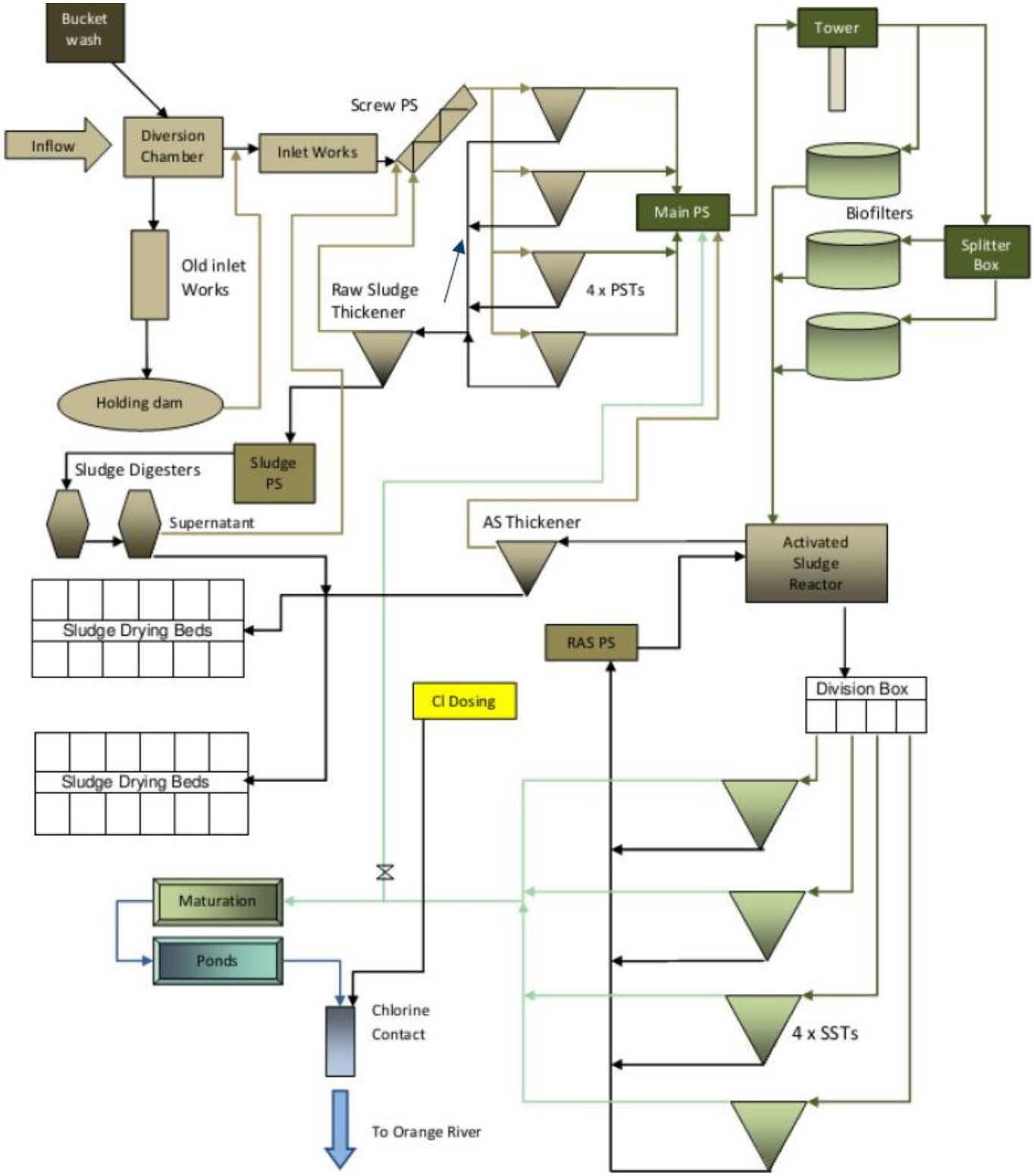

Figure 5: Schematic diagram of K-WWTW (Bigen, 2020)

9.2 Design Characterisation

9.2.1 Design Sewage Characterisation

The proposed design concentrations for the upgrade and expansion of the K-WWTW are as follows:

- Chemical oxygen demand: 450 mg/l;
- Total Kjeldahl Nitrogen: 49 mg/l;
- Ammonia: 39 mg/l;
- Total Phosphate: 10 mg/l;
- Ortho-Phosphate: 4 mg/l; and
- Total suspended solids: 194 mg/l.

9.2.2 Design Hydraulic Characterisation

The hydraulic parameters for the proposed upgrading and expansion of the K-WWTW are presented in **Table 10** below.

Table 10: Design hydraulic loading for the upgrade & expansion of K-WWTW (Bigen, 2021)

Description	Unit	Design flow
Ultimate influent design flows		
Average Dry Weather Flow	Ml/d	24
Average Wet Weather Flow	Ml/d	24
Peak Wet Weather Flow	Ml/d	48
Hourly Peak Flow Calculated	m^3/hr	3 000
Hourly Peak Flow Extreme event	m^3/hr	3 500
Assumed start-up influent design flows		
Average Dry Weather Flow	Ml/d	16
Minimum hydraulic design flow	m^3/hr	767

9.2.3 Design Discharge Limits

It is noted that the K-WWTW measures its effluent discharge standards in relation to the general limits as specified by the DWS. The DKM is in process of applying for a Water Use Licence (WUL) for the K-WWTW. The WUL generally provides the discharge standards which the Works must conform to. Until this process is finalised, it will be assumed that General Limits will remain as the specified discharge standard. This assumption will be verified once the WUL has been issued and the discharge limits have been confirmed.

It is also noted that DKM may reuse some of the treated effluent for irrigation purposes in the future. The International Organization for Standardization Guidelines for treated wastewater use for irrigation projects (ISO/DIS Standard No. 16075) provides quality criteria for this activity and will need to be adhered to.

9.3 Process Design Philosophy

Table 11 below provides a summary of the design philosophy applied to produce treated effluent quality at K-WWTW which complies with the relevant standards.

Table 11: Process design philosophy for K-WWTW (Bigen, 2021)

Parameter	Design philosophy	Technique, codes and standards applied
Emergency Storage	Flow attenuation.	Use of available infrastructure.
Biological activated sludge treatment	▪ Substrate (e.g. Chemical Oxygen Demand) removal ▪ Achieve biological nitrification, denitrification. ▪ Supplement Phosphate removal with chemical precipitation.	▪ Water Research Commission (WRC) theory, design and operation of nutrient removal AS plants. ▪ Biowin simulation model.
Secondary Sedimentation	▪ Design tanks for non-bulking sludge up to a diluted sludge volume index of 150ml/g ▪ Acceptable up flow velocity.	▪ Flux theory at 80% optimum recycle flow. ▪ WRC theory, design and operation of sedimentation tanks.
Disinfection	Inactivation of pathogenic microorganisms.	WRC theory, design and operation of chorine contact tanks.

9.4 Scope of Work for the K-WWTW

9.4.1 Introduction

The status quo treatment process requires major refurbishment as large sections of the Works' have been in operation since the 1970s, with the last upgrade and expansion having taken place during the 1990s. It was therefore proposed that the overall scope of work for the K-WWTW be split into the following: (i) refurbishment of existing mechanical and electrical equipment; and (ii) upgrade and expansion of the K-WWTW.

This Application focuses on the waste management activities associated with the upgrade and expansion of the K-WWTW, as it was understood that the refurbishment activities would not trigger any listed activities. This was discussed during the respective pre-application meetings that were held with the DAEARDLR and DFFE.

An overview of the scope of work for the refurbishment and upgrade components follows below.

9.4.2 Refurbishment

Although the refurbishment component is excluded from the Application, an overview is still provided in this Section to convey the full scope of the work to be undertaken at the K-WWTW.

The aims of the refurbishment activities include the following:

- To ensure systems/equipment remain operational until such time when the main upgrade and expansion of K-WWTW is commissioned; and
- To ensure the relevant system/equipment can be integrated and remain functional as part of the future treatment strategy.

A map of the general layout of the existing infrastructure to be refurbished is shown in **Figure 6** below and is also contained in **Appendix D1**.

Figure 6: K-WWTW existing infrastructure to be refurbished (Google Earth image)
*(Not all infrastructure is labelled in the map above due to scale – see full details in map in **Appendix D1**)*

9.4.3 Upgrade and Expansion

A map of the general layout of the upgrade and expansion works is shown in **Figure 7** below and is also contained in **Appendix D2**.

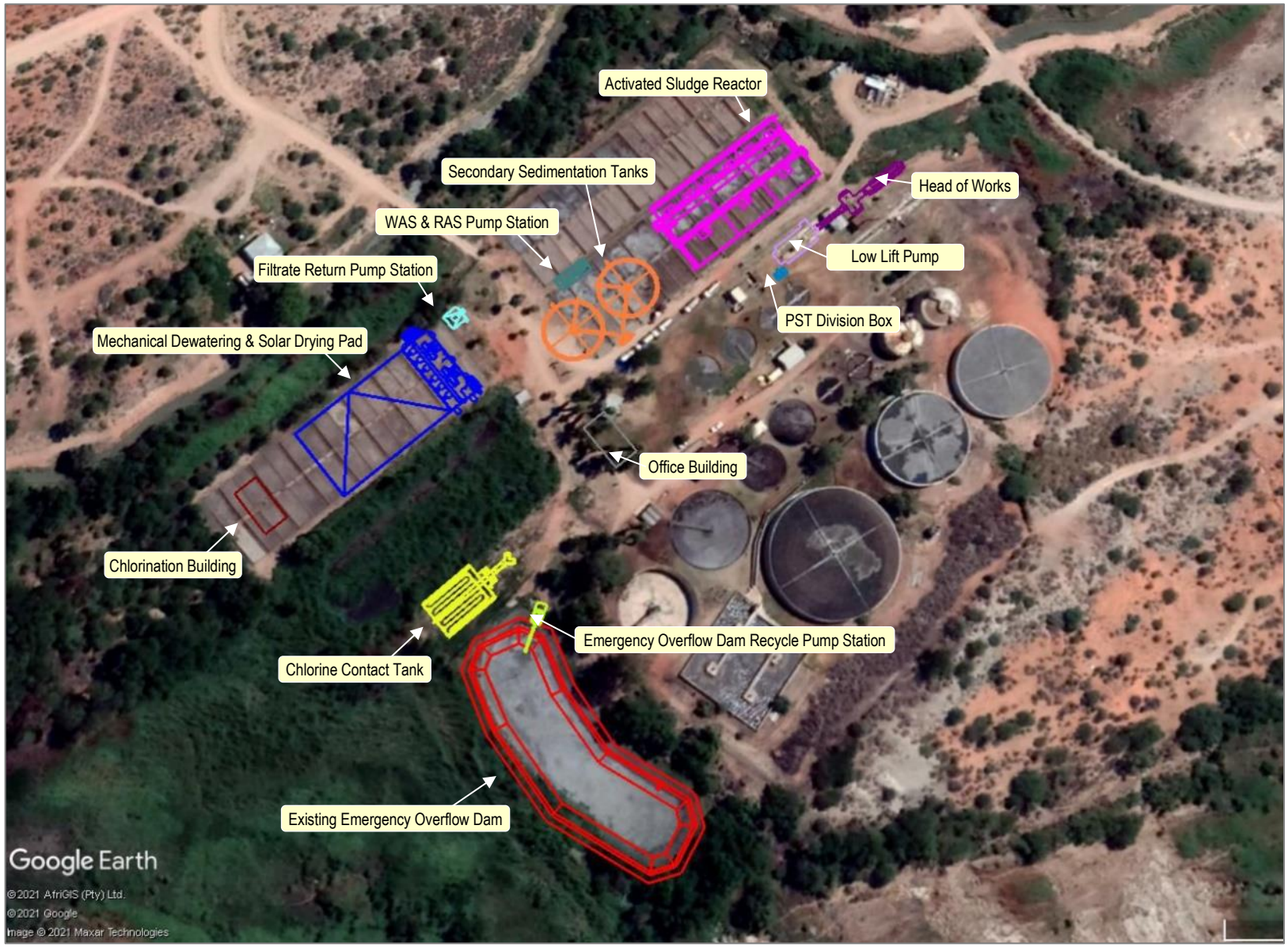

Figure 7: **K-WWTW upgrade and expansion works (Google Earth image)**

Key components of the K-WWTW associated with the upgrade and expansion works are discussed further in the sub-sections to follow.

9.4.3.1 Head of Works

A mothballed structure, previously used as the inlet works (shown in **Figure 8** below) will be demolished to avail space for the newly proposed Head of Works (HoW). The new HoW will comprise of two (2) trains operating in a duty standby configuration.

The new inlet works will be designed to accommodate an ADWF of 24 Ml/d and an Hourly Peak Flow (HPF) of 84 Ml/d (3 500 m^3/hr). The new inlet works will be fully equipped for this capacity and will comprise of the following components:

- Two (2) mechanical front rake coarse screens (25 mm aperture);
- Two (2) mechanical front rake fine screens (6 mm aperture);
- Two (2) vortex degritters;
- One (1) bypass channel equipped with manual screen (50 mm aperture); and
- One (1) Parshall flume for flow measurement downstream of degritters.

Figure 8: Obsolete "old" inlet works

A diesel-fired incinerator (shown in **Figure 9** and **Figure 10** below), which is located next to the inlet works structure, is currently used for the disposal of screenings at the K-WWTW. The incinerator is fitted with two Bentone B 30A burners each having a fuel burning capacity of 6 – 17 kg per hour. It is proposed to discontinue the incinerator as part of the upgrade and expansion works.

Figure 9: Incinerator at K-WWTW

Figure 10: Incinerator bed (top left), incinerator bed being raked manually (top right), temperature gauges (bottom left) and smoking chimney after loading of incinerator (bottom right) (Bigen, 2020)

9.4.3.2 Emergency Storage

An existing emergency overflow pond (shown in **Figure 11** below), which is located next to the existing aeration tank, intercepts high peak flows that cannot be handled by the installed equipment. It has a storage capacity of 4 375 m^3. Based on this volume and a design emergency overflow rate of 500 m^3/hr, the pond can provide a retention period of ±8 hrs during a peak influent event of 3500 m^3/hr.

Figure 11: Emergency pond at K-WWTW

A new recycle pump station will be installed to supply the content of the storage tank over an 8-hour period. Two pumps will be installed with a duty-standby configuration, each with a rated delivery of 76 l/s.

In the event that the overflow volume exceeds the storage capacity of the emergency overflow tank, excess flow will be diverted from the recycle pump station via an overflow weir to the chlorine contact tank for disinfection and discharged into the natural water course. The overflow system will be sized for hydraulic capacity of 500 m^3/hr.

9.4.3.3 Low Lift Pump Station

Flow from the HoW will collect in sump from where it will be pumped to the existing and new modules. The flow will be split between the existing and the proposed modules via overflow weirs. The flow rate to the new module will be measured via an ultrasonic flow meter.

A new low lift pump station is proposed for the upgrade and expansion of the K-WWTW. A total of four (4) screw pumps will be installed. Each pump will have a design capacity of 1000 m^3/hr, whereby three (3) pumps will have to be operational in order to accommodate instantaneous peak flow of 3000 m^3/hr. The estimated design head for the low lift pump station is 6 m. This will allow the flow to gravitate through the remainder of the process units.

9.4.3.4 Activated Sludge Train

A new 12 Ml/d (ADWF) ASP is proposed for the upgrade and expansion of the K-WWTW. The ASP consists of a single biological reactor equipped with mixers and aerators, Secondary Sedimentation Tanks (SST) for solids separation and multiple internal recycles.

A Mechanical Flow Diagram, which highlights the process units and flow streams within the ASP, is contained in **Appendix D3**. The general arrangement of the civil structure for the activated sludge reactor is shown in the drawing contained in **Appendix D5**.

The ASP design is based on three (3) main objectives, namely:

- Substrate removal;
- Conversion of ammonia to nitrate; and
- Biological Nitrogen Removal (specifically nitrogen and phosphate).

Sludge age will be controlled by wasting mixed liquor via a dedicated Waste Activated Sludge (WAS) pump station located next to the biological reactor. The Plant Operator will have the option to waste activated sludge from the aerobic zone directly or via the Return Activated Sludge (RAS) stream. Two (2) solids handling centrifugal type pumps will be installed in a duty-standby configuration, pumping the WAS directly to a dewatering facility. The WAS and RAS pump station will be combined in a single building.

Two new 23.1 m diameter, scraped conically bottomed circular SSTs equipped with peripherally driven rotating half bridges will be provided for the Project (refer to general arrangement of the civil structure for the SST in **Appendix D6**). The sludge removal system for the new SSTs will be scraped along the sloped floors towards a central hopper from where it is removed by the RAS pumps and recycled back to the biological reactor.

The maximum volume to be wasted per day, if done from the reactor, will be 382 m^3/d.

9.4.3.5 Disinfection & Reuse

It is proposed that a dual chlorination channel be provided to treat the total effluent from the K-WWTW. The tank will be sized to ensure a minimum contact period of 20 min at ADWF (i.e. 24 Ml/d). This equates to a total volume of 333 m^3. The condition and

configuration of the existing chlorine contact tank is not considered feasible for use in the upgraded and expanded works. A new tank will therefore be provided.

The dosing system will be installed in terms of the SANS 10298:2009 and be based on one (1)-tonne drum cylinders. Based on a dosing rate of 5 mg/l, one cylinder will remain operational for 8-days. This equates to a usage of 3.1-tonnes gas cylinders per month. The chlorine dosing and storage facility will make allowance for a total of 9 gas cylinders to limit delivery cycles to the K-WWTW.

9.4.3.6 Sludge Stabilisation & Dewatering

Sludge generated at the K-WWTW was classified in terms of the Guidelines for Utilisation and Disposal of Wastewater Sludge (GUDWS) and the results are summarised in **Table 12** below. It is predicted that the future sludge classification associated with the K-WWTW will remain B1a or be better (i.e. A1a).

Table 12: Sludge classification of K-WWTW (2017 to 2018) (Bigen, 2021)

Description	Sample 1	Sample 2	Sample 3	Sample 4
Sample date	July 2017	July 2018	Sept 2018	Nov 2018
Sludge type	Composted sludge			
Sampling point	Stockpile			
Microbiological parameters	B	B	B	B
Vector attraction reduction	1	2	1	1
Pollutant class	a	a	a	a
Classification	B1a	B2a	B1a	B1a

Sludge will be produced from two sludge trains, namely the existing Biological Trickling Filter (BTF) train and the new ASP train. The sludge from both trains will be treated at a new dewatering facility. The main processes associated with the sludge management include the following:

- Anaerobic digestion of Primary Sludge (PS) and WAS (status quo);
- Extended sludge age in activated sludge processes (new ASP); and
- Mechanical sludge dewatering.

A Mechanical Flow Diagram, which highlights the process units and flow streams within the sludge management train, is contained in **Appendix D4**.

According to the sludge mass balance (shown in **Figure 12** below), the anticipated minimum solids loading rates for WAS from the existing module, PS and WAS from the new module streams will be 0.9, 1.0 and 1.6 tonnes/d, respectively. The anticipated maximum solids loading rates for these streams will be 0.6, 1.6 and 1.8 tonnes/d, respectively.

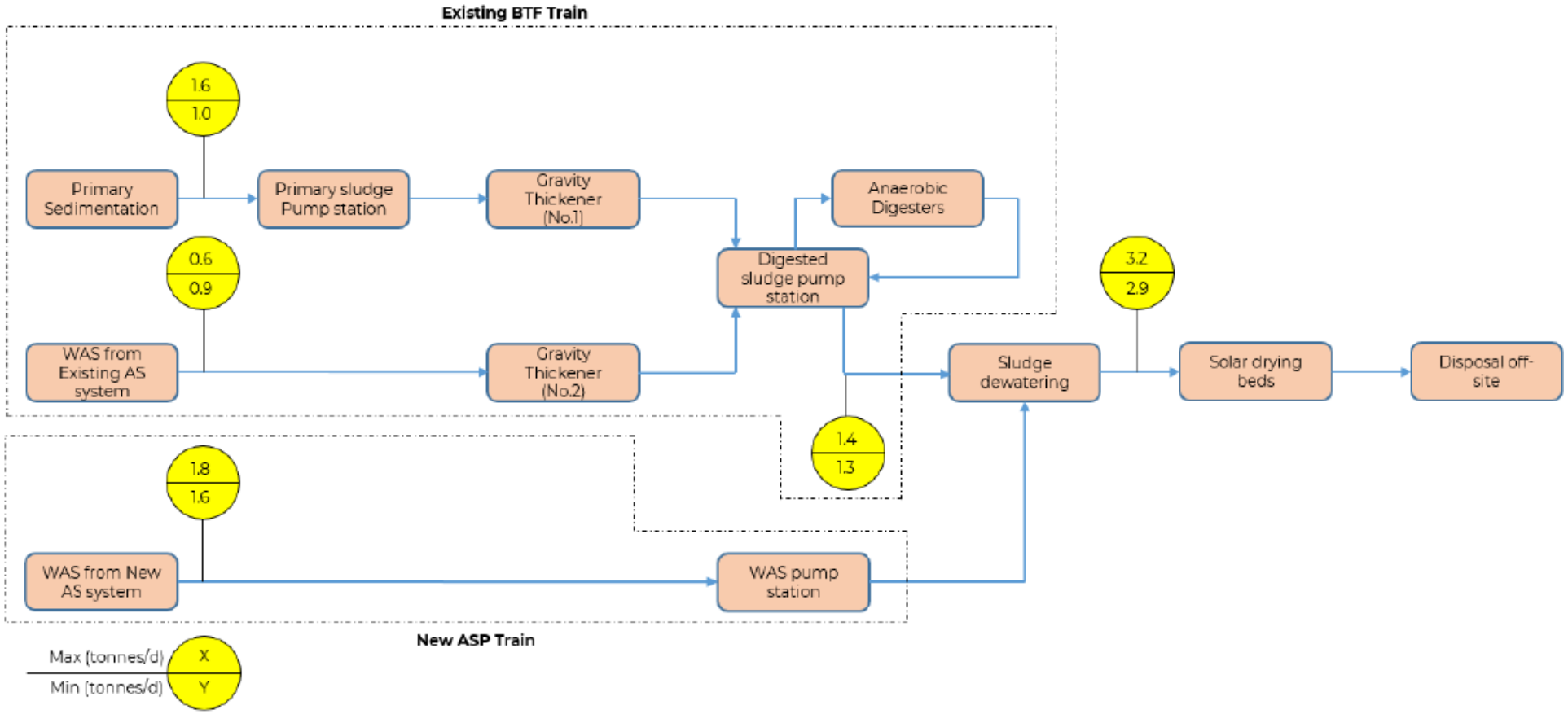

Figure 12: Sludge mass balance diagram (Bigen, 2021)

Currently, sludge drying beds are provided for the solar drying of the thickened WAS and the digested sludge. Each drying bed is 15.22 m x 6.1 m, giving a total surface area of 8 913 m^2 (some of the drying beds are shown in **Figure 13** below). These sludge drying beds will be decommissioned and demolished to avail space for the new ASP train. Therefore, a new, small footprint, sludge dewatering facility will be required to ensure effective sludge handling and disposal is maintained at the plant.

Figure 13: Sludge drying beds Set No 3 (top left), supernatant decanting Sets 1 & 2 (top right), Sludge drying beds Set 1 & 2 supernatant decanting (bottom left) and typical sludge drying bed (bottom right) (Bigen, 2020)

An option evaluation (refer to **Section 10.3.1** below) was done for the specific case of K-WWTW which concluded that that the most favourable solution is to generate sludge conforming to the requirements associated with beneficial use (i.e. source for fertilizer).

The proposed sludge handling facility will consist out of the following systems (shown in **Figure 7** above):

- Mechanical dewatering units;
- Poly electrolyte dosing system; and
- Solar-drying/stockpiling slab with associated sludge handling equipment.

Table 13 below provides a summary of the design aspects associated with the sludge management facility.

Table 13: Design summary of sludge management facility (Bigen, 2021)

Description	Unit	Value
Dewatering units		
Type of units	-	Screw-press units
Design flow rate	m^3/hr	56+5.4
No. of units	No.	5
Installed standby availability	%	67
Guaranteed sludge cake concentration (m/v)	%	18
Poly make system		
Poly make up system	-	Continuous make up
No of poly make up system	No.	2
Poly dosing pump	-	PC Pumps
No of poly dosing pumps	No.	5
Filtrate return pump station		
Pump installation	-	Submersible
Pumps	No.	2
Duty per pump	l/s	16
Discharge pressure	m	6
Installed standby availability	%	100
Discharge pipe diameter	mm	150 NB
Discharge manifold	mm	150 NB
Solar drying slab		
Slab material	-	Concrete
Total Area required for drying	m^2	1429
Turn-over rate for drying	days	9
Total area required for stockpiling	m^2	95.3
Turnover rate for stockpiling	days	30
Total area	m^2	1525

Solar drying slabs are widely used in SA and are especially recommended in climatic conditions associated with Upington (i.e. high sunshine, low rainfall and low humidity). Sludge cake from the dewatering units will be spread out on a dedicated solar drying slab for further processing. **Table 14** below provides an overview of the design parameters used to determine the required drying bed area for the predicted sludge production rates.

A total of 2364.3 m^2 (i.e. 2269+95.3) is required for the effective processing and stockpiling of sludge at the K-WWTW. The proposed slab will be manufactured from concrete and have overall dimensions of 30 m by 51 m. The general arrangement of the civil structure for the dewatering facility and solar drying bed is shown in the drawing contained in **Appendix D7**.

Table 14: Solar drying slab design parameters (Bigen, 2021)

Description	Value
Solar drying section of slab	
Total Solids Design Loading (kg/d)	2859
Sludge feed concentration (%)	18
Volume of cake per day (m^3/d)	15.9
Evaporation rate (mm)	7
Sludge layer application thickness (mm)	100
Drying time turnover rate (days)	14.3
Total solar drying area (m^2)	1429
Stockpiling section of sludge	
Sludge volume to be stockpiled per day (m^3/d)	4.8
Stockpiling allowance (days)	30
Stockpile height (m)	1.5
Total stock pile area (m^2)	95.3

After the sludge has been processed by the dewatering plant, it will be stockpiled, whereafter it will be distributed evenly on the solar drying slab. The sun (common sludge drying method of an area with the type of weather Upington has) will dry the sludge that has been laid down on the solar drying slab. The sludge will be disposed of offsite after it has dried. This will be a continuous process.

9.5 Summary of Sludge & Screenings

A summary of the sludge and screenings to be produced at K-WWTW is provided in **Table 15** below.

Table 15: Summary of sludge and screenings (based on ultimate capacity ADWF of 24 Ml/day)

Characteristics	Screenings	Sludge
Volumes produced (estimated)	▪ 0.418 tons/day ▪ 152.6 tons/year	▪ 3.1 tons/day ▪ 1 131.5 tons/year
Description	Mostly rags, plastics, rubber, unbiodegradable material, etc., as expected to be found in general municipal raw sewage.	Residual, semi-solid material produced as a by-product during sewage treatment.
Classification	Assumed to be hazardous.	B1a (GUDWS).
Disposal	Offsite at an appropriate landfill site.	Offsite at an appropriate landfill site.

9.6 Project Life Cycle

The typical project life cycle for the upgrade and expansion of a WWTW includes the following primary activities (high level outline only):

- Design phase –
  - Confirming key design features and specifications for the components of the WWTW to be upgraded and expanded;
  - Preparing detailed designs;
  - Preparing the Project schedule; and
  - Procurement process for Contractors.
- Construction phase –
  - Establishing temporary access roads, where needed;
  - Preparing the site (clearing, levelling, grading, etc.);
  - Decommissioning and demolishing structures and infrastructure, as relevant;
  - Establishing the site office;
  - Establishing laydown areas and storage facilities;
  - Transporting equipment to site;
  - Undertaking civil, mechanical and electrical work; and
  - Reinstating the working areas outside of permanent development footprint.
- Operational phase –
  - Testing and commissioning of the upgraded and expanded components;
  - Managing stormwater and waste;
  - Producing and discharging compliant effluent;
  - Producing and managing compliant sludge;
  - Conducting preventative and corrective maintenance; and
  - Monitoring of the Works' performance.
- Decommissioning –

  It is envisaged that the K-WWTW will be used indefinitely, under suitable maintenance. Decommissioning is thus not considered applicable to the K-WWTW, apart from the decommissioning of old and redundant structures and infrastructure associated with the upgrading and expansion of the plant.

9.7 Resources and Services required for Construction and Operation

This section briefly outlines the resources that will be required to execute the Project. Note that provision will be made in the EMPr to manage impacts associated with aspects listed below, as relevant.

9.7.1 Water

Construction

All water required during the construction phase will be obtained from a municipal source.

Operation

All water required during the operational phase (e.g. drinking water, water for toilets, water for cleaning purposes etc.) will be obtained from a municipal source.

9.7.2 Sanitation

Construction

Sanitation services will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier.

Operation

Ablution facilities are available at the K-WWTW for operational staff and visitors. Sewage from ablution facilities will be disposed of at the bucket washing facilities.

9.7.3 Waste

Construction

Solid waste generated during the construction phase will be temporarily stored at a suitable location (e.g. at the construction camp) and will be removed at regular intervals and be disposed of at a permitted waste disposal site. All the waste disposed of will be recorded.

According to the municipal IDP (DKM, 2020), the municipality has ten landfill sites namely, Leerkrans, De Duine, Askham, Welkom, Groot Mier, Loubos, Rietfontein, Philandersbron, Noenieput and Swartkop Dam.

Wastewater, which refers to any water adversely affected in quality through construction-related activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g. equipment, staff); and
- Drainage over contaminated areas (e.g. workshop, equipment storage areas).

Suitable measures will be implemented to manage all wastewater generated during the construction period.

Operation

Domestic waste generated during the operational phase will be removed on a regular basis and will be disposed of at a permitted waste disposal site. The management of sludge and screenings will be in accordance with the descriptions provided in **Section 9.4.3** above.

9.7.4 Roads & Stormwater

The existing access road to the K-WWTW, which is a gravel road, is directly from the N14 (shown in **Figure 14** below).

Figure 14: Access road to the K-WWTW from the N14 (Google Earth image)

Approximately 1100 m of fence will be located around the boundary of the K-WWTW.

9.7.5 Stormwater

Construction

Best environmental practices will be implemented during construction to manage stormwater.

Operation

Stormwater run-off from areas of higher elevation than the K-WWTW will be cut off and diverted by dished berms strategically placed to divert the water towards the river. The natural flow of stormwater over the site will be handled at ground level in a manner that ensures no concentration or pooling of water and that the natural flow of the water is not accelerated off the site. The layout of the Kameelmond WWTW is such that the contaminated stormwater is captured by the Emergency Pond, where after the contaminated stormwater is pumped back to the HoW to be treated.

9.7.6 Electricity

Construction

During the construction phase electricity will be obtained from diesel generators and / or municipal supply.

Operation

Power for the operational phase will be obtained from Eskom. Provision is also made for a standby power generator at the K-WWTW.

9.7.7 Laydown Areas

Construction

A laydown area will be required during the construction phase. The laydown area will be created inside the K-WWTW.

9.7.8 Construction Workers

Construction

The appointed Contractor will mostly make use of skilled labour. In those instances where casual labour is required, the Applicant will request that such persons are sourced from local communities as far as possible.

9.8 Implementation Programme

The following key dates are reflected in the Project's implementation programme:

- Refurbishment Contract –
  - Contract administration: December 2021 to September 2022; and
  - Close-out: October 2022 to September 2023.
- Main Upgrade and Expansion Contract –
  - Upgrade and Expansion Contract No.1 –
    - Contract administration: October 2023 to March 2025; and
    - Close-out: April 2025 to March 2026.
  - Upgrade and Expansion Contract No.2 –
    - Contract administration: April 2025 to September 2026; and
    - Close-out: October 2026 to September 2027.

10 ALTERNATIVES

10.1 Introduction

According to the EIA Regulations, “alternatives” in relation to a proposed activity, means different ways of meeting the general purpose and requirements of the activity, as well as the option of not implementing the activity (referred to as the “no-go option”). Alternatives may be considered for the following:

- The property on which or location where the activity is proposed to be undertaken;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity; or
- Operational aspects of the activity.

10.2 Location and Layout Alternatives

No location or layout alternatives were considered for the Project, as the proposed works entail upgrading and expanding the existing K-WWTW.

Some of the existing sludge drying beds at the facility will be decommissioned and demolished to avail space for the new ASP train. This ensures optimal utilisation of the site.

10.3 Technology Alternative

The alternatives considered for sludge treatment at the K-WWTW included sludge drying, belt presses and linear screens, and a sludge dewatering facility. A comparison of these alternatives is provided in **Section 14.3** below.

10.4 Waste Disposal Options

The sludge management options that were evaluated included using the sludge for agricultural purposes, as fertiliser product, or for commercial products. In addition, the disposal of sludge at a landfill site was also considered. These options are discussed further in in **Section 14.4** below.

10.5 No-Go Option

The “no-go option” is evaluated in **Section 13.21** below to understand the implications of the project not proceeding.

11 PROFILE OF THE RECEIVING ENVIRONMENT

11.1 General

This section provides a general description of the status quo of the receiving environment in the Project area. This serves to provide the context within which the EIA was conducted. It is noted that the areas earmarked for the Project components (shown in **Figure 7** above) occur within the K-WWTW site and most relate to existing structures and infrastructure that are intended to be upgraded and expanded.

This section allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed Project. The reader is referred to **Section 12** below for more elaborate explanations of the specialist studies and their findings for specific environmental features. The potential impacts to the receiving environment are discussed in **Section 13** below.

11.2 Land Use & Land Cover

The land cover of the areas surrounding the Project area is shown in **Figure 15** below.

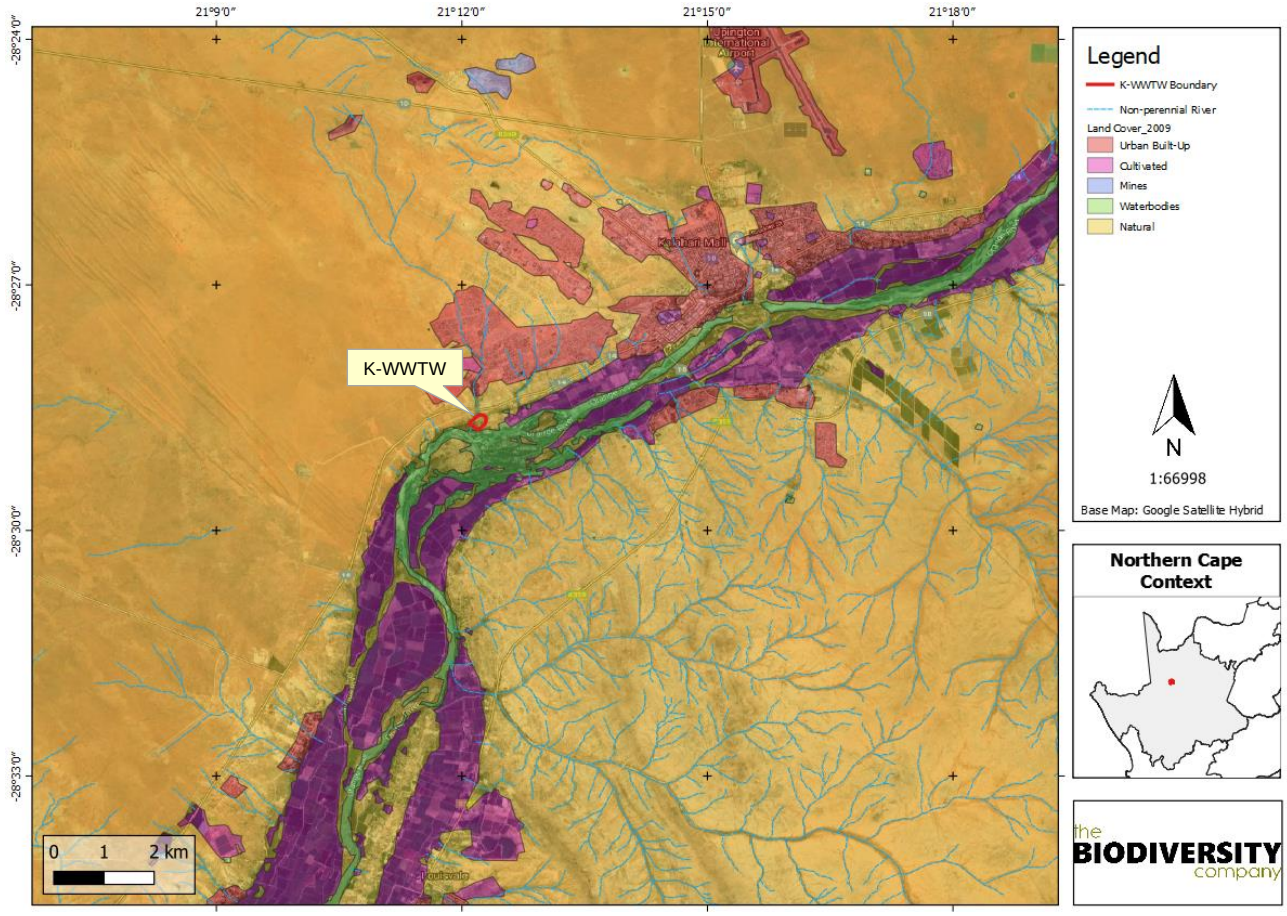

Figure 15: Land use associated with the project area (Kindler, 2021)

DKM's SDF of 2017 designates the area encompassed by the K-WWTW as a 'sewage plant'. The SDF further shows a 1000 m risk zone around the plant.

The land surrounding the K-WWTW is vacant and rural in nature. Agriculture is encountered approximately 200 m to the east of the site, in the area of Lemoendraai. Residential areas are located approximately 700 m and 580 m to the to the west and north of the site, respectively. The Kameelboom Cemetery is located approximately 600 m to the north-west of the K-WWTW.

The upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence.

11.3 Climate

The climate in Upington is classified as BWh by the Köppen-Geiger system. The average temperature for the year is 21.1°C. On average, the warmest month is January and the coolest month is July. The average precipitation for the year is 188 mm (https://www.weatherbase.com).

Average climatic information for Upington is provided in **Table 16** below.

Table 16: Average temperature and precipitation in Upington (South African Weather Service)

Position of Upington in DKLM: 28° 24' S 21° 16' E
Height above sea-level: 836m, Period: 1961-1990

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	42	36	20	10	24	4	33
February	42	34	20	9	35	6	59
March	41	32	18	5	37	6	46
April	38	28	13	2	26	5	52
May	34	24	8	-2	10	2	26
June	29	21	5	-5	4	2	13
July	29	21	4	-6	2	1	7
August	33	23	6	-7	4	1	40
September	39	27	9	-2	4	2	19
October	40	30	13	2	9	3	22
November	41	33	16	5	17	3	51
December	43	35	19	6	17	4	42

11.4 Geology and Soil

The geotechnical characteristics determine the suitability of the site in terms of foundations for structures and infrastructure. It is noted that the Project entails the upgrade and expansion of existing components of the K-WWTW.

As shown in **Figure 16** below, the K-WWTW site is located on the Jannelspan Formation (Mj) which comprises of calc-silicate rock types near the surface of the formation. Underlying the calc-silicate rock type the Jannelspan Formation is a hornblende-plagioclase amphibolite (also of the Jannelspan Formation) which has been formed due to metamorphism of basaltic lava and dolerite.

To the north of the K-WWTW the Jannelspan Formation is covered by read aeolian sands of the Kalahari Group of terrestrial sediment of Cenozoic age. The sands consist of rounded quartz grains, the red colour of the sands is attributed to a thin layer of haematite coating.

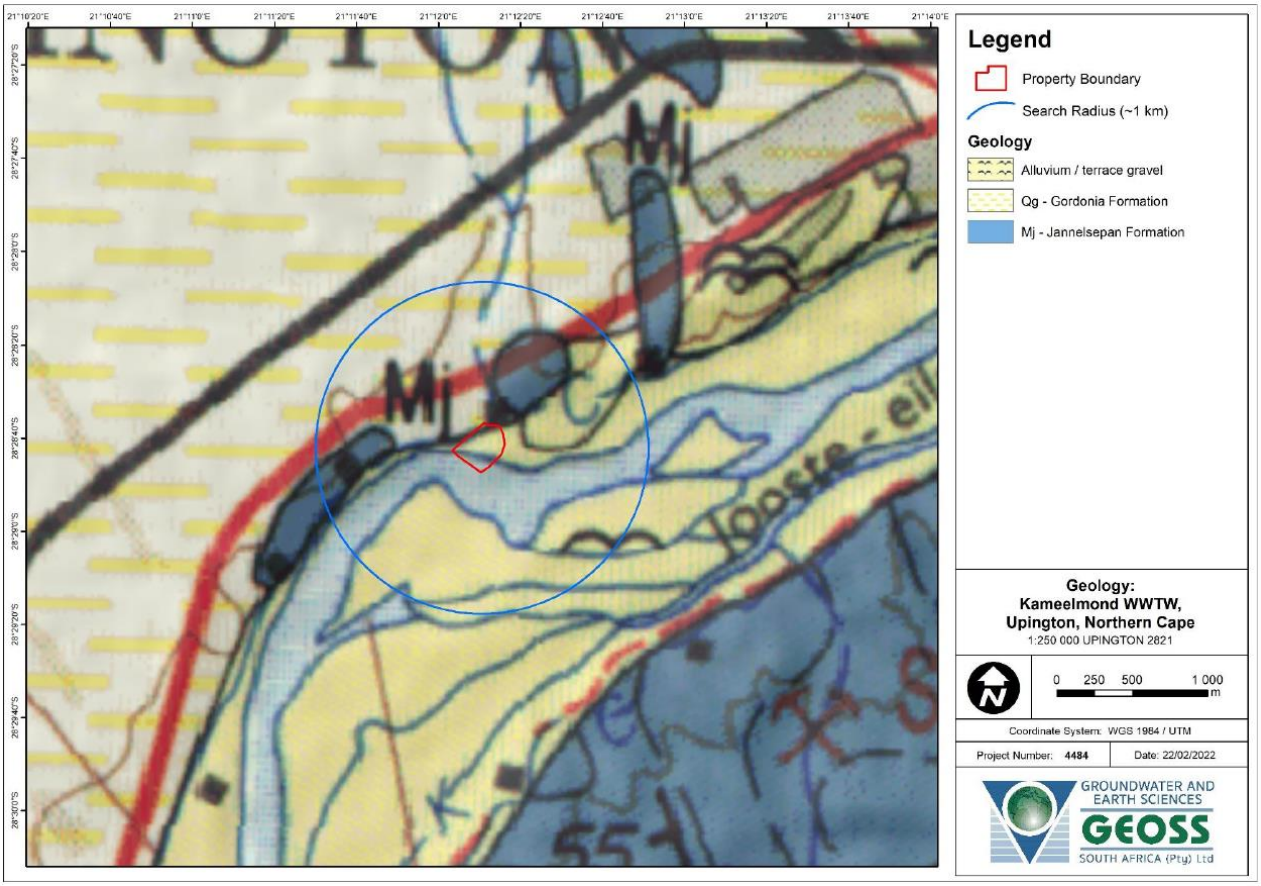

Figure 16: Geological setting of the area (2821 Upington, CGS 2012)

11.5 Hydrogeology

The information to follow was primarily obtained from the Groundwater Impact Assessment (van Staden, 2022). Refer to **Sections 12.6** and **13.10** below for a synopsis of the study and a related impact assessment, respectively. A copy of the specialist report is contained in **Appendix E4**.

The regional aquifer directly underlying the site was classified by the Department of Water Affairs and Forestry (DWAF) (2002) as a fractured aquifer with an average yield potential of 0.5 – 2.0 l/s. A fractured aquifer describes an aquifer where groundwater only occurs in narrow fractures within the bedrock. The groundwater quality for study area is classified as “marginal” (with respect to

drinking water standards) with an associated electrical conductivity (EC) of 70 – 300 mS/m (DWAF, 2002). Both these classifications are based on regional datasets, and therefore only provide a broad indication of conditions to be expected.

The national scale groundwater vulnerability map indicates that the site has a “medium to high” vulnerability to surface-based contaminants (Conrad and Munch, 2007) (refer to **Figure 17** below). This indicates that the likelihood of contaminants to move down to the aquifer is probable.

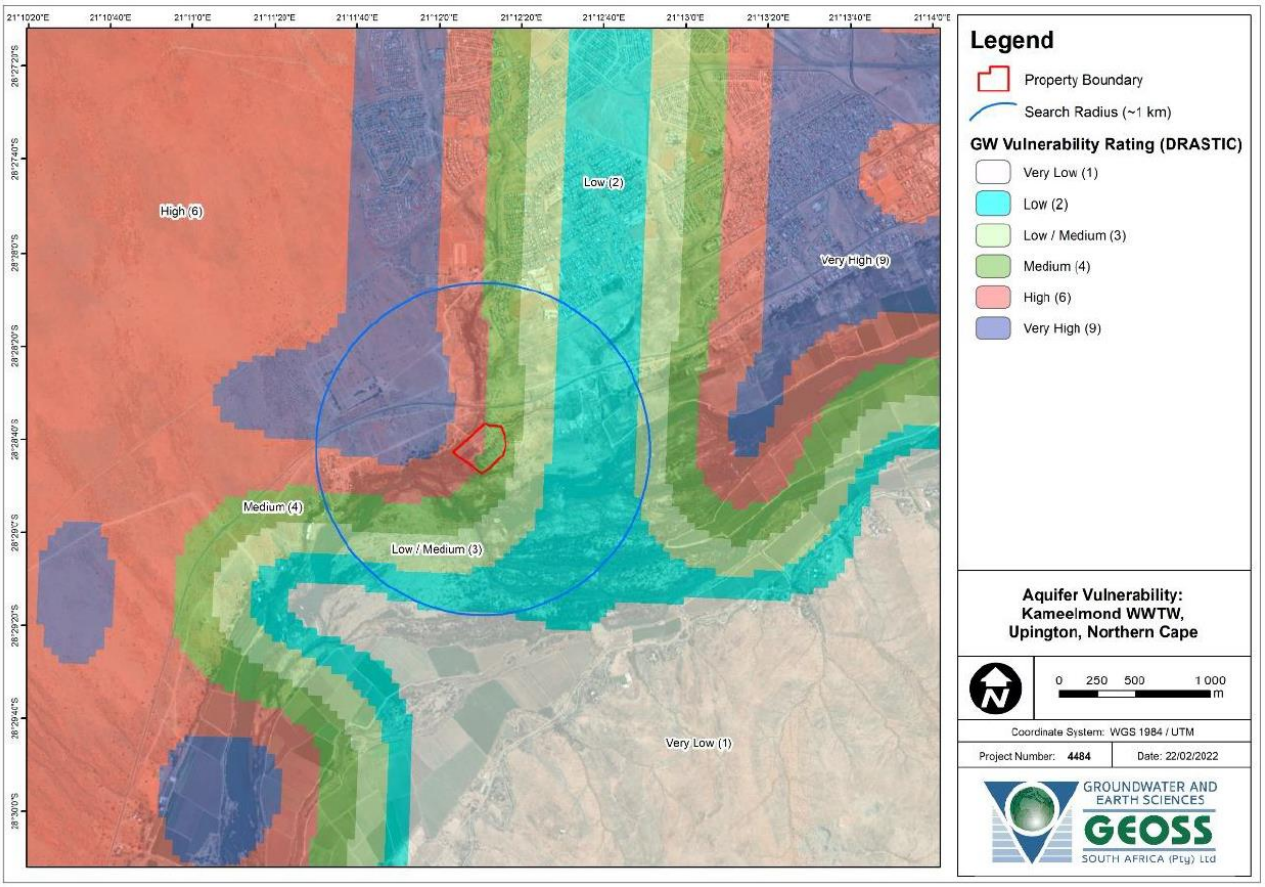

Figure 17: Regional groundwater vulnerability (Conrad and Munch, 2007)

11.6 Topography

Upington is 803 m above sea level, and the topography in the greater area can be described as large sandy plans with windblown sand dunes and low hills breaking the flat relief. In terms of the SOTER database, the landform encountered at the site is described as a valley at a medium level (see **Figure 18** below). The Orange River is a significant topographical feature, which is located to the south of the site.

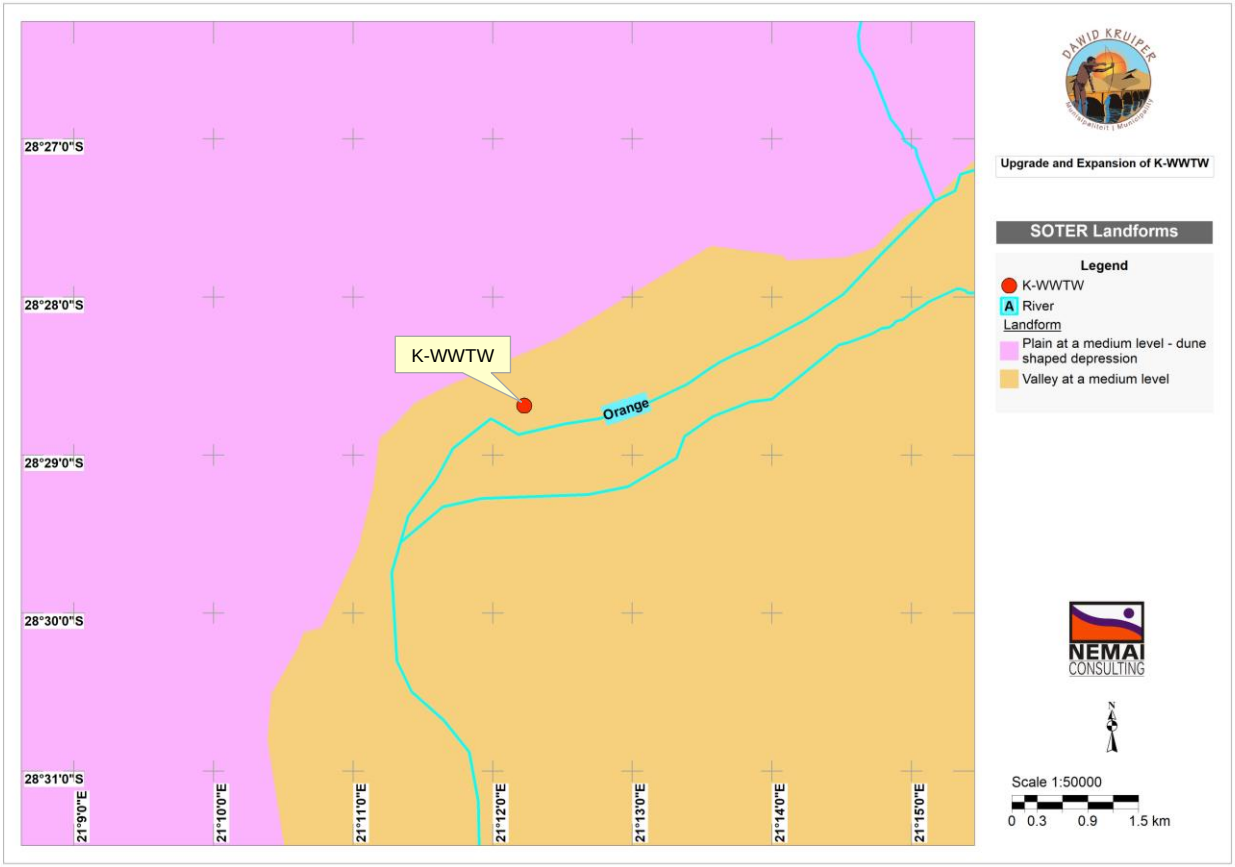

Figure 18: SOTER Landforms

The K-WWTW site predominantly slopes from east to west. The change in elevation from the most easterly point to the most westerly point is approximately 5 m (see **Figure 19** below).

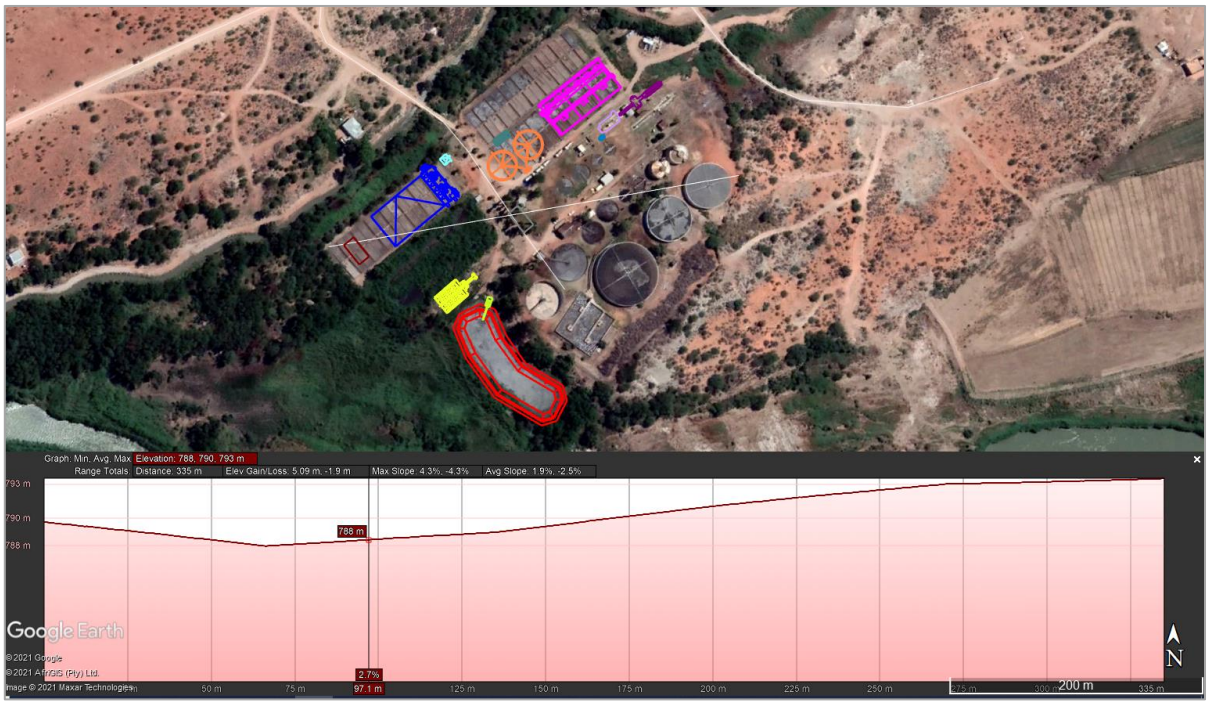

Figure 19: Elevation Profile (Google Earth Image)

11.7 Surface Water

The information to follow was primarily obtained from the Freshwater Assessment (Kindler, 2021). Refer to **Sections 12.3** and **13.13** below for a synopsis of the study and a related impact assessment, respectively. A copy of the specialist report is contained in **Appendix E1**.

11.7.1 Hydrological Setting

The watercourses associated with the Project are located in the D73F quaternary catchment, within the Orange Water Management Area (WMA 6) and the Nama Karoo - Lower ecoregion. The relevant Sub-Quaternary Reach (SQR) is the D73F-3032, which is a reach of the Orange River.

The footprint of the proposed Project is located within the existing perimeter fence of the K-WWTW, which is situated on the northern banks of the perennial Orange River with an unnamed non-perennial drainage system (hereafter referred to as the Orange tributary) running adjacent to the north-western perimeter fence (see **Figure 20** below).

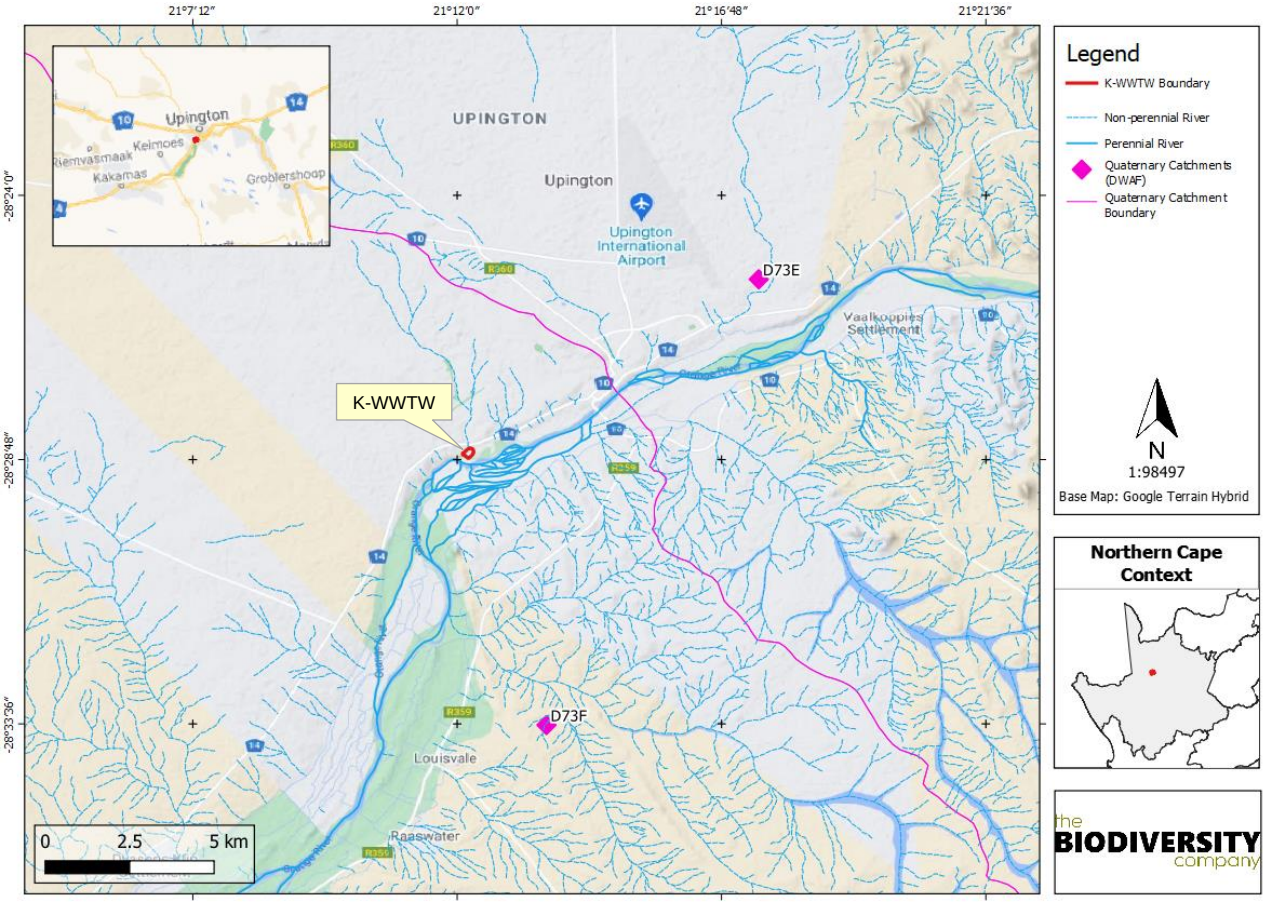

Figure 20: Watercourses in relation to the project area (Kindler, 2021)

The K-WWTW has a treated effluent discharge point on the Orange tributary which drains into the Orange River. The treated effluent discharge point is located approximately 4.5 kms downstream of the N14 highway bridge that traverses the Orange River in Upington.

The Orange River is extensively used for irrigation, with cultivated land occurring along its banks. The discharge of substandard and non-compliant effluent from the K-WWTW will adversely affect the river's aquatic health and its fitness for use for irrigation and other water uses. Addressing the quality of the work's effluent is one of the Project's key drivers.

11.7.2 National Freshwater Ecosystem Priority Area Status

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach for the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the NWA.

According to Nel *et al.* (2011), the Orange SQR D73F-3032 has a single allocated river FEPA which is listed as a Fish Support Area FEPA for *Enteromius anoplus* (Chubbyhead barb) (see **Figure 21** below). Conserving the ecological functioning within the project related SQR will aid in the protection of riverine and wetland habitat supporting fish species occurring within the entire catchment and water quality for the downstream aquatic and terrestrial biota. The SQR's in which human activities occur need to be managed to maintain water quality and prevent further degradation of downstream water resources in order to contribute to national biodiversity goals and support sustainable use of water resources.

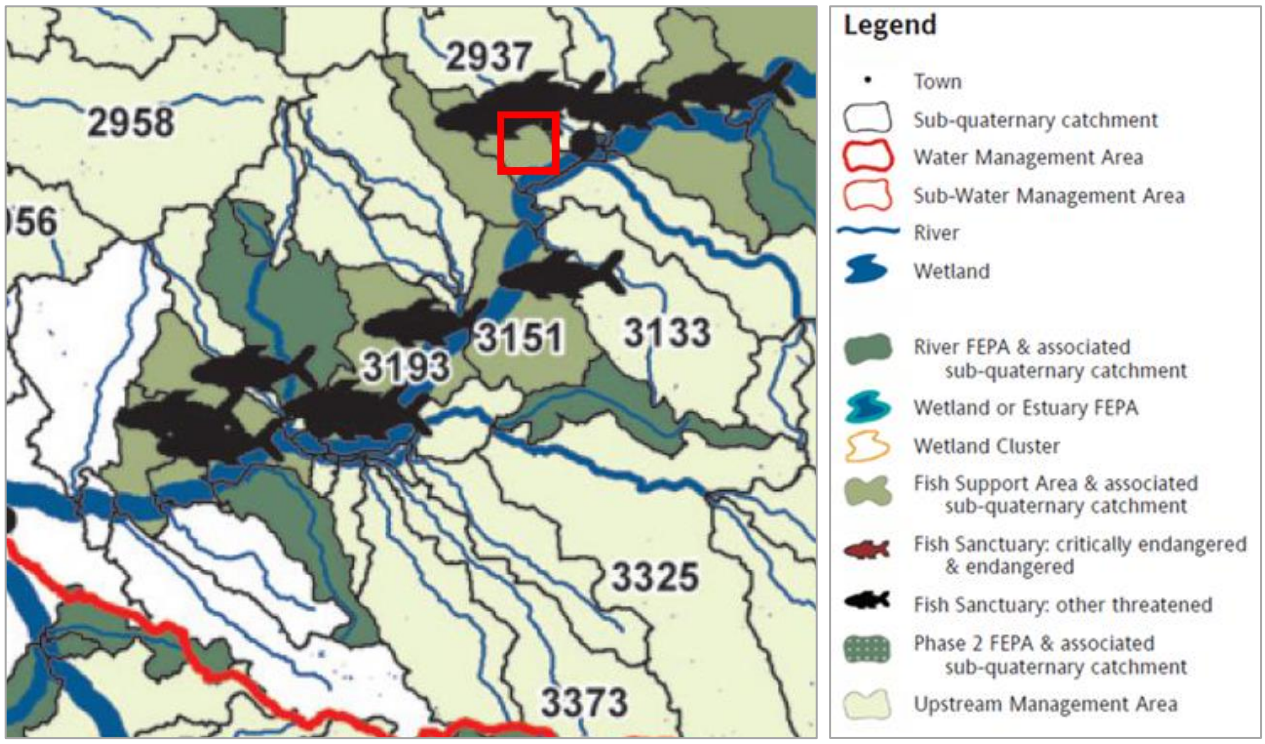

Figure 21: Illustration of NFEPAs within the project area (indicated by red square) (Kindler, 2021)

11.7.3 Desktop Present Ecological State

The Orange tributary reach has not been individually assessed in terms of the Present Ecological Status (PES) and falls within the Orange SQR. The desktop PES information for the Orange SQR is summarised in **Table 17** below. The desktop PES of the Orange catchment associated with the Project is a class D or largely modified. The confidence in this classification is moderate due to the length of the considered SQR which spans 15.82 km of the Orange River. The Ecological Importance and Ecological Sensitivity of the river reach was rated as moderate and high, respectively. The defined Default Ecological Category for the SQR was class B or largely natural.

The largely modified state of the reach is attributed to small to serious impacts to instream habitat, wetland and riparian zone continuity, flow modifications and large potential impacts on physico-chemical conditions (water quality). The factors influencing the current PES status for the catchment include irrigation, urban areas (Upington and surroundings), road crossing infrastructure, abstraction for dryland irrigation, indigenous vegetation removal, WWTW and runoff/effluent from industries and irrigation. Notably, physico-chemical (water quality) modifications within the SQR have been rated as large with effluent input from the K-WWTW and contaminated (pesticides and fertilizers) return water from the extensive agricultural activities within the riparian zones.

Table 17: Desktop data related to ecological condition and classification of reach(es) assessed (Kindler, 2021)

River Catchment	Orange
SQR	D73F-3032
Present Ecological Status	Largely Modified (class D)
Ecological Importance Class	Moderate
Ecological Sensitivity	High
Default Ecological Category (DWS, 2021)	Largely Natural (class B)
River Flow Type	Perennial

11.7.4 Freshwater Critical Biodiversity Area

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services.

According to the CapeNature, C.A.P.E. Fine-Scale Biodiversity Planning Project for the freshwater biodiversity assessment of the Northern Cape (SANBI, 2008), the Orange River and adjacent riparian areas were categorised as CBA 1 while the adjacent areas which includes the Orange tributary was categorised as CBA 2 (see **Figure 22** below).

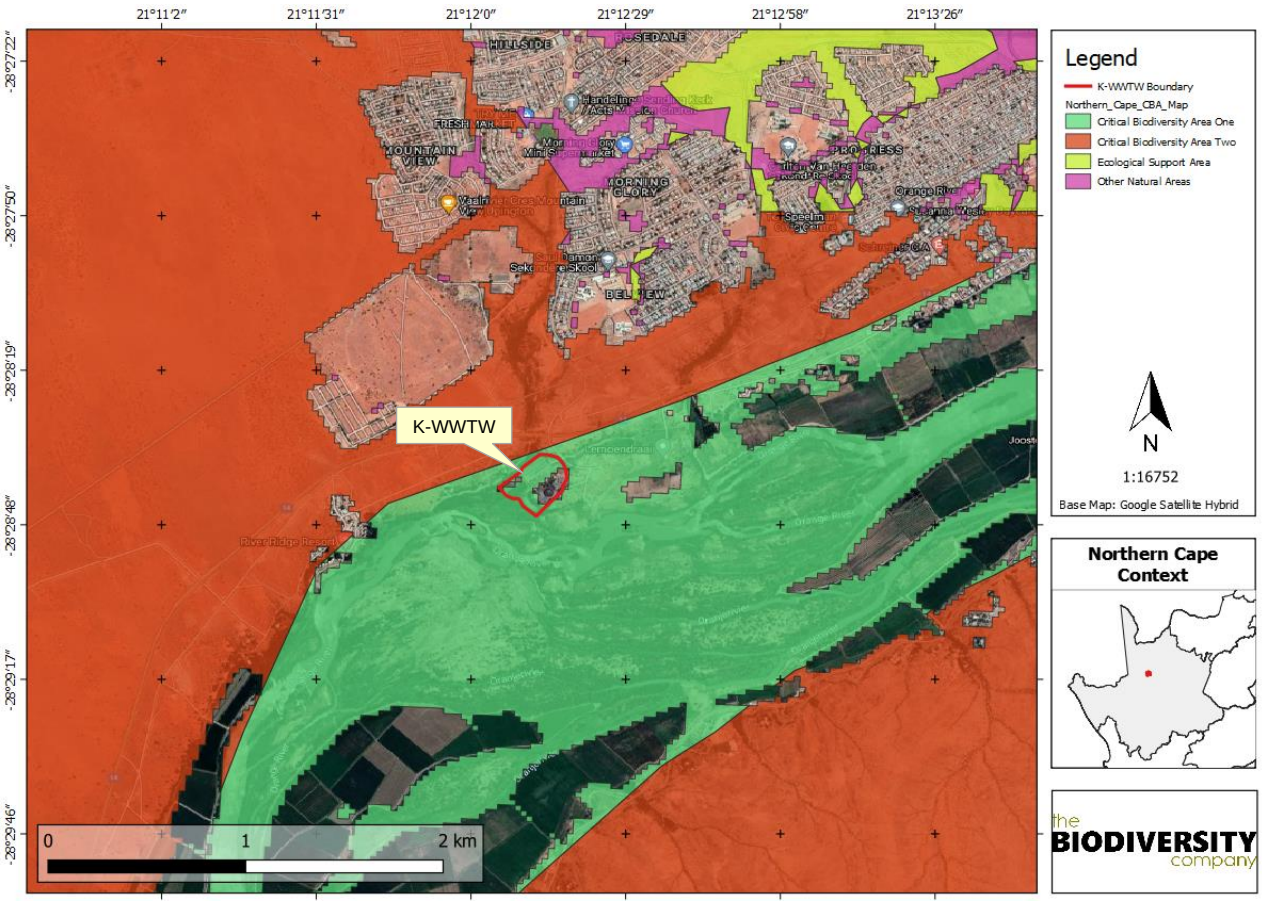

Figure 22: **Freshwater CBAs in relation to the project area (Kindler, 2021)**

11.8 Terrestrial Ecology

11.8.1 Biomes and Vegetation Types

According to Mucina and Rutherford (2018), the K-WWTW falls within the Azonal Vegetation Biome (see **Figure 23** below).

Based on the VEGMAP (2018) produced by the South African National Biodiversity Institute (SANBI), the vegetation type encountered at the site includes the Lower Gariep Alluvial Vegetation (see **Figure 24** below), which occurs within the riparian zone situated within the macro-channel banks and flood benches of the adjacent Orange River.

As mentioned, the areas earmarked for the Project components are degraded, as they occur within the K-WWTW site and most relate to existing structures and infrastructure that are intended to be upgraded and expanded. Refer to the photographs of the K-WWTW provided in **Figure 25** below. A Terrestrial Ecology Compliance Statement is provided in **Section 12.5** below.

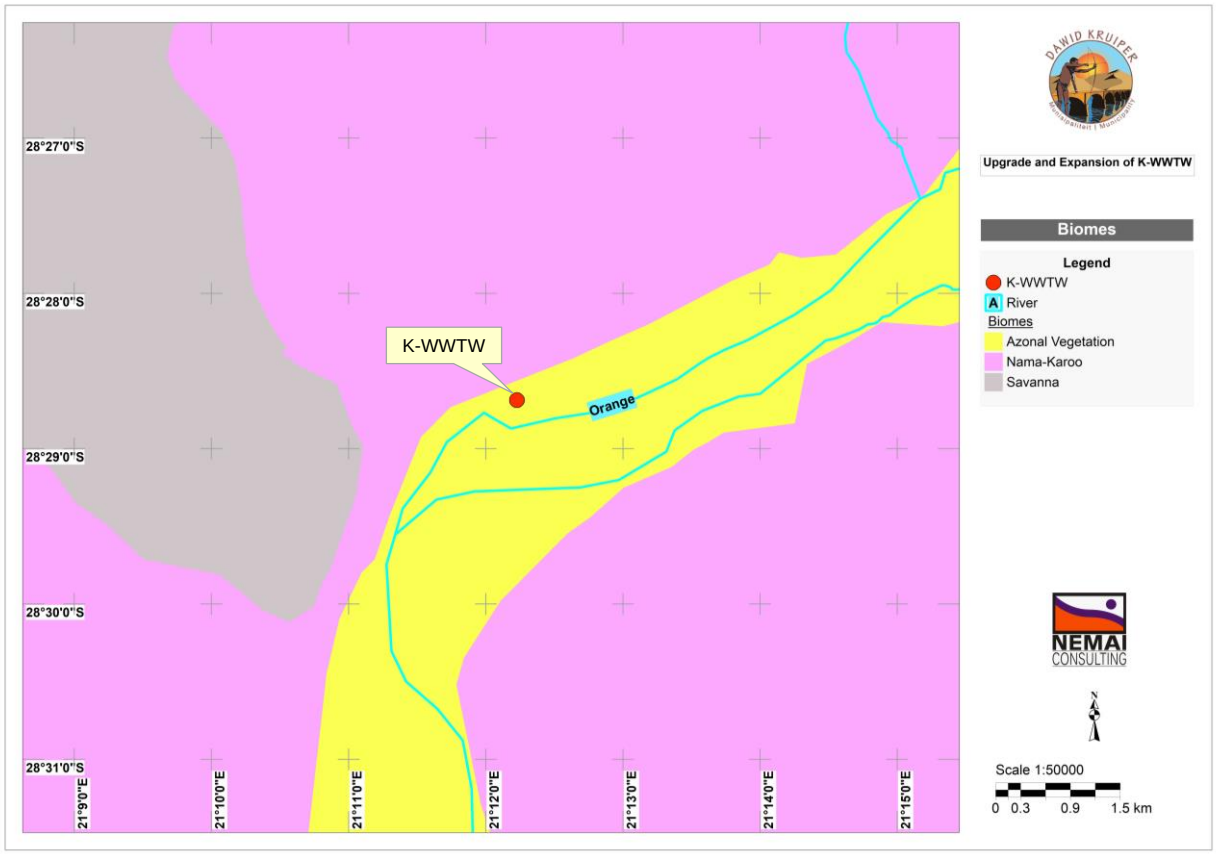

Figure 23: Biomes in relation to the K-WWTW

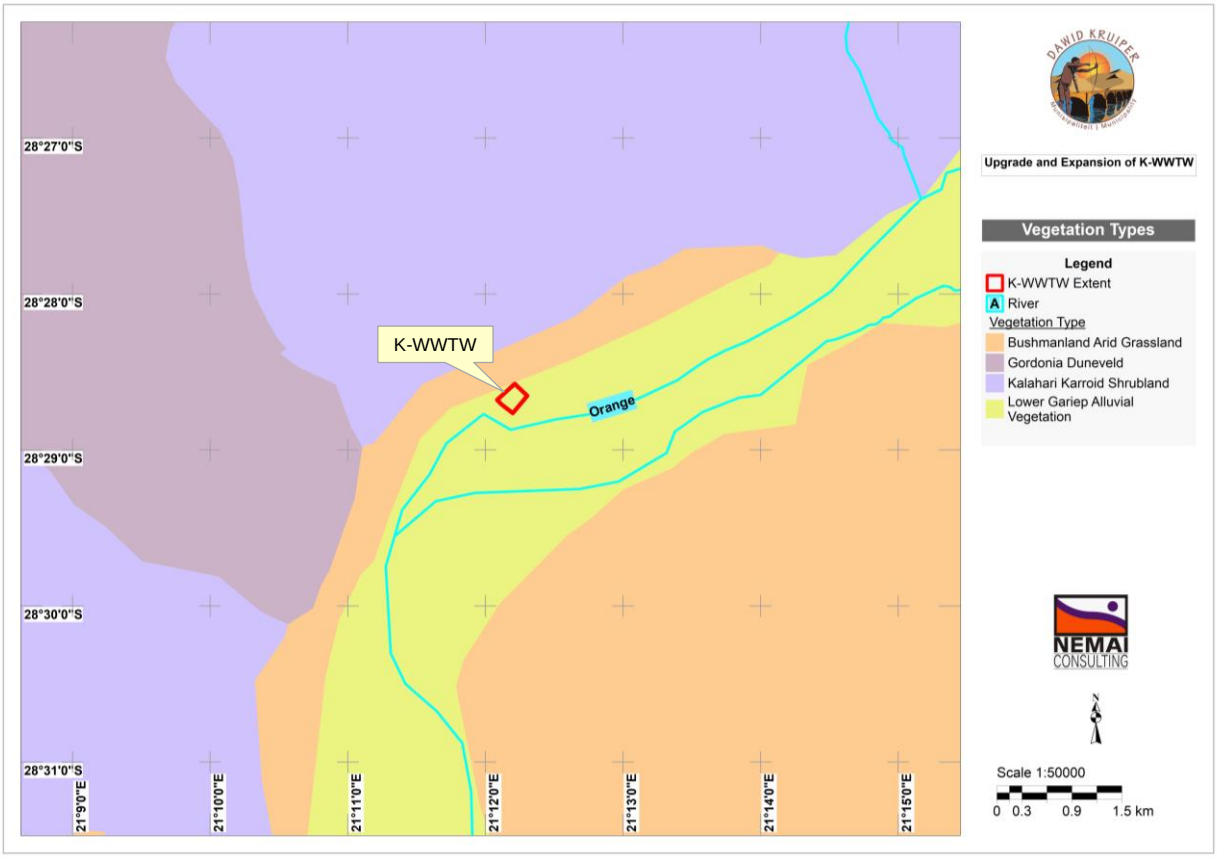

Figure 24: Vegetation types in relation to the K-WWTW

Figure 25: Photographs of the K-WWTW showing the degraded state of the vegetation

11.8.2 Protected Areas

As shown in **Figure 26** below, the nearest protected area to the site is the Augrabies Falls National Park, which is located approximately 78 km to the west.

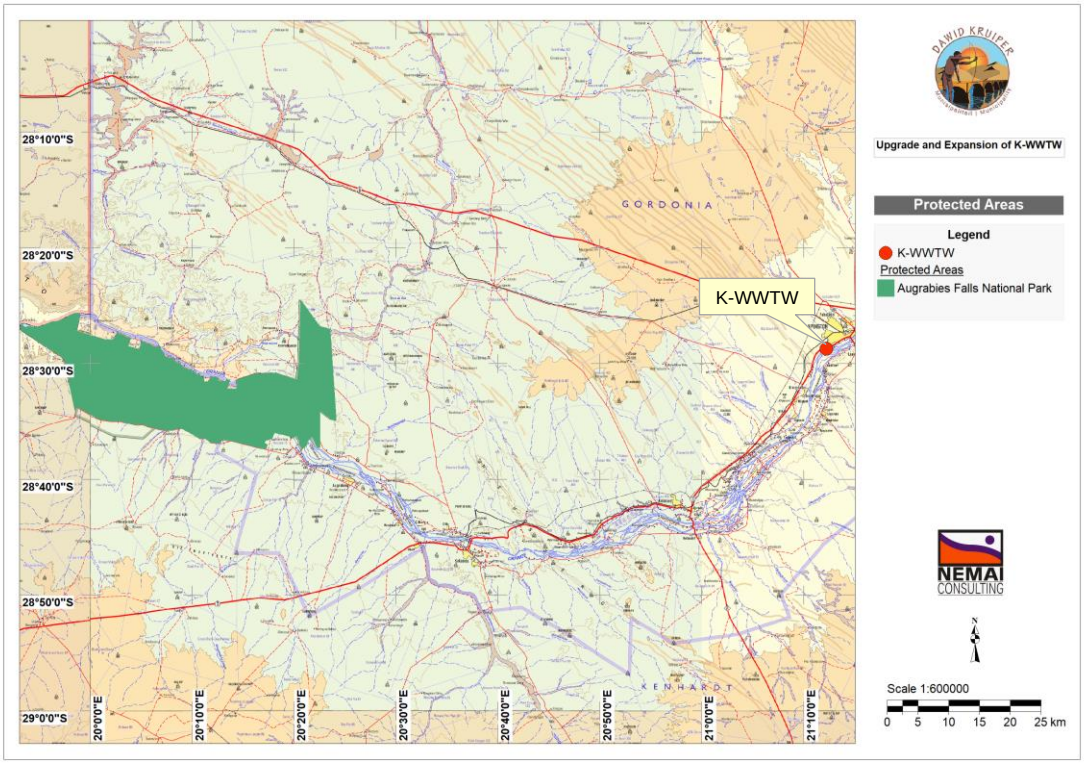

Figure 26: Protected areas in relation to the K-WWTW

11.8.3 Northern Cape Critical Biodiversity Areas Map

The Northern Cape Critical Biodiversity Areas (CBA) Map (Oosthuysen and Holness, 2016) identifies biodiversity priority areas, called CBAs and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species to ensure the long-term ecological functioning of the landscape as a whole.

The site encroaches into a CBA 1 area, as shown in **Figure 27** below. The areas where the waste management activities are proposed on the K-WWTW site have been transformed (refer to photographs of the K-WWTW provided in **Figure 25** above).

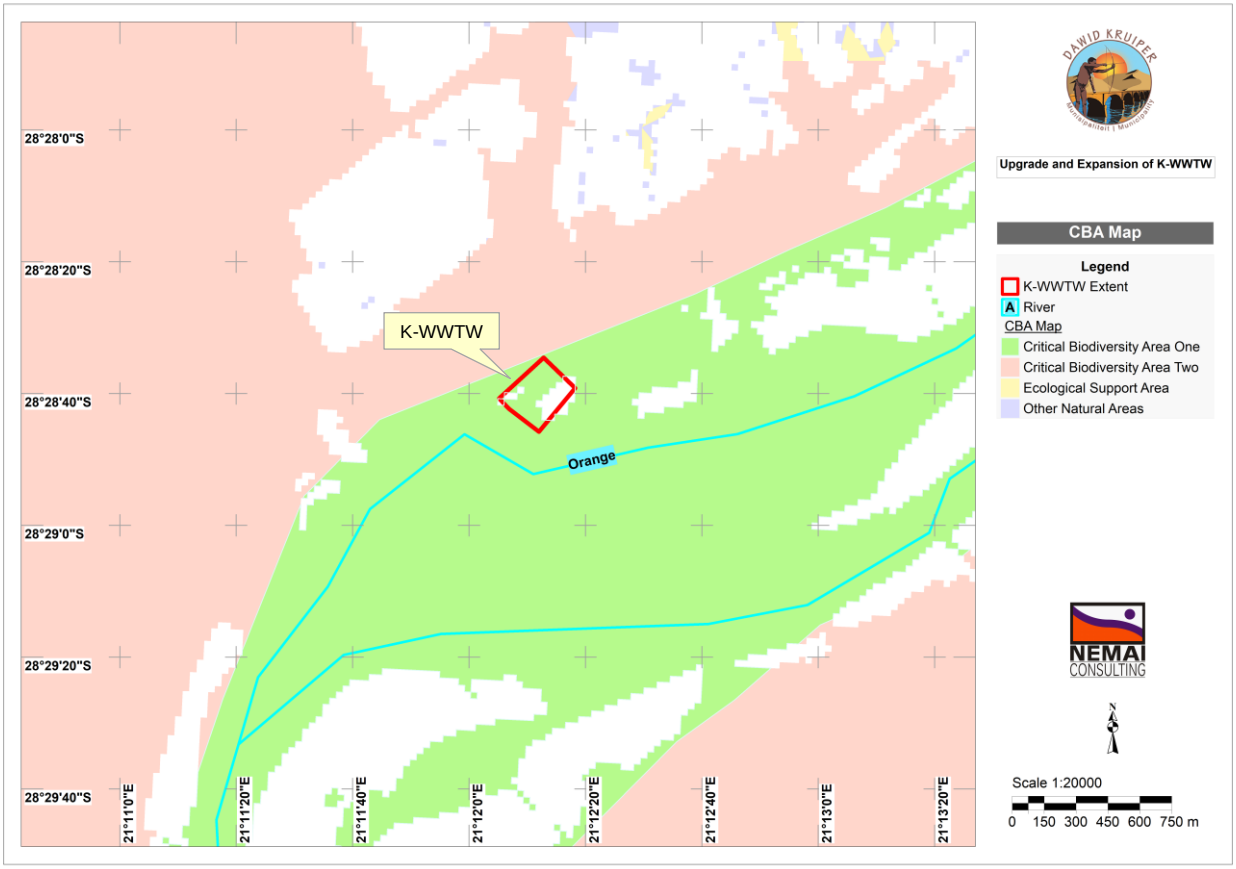

Figure 27: CBAs in relation to the K-WWTW

11.8.4 Environmental Management Framework

From an interpretation of the Siyanda District Municipality's EMF (Environomics, 2008), the site falls within the following demarcated areas:

- Environmental Control Zone 3 - potential high to very high vegetation conservation areas; and
- Geographical Area B - where activities may affect vegetation cover negatively that could lead to significant impacts on the environment.

The relevance of the Project site's location in terms of the above EMF areas, which relate to vegetation conservation and cover, needs to be interpreted within the transformed nature of the areas where the waste management activities are proposed within the K-WWTW.

The EMF notes that the Orange River is the most important element in the area in terms of natural and economic services that depend on it, and that it is a dynamic and complex system. This links to the Project's primary aim, which is to improve the quality of the K-WWTW's effluent that is discharged to the Orange River.

11.9 Socio-Economic Environment

The information to follow was primarily sourced from the IDP (DKM, 2020).

DKM is a Local (Category B) Municipality (NC087) located within the ZF Mcgawu District Municipality (DC8). The Municipality is approximately 344 446 ha in extent and straddles the Orange River. Upington is the main town of the DKM and it has a well-defined business centre with numerous residential areas, with a mixture of densifications present. Secondary activities in the municipality are mainly light industrial, warehousing, processing facilities and light engineering works.

Figure 28: Aerial view of Upington's central business district (https://commons.wikimedia.org/wiki/File:Upington.jpg)

Based on municipal statistics, the municipality's population was 107 162 in 2016. This reflects an overall population growth of 1.82% between 2011 up to 2016. The unemployment rate decreased significantly from 34% in 2001 to 22.1% in 2011. Although approximately 44.7% of the population is aged between 14 and 35 years old, the youth remains relatively marginalised. All municipal services except sewerage increased since 2001.

Figure 29 below shows residential areas surrounding the K-WWTW. The land surrounding the plant is vacant and rural in nature. The residential areas of Lemoendraai and Belview are located approximately 700 m and 580 m to the west and north of the site, respectively. Land used for commercial agriculture is encountered approximately 200 m to the east of the site.

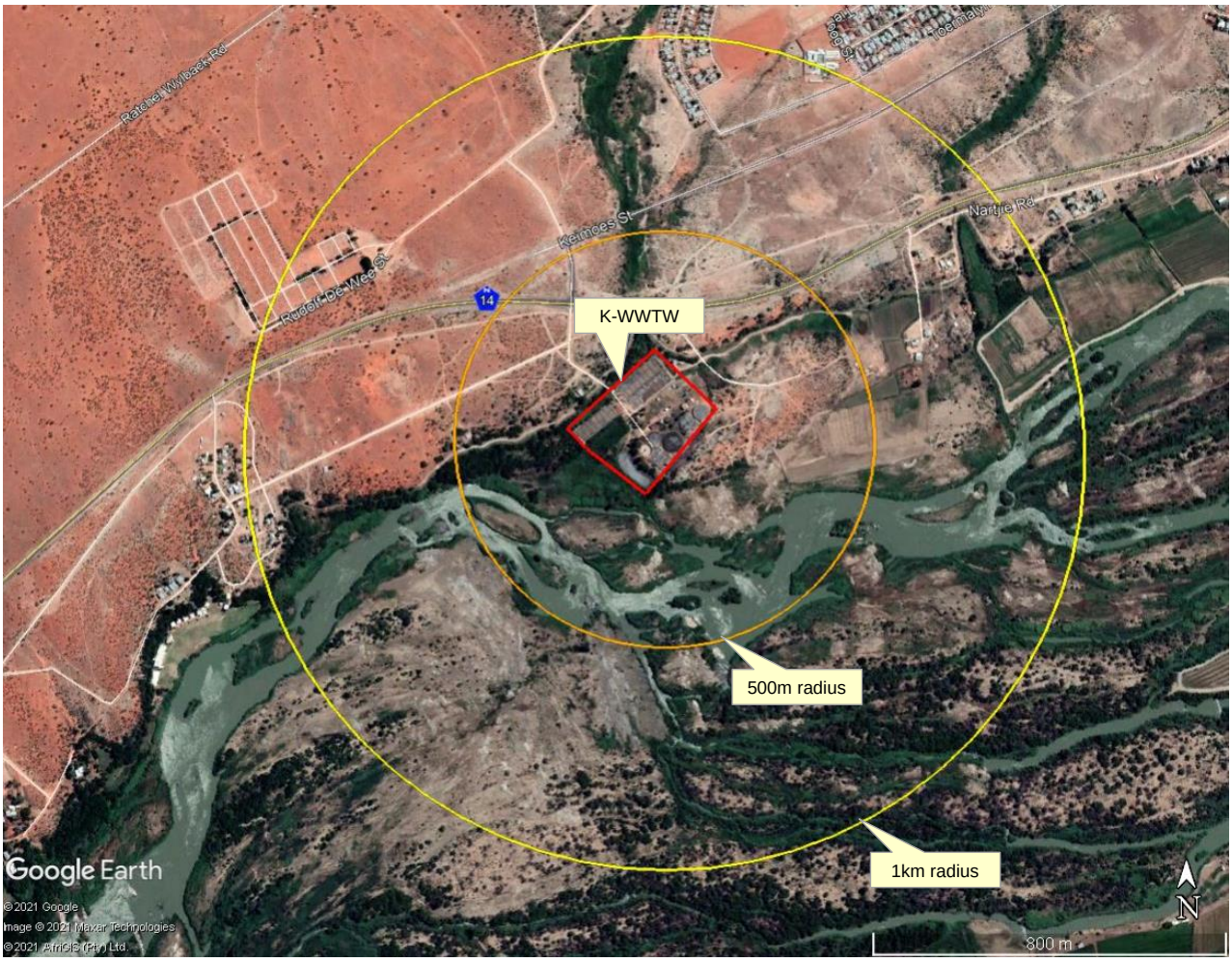

Figure 29: **Residential areas within a 500m radius (orange line) and 1km radius (yellow line) of the centre point of the K-WWTW (Google Earth image)**

11.10 Planning

The land on which the K-WWTW is situated is owned by the DKM. The municipal SDF of 2017 designates the area encompassed by the K-WWTW as a 'sewage plant' (see **Figure 30** below). The SDF further shows a 1000 m risk zone around the plant.

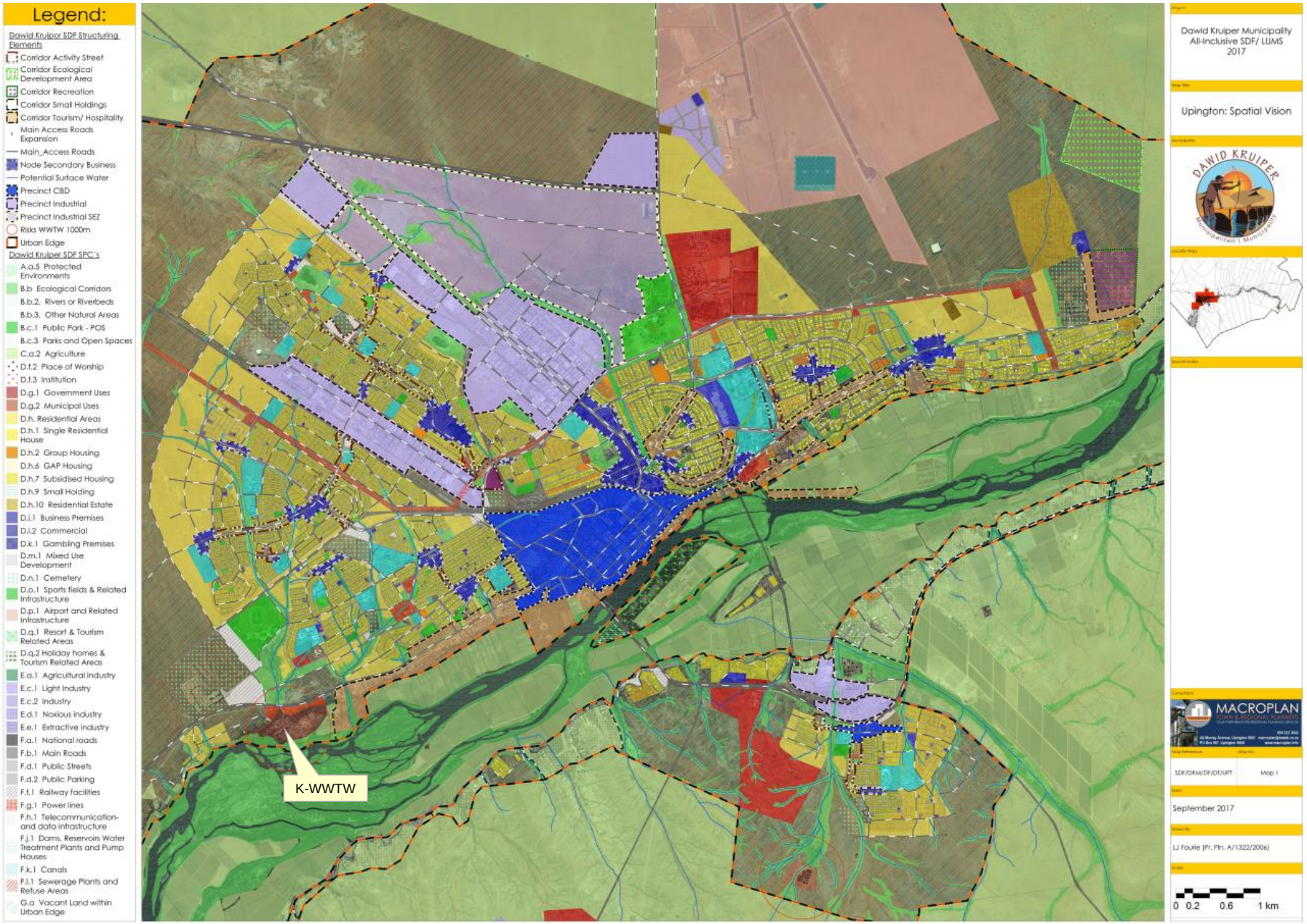

Figure 30: DKM's SDF (2017)

11.11 Transportation

The transportation network in the greater area is shown in **Figure 31** below.

Figure 31: Transportation network in the project area

The existing access road to the K-WWTW, which is a gravel road, is directly from the N14. A railway line runs approximately 1.2 km to the north of the plant. The Upington International Airport is located approximately 9 km to the north-west of the K-WWTW.

11.12 Visual Quality

The Project's footprint is within the existing K-WWTW. The area surrounding the plant is rural in nature and is afforded scenic value by the Orange River that flows to the immediate south. The K-WWTW is partially screened from the N14 and surrounding communities by vegetation and the terrain.

There are no anticipated impacts to visual quality or sense of place, as the proposed upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence, and the plant has been in existence since the 1970's.

11.13 Air quality

The land surrounding the K-WWTW is vacant and rural in nature. Potential sources of air pollution in the region include the following:

- Fugitive dust emissions from agricultural activities;
- Vehicle exhaust emissions from vehicles travelling on paved and unpaved roads, including on the N14, N10, R359 and other surrounding roads as well as on roads inside the town of Upington;
- Biomass burning (veld fires);
- Domestic fuel burning;
- Industrial operations in Upington;
- Waste treatment and disposal;
- Wastewater treatment and sludge disposal; and
- Other fugitive dust sources such as wind erosion from exposed areas.

11.14 Noise

In terms of the local acoustical environment, the background noise levels are expected to be typical of a rural area.

Noise in the greater area emanates primarily from farming operations (e.g. use of farming equipment), vehicles on the surrounding road network, human activities in surrounding settlements and trains passing on the railway.

11.15 Heritage

The information to follow was obtained from the Cultural Heritage Impact Assessment (van Schalkwyk, 2021) (contained in **Appendix E3**). Refer to **Sections 12.7** for a synopsis of the study.

11.15.1 Cultural Landscape

The cultural landscape qualities of the larger region essentially consist of two components. The first is a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial (farmer) component. The second component is an urban landscape dating to the colonial period and is linked to the rural colonial landscape.

From the official topographic map (see **Figure 32** below), dating to 1913, it can be seen that very little development existed in the larger region. Even years later, little development existed in the area, as is indicated on the various official aerial photographs (see **Figure 33** and **Figure 34** below). The 1971 version of the 1:50 000 topographic map (see **Figure 35** below) shows a number of structures located along the canal on the righthand bank of the river. No traces of these structures could be found during the site visit and it is accepted that they were demolished during the construction of the WWTW plant. The first time the WWTW is indicated on any image is the 1976 aerial photograph (see **Figure 36** below). Later images, dating to 2004 and 2021 shows that the layout has remained basically the same. Even in the surrounding area, development is very limited.

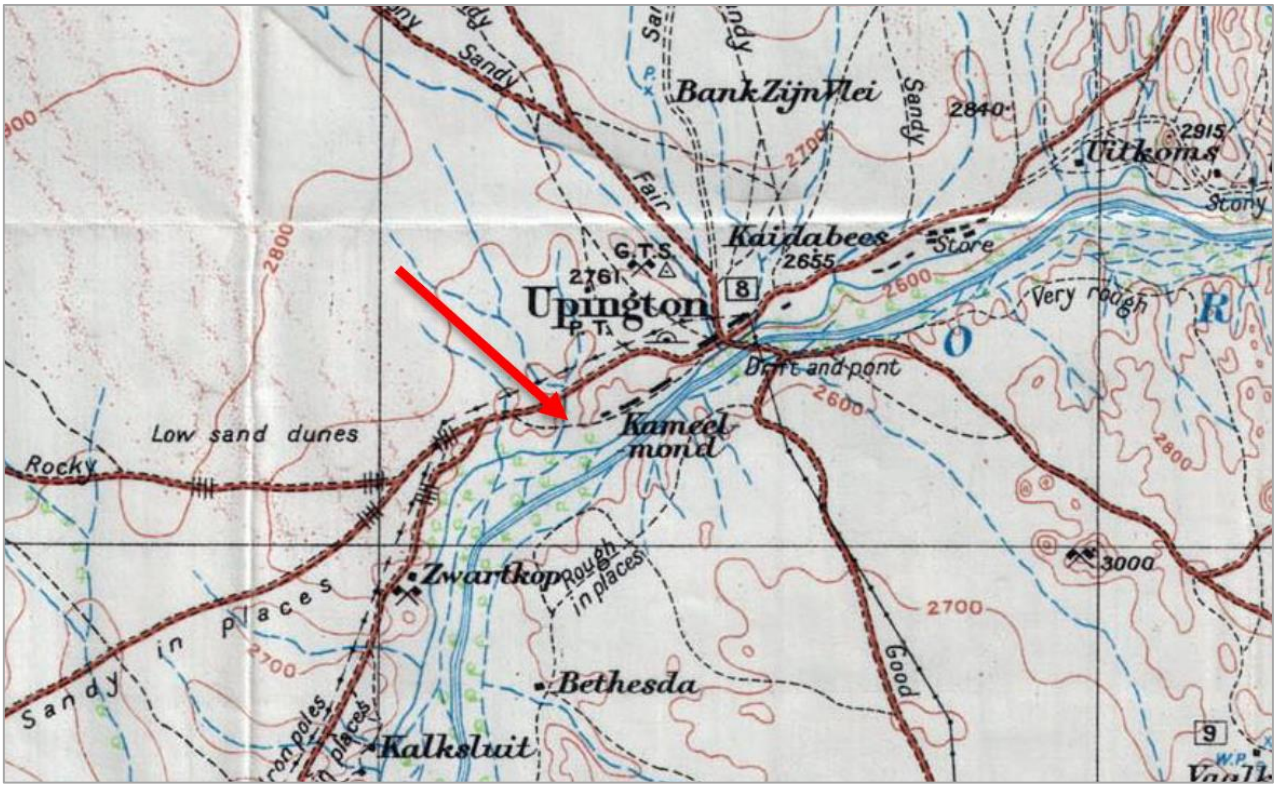

Figure 32: Section of the 1:250 000 topographic map dating to 1913 (Map: Cape of Good Hope: Upington (South-HD34/D)) (van Schalkwyk, 2021)

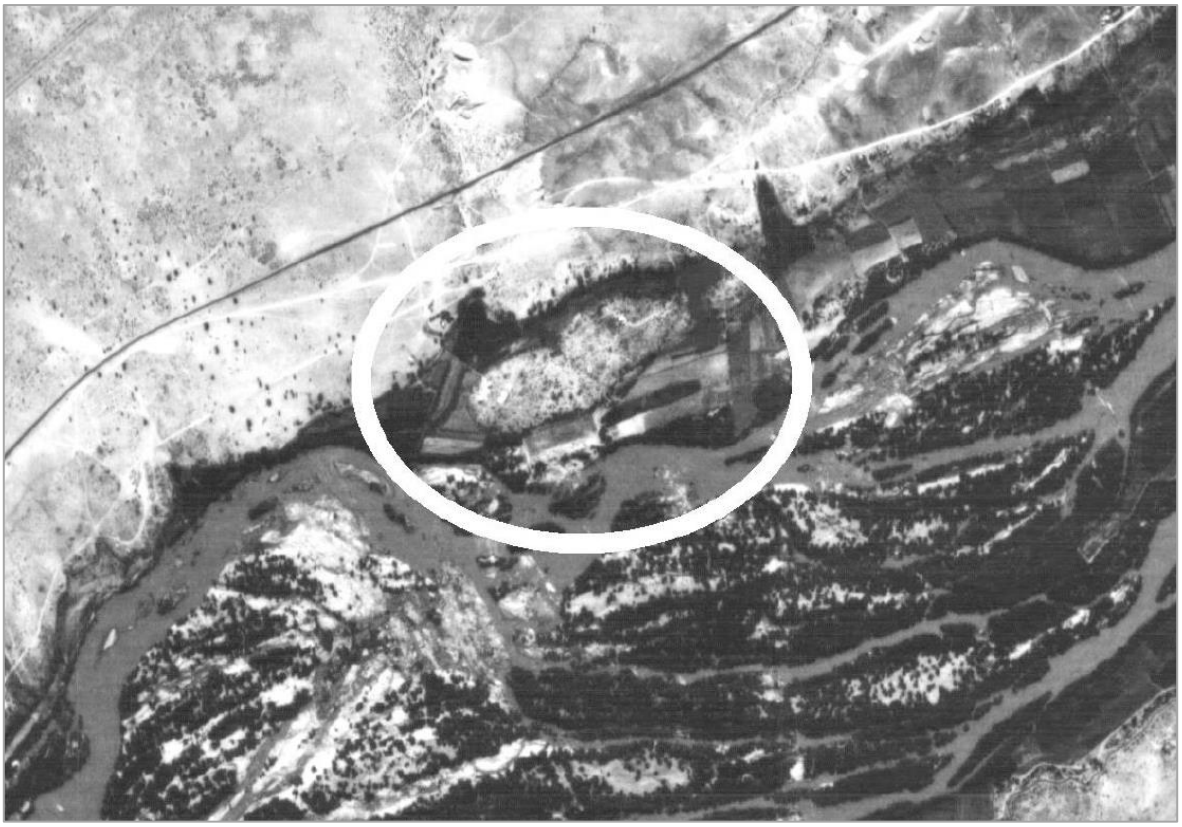

Figure 33: Aerial view of the project region dating to 1957 (CS-G photograph: 388_013_06805) (van Schalkwyk, 2021)

Figure 34: Aerial view of the project area dating to 1967 (CS-G photograph: 589_006_00882) (van Schalkwyk, 2021)

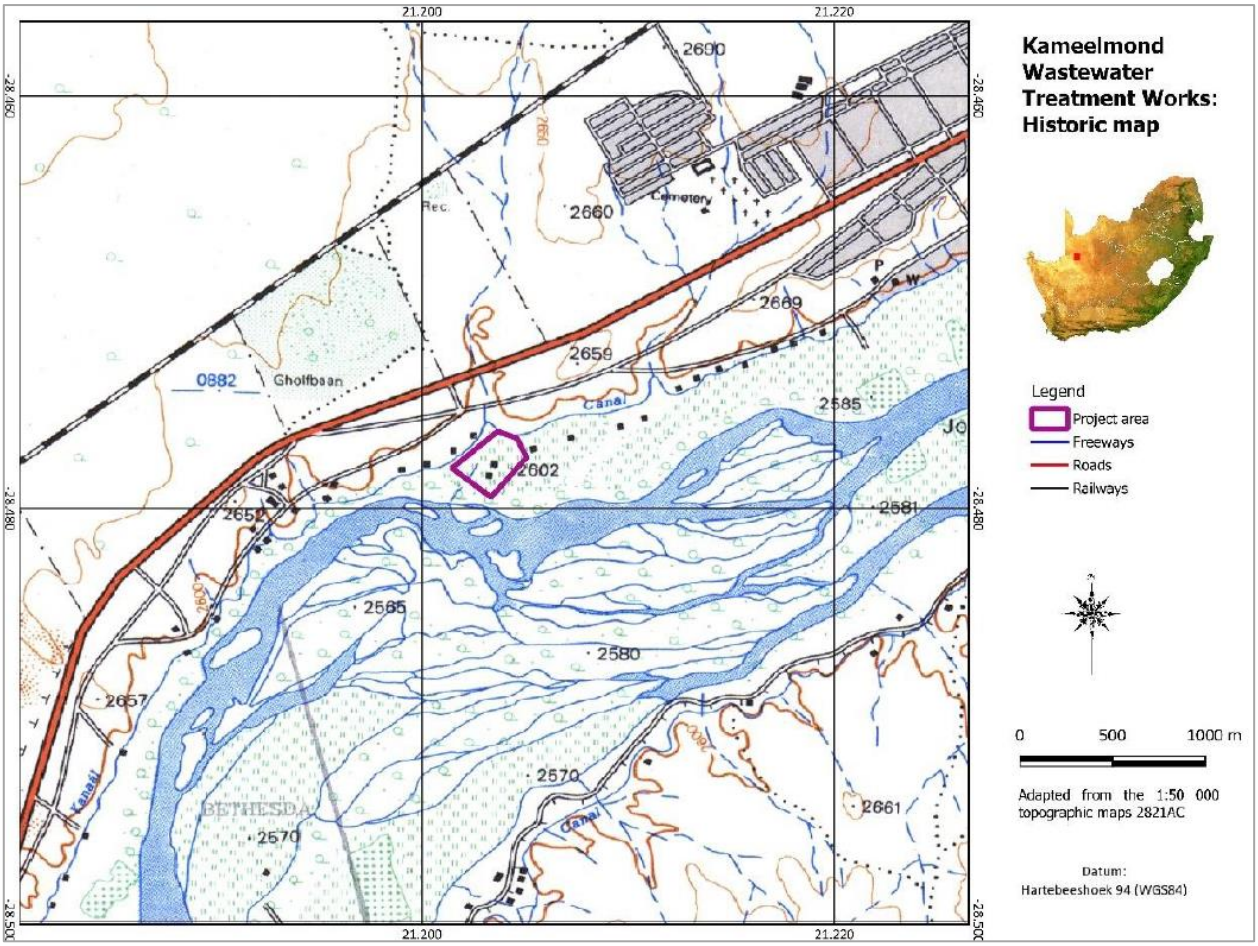

Figure 35: **Project area on 1973 version of the 1:50 000 topographic map (van Schalkwyk, 2021)**

Figure 36: **Aerial view of the project area dating to 1976 (CS-G photograph: 771_006_01690) (van Schalkwyk, 2021)**

11.15.2 Palaeontology

The site is underlain by red-brown, wind-blown sand and dunes of the Kalahari Group (Gordonia Formation). Underlying these rocks are rocks of the Precambrian Transvaal Supergroup. The Cenozoic Kalahari Group is the most widespread body of terrestrial sediments in southern Africa and range in thickness from a few metres to more than 180m (Partridge *et al*., 2006). The youngest formation of the Kalahari group is the Gordonia Formation which is generally termed Kalahari sand and comprises of red aeolian sands that covers most of the Kalahari Group sediments. The pan sediments of the area originated from the Gordonia Formation and contains white to brown fine-grained silts, sands, and clays. Some of the pans consist of clayey material mixed with evaporates that shows seasonal effects of shallow saline groundwaters. Quaternary alluvium, aolian sands, surface limestone, silcrete, and terrace gravels are also included in the Kalahari Group (Kent, 1980). Partridge *et al*., (2006) describes numerous types of superficial deposits of Late Caenozoic (Miocene to Pliocene to Recent) age throughout the Karoo Basin. Radiometric dating could thus far not establish a precise boundary between the Quaternary and Tertiary (Kent, 1980).

According to Butler (pers. comm., 2021), the fossil assemblages of the Kalahari are generally low in diversity and occur over a wide range and thus the palaeontological diversity of this Group is low (SAHRIS website). These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods, and trace fossils. The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect’s burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter.

As mentioned, the areas earmarked for the Project components are degraded, as they occur within the K-WWTW site and most relate to existing structures and infrastructure that are intended to be upgraded and expanded.

11.16 Health

According to the IDP (DKM, 2020), the municipality has two hospitals (one public and one private hospital), two Community Healthcare Centres, six Fixed Primary Healthcare Clinics, and five Satellite Healthcare Clinics.

12 SUMMARY OF SPECIALIST STUDIES

12.1 Specialist Studies undertaken as part of the EIA

A crucial element of the Plan of Study for the EIA prepared during the Scoping phase was to provide the Terms of Reference for the requisite specialist studies triggered during Scoping. According to Münster (2005), a 'trigger' is "*a particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an issue and/or potentially significant impact associated with that proposed development that may require specialist input*". The requisite specialist studies 'triggered' by the findings of the Scoping process, aimed at addressing the key issues and compliance with legal obligations, include:

1. Freshwater Assessment (refer to **Section 12.3** below);
2. Phase 1 Cultural Heritage Impact Assessment (refer to **Section 12.4** below);
3. Terrestrial Ecology Compliance Statement (refer to **Section 12.5** below); and
4. Groundwater Impact Assessment (refer to **Section 12.6** below).

12.2 Incorporating the Findings from Specialist Studies

The *Guideline for the review of specialist input in EIA processes* (Keatimilwe & Ashton, 2005) was used for including the findings of the specialist studies into the EIA Report. Key considerations included the following:

- Ensuring that the specialists have adequately addressed I&APs' issues and specific requirements prescribed by environmental authorities;
- Ensuring that the specialists' input is relevant, appropriate and unambiguous; and
- Verifying that information regarding the receiving ecological, social and economic environment has been accurately reflected and considered.

The information obtained from the respective specialist studies was incorporated into the EIA Report in the following manner:

1. The assumptions and limitations identified in each study were included in **Section 7** above;
2. The information was used to complete the description of the receiving environment (**Section 11**) in a more detailed and site-specific manner;
3. A summary of each specialist study is contained in the sub-sections to follow (**Sections 12.3 – 12.5** below), focusing on the approach to each study, key findings and conclusions drawn;
4. The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment contained in **Section 13** below;
5. Specialist input was obtained to address comments made by I&APs that related to specific environmental features pertaining to each specialist discipline; and

6. Salient recommendations made by the specialists were taken forward to the final EIA Conclusions (**Section 16**).

12.3 Freshwater Assessment

A summary of the Freshwater Assessment (Kindler, 2021) (contained in **Appendix E1**) follows.

12.3.1 Details of the Specialist

The details of the specialist that undertook the Freshwater Assessment follow.

Organisation:	The Biodiversity Company
Name:	D. Kindler
Qualifications:	MSc Aquatic Health
Affiliation (if applicable):	South African Council for Natural Scientific Professions (SACNASP) Professional Natural Scientist (Registration No.: 114743)

12.3.2 Objectives of the Study

The following tasks were completed in fulfilment of the terms of reference for this study:

- Review existing desktop information and literature (where available);
- Determine the PES and Environmental Importance and Sensitivity (EIS) of local watercourses;
- Undertake an impact assessment for the proposed activities; and
- Prescribe mitigation measures provide and recommendations for the identified risks.

12.3.3 Methodology

The methods applied during the study are listed in **Table 18** below.

Table 18: Methods applied during the Freshwater Assessment (Kindler, 2021)

Aspect	Analyses
Water Quality	*In situ*
Habitat	▪ Intermediate Habitat Integrity Assessment ▪ Biotope assessment
Biotic indices	▪ South African Scoring System version 5 (SASS5) ▪ The Average Score Per Taxon (ASPT) ▪ Macroinvertebrate Response Assessment Index (MIRAI) ▪ Qualitative Fish Assessment

Two sites (Up and Down) were assessed on the Orange River, while a single site (Discharge) was assessed at the discharge point of treated effluent within the K-WWTW facility (refer to photographs of the sampling sites in **Table 19** below). A single riverine survey was conducted of the watercourses associated with the Project. The survey was conducted in April 2021, which constitutes a high flow / wet season assessment.

Table 19: Photographs and GPS coordinates for the sites sampled (Kindler, 2021)

Site	Upstream	Downstream
Up		
GPS	28°28'47.34"S; 21°12'23.92"E	
Down		
GPS	28°28'45.39"S; 21°11'55.90"E	
Discharge		
GPS	28°28'42.75"S; 21°12'9.16"E	

12.3.4 Key Findings of the Study

12.3.4.1 Desktop Analysis

The findings of the desktop analysis are summarised in **Table 20** below. A description of the surface water features in the Project area is also contained in **Section 11.7** above.

Table 20: Desktop spatial features considered for the study (Kindler, 2021)

Desktop Information Considered	Relevance
NFEPA Rivers	Single river FEPA feature within the 500 m regulated area surrounding the Project area: Fish Support Area FEPA for *Enteromius anoplus* (Chubbyhead barb).
SQR	Located in quaternary reach D73F and SQR 3032 (Orange).
Strategic Water Source Areas	The Project area is not located within or near any Strategic Water Source Area.
Conservation Plan Aquatic	The Project area overlaps with the following aquatic features: River NFEPA: Fish Support Area, CBA 1 with adjacent CBA 2.
Ecosystem Threat Status	The Project area is situated within river ecosystems that were not assessed for Ecosystem Threat Status.
Ecosystem Protection Level	The Project area is situated within river ecosystems that were not assessed for Ecosystem Protection Level.

12.3.4.2 Aquatic Ecology Assessment

The *in situ* water quality results indicated modified water quality conditions within the Orange River system. Despite an influx of dissolved solids from catchment related land use, the water within the Orange River at Up and Down would not present chronic conditions to local aquatic biota. The Discharge did however have elevated dissolved solid levels of 1534 µS/cm and a lower pH when compared to the Orange River water with a slight reduction in pH and increase in dissolved solids at the downstream site. The large volume of Orange River water is expected to dilute the discharged treated effluent with greater dilution expected in a downstream direction. This was reflected at the downstream site. Influence is expected to be greatest at the confluence of the discharged treated effluent and the Orange River, where water conditions are expected to limit the diversity and abundances of sensitive taxa at this point, with a lesser influence on sensitive taxa in a downstream direction. This is subject to the quality and volume of the treated effluent being discharged. This highlights the importance of maintaining water quality guidelines for both treated wastewater and aquatic ecosystems, that they jointly maintain local biotic communities and ensure the survival of sensitive aquatic biota.

The instream and riparian habitat integrity of the Orange River were classed as moderately modified (class C) and largely modified (class D), respectively. Modifications to the river were attributed to catchment related land use associated with residential and agricultural activities which have altered surface flow, and the river bed, channel and flow characteristics from natural conditions, negatively influencing instream water quality and water quantity. These perturbations have cumulatively reduced the overall instream habitat and riparian integrity of the Orange River.

According to the sampled macroinvertebrate community, the biotic integrity within the reach during the high flow survey was largely modified (class C/D). The MIRAI results indicated modified ecological drivers related to water quality impairment, followed by flow and habitat modification within the reach. The macroinvertebrate community was dominated by tolerant taxa, with a moderately low diversity of moderately sensitive taxa sampled in the reach, which is indicative of water quality impacts associated with altered land use within the catchment. The instream habitat diversity although adequate for aquatic biota at both sites was considered modified through catchment influence and exotic grass carp that are known to reduce the vegetation abundance and diversity within a system. Many of the taxa with a preference for vegetation were absent from the sampled communities. Cumulatively, the modified water quality, flow and habitat drivers have resulted in the modified macroinvertebrate community.

The fish community was considered largely modified, with six of the twelve expected indigenous and an additional exotic fish species collected in the Orange River, of which none were of conservational concern. The sampled species are moderately tolerant of water quality and habitat modifications and a similar community structure was sampled at both sites. The presence of a wide diversity of habitat characteristics and flow classes was present at both sites which was deemed suitable to sustain majority of the expected Orange River fish community, which includes the Threatened *Labeobarbus kimberleyensis* (Largemouth Yellowfish), which is of conservational concern. The survey results likely underestimated the biological community due to deep waters that were inaccessible on-foot. It is likely that the remaining expected fish species will be recorded with additional sampling effort.

The Orange River reach has undergone modification, notably from a combination of long term treated effluent discharges from the K-WWTW and urban and agricultural influence within the catchment surrounding the Project area. Despite modification, the reach maintains sensitivity to further modification as was indicated by the presence of aquatic biota within the reach, albeit a low diversity of biota. This highlights the need to ensure preservation of the reach and associated aquatic biota recorded within the Project area, with a goal of improvement of the biotic integrity.

Conditions within the Project area should not deteriorate from current levels. Ideally the ecological category should be improved upon to promote a higher level of biotic integrity within the associated watercourse through responsible management of the system and associated catchment.

The sensitivity map produced as part of the Freshwater Assessment is shown in **Figure 37** below.

Figure 37: **Water resource sensitivity map (Kindler, 2021)**

The non-perennial drainage line (Orange tributary) was based on DWS river shapefiles and was dry at the time of the survey. Access to this system was limited by dense alien vegetation that has overgrown the access gate located near the Chlorine contact tank. The specialist created a potential flow path of this drainage line, which is also shown in **Figure 37** above. The reedbed in the south-western area associated with the discharge area is comprised of *Phragmites sp*. and falls within the riparian area associated with the Orange River.

12.3.5 Impact Assessment

Refer to **Section 13.13** below for the results from the impact assessment from the Freshwater Assessment.

12.3.6 Conclusions

Under the current layout, the Orange River is subject to risk from the Project. Of the various risks / impacts identified for the Project the most noteworthy residual (post-mitigation) ratings include two Moderate impacts. The Moderate (post-mitigation) rating assigned to the input of treated effluent into the Orange River considered both current capacity and proposed discharge volumes and the associated habitat and biotic effects related to changes to the current hydrological regime and water quality conditions, which cumulatively scored a High pre-mitigation rating. The reason for the elevated impact rating can be attributed to the presence, within the Project area, of fish species (*Labeobarbus kimberleyensis*) red listed as Threatened that have declining populations directly associated with water quality impairment. The associated increase in discharge volumes was assigned a Moderate (post-mitigation) rating as this activity represents a direct and unavoidable impact to the receiving watercourse for which mitigation is limited, hence its residual rating of Moderate. Both aforementioned post-mitigation Moderate activities are for the operation phase with impacts expected for the life of the Project, which pushed up their overall rating.

Given that the Project will remain within existing areas of disturbance with existing infrastructure to be upgraded and expanded, the remainder of the construction and operational impacts to the water resources ranged from Low to Moderate prior to mitigation. The significance of the Moderate impacts is reduced to Low post mitigation implementation.

If the Project is to proceed the Orange River will be subjected to changes to the current hydrological regime and water quality conditions with subsequent habitat and biotic community alterations expected. This is considered unavoidable, and mitigation associated with the treated effluent discharges is limited. The Project therefore warrants a full water use authorisation application process and must adhere to the stipulations or directives that may arise consequently.

12.4 Phase 1 Cultural Heritage Impact Assessment

A summary of the Phase 1 Cultural Heritage Impact Assessment (van Schalkwyk, 2021) (contained in **Appendix E3**) follows.

12.4.1 Details of the Specialist

The details of the specialist that undertook the Phase 1 Cultural Heritage Impact Assessment follow.

Name:	J. van Schalkwyk
Qualifications:	D Litt et Phil
Affiliation (if applicable):	Heritage Consultant: ASAPA Registration No.: 164 - Principal Investigator: Iron Age, Colonial Period, Industrial Heritage.

12.4.2 Objectives of the Study

The objectives of this study included the following:

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Identify any potential 'fatal flaws' related to the proposed development;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance; and
- Provide guideline measures to manage any impacts that might occur during the construction phase as well as the implementation phase.

12.4.3 Methodology

The methodology employed consisted of the following:

- A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological and historical sources were consulted.
- A survey was conducted of Heritage Impact Assessments that were undertaken for projects in the region by various heritage consultants, with the aim of determining the heritage potential of the area;
- The Heritage Atlas Database, various SAHRA databases, the Environmental Potential Atlas, the Chief Surveyor General and the National Archives of South Africa were consulted. Database surveys produced a number of sites located in the larger region of the proposed development.
- Aerial photographs and topocadastral and other maps were also studied.
- Previous experience in the documenting of WWTW was drawn on to assist in assessing the significance of the K-WWTW. In addition, information contained in a personal database (Heritage Atlas Database) was also accessed to assist in the classifying and evaluating the structures at the K-WWTW.

- In determining the significance of the Project area where the upgrades are to take place, the following strategy was implemented –
  - The structures (plant) itself was evaluated in terms of its typology, design qualities, materials used and age;
  - The immediate surroundings of the Project area were inspected for the presence of archaeological material such as tools dating to the Stone Age. Unfortunately, the groundworks done in preparation for the original construction of the WWTW would have destroyed any such material. In addition, the dense riverine vegetation occurring on some sections obscured ground visibility.

12.4.4 Key Findings of the Study

12.4.4.1 Desktop Study

Key findings from the desktop study include the following (see **Figure 38** below):

- Stone Age tools, dating to the Middle Stone Age and Later Stone Age occur as low-density scatters on some outcrops to the south in the larger region;
- Stone walled sites dating to the dating the Late Iron Age occur to the far north of the Project area;
- Historic structures, inclusive of buildings, monuments and bridges, occur sporadically all over the larger urban area; and
- Formal and informal burial sites occur sporadically throughout the region.

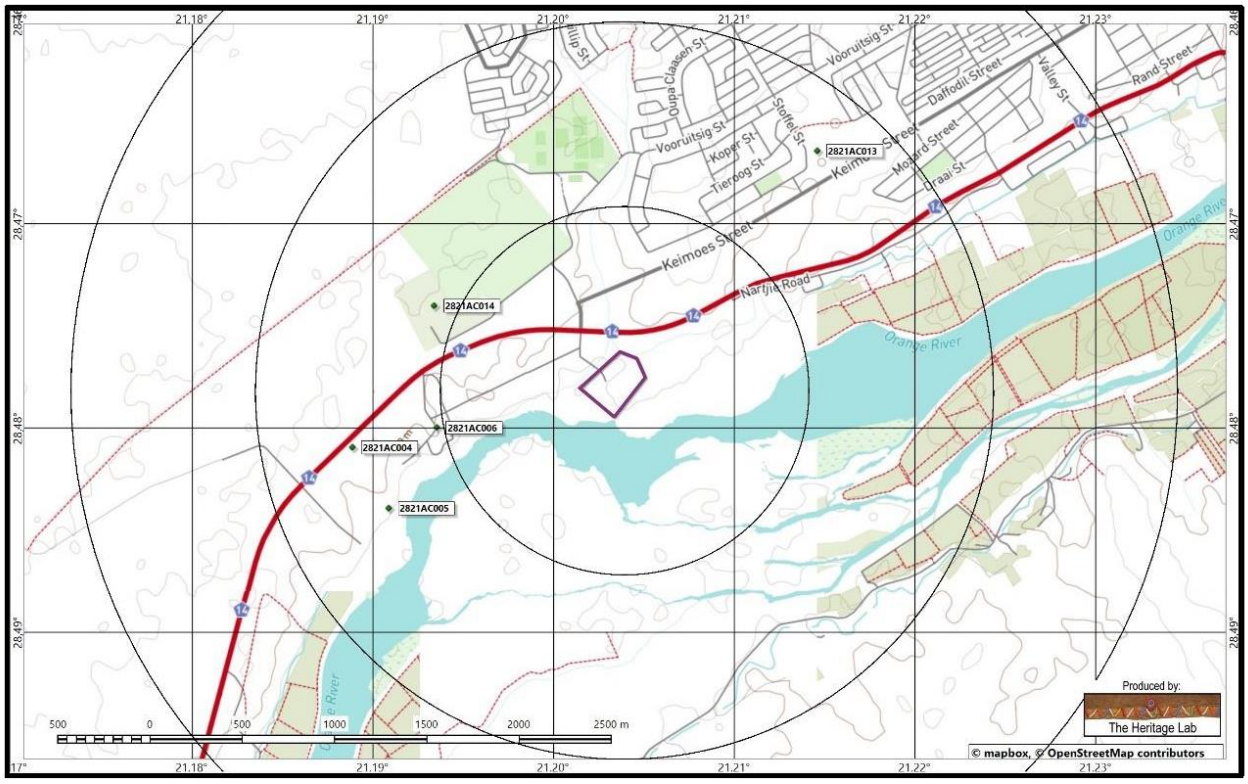

Figure 38: Location of known heritage sites and features in relation to the project area (van Schalkwyk, 2021) (Circles spaced at a distance of 1km: heritage sites = coded green dots)

The information collected during the desktop study was used to accommodate and integrate all data generated during the field survey. Based on the above assessment, the probability of cultural heritage sites, features and objects occurring in the Project area is deemed to be low.

12.4.4.2 Field survey

The following findings were made during the physical survey:

- The K-WWTW is not older than 60 years;
- It has already been updated during the 1990s, implying that some of the original features could have been altered;
- It shows no unique, distinctive features or design elements that sets it apart from what is found at other similar facilities; and
- No precolonial or early historical features were identified within the boundary of the Project area.

12.4.5 Impact Assessment

As no sites, features or objects of cultural significance were identified, no mitigation measures were proposed. Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

12.4.6 Conclusions

From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures are implemented.

12.5 Terrestrial Ecology Compliance Statement

A summary of the Terrestrial Ecology Compliance Statement (or opinion) (Erasmus, 2021) (contained in **Appendix E2**) follows.

12.5.1 Details of the Specialist

The details of the specialists that compiled the Terrestrial Ecology Compliance Statement follow.

Organisation:	The Biodiversity Company	
Name:	A. Husted	M. Erasmus
Qualifications:	MSc Aquatic Health	B-Tech Nature Conservation
Affiliation (if applicable):	SACNASP Professional Natural Scientist (Registration No.: 400213/11)	-

12.5.2 Objectives of the Study

The following tasks were completed in fulfilment of the terms of reference for this study:

- Description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist discipline (flora) that occur in the project area, and the manner in which these sensitive receptors may be affected by the activity;
- Identification of 'significant' ecological, botanical features within the proposed Project area;
- Identification of conservation significant habitats around the Project area which might be impacted;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application; and
- Provide outcomes to be included in the EMPr.

12.5.3 Methodology

The study included a desktop spatial assessment and fieldwork.

The approach took into consideration the "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", as published in GN No. 1150 in Government Gazette No. 43855 of 30 October 2020. The National Web based Environmental Screening Tool has characterised the terrestrial biodiversity theme as "very high".

12.5.4 Key Findings of the Study

12.5.4.1 Desktop Spatial Assessment

The findings of the desktop analysis are summarised in **Table 21** below.

Table 21: Desktop spatial features considered for the study (Erasmus, 2021)

Desktop Information Considered	Relevance
Northern Cape Biodiversity Conservation Plan	Relevant: Overlaps with CBA 1.
Terrestrial Ecosystem Threat Status	The Project area falls within an ecosystem which is listed as Least Concern.
Terrestrial Ecosystem Protection Level	The project area falls in a "Poorly Protected" area.
Protected area	Irrelevant: Does not overlap or occur in close proximity with any areas.
Vegetation Type	The project area occurs in the Lower Gariep Alluvial Vegetation (Aza3).

12.5.4.2 Field Assessment

A summary of the terrestrial field assessment regarding the vegetation component is provided in **Table 22** below.

Table 22: Summary of the field assessment findings (Erasmus, 2021)

Habitat state	The project area was found in in a modified state. The entire project area has been used historically as a WWTW since 2004, according to Google Earth images. The project area is intrinsically adjacent and connected to more 'natural' areas, i.e., the river and riparian areas and thus the relevant sections in the report regarding the wetland and aquatics need to be taken into consideration.			
Sensitivity	Low	Moderate	Moderate-High	High
Current Impacts	Alien vegetation, Existing infrastructure, Livestock, Litter Dumping and Roads.			
Special observation	Several individuals of Camel thorn (*Vachellia erioloba*) (see **Figure 39** below) were observed occurring at random within and around the Project Area. These trees are protected in terms of the National Forests Act (Act No. 84 of 1998) (NFA). In accordance with Section 15(1) of the aforementioned Act, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.			

Figure 39: Camel Thorn (*Vachellia erioloba*) from the project area, characteristics illustrated (Erasmus, 2021)

12.5.4.3 Habitat Assessment and Sensitivity

According to the National Web Based Environmental Screening Tool the terrestrial biodiversity for the Project area as mostly "high-sensitivity" (see **Figure 40** below) and the plant species "low sensitivity". The high terrestrial biodiversity sensitivity is due to the CBA classification of the area as well as an Endangered ecosystem, however due to the historic modified state of the area, the area within the WWTW doesn't contribute to the classification and is determined to be low.

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Critical Biodiversity Area 1
Very High	Critical Biodiversity Area 2
Very High	Endangered ecosystem

Figure 40: Map depicting relative terrestrial biodiversity theme sensitivity of the project (National Environmental Screening Tool, 2021) (Erasmus, 2021)

The completion of the biodiversity field assessment disputes the high sensitivity classification for the Terrestrial Biodiversity Theme sensitivity for the Project area due to the current land use that has modified this area.

According to the findings from the National Web Based Environmental Screening Tool, the site includes an area with medium sensitivity which is linked to the Ludwig's bustard (*Neotis ludwigii*). This Endangered species is a wide-ranging arid specialist with a preference for shrub and grasslands, with no reliance on the dense reedbed habitat in the south-western part of the site.

It is the specialist opinion that the site has been used historically as a WWTW and resulting in a low habitat sensitivity for the entire project area. However, due the sensitivity of the surround habitats, the specialist management plan as well as the findings of the aquatic report need to be strictly adhered to.

12.5.5 Conclusions

The Project area has been transformed/disturbed from its original state by the WWTW. The direct footprint area does not support any and Species of Conservation Concern (SCC), nor does it represent the sensitivities as identified in the National Web Based Environmental Screening Tool. The project area has an overall low sensitivity.

12.6 Groundwater Impact Assessment

A summary of the Groundwater Impact Assessment (van Staden, 2022) (contained in **Appendix E4**) follows.

12.6.1 Details of the Specialists

The details of the specialists that undertook the Groundwater Impact Assessment follow.

Organisation:	GEOSS South Africa (Pty) Ltd	
Name:	C. van Staden	J. Edward Conrad
Qualifications:	MSc Hydrogeology	M.Sc. Hydrogeology and GIS
Affiliation (if applicable):	Groundwater Division of the Geological Society of South Africa (GSSA) SACNASP Cand.Sci.Nat (Registration No.: 122591)	International Association of Hydrogeologists (IAH) (72593) Groundwater Division of GSSA (020/20) Water Institute of South Africa (WISA) (22117) Geo-Information Society of South Africa (GISSA) SACNASP (Registration No.: 400159/05)

12.6.2 Scope of Work

The scope of work for this study included the following:

- Obtain all relevant data to the project (i.e., obtain data from the National Groundwater Archive, Water Quality Management System and Water Information Management System), geological maps and geohydrological maps, as well as any groundwater reports of the area. Compile a project GIS and prepare for fieldwork.
- Complete a hydrocensus (i.e., visit boreholes on the property (and within 1 km of the property) and measure yields and water quality (pH, EC, TDS, ORP and temperature) (if borehole exist)

and update the existing hydrocensus data. Provision is made for detailed analysis of a single water sample.

- Analyse all the data, using geohydrological methods and use this as the basis for the geohydrological report.

12.6.3 Key Findings of the Study

A hydrogeological assessment was conducted for Project to assess what the potential impact will be on the groundwater of the area. It was found that all the workings are within concrete bunded surfaces except for the maturation pond and the solid waste that is currently stored on bare ground. The maturation pond is an area where the treated wastewater is stored before it is chlorinated and released into the Orange River.

The site overlies a fractured aquifer with a classified borehole yield of 0.5– 2.0 L/s. This aquifer consists of low permeability calc-silcrete rock overlying hornblende-plagioclase amphibolite which has been formed due to metamorphism of basaltic lava and dolerite. Therefore, the infiltration rate and transmissivity within this fractured system is regarded as low. From the augered holes and the excavated area it was seen that the bedrock is shallow and the soil overlying the bedrock is sandy clay. During the hydrocensus it was seen that there are no groundwater users in the surrounding area which is due to the fact that the Orange River is the main water resource for the area. The underlying aquifer is low yielding and or marginal quality.

The construction phase and the operational phase of the Project have several components that could potentially be sources of contamination to the environment and the groundwater. Pathways to the receptors include infiltration down to the groundwater table or surface drainage (overland flow) towards the Orange River. There are no groundwater users in the surrounding area therefore the main receptor in the surrounding area is the Orange River.

The potential for the proposed Project to contaminate groundwater is considered to be low. The classification is due to the fact that there are no groundwater users in the area and the risk to the Orange River is much greater than groundwater. Even though the risk related to the proposed facility is low it vital that industry best practice measures are implemented to ensure the activities does not contaminate groundwater or the environment. In case of a spillage occurring mitigation measures must be in place to swiftly respond to the incident.

12.6.4 Impact Assessment

Refer to **Section 13.10** below for the results from the impact assessment from the Groundwater Impact Assessment.

13 IMPACT ASSESSMENT

13.1 General

This section focuses on the pertinent environmental impacts that could potentially be caused during the pre-construction, construction and operational phases of the Project.

Note that an 'impact' refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.

The potentially significant environmental impacts associated with the Project were identified through an appraisal of the following:

- The Project's legal and policy context (see **Section 5** above);
- The scope of the proposed Project (see **Section 9** above);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes (see **Section 11** above);
- Findings from specialist studies (see **Section 12** above);
- Activities and environmental aspects associated with the project life-cycle (i.e. pre-construction, construction and operational phases) (see **Section 13.3** and **Section 13.4** below);
- Understanding of direct and indirect effects of the Project as a whole; and
- Comments received during public participation from authorities and I&APs, as captured in the CRR (contained in **Appendix H**).

13.2 Issues raised by Environmental Authorities and I&APs

The issues raised by authorities (both regulatory and commenting) and I&APs to date during the execution of the EIA are captured and addressed in the CRR (refer to **Appendix H**).

The consolidated issues raised by authorities and I&APs have been succinctly grouped into the following main categories (*Note: please refer to the Comments and Response Report for a comprehensive and accurate representation of the issues raised*):

- Water use –
  - Need for an application in terms of the NWA for water uses associated with the Project.
  - Sub-standard quality of the K-WWTW effluent.
  - Need for interim measures for the proper treatment and containment of sewage to be implemented as soon as possible.
  - Discharge limits for final effluent quality.
  - Root cause of the sewage infrastructure deficiencies in the municipality.

- No new development should be allowed in the absence of adequate infrastructure. This is related to challenges posed by rapid urbanisation.
- Sewage sludge as well as the liquid fraction extracted with the dewatering system should be treated with the utmost care to prevent any spillages towards the Orange River.
- Findings of the Freshwater Assessment - the K-WWTW discharge water presents critical adverse conditions to local aquatic biota.
- Potential sub-surface seepage from the existing emergency overflow dam or other facilities at the K-WWTW.

❑ Alternatives –
- Need for a site alternative to the K-WWTW.

❑ Terrestrial Ecology –
- Adherence to the NFA for protected trees.
- Pre-construction walk-through of the final development footprint.
- Search and rescue plan for any Threatened or Protected Species (TOPS) or species of conservation concern that have the likelihood of occurring in the study area.
- Sensitive habitats in close proximity to the development footprint must be avoided or demarcated as no-go area (i.e. Orange River).
- Alien Invasive Species Eradication Plan.
- Rehabilitation Plan.

❑ Existing infrastructure –
- Impacts to existing infrastructure.

❑ Heritage –
- Processing of development applications via the South African Heritage Resources Information System (SAHRIS)

❑ Project implementation –
- Need for expenditure oversight.

The issues raised by authorities and I&APs received further attention during the EIA phase.

13.3 Project Activities

In order to understand the Project's potential impacts it is necessary to unpack the activities associated with the project life-cycle, as done in the sub-sections to follow.

13.3.1 Project Phase: Pre-construction

Some of the main Project activities, as well as high-level environmental activities, to be undertaken in the pre-construction phase are listed in **Table 23** below.

Table 23: Simplified List of Activities associated with Pre-construction Phase

Project Phase: Pre-construction
Project Activities
▪ Confirming key design features and specifications for the components of the WWTW to be upgraded and expanded.
▪ Detailed engineering design.
▪ Prepare the Project schedule.
▪ Detailed geotechnical and hydrogeological investigations.
▪ Survey and mark proposed infrastructure.
▪ Procurement process for Contractor.
▪ Review Contractor's method statements (as relevant).
▪ Construction site planning, access and layout.
▪ Confirmation of the location and condition of all structures and infrastructure.
▪ Determining and documenting the conditions of the roads to be used during construction.
High Level Environmental Activities
▪ Diligent compliance monitoring of the EMPr, Environmental Authorisation, WML, WUL and other relevant environmental legislation.
▪ On-going consultation with I&APs, stakeholders and authorities (as relevant).
▪ Other activities as per EMPr.

13.3.2 Project Phase: Construction

Some of the main Project activities, as well as high-level environmental activities, to be undertaken in the construction phase are listed in **Table 24** below.

Table 24: Simplified List of Activities associated with Construction Phase

Project Phase: Construction
Project Activities
▪ Site establishment.
▪ Search and locate existing services.
▪ If necessary, relocate / safeguard existing services.
▪ Establish temporary access roads, where needed.
▪ Establish construction laydown area and storage facilities.
▪ Cordon off works area.
▪ Site preparation (clearing, levelling, grading, etc.).
▪ Delivery of construction material and offloading.
▪ Transportation of equipment, materials and personnel.
▪ Storage and handling of material.
▪ Use of tools, equipment and plant.
▪ Decommission and demolish relevant structures and infrastructure.
▪ Undertake civil, mechanical and electrical work.
▪ Earthworks (site clearing, excavations, disposal of spoil material).
▪ Waste and wastewater management.
▪ Reinstate the working areas outside of permanent development footprint.
High Level Environmental Activities

Project Phase: Construction
▪ Diligent compliance monitoring of the EMPr, Environmental Authorisation, WML, WUL and other relevant environmental legislation.
▪ Characterise waste types and confirm disposal requirements.
▪ Accommodate existing operations at the K-WWTW.
▪ Reinstate and rehabilitate the construction domain.
▪ On-going consultation with I&APs, stakeholders and authorities (as relevant)
▪ Other activities as per EMPr

13.3.3 Project Phase: Operation

Some of the main Project activities, as well as high-level environmental activities, to be undertaken in the operational phase are listed in **Table 25** below.

Table 25: Simplified List of Activities associated with Operational Phase

Project Phase: Operation
Project Activities
▪ Test and commission the upgraded and expanded components.
▪ Manage stormwater and waste.
▪ Produce and discharge compliant effluent.
▪ Produce and manage compliant sludge.
▪ Conduct preventative and corrective maintenance.
▪ Monitor the K-WWTW's performance.
High Level Environmental Activities
▪ Compliance with WML and WUL.
▪ Other activities as per EMPr for the Operational Phase.
▪ Implement odour control measures.
▪ Monitor effluent quality and receiving aquatic environment.
▪ Monitor groundwater.
▪ Monitor air quality.
▪ Mechanism to receive and address complaints regarding the operation of the K-WWTW.
▪ Safeguard K-WWTW against floods.

13.4 Environmental Aspects

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact.

The environmental aspects that have been identified for the proposed Project, which are linked to the project activities, are provided in **Table 26** below. Note that only high level aspects are provided.

Table 26: Environmental Aspects associated with Project Life-Cycle

Project Phase: Pre-construction
▪ Inadequate consultation with affected parties (e.g. downstream water users), stakeholders and authorities.
▪ Inadequate environmental and compliance monitoring.
▪ Poor construction site planning and layout.
▪ Site-specific environmental issues not fully understood.
▪ Absence of relevant permits (e.g. for protected trees).
▪ Lack of barricading of sensitive environmental features (e.g. riparian zone, protected trees).
▪ Absence of relevant environmental consents.
▪ Poor waste management.
▪ Absence of ablution facilities.
Project Phase: Construction
▪ Inadequate consultation with affected parties (e.g. downstream water users), stakeholders and authorities.
▪ Inadequate environmental and compliance monitoring.
▪ Lack of environmental awareness creation.
▪ Indiscriminate site clearing.
▪ Poor site establishment.
▪ Poor management of access and use of access roads.
▪ Disruptions to traffic.
▪ Poor transportation practices.
▪ Poor fencing arrangements.
▪ Failure to safeguard existing services and structures.
▪ Disruptions to existing operations at the K-WWTW.
▪ Poor management of excavations.
▪ Inadequate storage and handling of material.
▪ Inadequate storage and handling of hazardous material.
▪ Poor maintenance of equipment and plant.
▪ Poor management of labour force.
▪ Pollution (air, soil, surface water, groundwater, visual, noise) caused by construction activities.
▪ Inadequate management of construction camp and laydown area.
▪ Poor waste management practices – hazardous and general waste.
▪ Wastage of water.
▪ Damage to significant flora (if encountered).
▪ Damage to significant fauna (if encountered).
▪ Inadequate stormwater management.
▪ Damage of sensitive areas (including the Orange River and non-perennial watercourse).
▪ Damage to cultural heritage and palaeontological features (if encountered).
▪ Poor reinstatement and rehabilitation.
Project Phase: Operation
▪ Inadequate routine maintenance.
▪ Inadequate environmental and compliance monitoring.
▪ Pollution (air, soil, surface water, groundwater, visual) caused by operational activities.
▪ Discharge of sub-standard effluent.
▪ Failure to manage sludge and screenings.

Project Phase: Pre-construction
▪ Inadequate stormwater management.
▪ Malodour caused by the K-WWTW's operations.
▪ Inadequate access control to the K-WWTW.
▪ Failure to safeguard the K-WWTW against floods.
▪ Damage of sensitive areas (including the Orange River and non-perennial watercourse).

13.5 Potentially Significant Environmental Impacts

Environmental impacts are the changes to the environment resulting from an environmental aspect, whether desirable or undesirable. Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the Project's environmental aspects, but rather to focus on the potentially **significant** direct and indirect impacts identified during the Scoping phase and any additional issues uncovered during the EIA phase. These potentially significant environmental impacts are listed in **Table 27** below.

Table 27: Potentially Significant Environmental Issues

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
Land Use & Planning	▪ The upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence. No significant adverse impacts are thus anticipated in terms of immediate land use during construction. Surrounding land uses include the residential areas of Lemoendraai and Belview that are located approximately 700 m and 580 m to the west and north of the site, respectively, as well as commercial agriculture that is located approximately 200 m to the east of the site. ▪ Setbacks / conditions associated with surrounding land and infrastructure (as relevant).	▪ Setbacks / conditions associated with surrounding land and infrastructure (as relevant). ▪ Land use requirements and restrictions associated with the buffer zone of the K-WWTW will need to be enforced from a planning perspective. ▪ The Project aims to enhance the operation of the K-WWTW, which will manage impacts to surrounding land uses (such as odour control) and water users downstream of the plant (improved effluent quality) (*positive impact*).
Climate	▪ Greenhouse gas (GHG) emissions during construction.	▪ GHG emissions from biological processes at the Works. ▪ Climate change may lead to increased inflows, which can cause more frequent bypassing at the K-WWTW. ▪ The K-WWTW is located alongside the Orange River and may be at risk from extreme floods.
Geology	▪ Suitability of geological conditions to support the proposed structures and infrastructure.	
Groundwater	▪ Groundwater pollution due to spillages and poor construction practices.	▪ Groundwater pollution due to poor operation and maintenance practices, as well as through inadequate management of sewage, effluent, sludge, waste and hazardous substances.

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
		▪ Sub-surface seepage from the existing emergency overflow dam or other facilities.
Soil	▪ Encountering historically contaminated soil at the K-WWTW. ▪ Soil erosion due to clearance and inadequate stormwater management ▪ Soil compaction. ▪ Soil contamination due to spillages and poor construction practices.	▪ Soil erosion due to inadequate stormwater management. ▪ Soil contamination due to poor operation and maintenance practices, including inadequate management of sewage, effluent, sludge, waste and hazardous substances.
Surface Water	▪ Alteration of drainage over the site. ▪ Surface water pollution due to spillages and poor construction practices. ▪ Encroachment of construction activities into regulated area of the Orange River and non-perennial drainage line. ▪ Reduction in biodiversity of aquatic biota as a result of the abovementioned drivers.	▪ Sedimentation and contamination of the Orange River through runoff, caused by inadequate stormwater management on the site. ▪ Damage to the K-WWTW from major flood events. ▪ The Orange River could be contaminated through inadequate storage and handling of dangerous goods (e.g. chlorine) and poor management of sewage, effluent and waste. ▪ The proposed upgrade and expansion aim to ensure that the K-WWTW will discharge effluent of suitable quality, which will benefit the receiving river and downstream water users, including irrigators (*positive impact*).
Flora & Fauna	▪ Noise and vibration impacts to fauna. ▪ Nights lights may affect nocturnal faunal species. ▪ Illegal harvesting and poaching of faunal and floral species by construction workers. ▪ Pollution of the biophysical environment from poor construction practices. ▪ Proliferation of invasive alien species in disturbed areas. ▪ Loss of protected trees (notably the Camel thorn) and species of conservation concern. ▪ Human - animal conflicts.	▪ Proliferation of invasive alien species in disturbed areas. ▪ Environmental pollution caused by inadequate management of sewage, effluent, waste and hazardous substances. ▪ Operational activities that take place within watercourses and the riparian area of the Orange River.
Air Quality	▪ Dust from the use of dirt roads by construction vehicles, and from bare areas that have been cleared for construction purposes. ▪ Emissions from construction equipment and machinery. ▪ Tailpipe emissions from construction vehicles.	▪ Air emissions from wastewater treatment operations, which can also be a nuisance to workers and the surrounding community.
Socio-economic Environment	▪ Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes). ▪ Safety and security risks to surrounding communities. ▪ Use of local road network. ▪ Nuisance from dust and noise to surrounding communities. ▪ Consideration of local labourers and suppliers in area – stimulation of local economy (*positive impact*). ▪ Transfer of skills (*positive impact*).	▪ A wastewater treatment plant is an odorous facility that may cause a nuisance to surrounding communities. ▪ The pollution caused to the Orange River from sub-standard effluent quality impacts on agricultural practices of downstream irrigators. ▪ Groundwater contamination from poor waste management practices at the K-WWTW may impact on other groundwater users.

Environmental Factor	Construction Phase Potential Issues / Impacts	Operational Phase Potential Issues / Impacts
Noise	▪ Localised increases in noise may be caused by construction activities, which may pose a nuisance to workers, operational staff at the plant and the surrounding community.	▪ Localised noise caused by operation and maintenance vehicles and activities.
Historical, Cultural & Palaeontological Features	▪ Possible direct impacts on below-ground archaeological deposits and fossils as a result of ground disturbance.	▪ N/A
Existing Structures & Infrastructure	▪ Risk of damaging existing services, infrastructure and structures during construction. ▪ Disruptions caused to operations at the K-WWTW.	▪ N/A
Traffic	▪ Transportation of materials and construction personnel to site. ▪ Impacts to road conditions. ▪ Speeding and reckless driving by construction personnel. ▪ Construction vehicles accessing and leaving the site via the N14. ▪ Risks to other road users.	▪ Safe access, taking into consideration the high-speed environment along the N14.
Aesthetics	▪ Visual impacts associated with construction activities (e.g. poor housekeeping). ▪ Inadequate reinstatement and rehabilitation of construction footprint.	▪ Light pollution.
Health	▪ Hazards related to construction work. ▪ Risks posed by working inside an operational wastewater treatment plant. ▪ Increased levels of dust and particulate matter. ▪ Increased levels of noise. ▪ Poor water and sanitation. ▪ Communicable diseases. ▪ Psychosocial disorder (e.g. social disruptions). ▪ Safety and security. ▪ Lack of suitable health services.	▪ Hazards related to operation and maintenance work. ▪ Health risks associated with exposure to sewage or sludge.
Waste and Wastewater	▪ Environmental impacts caused by improper management of construction waste, sludge contained in old drying beds and wastewater.	▪ Environmental impacts caused by improper management of sewage, effluent, sludge and screenings produced at the plant.
Hazardous substances	▪ Environmental pollution caused by poor management of hazardous substances.	▪ Environmental pollution caused through inadequate storage and handling of hazardous substances (e.g. chlorine). ▪ Ingress of contaminants into stormwater system.

13.6 Impact Assessment Methodology

The impacts and the proposed management thereof are first discussed in **Section 13.9** to **Section 13.20** below on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts (refer to methodology provided in **Table 28** below). Where applicable, the impact assessments and significance ratings provided by the respective specialists are included.

The assessment considers impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

Table 28: Quantitative Impact Assessment Methodology

Nature (/Status)	The project could have the following impacts to the environment: • Positive; • Negative; or • Neutral.
Extent	• Local - extend to the site and its immediate surroundings. • Regional - impact on the region but within the province. • National - impact on an interprovincial scale. • International - impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources. • Low - natural and social functions and processes are not affected or minimally affected. • Medium - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way. • High - natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	• Short term - 0-5 years. • Medium term - 5-11 years. • Long term - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. • Permanent - mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	• Almost certain - the event is expected to occur in most circumstances. • Likely - the event will probably occur in most circumstances. • Moderate - the event should occur at some time. • Unlikely - the event could occur at some time. • Rare/Remote - the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- 0 - Impact will not affect the environment. No mitigation necessary. 1 - No impact after mitigation. 2 - Residual impact after mitigation / some loss of populations and habitats of non-threatened species. 3 - Impact cannot be mitigated / exceeds legal or regulatory standard / increases level of risk to public health / extinction of biological species, loss of genetic diversity, rare or endangered species, critical habitat.

In the case of the specialist studies, some of the impact assessment methodologies deviated from the approach shown in **Table 28** above. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of the EIA.

13.7 Impact Mitigation

13.7.1 Mitigation Hierarchy

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- Find more environmentally sound ways of executing an activity;
- Enhance the environmental benefits of a proposed activity;
- Avoid, minimise or remedy negative impacts; and
- Ensure that residual negative impacts are within acceptable levels.

Mitigation should strive to abide by the following hierarchy – (1) prevent; (2) reduce; (3) rectify/rehabilitate/remediate; and/or (4) compensate for the environmental impacts (implementation of offsets).

The proposed mitigation of the impacts associated with the Project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices.

Note that the mitigation measures in the subsequent sections are not intended to be exhaustive, but rather focus on the potentially significant impacts identified.

The EMPr (contained in **Appendix G**) provides a comprehensive list of mitigation measures for specific elements of the Project and the receiving environment, which extends beyond the impacts evaluated in the body of the EIA Report.

13.7.2 EMPr Framework

An EMPr represents a detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the life-cycle of a project.

The EMPr aims to satisfy the requirements stipulated in Section 24N of NEMA and Appendix 4 of the EIA Regulations.

The scope of the Project's EMPr, is as follows:

- Establish management objectives during the project life-cycle in order to enhance benefits and minimise adverse environmental impacts;
- Provide targets for management objectives, in terms of desired performance;
- Describe actions required to achieve management objectives;
- Outline institutional structures and roles required to implement the EMPr;
- Provide legislative framework; and

- Describe the requirements for record keeping, reporting, review, auditing and updating of the EMPr.

All liability for the implementation of the EMPr, as well as the EIA findings and the conditions of the WML (if granted), lies with the Project Proponent.

The following considerations and assumptions accompany the compilation of the EMPr:

- The EMPr is guided by the following principles, based on Lochner (2005) -
  - **Continuous improvement -** The Project Proponent should be committed to review and to continually improve environmental management, with the objective of improving overall environmental performance;
  - **Broad level of commitment -** A broad level of commitment is required from all levels of management as well as the workforce in order for the implementation of the EMPr to be successful and effective; and
  - **Flexible and responsive -** The implementation of the EMPr needs to be responsive to new and changing circumstances. The EMPr report is a dynamic "living" document that will need to be updated regularly throughout the duration of the project life-cycle.
- Compliance with the EMPr must be audited in terms of Regulation 34 of the EIA Regulations.
- The EMPr provides the framework for the overarching environmental management requirements for the project life-cycle. Following detailed design and planning, the EMPr may need to be revised to render the management actions more explicit and accurate to the final project specifications.
- Any amendments to the EMPr must be undertaken in accordance with Regulations 35 – 37 of the EIA Regulations (as relevant).
- The EMPr will be linked to the project's overall Environmental Management System (EMS) (if applicable), where the EMS constitutes an iterative process that aims achieve continuous improvement and enhanced environmental performance.
- Although every effort has been made to ensure that the scope and level of detail of the EMPr are tailored to the level of environmental risk (i.e. type and scale of activity and the sensitivity of the affected environment) and the project- and site-specific conditions, certain of the environmental management requirements within the EMPr may be regarded as generic to make provision for activities that may take place as part of the overall Project.

13.8 Land Use & Planning

13.8.1 Impact Description

The upgrade and expansion of the K-WWTW will take place within the confines of the plant's existing perimeter fence.

The Project aims to ensure that the K-WWTW will discharge effluent of suitable quality, which will benefit the receiving river and downstream water users, including irrigators. In addition, the Project

aims to enhance the operation of the K-WWTW, which will manage impacts to surrounding land uses (such as odour control).

Land use requirements and restrictions associated with the buffer zone of the K-WWTW will need to be enforced from a planning perspective by the DKM.

13.8.2 Impact Assessment

Environmental Feature	**Land Use & Planning**
Project life-cycle	Construction & operational phases.
Relevant Alternatives & Activities	▪ Construction activities with an influence beyond the boundaries of the K-WWTW. ▪ Operation of the K-WWTW.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Impacts to surrounding land uses. ▪ Encroachments of incompatible land uses into K-WWTW's buffer zone.	▪ The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence. ▪ The DKM must enforce land use requirements and restrictions associated with the buffer zone of the K-WWTW.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	high	long-term	Unlikely	-2
After Mitigation	-	local	low	long-term	Unlikely	-1

13.9 Climate

13.9.1 Impact Description

In general, GHG are emitted from a WWTW through the following main mechanisms (Mannina *et al*., 2016):

- Direct emissions - primarily related to biological processes (emissions of carbon dioxide from microbial respiration, nitrous oxide from nitrification and denitrification, and methane from anaerobic digestion);
- Indirect internal emissions - consumption of imported electrical or thermal energy; and
- Indirect external emissions - sources not directly controlled within the WWTW (e.g. production of chemicals and their transportation to the plant).

Technical considerations for the Project from a climate perspective include the following:

- There is not significant seasonal variation to consider, which can be expected from a region with such a low annual rainfall. This neglects the requirement for a seasonal adjustment in the design flow which implies that the design Annual Daily Flow (ADF), ADWF and Average Wet Weather Flow (AWWF) will be similar.

- Solar drying slabs are widely used in SA and are especially recommended in climatic conditions associated with Upington (i.e. high sunshine, low rainfall and low humidity).

One of the predicted impacts of climatic change on SA's water resources includes high levels of variability in rainfall, which will result in frequent floods and droughts. Refer to **Section 13.12** below for a discussion on the flood risks to the K-WWTW.

13.9.2 Impact Assessment

Environmental Feature	**Climate**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	All construction activities that emit GHG.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ GHG emissions and contributions towards global warming.	▪ Materials with a high recycled content should be used where possible and the re-use of site materials should be considered. ▪ Where possible the use of green building technologies will be used. ▪ Suitable training should be provided to operators to ensure that they maximise the efficiency of the plant and idling is reduced. ▪ Collective transportation arrangements should be made to reduce individual car journeys (transportation of workers and staff). ▪ All vehicles used should be properly maintained and be in good working order.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	regional	*unknown*	short-term	likely	*unknown*
After Mitigation	-	regional	*unknown*	short-term	moderate	*unknown*

[redacted]

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	Operation of the K-WWTW.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ GHG emissions from biological processes at the Works. ▪ Climate change may lead to increased inflows, which can cause more frequent bypassing at the K-WWTW. ▪ The K-WWTW is located alongside the Orange River and may be at risk from extreme floods.	▪ Designs to consider options for mitigating GHG emissions from the K-WWTW and to cater for increased inflows caused by changing climatic conditions. ▪ Improve energy efficiency at the K-WWTW. ▪ See mitigation measures related to hydrology (**Section 13.12**). ▪ See mitigation measures related to odour control (**Section 13.16**).

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local to regional	high	long-term	likely	-3
After Mitigation	-	local	medium	long-term	likely	-2

13.10 Hydrogeology

13.10.1 Impact Description

The information to follow was primarily obtained from the Groundwater Impact Assessment (van Staden, 2022).

The possible contamination sources relate to the wastewater that is stored and discharged into the Orange River. The K-WWTW workings are within concrete bunded surfaces except for the maturation pond and the solid waste that is currently stored on bare ground. The maturation pond is an area where the treated wastewater is stored before it is chlorinated and released into the Orange River. Therefore, the main contamination concern from the maturation pond is bacteriological contamination. These are all aspects of the current K-WWTW that could result in groundwater contamination or the contamination of the surrounding area. However, one must consider the following:

- The plant currently has more waste to process than it is made for and is currently undergoing refurbishment and upgrading;
- No shallow groundwater table is expected in the area;
- No groundwater users were identified in the surrounding area; and
- During the construction phase of the Project there is also a risk of accidental oil spills or fuel leakage from the construction vehicles.

Contamination from the main source (i.e. maturation pond) could potentially infiltrate into the sub-surface (i.e. soils [unsaturated zone] and eventually the groundwater [saturated zone]). The site overlies a fractured aquifer with a classified borehole yield of 0.5– 2.0 l/s. This aquifer consists of low permeability calc-silcrete rock, overlying hornblende-plagioclase amphibolite (which has been formed due to metamorphism of basaltic lava and dolerite). Therefore, the infiltration rate and transmissivity within this fractured system is regarded as low. From the augered holes and the excavated area it was seen that the bedrock is shallow and the soils overlying the bedrock is sandy clay. Therefore, it is possible that the pathway for contamination is if wastewater slowly infiltrates into the sub-surface and reaches the groundwater table. This is especially feasible for fractured aquifer settings.

Another pathway towards receptors would include surface drainage (overland flow) towards the Orange River or into the river itself.

Groundwater may be impacted by the Project as follows:

- Construction phase:
  - There is a potential impact on groundwater quality and/or the environment associated with the construction vehicles that will be used on-site during the upgrade and expansion of the K-WWTW. Accidental oil spillages or fuel leakages can occur from construction vehicles.

- Operational phase:
  - Groundwater could be contaminated through poor operation and maintenance practices, including the inadequate management of sewage, effluent, sludge, waste and hazardous substances.

13.10.2 Impact Assessment

The following impact assessment, as well as the mitigation measures to follow, were extracted from the Groundwater Impact Assessment (**Appendix E4**).

Potential impact on groundwater quality deterioration because of contamination from construction activities	
Impact	**Description**
Nature of Impact:	Negative
Type of impact	**Description**
Direct	Contaminated groundwater and surface water (the Orange River)
Recommended mitigation measures	**Description**
Impact avoidance/ Prevention/ Mitigation	▪ Vehicles must be maintained regularly and kept in a good working order. ▪ Dirty water should be captured, to be re-used where possible. No dirty water is allowed to be discharged into the surrounding environment. ▪ No heavy equipment or vehicles to be left in the excavation pit or on bare ground when not in use. ▪ Drip trays to be used under stationary vehicles and machinery where possible.
Impact minimization	Should be minimal due to short duration of operation activity.
Rehabilitation/ restoration/ repair	Removal of soil and water will need to be done if rehabilitation is required.
Degree to which the impact can be mitigated	Medium
Degree to which the impact can be reversed	Medium
Degree to which the impact may cause irreplaceable loss of resources	Low

Assessment of impact	**Rating before mitigation**	**Rating after mitigation**
Extent of impact	Local	Site specific
Duration of impact	Short term 0 – 5 years	Short term 0 – 5 years
Intensity of impact	Low	Low
Probability of occurrence	Possible	Improbable
Level of confidence in prediction	Medium	Medium
Significance	Low	Negligible
Confidence	Medium	Medium

Potential impact on groundwater quality deterioration (operational phase)	
Impact	**Description**
Nature of Impact:	Negative
Type of impact	**Description**
Direct	Contaminated groundwater and surface water (the Orange River)
Recommended mitigation measures	**Description**
Impact avoidance/ Prevention/ Mitigation	▪ Spillages or leakages from the K-WWTW could contaminate the surrounding environment or groundwater in the area. The monitoring of the WWTW must be done in according to the Minimum Requirements for Water Monitoring at Waste Management Facilities (DWAF, 1998). ▪ Containment of effluent should be appropriately lined to avoid discharge into the subsurface, and potentially groundwater. ▪ Solid waste should be stored on concrete bunded or lined surfaces and water drainage from the solid waste should be captured and returned to the K-WWTW. ▪ The maturation pond should be lined. ▪ The K-WWTW needs to assure that the water released into the environment is within the limits of the General Authorisation.
Impact minimization	Should be minimal due to short duration of operation activity.
Rehabilitation/ restoration/ repair	Removal of soil and water will need to be done if rehabilitation is required.
Degree to which the impact can be mitigated	Medium
Degree to which the impact can be reversed	Medium
Degree to which the impact may cause irreplaceable loss of resources	Low

Assessment of impact	Rating before mitigation	Rating after mitigation
Extent of impact	Local	Site specific
Duration of impact	Long term >15 years but <30 years	Short term 0 – 5 years
Intensity of impact	Medium	Low
Probability of occurrence	Possible	Improbable
Level of confidence in prediction	Medium	Medium
Significance	Medium	Low
Confidence	Medium	Medium

13.11 Soils

13.11.1 Impact Description

Soil may be impacted by the Project as follows:

- Construction phase:
  - Soil could be contaminated through inadequate storage and handling of hazardous materials, spillages from equipment and plant and poor management of waste, wastewater and cement mixing.
  - Erosion may take place if stormwater is not adequately managed.

- Operational phase:
  - Erosion may take place if stormwater is not adequately managed.
  - Groundwater could be contaminated through poor operation and maintenance practices, including the inadequate management of sewage, effluent, sludge, waste and hazardous substances. Sub-surface seepage may also occur from the existing emergency overflow dam or other facilities.

13.11.2 Impact Assessment

Environmental Feature	**Soils**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Site clearing, earthworks, stockpiling and general construction activities within Project site.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Soil erosion. ▪ Soil compaction.	▪ Consider findings from geotechnical investigations during Project design phase and incorporate mitigation measures (as relevant). ▪ Stabilise cleared areas to prevent and control erosion. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to the site-specific conditions. ▪ Control drainage over the site to minimise erosion. ▪ Acceptable reinstatement and rehabilitation of disturbed areas to prevent erosion during operational phase.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	moderate	-2
After Mitigation	-	local	low	short-term	unlikely	-1

▪ Encountering historically contaminated soil during construction.	▪ Excavated soil will be tested in line with the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GN 331 of 2014) and will be handled and disposed of accordingly.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	moderate	-2
After Mitigation	-	local	low	short-term	unlikely	-1

• Soil contamination from poor construction practices.	• See mitigation measures related to hazardous substances and waste (**Section 13.18**).

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium to high	short to long-term	likely	-2
After Mitigation	-	local	low	short-term	unlikely	-1

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	Activities that may affect the soil.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
• Soil erosion. • Contamination of soils from poor operation and maintenance practices.	• See mitigation measures related to hydrology (**Section 13.12**). • See mitigation measures related to hazardous substances and waste (**Section 13.18**).

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	moderate	-2
After Mitigation	-	local	low	short-term	unlikely	-1

13.12 Hydrology and Drainage

13.12.1 Impact Description

The Orange River is located to the immediate south of the K-WWTW and may be damaged by major flood events. Potential impacts that may be caused by flooding include the washing out of primary and secondary clarifiers, aeration tanks and chlorine contact tanks, as well as upset bioreactors. Other impacts from flood waters include damage to mechanical and electrical equipment/controls, interference with biosolids handling and disposal systems as well as washing of contaminants into the treatment train. Apart from the resultant damage to infrastructure and disruptions to the operations of a WWTW, the flooding will also cause contamination of the receiving environment at the facility.

It is noted that information related to a certified 1:100 flood line in and around the K-WWTW could not be obtained. DKM advised that developments in and around the Upington area are generally constructed in terms of the 1988 flood line, which is claimed to coincide with a 1:50 year flood event. In the absence of a certified 1:100 year flood line, the following related risk mitigation measures will be implemented by the engineering team with the design of the upgrade and expansion of the K-WWTW:

- The original plant built in 1973 will be used in establishing reference elevations and historic flood line levels to be applied for the design. The existing secondary settling tanks at Top of Concrete (TOC) level 790.27 were never overtopped to date with the highest level recorded the 1988 year flood;
- The existing outfall sewer daylights at an invert level of 785.62 meters above mean sea level (mamsl) and the finished ground level around the existing inlet works is approximately 787 mamsl;
- The 1988 flood line, as indicated via visual inspection on site, was indicated as approximately 789.50 mamsl;
- For the purpose of the detailed design, the 1:100 flood line shall be taken as 789.77 mamsl which coincides with a 500mm free board relative to the TOC of the existing SST;

- The protected civil structures forming part of the upgrade and expansion of the K-WWTW will be constructed with a TOC at 790.27 mamsl;
- The stipulated design approach will see the new treatment train's SST Top Water Level (TWL) coincide with the existing train's SST TWL; and
- The design approach shall generally ensure electromechanical equipment remains dry during the stipulated 1:100 year flood event.

Inadequate stormwater management during the construction and operational phases of the Project may contaminate the environment, cause erosion or damage the facility. According to Bigen (2021), stormwater run-off from areas of higher elevation than the K-WWTW will be cut off and diverted by dished berms strategically placed to divert the water towards the river. The natural flow of stormwater over the site will be handled at ground level in a manner that ensures no concentration or pooling of water and that the natural flow of the water is not accelerated off the site. The layout of the Kameelmond WWTW is such that the contaminated stormwater is captured by the Emergency Pond, where after the contaminated stormwater is pumped back to the HoW to be treated. Wherever possible the road system will be designed to accommodate the stormwater with suitable kerb inlets and stormwater pipe designed to convey the runoff away from the site to avoid erosion.

13.12.2 Impact Assessment

Environmental Feature	**Hydrology & Drainage**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Construction activities on the Project site.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Sedimentation through silt-laden runoff, caused by inadequate stormwater management.	▪ Implement suitable stormwater measures on the construction site to trap silt-laden runoff.
▪ Surface water pollution due to spillages and poor construction practices.	▪ Ensure proper storage and careful handling of material that could cause water pollution. ▪ See mitigation measures related to hazardous substances and waste (**Section 13.18**).
▪ Encroachment of construction activities into regulated area of the Orange River and non-perennial drainage line (running adjacent to the north-western perimeter fence).	▪ The upgrade and expansion works must take place within the confines of the K-WWTW's existing perimeter fence.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium to high	short-term	moderate	-3
After Mitigation	-	local	low	short-term	unlikely	-1

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	Operation of the K-WWTW.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Discharge of non-compliant effluent.	▪ Implement monitoring programme that includes *inter alia* the effluent quality and receiving aquatic environment. ▪ Comply with conditions of the WUL.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local to regional	high	long-term	likely to almost certain	-3
After Mitigation	-	local to regional	low	long-term	unlikely	-1

▪ Sedimentation and contamination of the Orange River caused by: o Inadequate stormwater management on the site; o Inadequate storage and handling of dangerous goods (e.g. chlorine); o Poor management of sewage, effluent and waste.	▪ Implement adequate stormwater management at the K-WWTW to prevent concentration or pooling of water, accelerated natural flow of the water from the site, and contamination of stormwater by the works. ▪ Develop an Emergency Preparedness and Response Plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution. ▪ See mitigation measures related to hazardous substances and waste (**Section 13.18**).

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local to regional	high	long-term	likely	-3
After Mitigation	-	local	low	long-term	moderate	-1

▪ Damage to the K-WWTW from major flood events.	• Determine the 1:100 year floodline of the Orange River in relation to the K-WWTW. • Safeguard the K-WWTW from major floods. • Develop an Emergency Preparedness and Response Plan for K-WWTW to deal with floods. • Elevate electrical equipment and essential systems and equipment above the 1:100 year floodline of the Orange River. • Provide flood barriers around essential systems and equipment. • Secure or elevate chemical and other tanks. • Adequate design of stormwater system at K-WWTW to cater minor and major flood events. • Flood damaged structures to be promptly repaired by the DKM.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local to regional	high	long-term	unlikely	-3
After Mitigation	-	local	medium	long-term	unlikely	-2

13.13 Aquatic Ecology

The findings from the Freshwater Assessment (contained in **Appendix E1**) follow.

13.13.1 Impact Description

The Project's potential impacts to aquatic ecology are listed in **Table 29** below.

Table 29: Potential impacts to aquatic ecology (Kindler, 2021)

Aspect	Activity	Impacts to Watercourses
Construction		
Habitat integrity	Clearing associated with upgrades and expansion	Smothering and subsequent loss of instream habitat due to sediment inputs
	Operation of equipment and machinery near watercourses (emergency overflow dam)	Disturbance and poaching of wetland / riverine soils and vegetation
Sediment balance	Demolition and reconstruction of existing infrastructure	Increase in sediment inputs & turbidity
		Alteration of soil profile
	Soil and building material stockpile management	Increase in sediment inputs & turbidity and associated smothering and loss of instream habitat
		Input of toxicants
Water quality	Contamination due to improper storage of chemicals, construction materials, fuel and machinery leaks	Physical changes (e.g. turbidity)
		Chemical changes (e.g. pH, salinity toxicants and heavy metals)
		Loss of aquatic habitat and biota
	Eutrophication and contamination from infrastructure waste	Nutrient loading
		Inputs of toxic organic contaminants
		Loss of aquatic habitat and biota
Rehabilitation	Final landscaping and post-construction rehabilitation	Excess rubble and construction material in channel and riparian areas
		Increased sedimentation
		Increased erosion from exposed surfaces
Operation		
Flow dynamics	Increased discharge volumes	Flow path modification
		Alteration to flow patterns and velocities
		Erosion of exposed surfaces and bank collapse
		Alteration/degradation of aquatic habitat and biota
Water quality	Input of treated effluent into watercourse	Nutrient loading
		Inputs of toxic organic contaminants
		Alteration/degradation of aquatic habitat and biota
	Leaks and spills from facility	As per Input of treated effluent into watercourse
	Contamination, dumping of solid wastes and input associated with WWTW facility	Input of toxicants
		Increased litter and refuse within the watercourse
Anthropogenic disturbance	Establishment of alien plants on disturbed areas	Degradation of watercourse flora and fauna through the spread of alien and invasive species

13.13.2 Impact Assessment

The following impact assessment, as well as the mitigation measures to follow, were extracted from the Freshwater Assessment (**Appendix E1**).

Table 30: DWS Risk Impact Matrix for the proposed project (Kindler, 2021)

Activity	Severity					Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Without Mitigation	* With Mitigation
	Flow Regime	Water Quality	Habitat	Biota	Total											
Construction Phase																
Clearing associated with upgrades and expansion	2	3	2	2	**2.3**	1	2	**5.3**	2	2	1	1	6	**31.5**	Low	Low
Operation of equipment and machinery near watercourses (emergency overflow dam)	2	4	4	3	**3.3**	1	2	**6.3**	4	3	1	1	9	**56.25**	Moderate	Low
Demolition and reconstruction of existing infrastructure	2	4	3	4	**3.3**	1	2	**6.3**	3	3	1	1	8	**50**	Low	Low
Soil and building material stockpile management	2	3	2	3	**2.5**	3	2	**7.5**	2	2	1	2	7	**52.5**	Low	Low
Contamination due to improper storage of chemicals, construction materials, fuel and machinery leaks	1	4	4	4	**3.3**	3	2	**8.3**	1	2	5	1	9	**74.25**	Moderate	Low
Eutrophication and contamination from infrastructure waste	3	4	4	4	**3.8**	3	2	**8.8**	1	2	5	1	9	**78.75**	Moderate	Low
Final landscaping and post-construction rehabilitation	1	2	4	3	**2.5**	1	1	**4.5**	1	3	1	3	8	**36**	Low	Low
Operational Phase																
Increased discharge volumes	4	3	4	4	**3.8**	3	4	**10.8**	5	4	5	1	15	**161.25**	Moderate	Moderate
Input of treated effluent into watercourse	4	5	4	5	**4.5**	3	4	**11.5**	5	4	5	1	15	**172.5**	High	Moderate
Leaks and spills from facility	3	4	4	4	**3.8**	3	2	**8.8**	1	2	5	1	9	**78.75**	Moderate	Low
Contamination, dumping of solid wastes and input associated with WWTW facility	1	3	3	3	**2.5**	2	4	**8.5**	1	4	1	2	8	**68**	Moderate	Low
Establishment of alien plants on disturbed areas	1	2	3	1	**1.8**	2	5	**8.8**	3	3	1	2	9	**78.75**	Moderate	Low

* In accordance with General Notice 509 of 2016, risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.

- Mitigation for Altered Surface Flow, & Hydrological Regime:
  - The recommended buffer zones (32m) should be strictly adhered to during the construction phase of the Project. Any supporting aspects and activities not required to be within the buffer area should adhere to the buffer zone.
  - During the excavation of trenches, surface flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any watercourse banks that could cause erosion.
  - All removed soil and material must not be stockpiled within the aquatic system or riparian area. Stockpiling should take place outside of the water resources and remain within the existing K-WWTW permitter fence. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
  - Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
  - Only primary activities related to the alteration/upgrade of discharge infrastructure to cater for increased flow volumes should be allowed within the watercourse area. All related construction activities related to the area must be restricted to have a minimum footprint of disturbance. [Insert: it is noted that the proposed upgrade and expansion works excludes the discharge infrastructure and will not increase the effluent volume].
  - Install appropriate erosion protection measures at the interface between the discharge infrastructure and the riverbanks in the form of gabions, reno mattresses or large boulders (preferred) secured in place. [Insert: it is noted that the proposed upgrade and expansion works excludes the discharge infrastructure].
  - Routine monitoring of discharge points should be conducted to identify areas prone to erosion and bank collapse. Problem areas should be addressed immediately.
  - Contamination of watercourses with unset cement or cement powder should be negated as it is detrimental to aquatic biota.
  - Discharge infrastructure should avoid impeding flows (damming) by facilitating streamflow and catering properly for both low flows and high flows. [Insert: it is noted that the proposed upgrade and expansion works excludes the discharge infrastructure].
  - Surface run-off from the Project Area flowing down the embankments often scours the watercourse on the sides of the stormwater infrastructure causing sedimentation of the river channel. This should be catered for with adequate concreted stormwater drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner.
- Mitigation for Impaired Water Quality:
  - All construction activities must be undertaken during the low flow (dry season) period as much as possible to limit surface flow transporting contaminants to the surrounding watercourse habitat.
  - Construction areas, laydown yards, camps and storage areas should not extend beyond the existing K-WWTW permitter fence, and the riparian and watercourse areas must be marked as “restricted” in order to prevent the unnecessary impact to and loss of these systems.

- The emergency overflow dam that intercepts high peak flows that cannot be handled by the installed equipment must be regularly inspected for signs of failure with immediate corrective actions taken to address areas of failure. This will limit pollution events in the receiving Orange River. [Insert: it is noted that the proposed upgrade and expansion works excludes the emergency overflow dam].
- The emergency overflow dam is subject to sludge accumulation lowering the capacity of the structure. This sludge needs to be removed on a bi-annual basis or more frequently should increased frequency be required to create additional capacity. [*Insert: it is noted that the proposed upgrade and expansion works excludes the emergency overflow dam*].
- The emergency overflow dam recycle pump station should be regularly serviced to avoid failure of the pump during critical periods and subsequent increased pollution input events in the receiving Orange River. [*Insert: it is noted that the proposed upgrade and expansion works excludes the emergency overflow dam*]
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”.
- During construction contractors used for the Project must have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly.
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- As much material must be prefabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site.
- All chemicals and toxicants during construction must be stored in bunded areas.
- All machinery and equipment should be inspected regularly for faults and possible leaks, and these should be serviced off-site.
- Adequate sanitary facilities and ablutions must be provided for all personnel throughout the Project Area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation and watercourse).
- Any materials excavated must not be deposited in the watercourse where it is prone to being washed downstream and smothering instream habitat.
- No dumping of construction material on-site may take place.
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.
- A suitable stormwater plan must be compiled for the facility and implemented during the construction phase. This plan must attempt to displace and divert stormwater from the Project Area and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced with energy dissipaters and flows discharged into the local watercourses. This plan must be ongoing and adaptive based on on-site conditions. All stormwater infrastructure must be monitored and maintained addressing areas on non-efficacy.

- It is preferred that during the operational phase, stormwater flows should pass through vegetated depressions and channels with stepped and vegetated swales for flow attenuation and phytoremediation before entering the watercourse.
- During operation, the K-WWTW infrastructure must be routinely monitored for maintenance needs for the life of the Project. It is advisable that monitoring occur weekly during the dry season and daily during the wet season to identify any system failure which could lead to contamination of the groundwater and surrounding watercourses.
- Sulphurous odours are normally the first indication that the WWTW is not functioning optimally. The source of odour must be investigated immediately and appropriate corrective measures taken.
- During operation of the WWTW all sewerage infrastructure must be properly and regularly managed, maintained and operated throughout the life of the Project.
- Any leaks and failures of the sewerage infrastructure must be fixed immediately, and areas rehabilitated as needed.
- The existing plant and equipment must be brought up to full operational capacity.
- Effluent quality must at a minimum be analysed monthly for the first two years after any upgrades and bi-monthly thereafter. Appropriate corrective action must be taken if contamination is detected or if effluent quality does not meet discharge standards.
- An independent professional wastewater treatment specialist should be appointed to monitor and audit the WWTW on a regular basis and ensure the quality of final effluent conforms to legal DWS' quality standards in terms of the NWA for both discharge and irrigation (downstream users).

❑ Mitigation for Erosion & Sedimentation:

- All removed soil and material must not be stockpiled within water resources. Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
- Install sandbags around soil stockpiles to prevent soils washing into water resources.
- Document the soil profile on removal and ensure the soil is backfilled in the same horizon order in which it was removed.
- Ensure that topsoil is appropriately stored and re-applied.
- Make sure that the soil is backfilled and compacted to appropriate geotechnical specifications for the Project Area.
- Signs of erosion must be addressed immediately to prevent further erosion of the upgraded infrastructure.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- Landscape and re-vegetate all cleared areas as soon as possible to limit erosion potential.

- Mitigation for Alien Vegetation Establishment:
  - Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the Project's footprint.
  - An alien invasive plant management plan needs to be compiled and implemented prior to construction to control and prevent the spread of invasive aliens. This is particularly applicable for the area beyond the perimeter fence at the discharge area, as access through the access gate was limited by dense alien vegetation that has not been maintained. Subsequently the monitoring of the discharge point and associated infrastructure cannot be conducted. [*Insert: it is noted that the proposed upgrade and expansion works excludes the discharge infrastructure*].
- Recommendations:
  - A competent Environmental Control Officer (ECO) must oversee the construction and rehabilitation phase of the Project, with watercourse areas as a priority.
  - An infrastructure monitoring and service plan must be compiled and implemented during the operational phase. This will include monitoring all stormwater discharge points, energy dissipation structures, and stability of watercourse banks in the Project footprint, which must include 100 m of the river reach below the discharge point.
  - A biannual aquatic biomonitoring programme is recommended to determine the efficacy of the treatment facility while achieving National biodiversity goals. An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative impacts brought about by the effluent discharges.

13.14 Terrestrial Ecology

13.14.1 Impact Description

According to the Terrestrial Ecology Compliance Statement (Erasmus, 2021), the project area is in a modified state, resulting in a low habitat sensitivity. The land classification as identified by the Northern Cape Biodiversity Conservation Plan; CBA 1, is not relevant to the footprint area.

Several individuals of Camel thorn (*Vachellia erioloba*) were observed in the project area. These trees are protected in terms of the NFA and must not be harmed whatsoever unless a permit to do so has been obtained.

The Project may cause the following impacts from a terrestrial ecological perspective:

- Construction phase:
  - Noise and vibration;
  - Nights lights may affect nocturnal faunal species;
  - Illegal harvesting and poaching of faunal and floral species by construction workers;
  - Pollution of the biophysical environment from poor construction practices; and

- Proliferation of invasive alien species in disturbed areas.

❑ Operational phase:

- Proliferation of invasive alien species in disturbed areas; and
- Environmental pollution caused by inadequate management of waste (sludge and screenings) and the discharge of sub-standard effluent from the plant.

13.14.2 Impact Assessment

The following impact assessment is based on the Terrestrial Ecology Compliance Statement (**Appendix E2**).

Environmental Feature	**Terrestrial Ecology**
Project life-cycle	Construction and operational phases.
Relevant Alternatives & Activities	All construction and operational activities that pose a risk to terrestrial ecology.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Loss and fragmentation of vegetation communities and the CBA 1 areas in the vicinity of the Project Area (including watercourses). ▪ Loss and disturbance of faunal species and community (including occurring and potentially occurring species of conservation concern).	▪ Areas of indigenous vegetation, even secondary communities outside of the direct Project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. ▪ The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence. ▪ All watercourses and riparian areas are no-go areas. Signs must be put up to enforce this. ▪ Where possible, existing access routes and walking paths must be made use of. ▪ All laydown areas should be restricted to already bare areas within the K-WWTW. Any materials may not be stored for extended periods of time and must be removed from the Project Area once the construction/closure phase has been concluded. ▪ Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species. Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion. ▪ No plant species whether indigenous or exotic should be brought into / taken from the Project Area, to prevent the spread of exotic or invasive species or the illegal collection of plants. ▪ A fire management plan needs to be complied and implemented to restrict the impact fire might have on the surrounding areas. ▪ Several individuals of Camel thorn (*Vachellia erioloba*) were observed occurring at random within and around the Project Area. These trees are protected in terms of the NFA. In accordance with Section 15(1) of the aforementioned Act, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. If left undisturbed the sensitivity and importance of these species needs to be part of the Environmental Awareness Programme to be implemented.

	▪ Noise must be kept to an absolute minimum during the evenings to minimize all possible disturbances to amphibian species and nocturnal mammals. ▪ No trapping, killing, or poisoning of any wildlife is to be allowed. Signs must be put up to enforce this. ▪ Try incorporating motion detection lights as much as possible to reduce the duration of illumination. Heights of light columns to be minimised to reduce light spill. ▪ Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas (watercourses and riparian areas). ▪ All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited. ▪ Use environmentally friendly cleaning and dust suppressant products. ▪ An alien management plan must be implemented quarterly for 3 years after construction. ▪ All construction staff are to undergo Environmental Awareness Training. Discussions are required on sensitive environmental receptors within the Project Area. The avoidance and protection of watercourses and riparian areas must be included in the training.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium to high	long-term	moderate	-3
After Mitigation	-	local	low	long-term	unlikely	-1

13.15 Socio-Economic Environment

13.15.1 Impact Description

The Project may cause the following impacts to the socio-economic environment:

- Construction phase:
  - Influx of people seeking employment and associated impacts (e.g. foreign workforce, cultural conflicts, squatting, demographic changes);
  - Safety and security;
  - Use of local road network;
  - Nuisance from dust and noise;
  - Consideration of local labourers and suppliers in area – stimulation of local economy (positive impact); and
  - Transfer of skills (positive impact).
- Operational phase:
  - A WWTW is an odorous facility that may cause a nuisance to surrounding communities; and
  - The pollution caused to the Orange River from sub-standard effluent quality impacts on agricultural practices such as downstream irrigators.

13.15.2 Impact Assessment

Environmental Feature	Socio-Economic Environment
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Disturbances arising from construction activities.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Influx of workers.	▪ All employment of locally sourced labour should be controlled on a contractual basis. If possible, and if the relevant Ward Councillors deem it necessary, the employment process should include the affected Ward Councillors. ▪ People in search of work may move into the area, however, the Project will create a limited number of job opportunities. Locally based people should be given an opportunity. ▪ No staff accommodation should be allowed on site.
▪ Worker Health and Safety.	▪ The Contractor should establish an HIV/AIDs awareness programme. ▪ See mitigation measures related to health and safety (**Section 13.20**).
▪ Worker Behaviour & Crime.	▪ Induction will be mandatory for all workers. ▪ Develop a Code of Conduct in terms of behaviour of construction staff. ▪ During construction, the working areas should be fenced to prevent trespassing and expansion of the working footprint. ▪ All the Contractor's staff should be easily identifiable through their uniforms. ▪ Develop a security policy for the Contractor's staff.
▪ Communicable Diseases.	▪ Define and implement pre-employment medical requirements for all workers. ▪ Provide adequate hygiene and sanitation facilities to workers. ▪ Implement all necessary measures to contain the spread of COVID-19 and to safeguard workers and the local communities from this virus.
▪ Grievances.	▪ The Contactor will develop and implement a formal grievance redress mechanism to record, investigate and resolve any complaints from communities.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	moderate	-2
After Mitigation	-	local	low	short-term	unlikely	-1

13.16 Air Quality

13.16.1 Impact Description

The land surrounding the K-WWTW is vacant and rural in nature. The nearest receptors of malodour and other forms of air pollution include residential areas referred to in **Section 11.9** above.

The Project may cause the following impacts to air quality:

- Construction phase:
  - Dust from the use of dirt roads by construction vehicles;
  - Dust from bare areas that have been cleared for construction purposes;
  - Emissions from construction equipment and machinery; and
  - Tailpipe emissions from construction vehicles.
- Operational phase:
  - According to Bigen (2021), the K-WWTW includes the following potential sources of malodour –
    - The HoW (including the bucket wash system inlet) is a likely source of odour pollution, as it comprises of screening, grit removal and a raw sewage pump station. All these unit processes promote turbulent flow which result in the escape of odour gasses from the liquid. In order to minimise odour emissions from this area of the works, all open areas will be covered with GRP panels and fitted with an active air extraction and scrubbing system. It will be possible to install bio-filters for odour scrubbing. These are containers filled with, inter alia, materials such as compost through which the odorous air is pumped. The ongoing biological activity inside the compost matrix then ensures the removal of odorous particles through biological activity, oxidation, and adsorption onto the media.
    - It is predicted that the emergency storage dam will not be particularly odorous operation. Care will be taken to ensure turbulent flows are limited in this unit, thus limiting the generation of odour (i.e. escape of gasses). It is also expected that the dam will not be active for the majority of the time (i.e. only during emergency conditions), which negates the requirement for full time odour control. However, the installation of odour masking equipment, consisting of aerosol sprays of aromatic compounds, can be considered as an alternative solution for this system.
    - The dewatering facility is a likely source of odour pollution, as it comprises of both digested sludge and WAS treatment. Dewatering of the sludge results in the release of odour gasses from the sludge. In order to minimise odour emissions from the dewatering facility, an active air extraction and scrubbing system will required. As is the case for the HoW, a similar installation of bio-filters for odour scrubbing can be utilised.
    - The solar drying unit is another likely source of odour pollution. Covering the concrete slab for odour control is not considered practical. The installation of odour masking equipment, consisting of aerosol sprays of aromatic compounds, can be considered as an alternative solution for this system.
  - Other impacts to air quality caused by the operation and maintenance of the plant include dust from the use of dirt roads and tailpipe emissions from vehicles.

Mitigation measures are included in the EMPr to ensure that the air quality impacts during the construction phase are suitably monitored and managed and that regulated thresholds are not exceeded. The EMPr also includes measures to control and minimize GHG emissions.

13.16.2 Impact Assessment

Environmental Feature	Air Quality
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Construction activities on the Project site.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Increased dust levels as a result of construction activities, which may impact on workers and the surrounding community, as well as on crop production.	▪ Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water or chemical soil binders), particularly during prolonged periods of dry weather. ▪ Speed limits on site to be strictly adhered to. ▪ Acceptable reinstatement and rehabilitation of disturbed areas, outside development footprint.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	short-term	moderate	-2
After Mitigation	-	local	low	short-term	unlikely	-1

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	▪ Operation of components such as the HoW, emergency storage dam, and dewatering facility at the K-WWTW that may serve as potential sources of malodour. ▪ Biogas, containing high methane concentrations, will be produced as a result of the treatment of the wastewater.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Air emissions from wastewater treatment operations, which are a nuisance to workers and the surrounding community.	▪ Implement effective odour control at the K-WWTW. ▪ Final design for odour control (should it be required) to be done on a design supply type solution, whereby a performance and material specification with predicted odorous locations will be specified for scrubbing/masking.
▪ Contribution of methane emissions to the GHG footprint of the K-WWTW. Methane gas is combustible and poses a safety risk.	▪ A gas flare will be used to burn off the methane gas produced as a result of the treatment of the wastewater. The flare will be operated in accordance with all relevant standards.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium	long-term	likely	-2
After Mitigation	-	local	low	long-term	unlikely	-1

13.17 Noise

13.17.1 Impact Description

Sensitive receptors to noise impacts in the study area include people residing in the surrounding urban and rural areas, as well as ecological receptors (fauna).

During construction, localised increases in noise will be caused by earthworks, establishment and operating of site construction laydown area, construction of new infrastructure, transportation of construction workers and material, activities at the construction camp, and general construction noise.

Noise that emanates from construction and operational activities are addressed through targeted best practices in the EMPr. The associated regulated standards need to be adhered to.

Project personnel working on the construction site will experience the greatest potential exposure to the highest levels of noise and vibration. Workplace noise and vibration issues will be managed as part of the OHS Management System to be employed on site, which will include specific measures aimed at preventing hearing loss and other deleterious health impacts.

13.17.2 Impact Assessment

Environmental Feature	**Noise**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Construction activities on the Project site.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Localised increase in noise caused by construction activities, which may cause a nuisance to workers and the surrounding community.	▪ Provisions of SANS 10103:2008 to apply to construction areas within audible distance of residents. ▪ Working hours to be agreed upon with the Engineer, so as to minimise noise disturbance. ▪ Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed, where necessary.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	unlikely	-2
After Mitigation	-	local	low	short-term	unlikely	-1

13.18 Hazardous Substances & Waste

13.18.1 Impact Description

Improper management of hazardous substances and waste during the construction and operational phases may pollute the biophysical environment (air, surface water, groundwater and soil), and pose risks to humans, flora and fauna. It may also cause visual impacts.

Examples of hazardous substances stored at a WWTW include substances applied for coagulation, flocculation, lubrication, pH correction, odour abatement filter material, and chemical dosing (amongst others).

A small proportion of the waste generated during the construction phase will be hazardous and may include used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags (amongst others). Wastewater, including water adversely affected in quality through construction-related activities and human influence, will include sewage, water used for washing purposes (e.g. equipment, staff) and drainage over contaminated areas (e.g. workshop, equipment storage areas).

Provision is made in the EMPr to manage impacts associated with hazardous substances and waste.

13.18.2 Impact Assessment

Environmental Feature	**Hazardous Substances & Waste**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Storage and use of hazardous substances, as well as generation of waste.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Environmental pollution caused by improper management of hazardous substances and waste.	▪ Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the NEM:WA, Hazardous Substances Act (No. 15 of 1973), OHS Act (No. 85 of 1993), norms and standards in GN No. R. 926 of 29 November 2013, relevant associated Regulations, and applicable SANS standards. ▪ Record details and quantities of hazardous substances on the construction site. ▪ Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination and will adhere to the requirements stipulated on the Material Safety Data Sheets. ▪ All storage tanks containing hazardous materials must be placed in bunded containment area with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. ▪ In the event of spillages of hazardous substances, the appropriate clean up and disposal measures shall be implemented. A spill management plan shall be in place. ▪ All waste (general and hazardous) generated during the construction phase shall be disposed of at an appropriately licenced waste disposal facility.

	▪ Prevent or minimize spills, releases, and exposures to employees and the public during transportation of waste. All waste containers shall be secured and labelled with the contents and associated hazards, be properly loaded on the transport vehicles, and be accompanied by a manifest that describes the load and its associated hazards. ▪ Wastewater to be properly disposed of.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium to high	short to medium-term	likely	-3
After Mitigation	-	local	low	short-term	unlikely	-1

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	Storage and use of hazardous substances (e.g. chlorine or other compounds used for disinfection), as well as generation of waste, associated with the operation of the K-WWTW.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Environmental pollution caused by improper management of hazardous substances and waste.	▪ Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the NEM:WA, Hazardous Substances Act (No. 15 of 1973), OHS Act (No. 85 of 1993), norms and standards in Government Notice No. R. 926 of 29 November 2013, relevant associated Regulations, and applicable SANS standards. ▪ Record the details and quantities of hazardous substances at facility. ▪ Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination and will adhere to the requirements stipulated on the Material Safety Data Sheets. ▪ All storage tanks containing hazardous materials must be placed in bunded containment area with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. ▪ Prevent uncontrolled releases of hazardous substances to the environment. ▪ Implement engineering controls (e.g. containment, automatic alarms, and shut-off systems) for storage areas of hazardous substances. ▪ Develop an Emergency Preparedness and Response Plan, which includes the management of spills (amongst others). Such a plan must make provision for inter alia training, inspections, Standard Operating Procedures, mapping of locations of hazardous materials, specific Personal Protective Equipment (PPE) required, spill response equipment, response activities and responsibilities. ▪ All waste (general and hazardous) generated during operational phase to be disposed of at appropriately licenced waste disposal facility. ▪ Ensure adequate disposal of wastewater. Contaminated water will not be discharged to the environment. ▪ Comply with WML conditions (if granted) for sludge management.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local to regional	high	long-term	likely	-3
After Mitigation	-	local	low	long-term	moderate	-1

13.19 Traffic

13.19.1 Impact Description

The main trip generation will be during the construction period and will depend on the tempo of construction and the types of vehicles to be used to transport materials and construction staff. Construction vehicles accessing and leaving the gravel toad to the site via the N14 may pose risks to other road users. The gravel road leading to the K-WWTW may also be damaged by construction vehicles.

The traffic generated by the Project during the operational phase is expected to be limited.

13.19.2 Impact Assessment

Environmental Feature	**Traffic**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	Use of surrounding road network by construction vehicles.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Disruptions to existing road users during construction. ▪ Impacts to road conditions.	▪ Adhere to SANRAL's requirements in terms of access to the site from the N14 and traffic management measures. ▪ Clearly demarcate all construction access roads and maintain access control to site. ▪ Strict adherence to speed limits by construction vehicles on public roads and access roads. Appropriate speed limits shall be posted on all construction roads. ▪ Implement appropriate safety and traffic calming measures (e.g. flag men, speed reductions and warning signage).

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	medium	short-term	moderate	-2
After Mitigation	-	local	low	short-term	unlikely	-1

[redacted]

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	Accessing the K-WWTW via the N14.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
▪ Traffic hazards associated with accessing the K-WWTW via the N14.	▪ Ensure safe access to the K-WWTW, taking into consideration the high-speed environment along the N14. ▪ Adhere to SANRAL's requirements in terms of access to the site from the N14.

	+/- Impacts	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**
Before Mitigation	-	local	low to medium	long-term	unlikely	-2
After Mitigation	-	local	low	long-term	unlikely	-1

13.20 Health and Safety

13.20.1 Impact Description

Health and safety related risks associated with the Project during the construction phase include the following:

- Hazards related to construction work;
- Risks posed by working inside an operational WWTW;
- Increased levels of dust and particulate matter;
- Increased levels of noise;
- Water (surface and ground) contamination;
- Poor water and sanitation;
- Communicable diseases;
- Psychosocial disorder (e.g. social disruptions);
- Safety and security; and
- Lack of suitable health services.

Examples of hazards associated with the operational phase of a WWTW include the following:

- Exposure to hazardous chemical and biological materials contained within the effluent and the reagents used at the facility
- Injuries caused by slips, trips and falls on wet floors and by falls into treatment ponds, pits, clarifiers or vats;
- Injuries from sharp tools; and
- Exposure to hazards related to work in confined spaces.

Health and safety related risks are addressed through mitigation measures identified under other environmental features, such as socio-economic environment, surface water, air quality, noise, as well as best practices included in the EMPr. Additional management requirements will be included in the Project's OHS system.

13.20.2 Impact Assessment

Environmental Feature	**Health and Safety**
Project life-cycle	Construction phase.
Relevant Alternatives & Activities	All construction activities that pose risks to health and safety.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Health and safety risks during construction.	▪ Dedicated OHS system to be implemented by the Contractor. ▪ Undertake a hazard identification and risk assessment and identify preventive and protective measures. ▪ Conduct basic safety awareness training with construction workers. ▪ Provide all workers with the necessary PPE. ▪ Prevent environmental contamination. ▪ Provide potable water and sanitation services to workers. ▪ All workers shall be clearly identifiable.

	▪ Prepare an Emergency Preparedness and Response Plan. ▪ Ensure adequate control of communicable diseases. ▪ Maintain access control to construction domain.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium to high	short-term	moderate	-3
After Mitigation	-	local	low	short-term	unlikely	-1

Project life-cycle	Operational phase.
Relevant Alternatives & Activities	All operation and maintenance activities that pose risks to health and safety.
Potential Aspects & Impacts	**Proposed Management Objectives / Mitigation Measures**
Health and safety risks posed by operation and maintenance activities.	▪ Dedicated OHS system to be implemented during the operational phase. ▪ Conduct basic safety awareness training with all operational staff. Include in safety training programme for staff, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors associated with the K-WWTW. ▪ Provide and require use of suitable PPE and equipment to prevent contact with wastewater. ▪ Temporary Contractors to adhere to OHS requirements. ▪ Maintain good housekeeping in sewage processing and storage areas. ▪ Provide potable water and sanitation services to operational staff. ▪ Prepare an Emergency Preparedness and Response Plan. ▪ Control access to the K-WWTW.

	+/- Impacts	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	-	local	medium to high	long-term	moderate	-3
After Mitigation	-	local	low	long-term	unlikely	-1

13.21 "No-Go" Impacts

The "no-go option" is the alternative of not implementing the activity. It needs to be considered in light of the motivation (see **Section 3.1** above) as well as the need and desirability (see **Section 8** above) of the Project.

The "no-go option" can be regarded as the baseline scenario against which the impacts of the Project are evaluated. This implies that the current status and conditions associated with the K-WWTW will be used as the benchmark against which to assess the possible changes (impacts) associated with the Project.

Should the proposed Project not go ahead, any potentially significant environmental issues associated with the Project's scope would be irrelevant, and the status quo will remain. The objectives of the Project will not materialise, with the following implication:

- The quality of the effluent will not be improved and will remain in non-compliance with DWS' effluent quality standards. The poor quality of the water abstracted by downstream irrigators, which is caused by the discharge of sub-standard effluent from K-WWTW, will continue to compromise agricultural products for local and international markets;
- The potential reuse of the works' effluent will also not be possible;
- The operations of the K-WWTW will not be enhanced;
- The capacity of the works will not increase, and it will be unable to service new residential and, to a lesser extent, industrial runoff located within the Works' planned drainage area;
- Sludge quality will be such that it can only be disposed of at a hazardous landfill site, which will result in extensive costs; and
- As influent increases due to rising population growth, mechanical equipment failure will be experienced more frequently as the plant will operate at a higher demand than what it was designed for. This will result in the worse effluent quality and poor sludge quality, as well as the overall regression of quality in the civil and mechanical infrastructure until the WWTW is no longer operational.

13.22 Cumulative Impacts

13.22.1 Introduction

A cumulative impact, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Cumulative impacts can be identified by combining the potential environmental implications of the Project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the Project area. It is noted that the accurate characterisation of the future state of the Project area is inherently speculative to an extent, due to the dynamic nature of future decisions related to land use and growth, water use (consumptive, waste-related and encroachments), protection of terrestrial and aquatic biological resources, etc.

13.22.2 Cumulative Land Use Impacts

Cumulative impacts need to be considered in light of the Project's aim to upgrade and expand the current K-WWTW, which was already built in the 1970's, to increase its capacity to allow for the efficient operation of the plant according to the relevant standards. This also includes improving the quality of the effluent discharged by the plant to satisfy DWS' effluent quality standards.

As mentioned, the municipal SDF of 2017 designates the area encompassed by the K-WWTW as a 'sewage plant' (see **Figure 30** above) and further shows a 1000 m risk zone around the plant. The future planning for this area should aim to enforce the K-WWTW's risk zone and to be aligned

with the SDF. If this is the case, certain cumulative impacts that relate to the immediate vicinity of the K-WWTW and its surrounding environment may be avoided.

13.22.3 Cumulative Soil Impacts

Developments in the surrounding area will disturb surface soils, which may cause cumulative impacts in terms of erosion. The respective developments will need to implement the recommendations from geotechnical studies and make provision for suitable stormwater management and rehabilitation. Measures to manage impacts to soil are included in the EMPr.

13.22.4 Cumulative Water Resources Impacts

Although the focus of the WML is not on the quality of the effluent, which is addressed through the WULA, it is recognised that the effluent from a wastewater treatment plant may contribute significantly towards the deterioration of the water quality in a receiving watercourse.

According to the Freshwater Assessment (Kindler, 2021), the modified water quality, flow and habitat drivers of the Orange River have cumulatively decreased the ecological integrity of the system, as was illustrated by the sampled macroinvertebrate and fish community, which was dominated by tolerant taxa, with a low diversity of moderately sensitive taxa.

From the perspective of the Orange River, cumulative impacts from the discharge of sub-standard effluent from the K-WWTW may include increased nutrient loading and inputs of toxic organic contaminants. This will lead to the alteration/degradation of aquatic habitat and biota. It will also impact on downstream water users, such as irrigators. It is emphasised that the proposed Project aims to ensure that the K-WWTW will discharge effluent of suitable quality, which will benefit the receiving river and downstream water users.

13.22.5 Cumulative Terrestrial Biodiversity Impacts

The area earmarked for the waste management activities have been historically transformed/disturbed. According to the Terrestrial Ecology Compliance Statement (Erasmus, 2021), the Project area is in a modified state, resulting in a low habitat sensitivity. The Project's contribution to cumulative impacts to terrestrial biodiversity are thus not anticipated to be significant.

13.22.6 Cumulative Heritage Impacts

Due to the disturbed nature of the areas where the waste management activities are planned at the existing K-WWTW, it is anticipated that the Project's contribution to cumulative heritage impacts will not be significant. No cumulative impacts were identified as part of the Phase 1 Cultural Heritage Impact Assessment.

13.22.7 Cumulative Transportation Impacts

The construction period may cause traffic-related impacts in terms of the local road network, which will be associated with heavy vehicle construction traffic for the delivery of material and the transportation of construction workers. This may compound traffic impacts if other large-scale projects are planned during the same period.

13.22.8 Cumulative Air Quality Impacts

The land surrounding the K-WWTW is vacant and rural in nature. The nearest receptors of malodour and other forms of air pollution include the residential areas of Lemoendraai and Belview that are located approximately 700 m and 580 m to the west and north of the site, respectively, as well as land used for commercial agriculture that is located approximately 200 m to the east of the site.

Odour control measures at the K-WWTW are discussed in **Section 13.16** above.

13.22.9 Cumulative Noise Impacts

Construction of the proposed facilities along with construction activities of other developments in the Project area could potentially increase noise impacts on surrounding land uses. This impact will be temporary in nature. It is further noted that noise is a localised issue that diminishes in intensity with distance from the source. Sensitive receptors to noise are similar to those that may be adversely affected by air pollution. Refer to a description of these receptors, in terms of surrounding residential areas, in **Section 13.23.8** above.

The Project's contribution to cumulative noise impacts is thus not anticipated to be significant. Measures are included in the EMPr to manage noise impacts that may be caused by the Project.

13.22.10 Cumulative Services & Utilities Impacts

Developments in the area, including in the town of Upington, will increase the demand on public services and utilities. It will need to be determined whether adequate capacity exists to cater for each development, through consultation with and applications (where relevant) to the relevant service providers, including the DKM and Eskom.

It is noted that the aim of the Project is to increase the capacity of the K-WWTW from 16 Ml/d to 24 Ml/d, which is to cater for the next 20-years of demand.

14 ANALYSIS OF ALTERNATIVES

14.1 General

Alternatives are the different ways in which a project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project.

By conducting the comparative analysis, the BPEO can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "*provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term*".

14.2 "No-Go" Option

The implications of the "no-go" option are discussed in **Section 13.21** above.

The "no go option" is not preferred, as the objectives of the Project will not be met, and the associated benefits will not materialise. Although not proceeding with the Project would avoid the adverse environmental impacts, these impacts are considered to be manageable through the provisions contained in the EIA Report and EMPr.

14.3 Technology Alternative

14.3.1 Sludge Treatment

Table 31 below compares the sludge treatment options that were considered for the K-WWTW.

Table 31: Comparison of sludge treatment options considered for the K-WWTW

Options	Advantages	Disadvantages
Sludge drying	▪ Not cost intensive. ▪ Requires minimum operational control. ▪ Minimum electricity required.	▪ The dried sludge cannot be used for agricultural or construction purposes due to the silica involved in the process.
Belt presses and linear screens	▪ Provides very good quality sludge and a good % dry solids content. ▪ This sludge can be reused.	▪ More cost intensive. ▪ Requires strict operational control.
Sludge dewatering facility	▪ The dewatering equipment and screw presses are easy to operate, endurable and sufficient for the sludge treatment requirements at K-WWTW.	▪ Requires operational control. ▪ More cost intensive than drying beds. ▪ Requires electricity supply to operate.

Based on **Table 31** above, the option of a Sludge dewatering facility was identified as the BPEO.

14.4 Waste Disposal Options

14.4.1 Disposal of Screenings

The use of the incinerator as an option for the disposal of screenings was considered. However, after combining the high costs for usage of an incinerator, the complexity of operational usage, as well as the high likelihood for failure of components, it was concluded that the disposal of screenings off-site at a landfill site is the most suitable solution (Bigen, 2021).

14.4.2 Sludge Management & Disposal

The key driver for selecting an appropriate disposal strategy is the sludge classification achievable by the WWTW. The sludge generated at the K-WWTW is classified as B1a, in terms of the GUDWS (see **Table 12** above), and it is thus regarded as low hazardous material. It is predicted that the future sludge classification associated with the K-WWTW will remain B1a or be better (i.e. A1a).

Four sludge management options were evaluated in the Preliminary Design Report (Bigen, 2021), namely:

- Sludge for agricultural use;
- Sludge as fertiliser product;
- Sludge for commercial products; and
- Disposal of sludge at a landfill site.

The proposed dewatering facility will facilitate a screw press and stockpile, resulting in a sludge viable for commercial and agricultural use. It was thus proposed that the agricultural/commercial strategies be implemented.

It is noted that the current WML Application only focuses on the proposed upgrade and expansion of the existing K-WWTW and does not include activities associated with agricultural/commercial use of the sludge. The preferred option to be pursued by the DKM at a later stage will need to be screened against the relevant environmental legislation to determine the consents required.

At this stage, it is assumed that the option of disposing the sludge and screenings at a waste disposal site is the current preferred alternative. Depending on the classification, this will either mean disposal at a hazardous waste disposal site (such as Vissershok Landfill in the Western Cape or Holfontein Landfill in Gauteng) or at a general waste disposal site (refer to municipal landfills in **Section 9.7.3** above).

15 PUBLIC PARTICIPATION

15.1 General

The purpose of public participation includes the following:

1. To provide I&APs with an opportunity to obtain information about the Project;
2. To allow I&APs to express their views, issues and concerns with regard to the Project;
3. To grant I&APs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the Project; and
4. To enable the Applicant to incorporate the needs, concerns and recommendations of I&APs into the Project, where feasible.

The public participation process followed for the EIA is governed by NEMA and the EIA Regulations. **Figure 41** below outlines the public participation process for the upfront Announcement Phase (completed), Scoping Phase (completed) and EIA Phase (current).

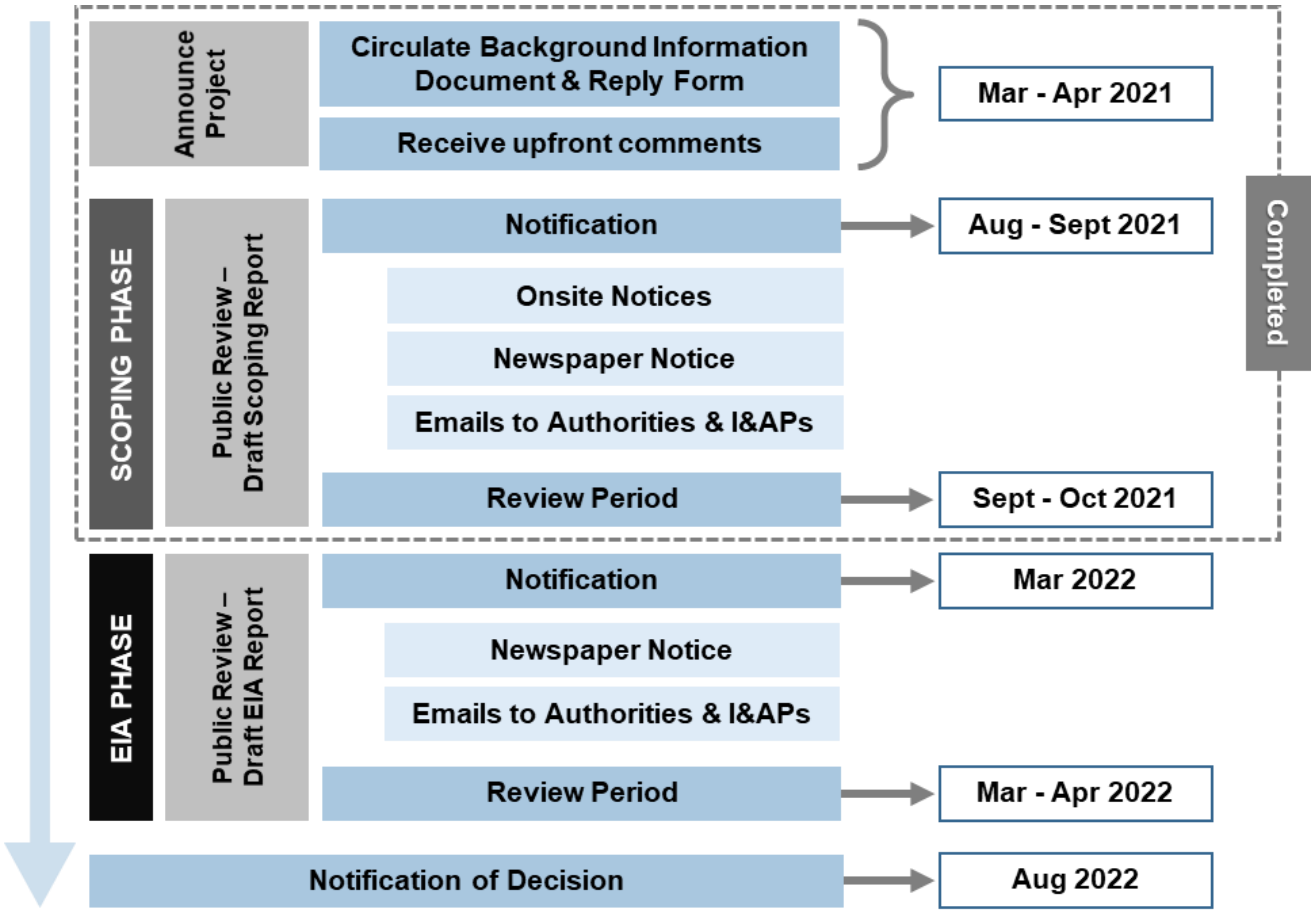

Figure 41: **Outline of Public Participation Process (*note: dates for EIA phase are subject to change*)**

15.2 Public Participation during the Announcement & Scoping Phases

The primary tasks undertaken as part of public participation during the Announcement and Scoping Phases included the following (details provided in the Scoping Report):

1. Compiling a database of I&APs;
2. Announcing the Project through the circulation of a Background Information Document and Reply Form to the I&APs;
3. Submitting a Public Participation Plan to DFFE, which was compiled in terms of the Directions regarding measures to address, prevent and combat the spread of COVID-19 relating to National Environmental Management Permits and Licences, as published in GN No. 650 of 5 June 2020, as well as Chapter 6 of the EIA Regulations. The Public Participation Plan was subsequently approved by DFFE;
4. Notifying I&APs of the review of the draft Scoping Report by erecting a site notice, placing a newspaper notice and forwarding emails to I&APs on the database;
5. Granting I&APs and authorities an opportunity to review the draft Scoping Report; and
6. Compiling and maintaining a CRR (contained in **Appendix H**).

15.3 Public Participation during the EIA Phase

15.3.1 Maintenance of the I&AP Database

The database of I&APs (contained in **Appendix F**), which includes authorities, different spheres of government (national, provincial and local), parastatals, stakeholders, landowners, interest groups and members of the general public, was maintained during the EIA phase.

15.3.2 Period to Review the Draft EIA Report

In accordance with Regulation 43(1) of the EIA Regulations, I&APs are granted an opportunity to review and comment on the draft EIA Report from **3 March until 4 April 2022**.

15.3.3 Notification of Review of Draft EIA Report

The following notifications were provided with regards to the review of the draft EIA Report:

- Authorities and I&APs contained in the database (refer to **Appendix F**) were notified via email (copies of emails to be included in the final EIA Report); and
- A notice was placed in the Gemsbok Newspaper (a copy of the notice will be included in the final EIA Report).

15.3.4 I&APs' Access to the Draft EIA Report

A hardcopy of the draft EIA Report was placed at the Library in Upington. The document was also uploaded to the following website, for downloading purposes - https://nemai.co.za/proposed-upgrade-and-expansion-of-the-kameelmond-wastewater-treatment-works-in-upington-northern-

cape/.

Copies of the draft EIA Report were provided to the following parties, which include key regulatory and commentary authorities:

- DFFE;
- DAEARDLR;
- DWS: Northern Cape Region;
- Northern Cape Provincial Heritage Resources (Ngwao-Boswa Jwa Kapa Bokone);
- SANRAL;
- ZF Mgcawu District Municipality; and
- DKM.

15.3.5 Public Meeting to Present the Draft EIA Report

Anyone that has an interest in attending a virtual public meeting will need to inform Nemai Consulting in writing by 10 March 2022 and will need to provide an email address. Only preregistered parties that confirmed interest will receive an invitation to the public meeting.

15.3.6 Adherence to COVID-19-related Requirements

All I&APs accessing the hardcopy of the draft EIA Report will need to comply with the prevailing COVID-19-related protocols and requirements.

15.3.7 Comments Received on the Draft EIA Report

The CRR will be updated with all comments received from authorities and I&APs during the review period of the draft EIA Report. The updated CRR will be appended to the final EIA Report that will be submitted to DFFE.

15.4 Notification of DFFE Decision

Registered I&APs will be notified after having received written notice from DFFE (in terms of NEMA) on the final decision for the Project. The notification will include the appeal procedure to the decision and key reasons for the decision.

16 EIA CONCLUSIONS

16.1 Outcomes of the EIA Phase

The following key tasks were undertaken during the EIA phase for the Project:

- The specialist studies identified in the Plan of Study for the EIA were undertaken and the findings were incorporated into the EIA Report in terms of understanding the environmental status quo and sensitive features, as well as assessing the potential impacts and establishing concomitant mitigation measures;
- Issues raised during public participation to date were considered further;
- Potentially significant impacts pertaining to the pre-construction, construction and operational phases of the Project were identified and assessed, and mitigation measures were provided;
- Alternatives for achieving the objectives of the proposed activity were considered, and the BPEO was identified. The “no-go” option is not supported when considering the implications of not implementing the Project; and
- Authorities and I&APs were notified of the review of the draft EIA Report.

The outcomes of these tasks are captured below.

16.2 Sensitive Environmental Features

The following sensitive and significant environmental features and aspects that are associated with the Project and its receiving environment are highlighted, for which mitigation measures are included in the EIA Report and EMPr (refer to map in **Figure 42** below):

- The K-WWTW is situated on the northern banks of the perennial Orange River with an unnamed non-perennial drainage system running adjacent to the north-western perimeter fence. The facility has a treated effluent discharge point on the non-perennial drainage system which drains into the Orange River;
- Existing lawful water users downstream of the K-WWTW effluent discharge point use the water from the Orange River for the irrigation of agricultural products for local and international markets;
- Groundwater is susceptible to pollution from construction and operational activities at the plant;
- The residential areas of Lemoendraai and Belview are located approximately 700 m and 580 m to the west and north of the site, respectively;
- Land used for commercial agriculture is located approximately 200 m to the east of the site;
- Although the environment within the K-WWTW where the upgrade and expansion works are proposed is degraded, the area surrounding the plant falls within CBA 1 according to the Northern Cape Biodiversity Conservation Plan;
- Several individuals of Camel thorn (*Vachellia erioloba*), which are protected trees in terms of the NFA, were observed occurring at random within and around the Project area;

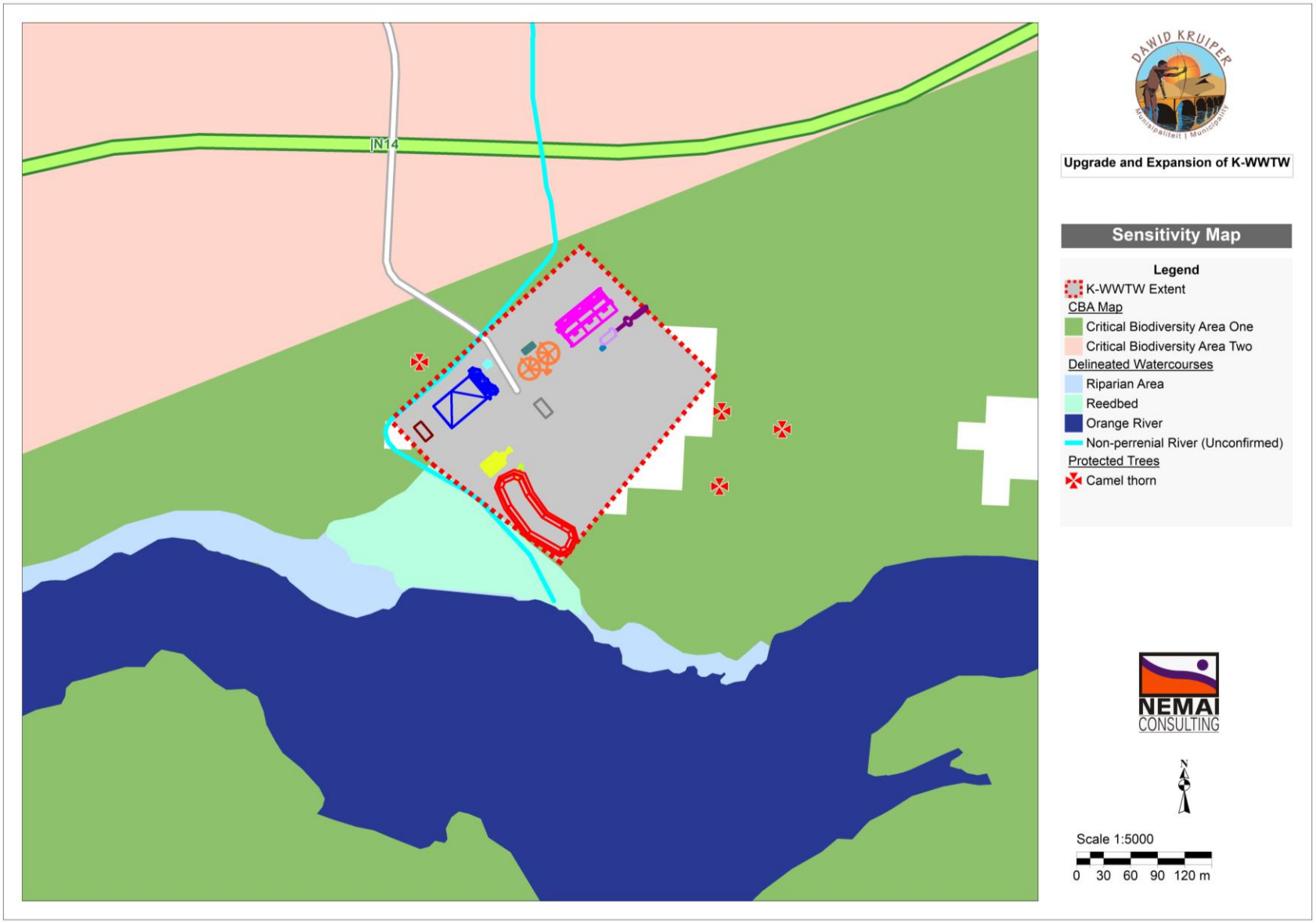

Figure 42: Sensitivity Map

- Existing access road to the K-WWTW is directly from the N14, which is a national route; and
- The proposed construction activities of the Project will take place within an operational WWTW.

16.3 Environmental Impact Statement

The Project aims to upgrade and expand the current K-WWTW, which was already built in the 1970's, to increase its capacity to allow for the efficient operation of the plant according to the relevant standards. This also includes improving the quality of the effluent discharged by the plant to satisfy DWS' effluent quality standards. The option of a sludge dewatering facility was identified as the BPEO.

It is noted that the current WML Application only focuses on the proposed upgrade and expansion of the existing K-WWTW and does not include activities associated with the potential agricultural/commercial use of the sludge. At this stage, it is assumed that the option of disposing the sludge and screenings at a waste disposal site is the current preferred alternative. Depending on the classification, this will either mean disposal at a hazardous or a general waste disposal site.

The DKM's SDF of 2017 designates the area encompassed by the K-WWTW as a 'sewage plant' and further shows a 1000 m risk zone around the plant. The Project is thus considered to be compatible with existing land uses encountered in the area.

Based on the impact assessment that was undertaken, the potentially significant adverse impacts associated with the Project can be mitigated to a satisfactory level, and the residual impacts (where relevant) would also be considered acceptable.

Key recommendations that emanated from the EIA, which may also influence the conditions of the Environmental Authorisation (if granted), include the following:

- The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence.
- Develop an Emergency Preparedness and Response Plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.
- Determine the 1:100 year floodline of the Orange River in relation to the K-WWTW. Safeguard the facility from major floods.
- Line large ponds (i.e., emergency storage pond and maturation pond) as part of the upgrade and expansion process.
- Excavated soil to be tested for contamination levels and to be handled and disposed of accordingly.
- Implement adequate stormwater management at the K-WWTW to prevent concentration or pooling of water, accelerated natural flow of the water from the site, and contamination of stormwater by the works.

- Implement a monitoring programme at the K-WWTW conducted by trained individuals using properly calibrated and maintained equipment, with adequate resources and management oversight, for effluent quality, groundwater, sludge and air quality.
- Recommendations from the Freshwater Assessment (Kindler, 2021):
  - A competent ECO must oversee the construction and rehabilitation phase of the Project, with watercourse areas as a priority;
  - An infrastructure monitoring and service plan must be compiled and implemented during the operational phase. This will include the monitoring the road reserve route, all stormwater discharge points, energy dissipation structures, and stability of watercourse banks in the Project footprint, which must include 100 m of the river reach below the discharge point; and
  - A biannual aquatic biomonitoring programme is recommended to determine the efficacy of the treatment facility while achieving national biodiversity goals. An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative impacts caused by the effluent discharges.
- Recommendations from the Groundwater Impact Assessment (van Staden, 2022):
  - The development should only proceed on condition that all measures are in place to prevent contamination of the underlying aquifer or the environment taking place. This will require the appropriate protection, mitigation and monitoring measures to be in place, as identified in this study;
  - The maturation pond should be line to ensure no bacteriological contaminants infiltrate down to the groundwater (and then possibly to the Orange River;
  - Monthly monitoring of the wastewater release into the Orange River should continue;
  - The expansion and upgrades of the facility should be of such a standard that the wastewater released into the environment is within the general limits; and
  - A groundwater monitoring network should be implemented, and a sampling protocol developed. During the development of a groundwater monitoring network, essential information will also be obtained about the geological conditions of the site as well as geohydrological characteristics (which is larger absent to date). The network will also address the issue of groundwater / surface water connectivity and enable a better understanding of potential contamination “pathways”.

With the adoption of the mitigation measures and recommendations, as well as through the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this Project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the Project and that the WML can be issued, based on the findings of the specialists and the impact assessment and through the compliance with the identified environmental management provisions.

It is further the opinion of the EAP that the EIA was executed in an objective manner and that the process and EIA Report conform to the requirements stipulated in the EIA Regulations.

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APPENDICES