# Proposed Upgrade and Expansion of the Kameelmond Wastewater Treatment Works in Upington, Northern Cape

## Basic Assessment Report

**Draft**

August 2021

Applicant: Dawid Kruiper Municipality


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(For official use only)

| | |
|---|---|
| **File Reference Number:** | |
| **Application Number:** | |
| **Date Received:** | |

**Basic Assessment Report in terms of the Environmental Impact Assessment Regulations, 2014, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.**

**Kindly note that:**

1. This **basic assessment report** is a standard report that may be required by a competent authority in terms of the EIA Regulations, 2014 and is meant to streamline applications. Please make sure that it is the report used by the particular competent authority for the activity that is being applied for.
2. This report format is current as of 07 April 2017. It is the responsibility of the applicant to ascertain whether subsequent versions of the form have been published or produced by the competent authority
3. The report must be typed within the spaces provided in the form. The size of the spaces provided is not necessarily indicative of the amount of information to be provided. The report is in the form of a table that can extend itself as each space is filled with typing.
4. Where applicable **tick** the boxes that are applicable in the report.
5. An incomplete report may be returned to the applicant for revision.
6. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the regulations.
7. This report must be handed in at offices of the relevant competent authority as determined by each authority.
8. No faxed or e-mailed reports will be accepted.
9. The signature of the EAP on the report must be an original signature.
10. The report must be compiled by an independent environmental assessment practitioner.
11. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.
12. A competent authority may require that for specified types of activities in defined situations only parts of this report need to be completed.
13. Should a specialist report or report on a specialised process be submitted at any stage for any part of this application, the terms of reference for such report must also be submitted.

# SECTION A: ACTIVITY INFORMATION

Has a specialist been consulted to assist with the completion of this section? [redacted] NO

If YES, please complete the form entitled "Details of specialist and declaration of interest" for the specialist appointed and attach in Appendix I.

## 1. ACTIVITY DESCRIPTION

### a) Describe the project associated with the listed activities applied for

**A. SITE LOCATION**

The Kameelmond Wastewater Treatment Works (K-WWTW) is situated north of the Orange River, on the south western side of Upington (coordinates: 28°28'41"S; 21°12'12"E) on the N14 between Upington and Keimoes, in the Northern Cape. The site is located in the Dawid Kruiper Municipality (DKM) and in the ZF Mgcawu District Municipality (refer to the locality map contained in **Appendix A**).

**B. PROJECT MOTIVATION**

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

**C. K-WWTW'S STATUS QUO TREATMENT PROCESS**

The works 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;
- 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 1** below.

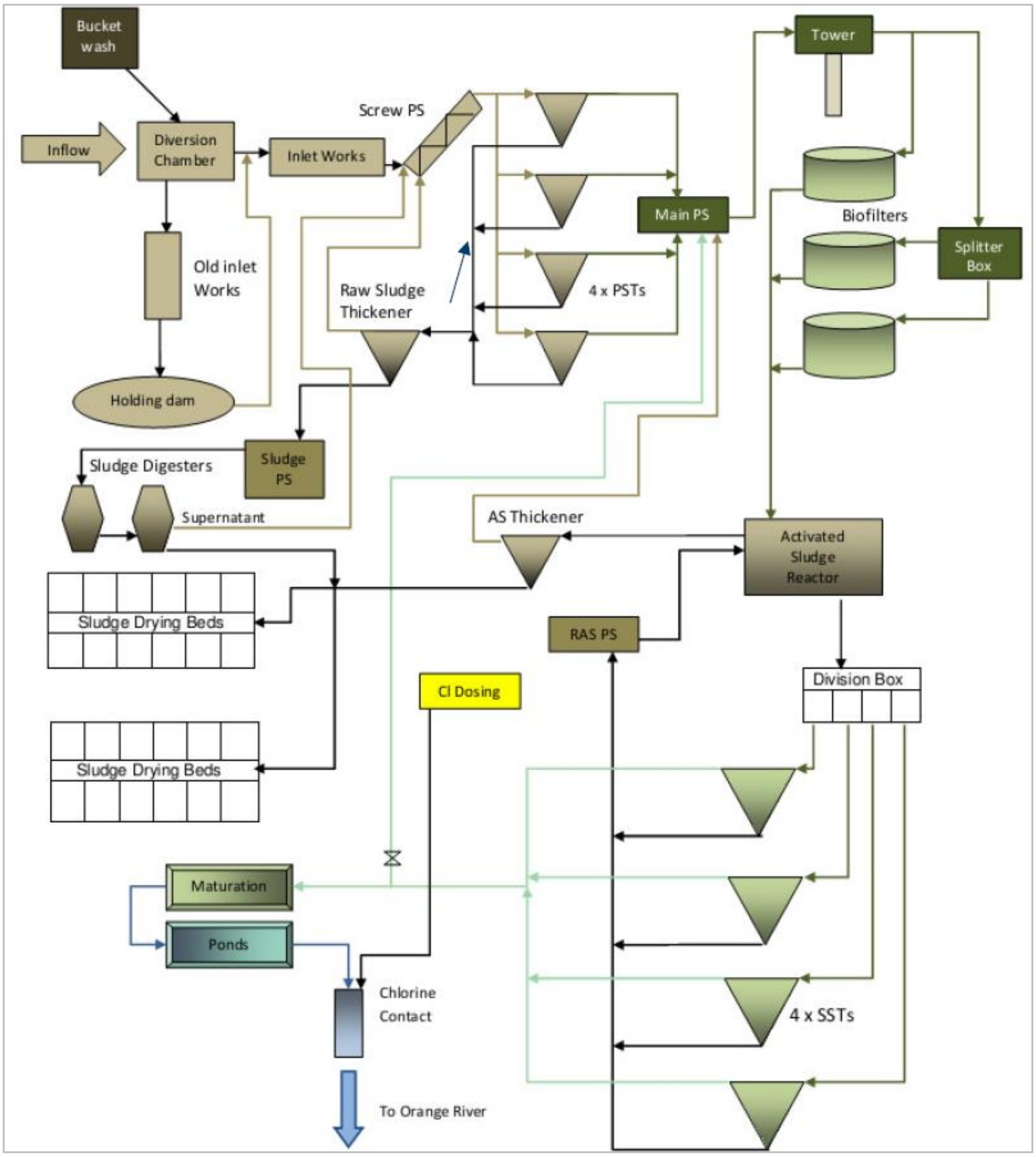



**Figure 1: Schematic diagram of works**

## D. DESIGN CHARACTERISATION

### 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
- Total suspended solids: 194 mg/l

### 2) Design Hydraulic Characterisation

The hydraulic parameters for the proposed upgrading and expansion of the K-WWTW are presented in **Table 1** below.

**Table 1: Design hydraulic loading for the upgrade & expansion of K-WWTW**

| 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 $_{\text{Calculated}}$ | $m^3/hr$ | 3 000 |
| Hourly Peak Flow $_{\text{Extreme event}}$ | $m^3/hr$ | 3 500 |
| **Assumed start-up influent design flows** | | |
| Average Dry Weather Flow | Ml/d | 16 |
| Minimum hydraulic design flow | $m^3/hr$ | 767 |

### 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. 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 intends to reuse some of the treated effluent for irrigation purposes. The International Organization for Standardization Guidelines for treated wastewater use for irrigation projects (ISO/DIS Standard No. 16075) provides quality criteria for this activity. Due to the planned reuse at school yards it has been assumed that the reuse limits shall have to adhere to the standards specified under category A of these standards (i.e. unrestricted irrigation).

## E. SCOPE OF WORK FOR THE K-WWTW

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 for Environmental Authorisation focuses on 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 pre-application meeting held with the DENC.

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

**1) Refurbishment**

A map of the general layout of the existing infrastructure to be refurbished is shown in **Figure 2** below and is also contained in **Appendix A**.


Figure 2: **K-WWTW existing infrastructure to be refurbished (Google Earth image)**
*(Note: not all infrastructure is labelled in the map above due to scale – see full details in map in Appendix A)*

The refurbishment activities aim to ensure 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.

As noted, the refurbishment activities do not form part of this application.

**2) Upgrade and Expansion**

A map of the general layout of the upgrade and expansion works is shown in **Figure 3** below and is also contained in **Appendix A**.

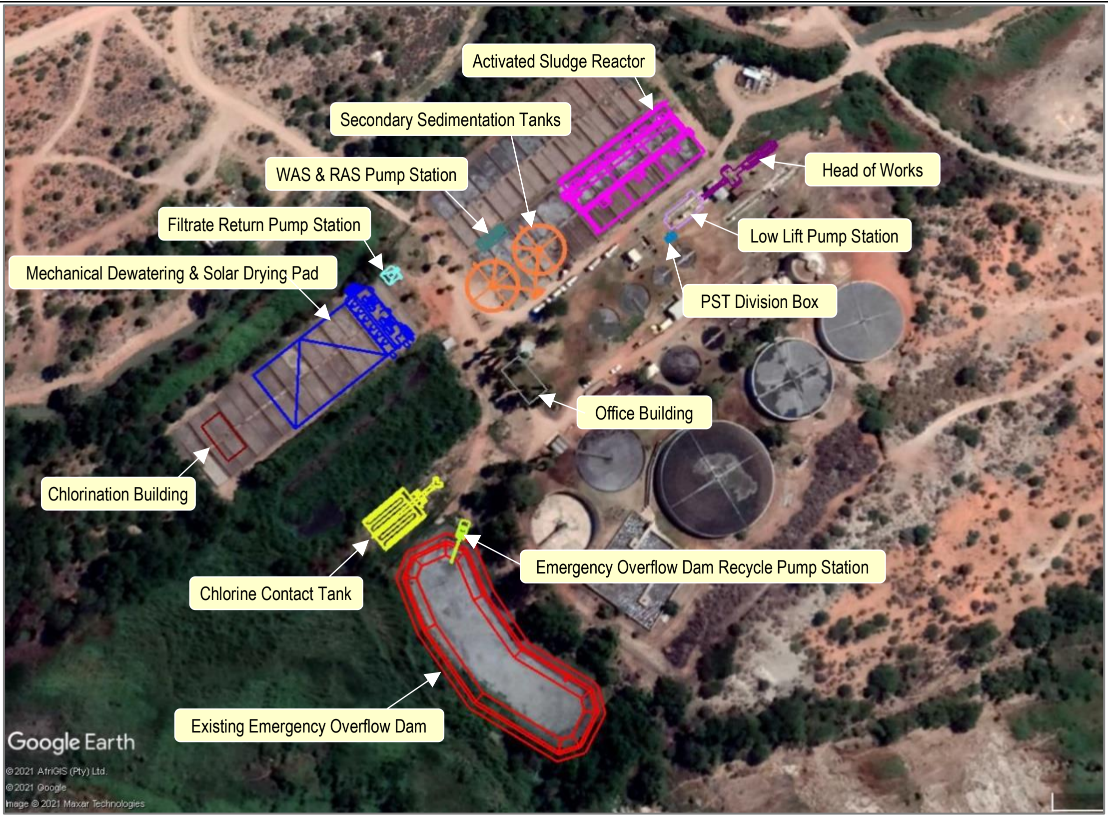



**Figure 3: K-WWTW Upgrade and expansion works (Google Earth image)**

Based on the Preliminary Design Report, which was compiled by Bigen Africa Services (Pty) Ltd in February 2021, the following components of the K-WWTW are to be upgraded and expanded (shown in **Figure 3** above):

a) **Head of Works** –
A mothballed structure, previously used as the inlet works (shown in **Figure 4** 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 Average Dry Weather Flow (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 (50mm aperture); and
- One (1) Parshall flume for flow measurement downstream of degritters.

**Figure 4:** **Obsolete "old" inlet works**

A diesel-fired incinerator (shown in **Figure 5** below) is currently used for the disposal of screenings at the K-WWTW. The incinerator will be discontinued as part of the upgrade and expansion works.

**Figure 5:** **Incinerator at K-WWTW**

b) **Emergency Storage** –
An existing emergency overflow pond (shown in **Figure 6** 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 6: 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.

c) **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.

d) **Activated Sludge Train** –
A drawing showing the process units and flow streams within the Activated Sludge Process (ASP) is provided in **Appendix A**.

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.

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

- Substrate removal;
- Conversion of ammonia to nitrate;
- 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. 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.

e) **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.

f) **Sludge Stabilisation & Dewatering** –
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 are:

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

K-WWTW currently has 96 drying beds (shown in **Figure 7** below) which 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 7: Sludge drying bed at K-WWTW**

An option evaluation 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:

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

**Table 2** below provides a summary of the design aspects associated with the sludge management facility.

**Table 2: Design summary of sludge management facility**

| 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 |

## F. ALTERNATIVES

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

From a technology perspective, the following options were considered for sludge treatment at K-WWTW:

- Sludge drying. With this option, the dried sludge cannot be used for agricultural or construction purposes due to the silica involved in the process.
- Belt presses and linear screens. This option is more cost intensive and requires strict operational control.
- Sludge dewatering facility. The dewatering equipment are screw presses and are easy to operate, endurable and sufficient for the sludge treatment requirements at K-WWTW.

The above sludge treatment options form part of the Waste Management Licence (WML) Application in terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA).

## G. 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:

1. **A Basic Assessment process in terms of the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended) to seek Environmental Authorisation in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA), where the mandated authority is the Northern Cape Department of Environment and Nature Conservation** (DENC). This Basic Assessment Report was compiled in terms of the aforementioned process.
2. A Scoping and Environmental Impact Reporting (S&EIR) process in terms of the EIA Regulations of 2014 (as amended) to seek a WML in terms of the NEM:WA, where the mandated authority is the Department of Forestry, Fisheries and the Environment (DFFE); and
3. 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 this application is the Department of Water and Sanitation (DWS).

**b) Provide a detailed description of the listed activities associated with the project as applied for**

| Listed activity as described in GN 327, 325 and 324 | Description of project activity |
|---|---|
| **GN R. 327 Activity 31**<br><br>The decommissioning of existing facilities, structures or infrastructure for -<br>(i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;<br>(ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014. | *The diesel-fired incinerator, which is used for the disposal of screenings at the K-WWTW, will be discontinued as part of the upgrade and expansion Project.*<br><br>*Other existing structures at the K-WWTW to be decommissioned as part of the upgrade and expansion Project include the sludge drying beds, obsolete old inlet works and the existing screw pump station.*<br><br>*Certain parts of the existing sludge drying beds, which are to be decommissioned, are located within 32 metres of a non-perennial drainage line, as delineated during the Freshwater Assessment (contained in **Appendix D2**).*<br><br>*Although the areas where the abovementioned existing structures are to be decommissioned fall within Critical Biodiversity Area (CBA) 1, the K-WWTW site has been historically modified. According to the Terrestrial Ecology Compliance Statement (contained in **Appendix D1**), the land classification identified by the Northern Cape Biodiversity Conservation Plan, namely CBA 1, is not relevant to the Project footprint.* |
| **GN R. 324 Activity 10 - (g)(ii)**<br><br>The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres, within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland in the Northern Cape. | *The location of the new chlorination building in terms of watercourses is as follows:*<br>• *It is located within 100m of the non-perennial drainage line and manmade water canal north of the new building; and*<br>• *It is located within 100m of the reedbed and riparian area of the Orange River south of the new building.*<br><br>*Although the new chlorination building falls within CBA 1 area, the K-WWTW site has been historically modified. According to the Terrestrial Ecology Compliance Statement (contained in **Appendix D1**), the land classification identified by the Northern Cape Biodiversity Conservation Plan, namely CBA 1, is not relevant to the Project footprint.* |

| GN R. 324 Activity 14(ii)(c) - (g)(ii)(dd) & (ff) | *The following components of the upgrade and expansion Project have a physical footprint of 10 square metres or more and are located within 32 metres from a watercourse, within an area classified as CBA1:* |
|---|---|
| The development of -<br>(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or<br>(ii) infrastructure or structures with a physical footprint of 10 square metres or more;<br><br>where such development occurs—<br>(a) within a watercourse;<br>(b) in front of a development setback; or<br>(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;<br><br>excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. | • *New chlorination building;*<br>• *Chlorine contact tank;*<br>• *Mechanical dewatering units and solar drying pad; and*<br>• *Filtrate return pump station.* |

## 2. FEASIBLE AND REASONABLE ALTERNATIVES

***"alternatives"***, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

Describe alternatives that are considered in this application as required by Appendix 1 (3)(h), Regulation 2014.Alternatives should include a consideration of all possible means by which the purpose and need of the proposed activity (NOT PROJECT) could be accomplished in the specific instance taking account of the interest of the applicant in the activity. The no-go alternative must in all cases be included in the assessment phase as the baseline against which the impacts of the other alternatives are assessed.

The determination of whether site or activity (including different processes, etc.) or both is appropriate needs to be informed by the specific circumstances of the activity and its environment. After receipt of this report the, competent authority may also request the applicant to assess additional alternatives that could possibly accomplish the purpose and need of the proposed activity if it is clear that realistic alternatives have not been considered to a reasonable extent.

Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees, minutes and seconds. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection.

## a) Site alternatives

| Alternative 1 (preferred alternative) | | |
|---|---|---|
| Description | Lat (DDMMSS) | Long (DDMMSS) |
| No site alternatives were considered for the Project, as the proposed works entail the upgrading and expansion of existing structures at the K-WWTW.<br><br>Centre point coordinates for the K-WWTW: | 28°28'41"S | 21°12'12"E |
| **Alternative 2** | | |
| Description | Lat (DDMMSS) | Long (DDMMSS) |
| [redacted] | | |
| **Alternative 3** | | |
| Description | Lat (DDMMSS) | Long (DDMMSS) |
| [redacted] | | |

In the case of linear activities:

| **Alternative:** | **Latitude (S):** | **Longitude (E):** |
|---|---|---|
| Alternative S1 (preferred) | | |
| • Starting point of the activity | [redacted] | [redacted] |
| • Middle/Additional point of the activity | [redacted] | [redacted] |
| • End point of the activity | [redacted] | [redacted] |
| Alternative S2 (if any) | | |
| • Starting point of the activity | [redacted] | [redacted] |
| • Middle/Additional point of the activity | [redacted] | [redacted] |
| • End point of the activity | [redacted] | [redacted] |
| Alternative S3 (if any) | | |
| • Starting point of the activity | [redacted] | [redacted] |
| • Middle/Additional point of the activity | [redacted] | [redacted] |
| • End point of the activity | [redacted] | [redacted] |

For route alternatives that are longer than 500m, please provide an addendum with co-ordinates taken every 250 meters along the route for each alternative alignment.

In the case of an area being under application, please provide the co-ordinates of the corners of the site as indicated on the lay-out map provided in Appendix A of this form.

## b) Lay-out alternatives

| Alternative 1 (preferred alternative) | | |
|---|---|---|
| Description | Lat (DDMMSS) | Long (DDMMSS) |
| No layout alternatives were considered for the Project, as the proposed works entail the upgrading and expansion of existing structures at the K-WWTW.<br><br>Centre point coordinates for the K-WWTW: | 28°28'41"S | 21°12'12"E |

| | | |
|---|---|---|
| **Alternative 2** | | |
| Description | Lat (DDMMSS) | Long (DDMMSS) |
| [redacted] | | |
| **Alternative 3** | | |
| Description | Lat (DDMMSS) | Long (DDMMSS) |
| [redacted] | | |

## c) Technology alternatives

| |
|---|
| **Alternative 1 (preferred alternative)** |
| **Sludge dewatering facility**. The dewatering equipment are screw presses and are easy to operate, endurable and sufficient for the sludge treatment requirements at K-WWTW. |
| **Alternative 2** |
| **Sludge drying**. With this option, the dried sludge cannot be used for agricultural or construction purposes due to the silica involved in the process. |
| **Alternative 3** |
| **Belt presses and linear screens**. This option is more cost intensive and requires strict operational control. |

## d) Other alternatives (e.g. scheduling, demand, input, scale and design alternatives)

| |
|---|
| **Alternative 1 (preferred alternative)** |
| [redacted] |
| **Alternative 2** |
| [redacted] |
| **Alternative 3** |
| [redacted] |

## e) No-go alternative

The no-go alternative 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.

In contrast, 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, namely improving the operational efficiency of the K-WWTW and ensuring that the plant complies with the relevant standards in terms of effluent quality and sludge management, will not materialise.

**Paragraphs 3 – 13 below should be completed for each alternative.**

## 3. PHYSICAL SIZE OF THE ACTIVITY

**a) Indicate the physical size of the preferred activity/technology as well as alternative activities/technologies (footprints):**

| **Alternative:** | **Size of the activity:** |
|---|---|
| Alternative A1[1] (preferred activity alternative) | Approximately 6400m$^2$ |
| Alternative A2 (if any) | [redacted] |
| Alternative A3 (if any) | |

or, for linear activities:

| **Alternative:** | **Length of the activity:** |
|---|---|
| Alternative A1 (preferred activity alternative) | [redacted] |
| Alternative A2 (if any) | |
| Alternative A3 (if any) | |

**b) Indicate the size of the alternative sites or servitudes (within which the above footprints will occur):**

| **Alternative:** | **Size of the site/servitude:** |
|---|---|
| Alternative A1 (preferred activity alternative) | Approximately 6400m$^2$ |
| Alternative A2 (if any) | [redacted] |
| Alternative A3 (if any) | |

## 4. SITE ACCESS

| | | |
|---|---|---|
| Does ready access to the site exist? | YES | [redacted] |
| If NO, what is the distance over which a new access road will be built | | |

Describe the type of access road planned:

The existing access road to the K-WWTW, which is a gravel road, is directly from the N14. The same road will be used for construction and operational phases.

[1] "Alternative A.." refer to activity, process, technology or other alternatives.

Include the position of the access road on the site plan and required map, as well as an indication of the road in relation to the site.

## 5. LOCALITY MAP

An A3 locality map must be attached to the back of this document, as Appendix A. The scale of the locality map must be relevant to the size of the development (at least 1:50 000. For linear activities of more than 25 kilometres, a smaller scale e.g. 1:250 000 can be used. The scale must be indicated on the map.). The map must indicate the following:

- an accurate indication of the project site position as well as the positions of the alternative sites, if any;
- indication of all the alternatives identified;
- closest town(s;)
- road access from all major roads in the area;
- road names or numbers of all major roads as well as the roads that provide access to the site(s);
- all roads within a 1km radius of the site or alternative sites; and
- a north arrow;
- a legend; and
- locality GPS co-ordinates (Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection).

## 6. LAYOUT/ROUTE PLAN

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as Appendix A to this document.

The site or route plans must indicate the following:

- the property boundaries and numbers of all the properties within 50 metres of the site;
- the current land use as well as the land use zoning of the site;
- the current land use as well as the land use zoning each of the properties adjoining the site or sites;
- the exact position of each listed activity applied for (including alternatives);
- servitude(s) indicating the purpose of the servitude;
- a legend; and
- a north arrow.

## 7. SENSITIVITY MAP

The layout/route plan as indicated above must be overlain with a sensitivity map that indicates all the sensitive areas associated with the site, including, but not limited to:

- watercourses;
- the 1:100 year flood line (where available or where it is required by DWS);
- ridges;

- cultural and historical features;
- areas with indigenous vegetation (even if it is degraded or infested with alien species); and
- critical biodiversity areas.

The sensitivity map must also cover areas within 100m of the site and must be attached in Appendix A.

## 8. SITE PHOTOGRAPHS

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached under Appendix B to this report**.** It must be supplemented with additional photographs of relevant features on the site, if applicable.

## 9. FACILITY ILLUSTRATION

A detailed illustration of the activity must be provided at a scale of at least 1:200 as Appendix C for activities that include structures. The illustrations must be to scale and must represent a realistic image of the planned activity. The illustration must give a representative view of the activity.

## 10. ACTIVITY MOTIVATION

Motivate and explain the need and desirability of the activity (including demand for the activity):

| | | | |
|---|---|---|---|
| **1. Is the activity permitted in terms of the property's existing land use rights?** | YES | [redacted] | Please explain |
| In terms of land use rights, 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. | | | |
| **2. Will the activity be in line with the following?** | | | |
| **(a) Provincial Spatial Development Framework (PSDF)** | YES | [redacted] | Please explain |
| The Project is in line with the PSDF, as it proposes the upgrading and expansion of the existing K-WWTW in Upington to improve its operational efficiency and to ensure that the plant complies with the relevant standards related to effluent quality and sludge management. | | | |
| **(b) Urban edge / Edge of Built environment for the area** | YES | [redacted] | Please explain |
| According to the Dawid Kruiper Municipality's Spatial Development Framework (SDF) of 2017, the K-WWTW is located within the urban edge. | | | |

| | | | |
|---|---|---|---|
| **(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).** | YES | [redacted] | Please explain |
| The Project is in line with the municipal SDF and IDP. The following is noted in this regard:<br>• Dawid Kruiper Municipality'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.<br>• The Dawid Kruiper Municipality's IDP for 2020/2021 lists the Upgrading of the K-WWTW as one of the capital projects, which is aimed improved service delivery by the Municipality. | | | |
| **(d) Approved Structure Plan of the Municipality** | YES | [redacted] | Please explain |
| The Project proposes the upgrade and expansion of the existing K-WWTW. | | | |
| **(e) An Environmental Management Framework (EMF) adopted by the Department (e.g. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)** | YES | [redacted] | Please explain |
| From an interpretation of the Siyanda District Municipality's EMF (Environomics, 2008), the site falls within the following demarcated areas:<br>• Environmental Control Zone 3 - potential high to very high vegetation conservation areas; and<br>• Geographical Area B - where activities may affect vegetation cover negatively that could lead to significant impacts on the environment.<br><br>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, as confirmed in the Terrestrial Ecology Compliance Statement.<br><br>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. | | | |
| **(f) Any other Plans (e.g. Guide Plan)** | [redacted] | NO | [redacted] |
| [redacted] | | | |

| | | | |
|---|---|---|---|
| **3. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved 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 credible IDP)?** | YES | [redacted] | Please explain |
| 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.<br><br>The Project is in line with the municipal SDF and IDP. The following is noted in this regard:<br>• Dawid Kruiper Municipality'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.<br>• The Dawid Kruiper Municipality's IDP for 2020/2021 lists the Upgrading of the K-WWTW as one of the capital projects, which is aimed improved service delivery by the Municipality. | | | |
| **4. 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 | [redacted] | Please explain |
| The Dawid Kruiper Municipality 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 Dawid Kruiper Municipality undertake concrete measures to improve on the existing situation.<br><br>The Project will also enhance the operation of the K-WWTW, which will manage impacts to surrounding land uses (such as odour control). | | | |
| **5. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? (Confirmation by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as Appendix I.)** | YES | [redacted] | Please explain |
| The development proposes the upgrading and expansion of the existing K-WWTW to *inter alia* improve its operational efficiency. It is therefore assumed that the necessary services to continue operating the plant are available. | | | |

| | | | |
|---|---|---|---|
| **6. 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 and opportunity costs)? (Comment by the relevant Municipality in this regard must be attached to the final Basic Assessment Report as Appendix I.)** | YES | | Please explain |
| The Dawid Kruiper Municipality's IDP for 2020/2021 lists the Upgrading of the K-WWTW as one of the capital projects. | | | |
| **7. Is this project part of a national programme to address an issue of national concern or importance?** | YES | | Please explain |
| The K-WWTW is scored against the Green Drop Programme. | | | |
| **8. 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 | | Please explain |
| The Project entails the upgrading and expansion of the existing K-WWTW. | | | |
| **9. Is the development the best practicable environmental option for this land/site?** | YES | | Please explain |
| The Project entails the upgrading and expansion of the existing K-WWTW. | | | |
| **10. Will the benefits of the proposed land use/development outweigh the negative impacts of it?** | YES | | Please explain |
| It is believed that the Project's intended benefits, which includes ensuring that the plant discharges effluent of suitable quality in terms of the receiving river and downstream water users and manages sludge in a manner that is compliant with the relevant standards, will outweigh potential negative impacts.<br><br>The negative impacts associated with the development can be adequately managed through the mitigation measures contained in this report and in the Environmental Management Programme (EMPr) (contained in **Appendix G**), whilst optimising the project's positive environmental impacts. | | | |
| **11. Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?** | | NO | Please explain |
| 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.<br><br>As mentioned, the municipal 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 future planning for this area should aim to enforce the K-WWTW's risk zone and to be aligned with the SDF. | | | |
| **12. Will any person's rights be negatively affected by the proposed activity/ies?** | | NO | Please explain |
| With the implementation of the management measures contained in the Environmental Management Programme (EMPr) contained in **Appendix G**, as well as compliance with the relevant environmental consents, it is believed that the Project's activities will not adversely affect any person's rights. | | | |

| | | | |
|---|---|---|---|
| **13. Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?** | [redacted] | NO | Please explain |

According to the Dawid Kruiper Municipality's Spatial Development Framework (SDF) of 2017, the K-WWTW is located within the urban edge.

| | | | |
|---|---|---|---|
| **14. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)?** | YES | [redacted] | Please explain |

The project contributes towards SIP 18: Water and sanitation infrastructure.

| | |
|---|---|
| **15. What will the benefits be to society in general and to the local communities?** | Please explain |

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 adversely affects 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.

| | |
|---|---|
| **16. Any other need and desirability considerations related to the proposed activity?** | Please explain |

[redacted]

| | |
|---|---|
| **17. How does the project fit into the National Development Plan for 2030?** | Please explain |

According to the National Development Plan for 2030, South Africa's water resources need to be managed, monitored and protected in a sustainable way, while allowing for economic growth. Amongst others, this includes regulating water uses such as the disposal of wastewater to ensure sustainability. Addressing the quality of the K-WWTW's effluent is one of the Project's key drivers.

**18. Please describe how the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account.**

The general objectives of Integrated Environmental Management (IEM), as set out in Section 23 of NEMA, have been taken into account in the Basic Assessment Process as follows (amongst others):

- The Basic Assessment Process provided adequate and appropriate opportunity for public participation;
- The assessment takes into consideration the comments received from authorities and interested and affected parties, and aims to adequately address the concerns raised;
- The Specialist Studies undertaken as part of the Basic Assessment Process evaluated the receiving environment and identified measures to protect sensitive features;
- Mitigation measures are included in this Basic Assessment Report and in the EMPr (contained in **Appendix G**) to safeguard sensitive environmental features that may be adversely affected by the project; and
- Through the Basic Assessment, including the application of the mitigation hierarchy, it is demonstrated that the Project is socially, environmentally and economically sustainable.

It is noted that the best practicable environmental option for sludge management will be identified under the WML, which is a separate environmental process from the Basic Assessment.

| **19. Please describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.** |
|---|
| Section 2 of NEMA provides the principles that govern environmental management, which include imperatives for sustainable development.<br><br>The Basic Assessment for the proposed Project shows that this development is socially, environmentally and economically sustainable. This was determined during the process by adequately assessing the receiving environment (including the Specialist Studies that were executed), by understanding the concerns raised during public participation, and by applying the mitigation hierarchy to ensure that negative impacts are adequately managed. |

## 11. APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

List all legislation, policies and/or guidelines of any sphere of government that are applicable to the application as contemplated in the EIA regulations, if applicable:

| Title of legislation, policy or guideline | Applicability to the project | Administering authority | Date |
|---|---|---|---|
| Constitution of the Republic of South Africa | • Chapter 2 – Bill of Rights.<br>• Section 24 – Environmental Rights. | | 1996 |
| National Environmental Management Act (Act No. 107 of 1998) (NEMA) | • Section 2 – National Environmental Management Principles.<br>• Section 23 – General Objectives of Integrated Environmental Management.<br>• Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment).<br>• Section 28 – Duty of care and remediation of environmental damage. | National: DFFE.<br><br>Provincial: DENC. | 1998 |
| GN No. R 982 of 4 December 2014 (as amended) | • Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental | National: DFFE.<br><br>Provincial: DENC. | 2014 (as amended in 2017) |

| Title of legislation, policy or guideline | Applicability to the project | Administering authority | Date |
|---|---|---|---|
| | impacts, and for matters pertaining thereto. | | |
| National Environmental Management: Waste Act (Act No. 59 of 2008) | • Management of waste.<br>• Section 16 – General duty in respect of waste management.<br>• Chapter 5 – licensing requirements for listed waste activities - GN No. R. 921 of 29 November 2013 (as amended).<br>• Authorisation type – Waste Management Licence (WML). A separate process is being undertaken to apply for a WML for the Project under DFFE. | National: DFFE.<br><br>Provincial: DENC. | 2008 |
| National Water Act (Act No. 36 of 1998) | • Sustainable and equitable management of water resources.<br>• Chapter 3 – Protection of water resources.<br>• Section 19 – Prevention and remedying effects of pollution.<br>• Section 20 – Control of emergency incidents.<br>• Chapter 4 – Water use.<br>• Authorisation type – Schedule 1 Use, Existing Lawful Use, General Authorisation or Licence. A separate process is being undertaken to apply for a Water Use Licence for the Project. | Department of Water and Sanitation (DWS) | 1998 |
| National Environmental Management Air Quality Act (Act No. 39 of 2004) | • Air quality management.<br>• Section 22A – Illegal emissions.<br>• Section 29 – Pollution prevention plans.<br>• Section 32 – Dust control.<br>• Section 34 – Noise control.<br>• Section 35 – Control of offensive odours.<br>• Authorisation type – Atmospheric Emission License. | National: DFFE.<br><br>Provincial: DENC.<br><br>Local: ZF Mgcawu District Municipality. | 2004 |
| National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) | • Management and conservation of the country's biodiversity.<br>• Protection of species and ecosystems. | National: DFFE.<br><br>Provincial: DENC. | 2004 |

| Title of legislation, policy or guideline | Applicability to the project | Administering authority | Date |
|---|---|---|---|
| | • Authorisation type – Permit. *Note that it is not anticipated that a permit under this Act will be required for the Project.* | | |
| National Environmental Management: Protected Areas Act (Act No. 57 of 2003) | • Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes.<br>• Note that no protected areas are affected by the Project footprint. | Assigned Management Authority. | 2003 |
| 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.<br>• Section 15 – Authorisation required for impacts to protected trees.<br>• Authorisation type – Permit. *Note that it is not anticipated that a permit under this Act will be required for the Project.* | DFFE. | 1998 |
| Occupational Health & Safety Act (Act No. 85 of 1993) | • Provisions for Occupational Health & Safety.<br>• Relevant regulations, such as Construction Regulations, etc. | Department of Employment and Labour (DEL). | 1993 |
| National Heritage Resources Act (Act No. 25 of 1999) | • Section 34 – protection of structure older than 60 years.<br>• Section 35 – protection of heritage resources.<br>• Section 36 – protection of graves and burial grounds.<br>• Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m² in extent, etc.<br>• Authorisation type – Permit. *Note that it is not anticipated that a permit under this Act will be required for the Project.* | South African Heritage Resources Agency (SAHRA) and Northern Cape Provincial Heritage Resources Authority (Ngwao-Boswa Jwa Kapa Bokone). | 1999 |
| Conservation of Agricultural Resources Act (Act No. 43 of 1983) | • Control measures for erosion.<br>• Control measures for alien and invasive plant species. | Department of Agriculture. | 1983 |
| Northern Cape Conservation Act (Act No. 9 of 2009) | • Protected and Specially Protected Species.<br>• Authorisation type – Permit. *Note that it is not anticipated* | DENC. | 2009 |

| Title of legislation, policy or guideline | Applicability to the project | Administering authority | Date |
|---|---|---|---|
| | *that a permit under this Act will be required for the Project.* | | |

## 12. WASTE, EFFLUENT, EMISSION AND NOISE MANAGEMENT

### a) Solid waste management

Will the activity produce solid construction waste during the construction/initiation phase?
If YES, what estimated quantity will be produced per month?

| | |
|---|---|
| YES | [redacted] |
| ± 3000$m^3$ | |

How will the construction solid waste be disposed of (describe)?

The types of solid waste associated with the construction phase include the following:

- Waste generated from site preparations (e.g. plant material);
- Waste from demolished structures at the K-WWTW;
- Domestic waste;
- Surplus and used building material; and
- Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags).

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 transported and disposed of at a permitted waste disposal site. All the waste disposed of will be recorded.

Where will the construction solid waste be disposed of (describe)?

General waste will be disposed of at the permitted Waste Disposal Site, which is the De Duine site in Upington.

Hazardous waste will be removed by a waste service provider and will be disposed of at permitted site(s).

Will the activity produce solid waste during its operational phase?
If YES, what estimated quantity will be produced per month?

| | |
|---|---|
| YES | [redacted] |
| ± 5$m^3$ | |

How will the solid waste be disposed of (describe)?

Refuse generated during the operational phase at the K-WWTW will be removed on a regular basis and will be disposed of at a permitted waste disposal facility in the Dawid Kruiper Municipality.

The WML process will explain the manner in which sludge will be managed.

If the solid waste will be disposed of into a municipal waste stream, indicate which registered landfill site will be used.

See response above with regards to the landfill sites in the municipality.

Where will the solid waste be disposed of if it does not feed into a municipal waste stream (describe)?

It is anticipated that the solid waste will only feed into a municipal waste stream.

*If the solid waste (construction or operational phases) will not be disposed of in a registered landfill site or be taken up in a municipal waste stream, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.*

Can any part of the solid waste be classified as hazardous in terms of the NEM:WA? YES [redacted]

If YES, inform the competent authority and request a change to an application for scoping and EIA. An application for a waste permit in terms of the NEM:WA must also be submitted with this application.

Is the activity that is being applied for a solid waste handling or treatment facility? YES [redacted]

If YES, then the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA. An application for a waste permit in terms of the NEM:WA must also be submitted with this application.

Note: A S&EIR process is being undertaken in terms of the EIA Regulations of 2014 (as amended) to seek a WML under NEM:WA. As the waste type under consideration, which includes sludge and screenings, is classified as hazardous the mandated authority is the National DFFE.

**b) Liquid effluent**

| | | |
|---|---|---|
| Will the activity produce effluent, other than normal sewage, that will be disposed of in a municipal sewage system? | [redacted] | NO |
| If YES, what estimated quantity will be produced per month? | [redacted] | |
| Will the activity produce any effluent that will be treated and/or disposed of on site? | [redacted] | NO |

Note: The activities form part of the overall upgrading of the existing K-WWTW.

*If YES, the applicant should consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.*

| | | |
|---|---|---|
| Will the activity produce effluent that will be treated and/or disposed of at another facility? | [redacted] | NO |

If YES, provide the particulars of the facility:

| | | | |
|---|---|---|---|
| **Facility name:** | [redacted] | | |
| **Contact person:** | [redacted] | | |
| **Postal address:** | [redacted] | | |
| **Postal code:** | [redacted] | | |
| **Telephone:** | [redacted] | **Cell:** | [redacted] |
| **E-mail:** | [redacted] | **Fax:** | [redacted] |

Describe the measures that will be taken to ensure the optimal reuse or recycling of waste water, if any:

| |
|---|
| No measures will be taken during the upgrade phase.<br><br>Allowance will however be made if DKM want to use the effluent for irrigation purposes. |

## c) Emissions into the atmosphere

Will the activity release emissions into the atmosphere other that exhaust emissions and dust associated with construction phase activities?
If YES, is it controlled by any legislation of any sphere of government?

| | |
|---|---|
| [redacted] | NO |
| [redacted] | [redacted] |

If YES, the applicant must consult with the competent authority to determine whether it is necessary to change to an application for scoping and EIA.
If NO, describe the emissions in terms of type and concentration:

One of the activities applied for is the proposed decommissioning of the existing diesel-fired incinerator, which is used for the disposal of screenings at the K-WWTW, which caused emissions.

A gas flare will be used to burn off the biogas produced as a result of the treatment of the wastewater.

Effective odour management is required at the K-WWTW. According to Bigen (2021), the final design for odour control (should it be required) will be done on a design supply type solution, whereby a performance and material specification with predicted odorous locations will be specified for scrubbing/masking. These aspects will be analysed for areas such as the HoW, emergency storage dam, and dewatering facility.

## d) Waste permit

Will any aspect of the activity produce waste that will require a waste permit in terms of the NEM:WA?

| | |
|---|---|
| YES | [redacted] |

> Note: A S&EIR process is being undertaken in terms of the EIA Regulations of 2014 (as amended) to seek a WML under NEM:WA. As the waste type under consideration, which includes sludge and screenings, is classified as hazardous the mandated authority is the National DFFE.

If YES, please submit evidence that an application for a waste permit has been submitted to the competent authority

> Note: The environmental assessments for the Project are running concurrently.

## e) Generation of noise

Will the activity generate noise?
If YES, is it controlled by any legislation of any sphere of government?

| | |
|---|---|
| YES | [redacted] |
| YES | [redacted] |

Describe the noise in terms of type and level:

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

During the construction phase, localised increases in noise may be caused by:

- Construction equipment, machinery and vehicles;
- Construction material delivery vehicles; and
- General activities at the construction camp.

During the operational phase, localised noise will be caused by operation and maintenance vehicles and activities.

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

## 13. WATER USE

Please indicate the source(s) of water that will be used for the activity by ticking the appropriate box(es):

| | |
|---|---|
| Municipal | [redacted] |

| | | |
|---|---|---|
| If water is to be extracted from groundwater, river, stream, dam, lake or any other natural feature, please indicate the volume that will be extracted per month: | [redacted] | |
| Does the activity require a water use authorisation (general authorisation or water use license) from the Department of Water Affairs? | YES | [redacted] |

If YES, please provide proof that the application has been submitted to the Department of Water Affairs.

## 14. ENERGY EFFICIENCY

Describe the design measures, if any, which have been taken to ensure that the activity is energy efficient:

Energy efficiency measures to be employed include the following:

- Auto aeration control will be installed;
- High energy efficient electric motors to be installed; and
- Pump selection based on best sufficiency point.

Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

Biogas to power generation was considered. With the quantity of sludge generated, energy required for heating, power generation was not deemed to be feasible.

## SECTION B: SITE/AREA/PROPERTY DESCRIPTION

**Important notes:**

1. For linear activities (pipelines, etc) as well as activities that cover very large sites, it may be necessary to complete this section for each part of the site that has a significantly different environment. In such cases please complete copies of Section B and indicate the area, which is covered by each copy No. on the Site Plan.

Section B Copy No. (e.g. A): **A**

2. Paragraphs 1 - 6 below must be completed for each alternative.

3. Has a specialist been consulted to assist with the completion of this section? YES [redacted]

If YES, please complete the form entitled "Details of specialist and declaration of interest" for each specialist thus appointed and attach it in Appendix I. All specialist reports must be contained in Appendix D.

**Property description/physical address:**

| | |
|---|---|
| **Province** | Northern Cape |
| **District Municipality** | ZF Mgcawu District Municipality |
| **Local Municipality** | Dawid Kruiper Municipality |
| **Ward Number(s)** | Ward 1 (based on 2016 Ward Delimitation) |
| **Farm name and number** | Upington Township |
| **Portion number** | Erf Number 18896 |
| **SG Code** | C02800070001889600000 |

Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application including the same information as indicated above.

**Current land-use zoning as per local municipality IDP/records:**

| |
|---|
| Dawid Kruiper Municipality'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. |

In instances where there is more than one current land-use zoning, please attach a list of current land use zonings that also indicate which portions each use pertains to, to this application.

Is a change of land-use or a consent use application required? [redacted] NO

## 1. GRADIENT OF THE SITE

Indicate the general gradient of the site.

**Alternative S1:**

| | | |
|---|---|---|
| [redacted] | 1:50 – 1:20 ✓ | [redacted] |

**Alternative S2 (if any):**

[redacted]

**Alternative S3 (if any):**

[redacted]

## 2. LOCATION IN LANDSCAPE

Indicate the landform(s) that best describes the site:

| | | | | | |
|---|---|---|---|---|---|
| 2.1 Ridgeline | [redacted] | 2.4 Closed valley | [redacted] | 2.7 Undulating plain / low hills | [redacted] |
| 2.2 Plateau | [redacted] | 2.5 Open valley | X | 2.8 Dune | [redacted] |
| 2.3 Side slope of hill/mountain | [redacted] | 2.6 Plain | [redacted] | 2.9 Seafront | [redacted] |
| 2.10 At sea | [redacted] | | | | |

## 3. GROUNDWATER, SOIL AND GEOLOGICAL STABILITY OF THE SITE

> Note: A Geotechnical Investigation and hydrocensus survey will be undertaken.

Is the site(s) located on any of the following?

| | Alternative S1: | Alternative S2 (if any): | Alternative S3 (if any): |
|---|---|---|---|
| Shallow water table (less than 1.5m deep)<br>Dolomite, sinkhole or doline areas<br>Seasonally wet soils (often close to water bodies)<br>Unstable rocky slopes or steep slopes with loose soil<br>Dispersive soils (soils that dissolve in water)<br>Soils with high clay content (clay fraction more than 40%)<br>Any other unstable soil or geological feature<br>An area sensitive to erosion | *To be determined during Geotechnical Investigation and hydrocensus survey.* | [redacted] | [redacted] |

If you are unsure about any of the above or if you are concerned that any of the above aspects may be an issue of concern in the application, an appropriate specialist should be appointed to assist in the completion of this section. Information in respect of the above will often be available as part of the project information or at the planning sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by the Council for Geo Science may also be consulted.

## 4. GROUNDCOVER

Indicate the types of groundcover present on the site. The location of all identified rare or endangered species or other elements should be accurately indicated on the site plan(s).

| | | | | |
|---|---|---|---|---|
| [redacted] | | | Veld dominated by alien species[E] ✓ | [redacted] |
| [redacted] | | Paved surface ✓ | Building or other structure ✓ | Bare soil ✓ |

If any of the boxes marked with an "[E] "is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

## 5. SURFACE WATER

Indicate the surface water present on and or adjacent to the site and alternative sites?

| | | | |
|---|---|---|---|
| Perennial River | YES | [redacted] | |
| Non-Perennial River | YES | | |
| Permanent Wetland | YES | | |
| Seasonal Wetland | [redacted] | NO | [redacted] |
| Artificial Wetland | | NO | |
| Estuarine / Lagoonal wetland | | NO | |

If any of the boxes marked YES or UNSURE is ticked, please provide a description of the relevant watercourse.

| |
|---|
| The Biodiversity Company was appointed to undertake a freshwater ecology baseline and supporting impact (risk) assessment for the proposed Project on local freshwater resources. The specialist report is contained in **Appendix D**.<br><br>The watercourses associated with the Project are located in the D73F quaternary catchment, within the Orange Water Management Area and the Nama Karoo - Lower ecoregion. The relevant Sub-Quaternary Reach is the D73F-3032, which is a reach of the Orange River.<br><br>The proposed Project infrastructure is located within the K-WWTW's existing perimeter fence 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. The K-WWTW facility 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. |

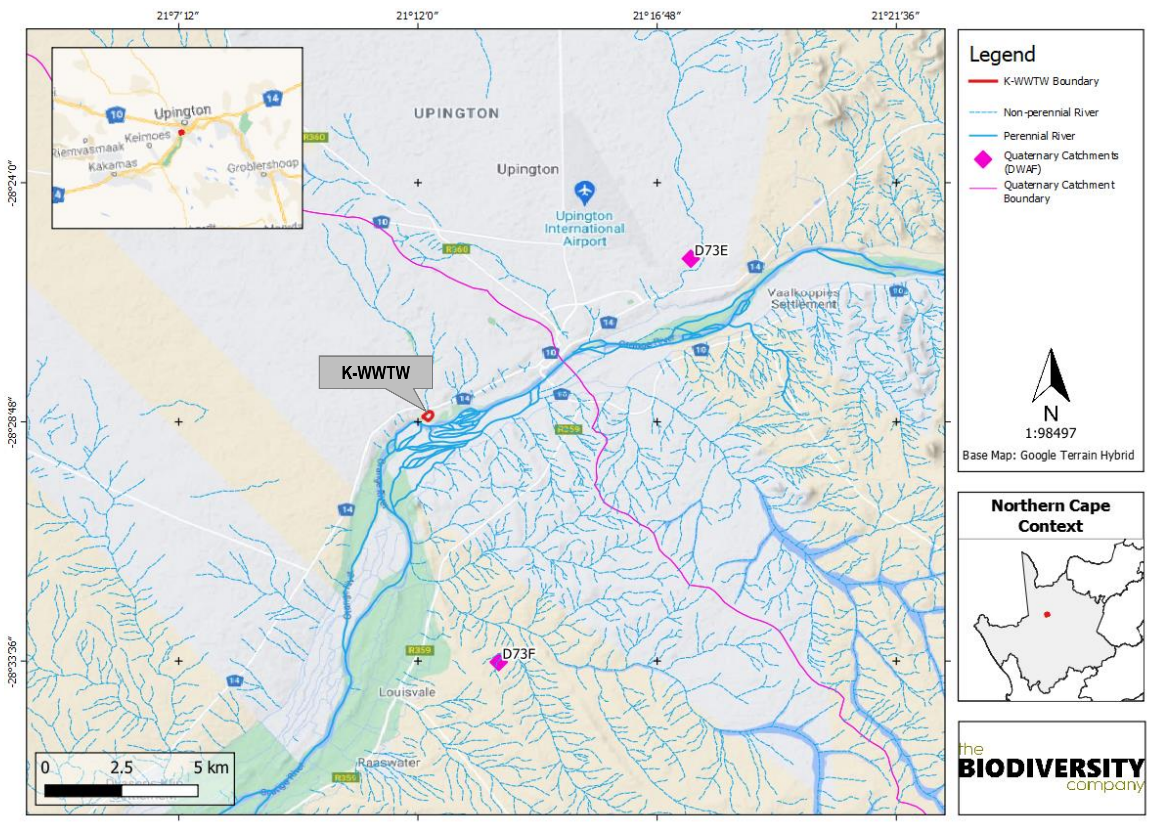



Figure 8: Locality Map showing watercourses in relation to the K-WWTW (Kindler, 2021)

## 6. LAND USE CHARACTER OF SURROUNDING AREA

Indicate land uses and/or prominent features that currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

| | | |
|---|---|---|
| Natural area ✓ | [redacted] | [redacted] |
| Low density residential ✓ | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | Agriculture ✓ |
| [redacted] | [redacted] | River, stream or wetland ✓ |
| [redacted] | Sewage treatment plant[A] ✓ | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | Major road (4 lanes or more) [N] ✓ | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | Other land uses (describe) ✓ |

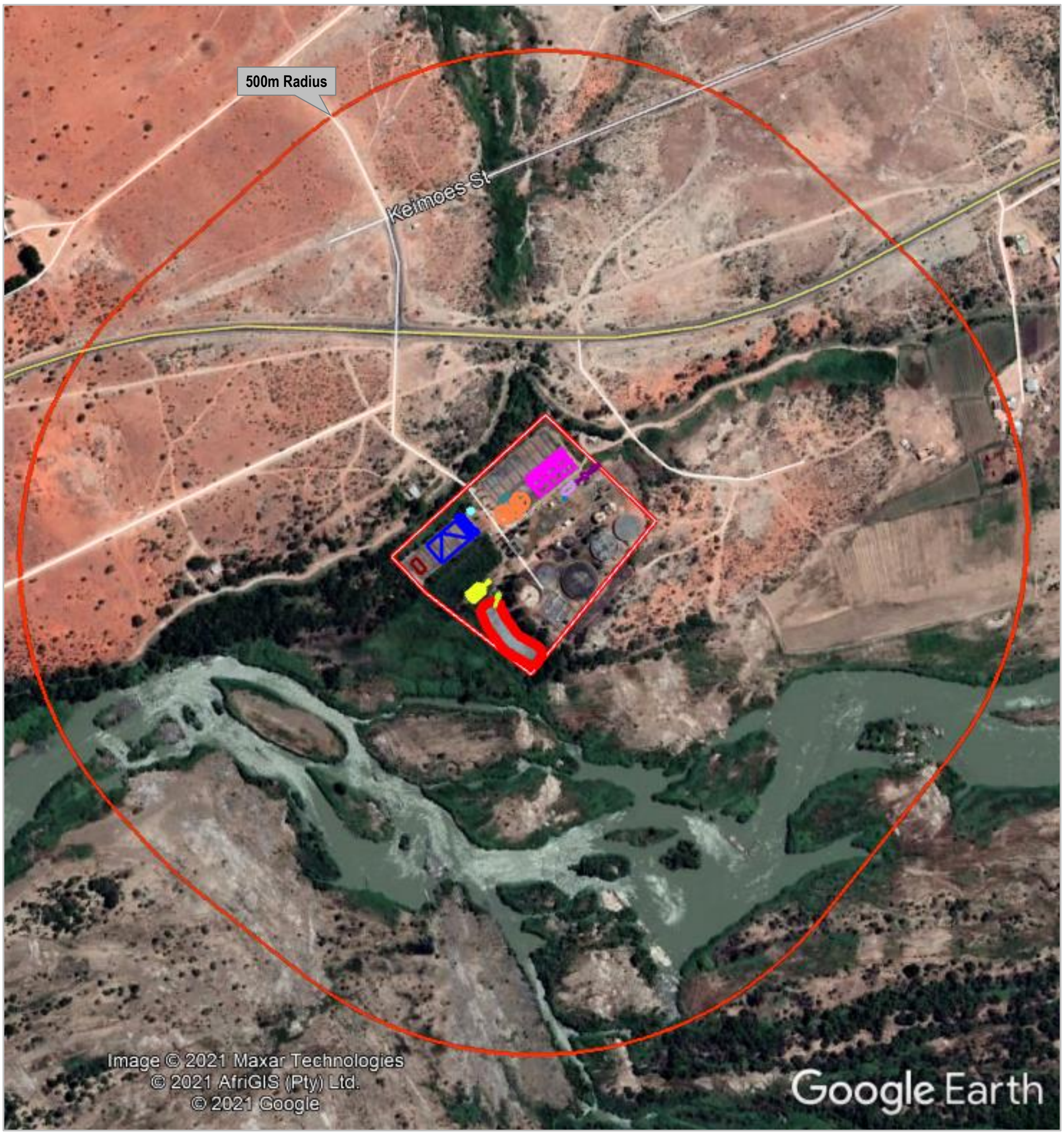



**Figure 9: K-WWTW Upgrade and expansion works (Google Earth image)**

If any of the boxes marked with an “N “are ticked, how this impact will / be impacted upon by the proposed activity? Specify and explain:

| |
|---|
| The existing access road to the K-WWTW, which is a gravel road, is directly from the N14.<br><br>The Project may cause the following potential impacts from a traffic perspective:<br>• Construction phase –<br>  ○ Transportation of materials and construction personnel to site;<br>  ○ Impacts to road conditions;<br>  ○ Speeding and reckless driving by construction personnel; and<br>  ○ Construction vehicles accessing and leaving the gravel road to the site via the N14.<br>• Operational phase –<br>  ○ Safe access, taking into consideration the high-speed environment along the N14; and<br>  ○ Transportation of maintenance materials, and operational and maintenance staff, to site.<br><br>The Project will need to comply with the requirements of SANRAL. Suitable mitigation measures in terms of traffic management and the use of roads are included in the EMPr (contained in **Appendix G**). |

If any of the boxes marked with an "An" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

If any of the boxes marked with an "H" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

Does the proposed site (including any alternative sites) fall within any of the following:

| | | |
|---|---|---|
| Critical Biodiversity Area (as per provincial conservation plan) | YES | |
| Core area of a protected area? | | NO |
| Buffer area of a protected area? | | NO |
| Planned expansion area of an existing protected area? | | NO |
| Existing offset area associated with a previous Environmental Authorisation? | | NO |
| Buffer area of the SKA? | | NO |

If the answer to any of these questions was YES, a map indicating the affected area must be included in Appendix A.

## 7. CULTURAL/HISTORICAL FEATURES

| | | |
|---|---|---|
| Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or paleontological sites, on or close (within 20m) to the site? If YES, explain: | [redacted] | NO |

[redacted]

If uncertain, conduct a specialist investigation by a recognised specialist in the field (archaeology or palaeontology) to establish whether there is such a feature(s) present on or close to the site. Briefly explain the findings of the specialist:

In accordance with Section 38 of the National Heritage Resources Act (Act No. 25 of 1999), an independent heritage consultant (J.A. van Schalkwyk) was appointed to conduct a cultural heritage assessment to determine if the proposed Project would have an impact on any sites, features or objects of cultural heritage significance. The specialist report is contained in **Appendix D**.

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.

After reviewing the K-WWTW facility, the following was found:

- 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.

For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

| | | |
|---|---|---|
| Will any building or structure older than 60 years be affected in any way? | [redacted] | NO |
| Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)? | | NO |

If YES, please provide proof that this permit application has been submitted to SAHRA or the relevant provincial authority.

## 8. SOCIO-ECONOMIC CHARACTER

### a) Local Municipality

Please provide details on the socio-economic character of the local municipality in which the proposed site(s) are situated.

Level of unemployment:

According to the Dawid Kruiper Municipality's IDP for 2020/2021, the unemployment rate decreased from 34% in 2001 to 22.1% in 2011.

Economic profile of local municipality:

| |
|---|
| According to the Dawid Kruiper Municipality's IDP for 2020/2021, the economy of the municipality is rather centred on the trade and retail sectors, due to its strong tourism and agricultural sectors, leaving the local economy fairly vulnerable for any significant changes in this industry. It is therefore important that the Municipality seeks to further diversify its economy into other sectors to counter this vulnerability in the future. |

Level of education:

| |
|---|
| According to the Dawid Kruiper Municipality's IDP for 2020/2021, there was an increase of 5.1% (20.9% in 2001 to 26% in 2011) of people living in the municipality over the age of twenty years that had completed 12th grade, while there was a decline of 6.5% (13.6 in 2001 to 7.1% in 2011) in people that had no schooling at all. Higher education increased from 20.9% in 2001 to 26% in 2011. |

**b) Socio-economic value of the activity**

| | | |
|---|---|---|
| What is the expected capital value of the activity on completion? | **R 170 000 000.00** | |
| What is the expected yearly income that will be generated by or as a result of the activity? | Unknown at this stage | |
| Will the activity contribute to service infrastructure? | YES | |
| Is the activity a public amenity? | | NO |
| How many new employment opportunities will be created in the development and construction phase of the activity/ies? | Unknown at this stage | |
| What is the expected value of the employment opportunities during the development and construction phase? | | |
| What percentage of this will accrue to previously disadvantaged individuals? | | |
| How many permanent new employment opportunities will be created during the operational phase of the activity? | | |
| What is the expected current value of the employment opportunities during the first 10 years? | | |
| What percentage of this will accrue to previously disadvantaged individuals? | | |

## 9. BIODIVERSITY

Please note: The Department may request specialist input/studies depending on the nature of the biodiversity occurring on the site and potential impact(s) of the proposed activity/ies. To assist with the identification of the biodiversity occurring on site and the ecosystem status consult http://bgis.sanbi.org or BGIShelp@sanbi.org. Information is also available on compact disc (cd) from the Biodiversity-GIS Unit, Ph (021) 799 8698. This information may be updated from time to time and it is the applicant/ EAP's responsibility to ensure that the latest version is used. A map of the relevant biodiversity information (including an indication of the habitat conditions as per (b) below) and must be provided as an overlay map to the property/site plan as Appendix D to this report.

**a) Indicate the applicable biodiversity planning categories of all areas on site and indicate the reason(s) provided in the biodiversity plan for the selection of the specific area as part of the specific category)**

| Systematic Biodiversity Planning Category | | If CBA or ESA, indicate the reason(s) for its selection in biodiversity plan |
|---|---|---|
| Critical Biodiversity Area (CBA) | [redacted] | Findings from the Terrestrial Ecology Compliance Statement that was compiled by The Biodiversity Company (contained in **Appendix D**) follow.<br><br>The National Web based Environmental Screening Tool characterised the terrestrial biodiversity for the Project Area as mostly "high-sensitivity" 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 site, the area within the WWTW doesn't contribute to the classification and is determined to be low. |

**b) Indicate and describe the habitat condition on site**

| Habitat Condition | Percentage of habitat condition class (adding up to 100%) | Description and additional Comments and Observations (including additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc). |
|---|---|---|
| Natural | 5% | The natural areas are thinly spread throughout the K-WWTW site, due to historical disturbances associated with the facility. |
| Near Natural (includes areas with low to moderate level of alien invasive plants) | 10% | These areas, although invaded by invasives, are limited to the canal, western and south-western portions of the perimeter fence which includes the reedbed. |
| Degraded (includes areas heavily invaded by alien plants) | 20% | The extent of alien plant invasion is extensive across the Project Area, with a maze of vehicle and pedestrian/livestock tracks across the Project Area. Local residents have littered across majority of the project area with illegal dumping occurring to the east and south east of the perimeter fence. Some evidence of grazing is present. Some excavation work for agriculture is present to the east of the Project Area. |
| Transformed (includes cultivation, dams, urban, plantation, roads, etc) | 65% | The existing K-WWTW's infrastructure and associated road network occupies the majority of the site. |

**c) Complete the table to indicate:**

(i) the type of vegetation, including its ecosystem status, present on the site; and

(ii) whether an aquatic ecosystem is present on site.

| Terrestrial Ecosystems | | Aquatic Ecosystems | | | | | |
|---|---|---|---|---|---|---|---|
| **Ecosystem threat status as per the National Environmental Management: Biodiversity Act (Act No. 10 of 2004)** | ~~Critical~~ | Wetland (including rivers, depressions, channelled and unchanneled wetlands, flats, seeps pans, and artificial wetlands) | | Estuary | | Coastline | |
| | ~~Endangered~~ | | | | | | |
| | ~~Vulnerable~~ | | | | | | |
| | Least Threatened | YES | | | NO | | NO |

**d) Please provide a description of the vegetation type and/or aquatic ecosystem present on site, including any important biodiversity features/information identified on site (e.g. threatened species and special habitats)**

The K-WWTW falls within the Azonal Vegetation Biome. 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, which occurs within the riparian zone situated within the macro-channel banks and flood benches of the adjacent Orange River.

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 (see photographs below).

Figure 10: Photographs of the K-WWTW showing the degraded state of the vegetation

Findings from the relevant specialist studies (contained in **Appendix D**) follow.

**Terrestrial Ecology Compliance Statement (Appendix D1)**

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

The "very high" terrestrial biodiversity sensitivity within the Project Area reflected by the National Web Based Environmental Screening Tool is due to the CBA classification of the area, however, due to the historical modification the area within the WWTW does not contribute to the classification and is determined to be low. The land classification as identified by the Northern Cape Biodiversity Conservation Plan, namely CBA 1, is not relevant to the Project's footprint.

According to 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 Project Area has been used historically as a WWTW and resulting in a low habitat sensitivity. However, due the sensitivity of the surround habitats, the specialist management plan as well as the findings of the Freshwater Assessment need to be strictly adhered to.

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 National Forests Act (Act No. 84 of 1998). 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.

**Freshwater Assessment (Appendix D2)**

The proposed Project infrastructure is located within the K-WWTW's existing perimeter fence 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 K-WWTW facility has a treated effluent discharge point on the Orange tributary which drains into the Orange River.

It is expected that the reedbed, which is located in the south western part of the K-WWTW associated with the discharge area, offers some phytoremediation capacity to the treated effluent. The flow paths and the association of the reedbed would need ground truthing provided alien vegetation removal take place to facilitate access. This reedbed is dominated by common widespread *Phragmites sp* that are tolerant of altered physico-chemical conditions and is considered to have a low sensitivity to the Project. The reedbed would fall within the riparian area associated with the Orange River.

A total of three aquatic sampling sites were selected to establish baseline riverine conditions for the proposed Project. 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. Desktop information indicated that the Orange River catchment associated with the Project was largely modified. The 2021 Ecostatus determination indicated similar conditions to the desktop information for the Orange River with a largely modified status attained from the data collected.

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 the “Up” and “Down” sites 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 where influence was present, however 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 reach providing an indication of the misuse and mismanagement of the river and riparian areas.

According to the sampled macroinvertebrate community, the biotic integrity within the reach during the high flow survey was largely modified (class C/D). The Macroinvertebrate Response Assessment Index (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.

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.

The sensitivity map compiled as part of the Freshwater Assessment is provided in **Figure 11** below.

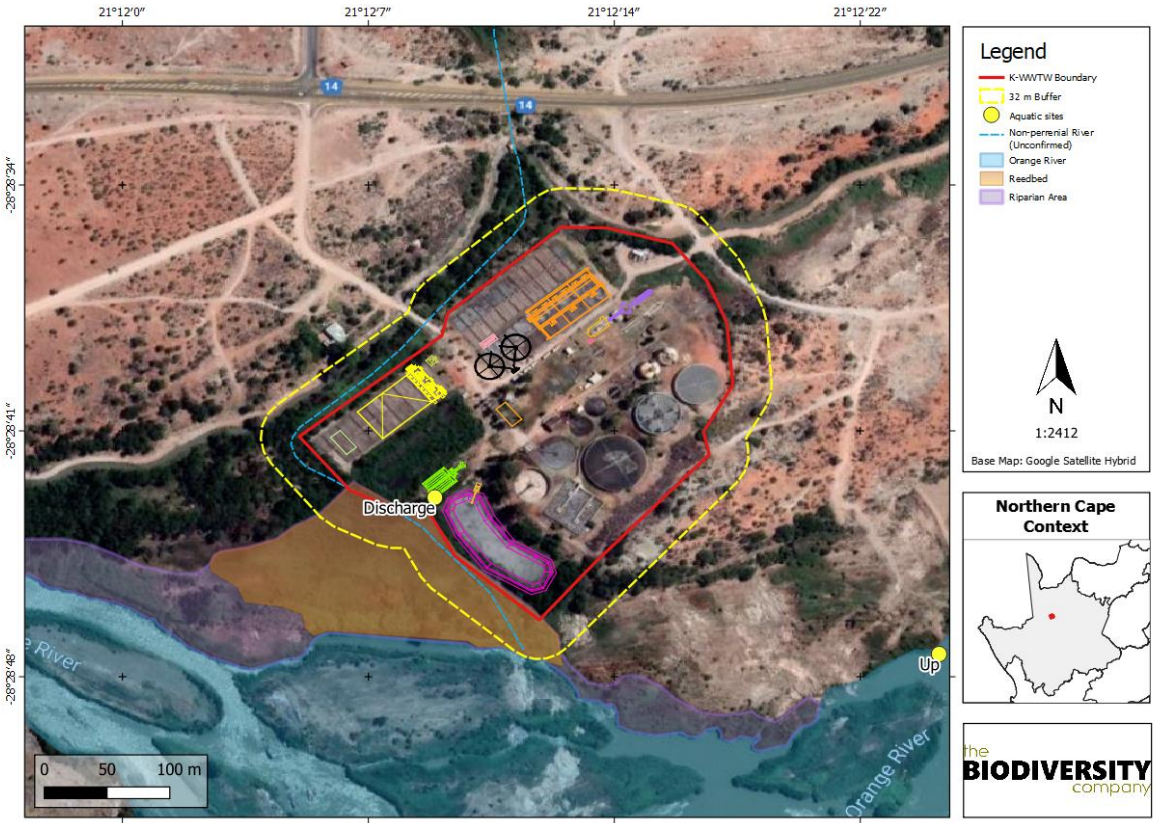



**Figure 11: Water resource sensitivity map (Kindler, 2021)**

# SECTION C: PUBLIC PARTICIPATION

## 1. ADVERTISEMENT AND NOTICE

**Note:** *To date, the Announcement Phase of the Public Participation Process was undertaken in March 2021, which served to obtain upfront comments regarding the proposed Project to understand potential concerns and to guide the Basic Assessment. A database of authorities and Interested and Affected Parties (I&APs) was compiled and a Background Information Document and Reply Form was sent to these parties. Refer to public participation information contained in* ***Appendix E****.*

*A newspaper notice and site notices will be placed as notification of the review of the Draft Basic Assessment Report (BAR) prior to the lodging of the document in the public domain. Parties contained in the database will also be notified of the review period. Details of these notices and the accompanying proof of public participation tasks will be included in the Final BAR.*

***Figure 11*** *below outlines the public participation process.*

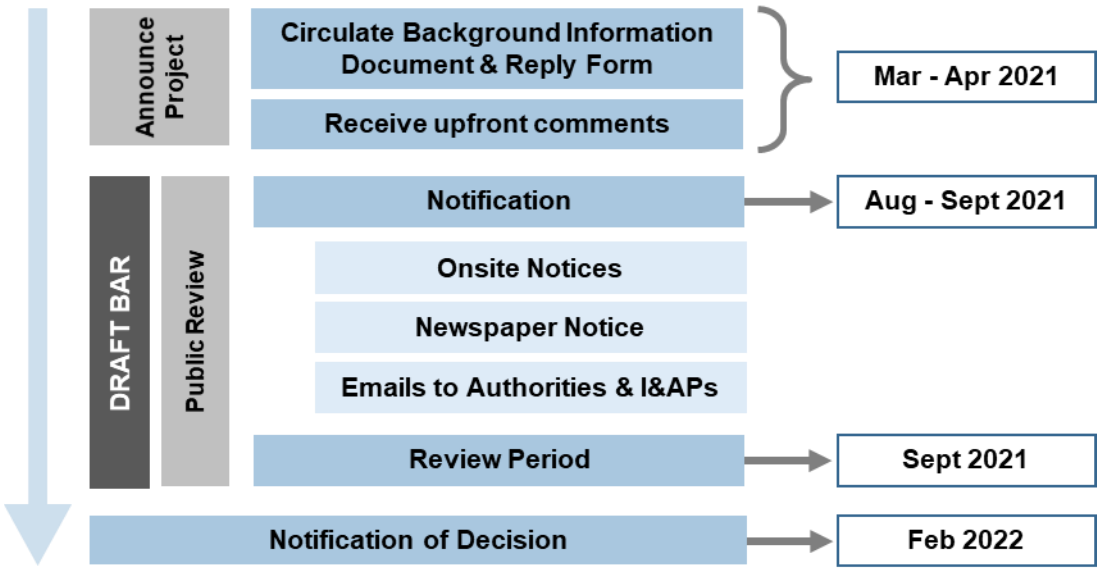



**Figure 11: Outline of Public Participation Process (note: dates are subject to change)**

| | | |
|---|---|---|
| **Publication name** | *Details to be provided in the Final BAR.* | |
| **Date published** | | |
| **Site notice position** | **Latitude** | **Longitude** |
| **Date placed** | *Details to be provided in the Final BAR.* | |

Include proof of the placement of the relevant advertisements and notices in Appendix E1.

## 2. DETERMINATION OF APPROPRIATE MEASURES

Provide details of the measures taken to include all potential I&APs as required by Regulation 41(2)(e) and 41(6) of GN 733.

Key stakeholders (other than organs of state) identified in terms of Regulation 41(2)(b) of GN 733

| Title, Name and Surname | Affiliation/ key stakeholder status | Contact details (tel number or e-mail address) |
|---|---|---|
| *Refer to the stakeholders' database contained in* ***Appendix E5****.* | | |

Include proof that the key stakeholder received written notification of the proposed activities as Appendix E2. This proof may include any of the following:

- e-mail delivery reports;
- registered mail receipts;
- courier waybills;
- signed acknowledgements of receipt; and/or
- or any other proof as agreed upon by the competent authority.

## 3. ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES

| Summary of main issues raised by I&APs | Summary of response from EAP |
|---|---|
| **M.T. Hadebe (Transnet)**: Transnet pipeline servitudes are not affected by the proposed work / installations / excavations / connections / construction / road upgrade / development / etc. as depicted on your Locality and/or Project/Site Layout Plans. This wayleave authorisation is valid for thirty six (36) months from today's date – 25 March 2021. | The Applicant will need to apply for all relevant wayleaves.<br><br>Provision is made in the BAR and Environmental Management Programme (EMPr) to manage impacts to existing infrastructure, as relevant. |
| **M.D. Kgagara (Sasol)**: Sasol Gas is not affected. | No response needed, as Sasol Gas infrastructure is not affected according to the comment received. |
| **Z. Pama (Transnet Property)**: Please be informed that Transnet will NOT be affected by this proposal as the property in question is approximately 1.4km from Transnet Land. | No response needed, as the railway line is not affected according to the comment received. |
| **R. de Kock (SANRAL):** Please provide me with the property description of the WWTW. | Erf Number 18896, Upington Township. The kmz file was also provided. |

## 4. COMMENTS AND RESPONSE REPORT

The practitioner must record all comments received from I&APs and respond to each comment before the Draft BAR is submitted. The comments and responses must be captured in a comments and response report as prescribed in the EIA regulations and be attached to the Final BAR as Appendix E3.

## 5. AUTHORITY PARTICIPATION

Authorities and organs of state identified as key stakeholders:

| Authority/Organ of State | Contact person (Title, Name and Surname) | Tel No | Fax No | e-mail | Postal address |
|---|---|---|---|---|---|
| *Refer to the organs of state listed in the stakeholders' database, which is contained in **Appendix E5**.* | | | | | |

Include proof that the Authorities and Organs of State received written notification of the proposed activities as appendix E4.

In the case of renewable energy projects, Eskom and the SKA Project Office must be included in the list of Organs of State.

## 6. CONSULTATION WITH OTHER STAKEHOLDERS

Note that, for any activities (linear or other) where deviation from the public participation requirements may be appropriate, the person conducting the public participation process may deviate from the requirements of that sub-regulation to the extent and in the manner as may be agreed to by the competent authority.

Proof of any such agreement must be provided, where applicable. Application for any deviation from the regulations relating to the public participation process must be submitted prior to the commencement of the public participation process.

A list of registered I&APs must be included as appendix E5.

Copies of any correspondence and minutes of any meetings held must be included in Appendix E6.

# SECTION D: IMPACT ASSESSMENT

The assessment of impacts must adhere to the minimum requirements in the EIA Regulations, 2014 and should take applicable official guidelines into account. The issues raised by interested and affected parties should also be addressed in the assessment of impacts.

## 1. IMPACTS THAT MAY RESULT FROM THE PLANNING AND DESIGN, CONSTRUCTION, OPERATIONAL, DECOMMISSIONING AND CLOSURE PHASES AS WELL AS PROPOSED MANAGEMENT OF IDENTIFIED IMPACTS AND PROPOSED MITIGATION MEASURES

Provide a summary and anticipated significance of the potential direct, indirect and cumulative impacts that are likely to occur as a result of the planning and design phase, construction phase, operational phase, decommissioning and closure phase, including impacts relating to the choice of site/activity/technology alternatives as well as the mitigation measures that may eliminate or reduce the potential impacts listed. This impact assessment must be applied to all the identified alternatives to the activities identified in Section A(2) of this report.

> Refer to the full Impact Assessment contained in **Appendix F**.

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| **Alternative 1 (preferred alternative)** | | | |
| **Land Use & Planning**<br>Construction and operational activities with an influence beyond the boundaries of the K-WWTW | ***Direct impacts:***<br>• Impacts to surrounding land uses.<br>• Encroachments of incompatible land uses into K-WWTW's buffer zone.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>- | -1 (low) | • The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence.<br>• The Dawid Kruiper Municipality must enforce land use requirements and restrictions associated with the buffer zone of the K-WWTW.- |
| **Climate**<br>All construction activities that emit greenhouse gasses (GHG). | ***Direct impacts:***<br>GHG emissions and contributions towards global warming.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>Unknown. | Unknown | • Materials with a high recycled content should be used where possible and the re-use of site materials should be considered.<br>• Suitable training should be provided to operators to ensure that they maximise the efficiency of the plant and idling is reduced.<br>• In terms of transportation of workers and staff, collective transportation arrangements should be made to reduce individual car journeys.<br>• All vehicles used should be properly maintained and be in good working order. |
| **Climate**<br>All operational activities that emit GHG. | ***Direct impacts:***<br>GHG emissions from biological processes at the Works, and associated contributions towards global warming.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>Unknown. | Unknown | • Designs to consider options for mitigating GHG emissions from the K-WWTW.<br>• Improve energy efficiency at the K-WWTW. |
| **Climate**<br>Influence of climate change to the | ***Direct impacts:***<br>• Climate change may lead to increased inflows, which can cause more frequent bypassing at the K-WWTW. | -2 (medium) | • Designs to cater for increased inflows caused by changing climatic conditions. |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| operation of the K-WWTW. | • The K-WWTW is located alongside the Orange River and may be at risk from extreme floods.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>Unknown. | | • *See mitigation measures below related to surface water.* |
| **Geology**<br>Site preparations and earthworks during construction, as well as the operation of the K-WWTW. | ***Direct impacts:***<br>• Restrictions posed by unsuitable geological conditions.<br>• It is noted that geotechnical investigations still need to be undertaken and this impact can thus not be quantified at this stage.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>Unknown. | Unknown | Undertake geotechnical investigations and implement recommendations. |
| **Groundwater**<br>Construction activities that pose a risk of contaminating groundwater. | ***Direct impacts:***<br>Contamination of groundwater from poor construction practices.<br>***Indirect impacts:***<br>Indirect impacts from use of polluted groundwater.<br>***Cumulative impacts:***<br>Unknown. | -1 (low) | • Provide sufficient and suitable sanitation facilities, which conform to all relevant health and safety standards and codes.<br>• Reduce sediment loads in water from dewatering operations. All dewatering shall be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales).<br>• Suitable protection of groundwater during excavations. Implement mitigation measures suggested as part of the geotechnical investigations for managing groundwater.<br>• *See mitigation measures below related to hazardous substances and waste.* |
| **Groundwater**<br>Operational activities that pose a risk of contaminating groundwater. | ***Direct impacts:***<br>• Contamination of groundwater from poor operation and maintenance practices.<br>• Discharge of non-compliant effluent.<br>• It is noted that hydrogeological investigations still need to be undertaken and this impact can thus not be quantified at this stage.<br>***Indirect impacts:***<br>Indirect impacts from use of polluted groundwater.<br>***Cumulative impacts:***<br>Unknown. | Unknown | • Undertake hydrogeological investigations and implement recommendations. Determine vulnerability of groundwater to pollution incidents at the K-WWTW.<br>• Develop an emergency response plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.<br>• Implement adequate stormwater management at the K-WWTW.<br>• Implement monitoring programme that includes inter alia the effluent quality and groundwater.<br>• *See mitigation measures below related to hazardous substances and waste.* |
| **Soil**<br>Site clearing, earthworks, stockpiling and general construction activities within Project site. | ***Direct impacts:***<br>Soil erosion.<br>***Indirect impacts:***<br>Sedimentation of the Orange River and impacts to downstream water users and the aquatic environment.<br>***Cumulative impacts:***<br>Developments in the surrounding area will disturb surface soils, which may cause cumulative impacts in terms of erosion. | -1 (low) | • 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.<br>• Control drainage over the site to minimise erosion.<br>• Acceptable reinstatement and rehabilitation of disturbed areas to |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | | | prevent erosion during operational phase.<br>• Implement recommendations from geotechnical study. |
| **Soil**<br>Encountering historically contaminated soil during construction. | ***Direct impacts:***<br>Impacts related to the stockpiling, handling and disposal of historically contaminated soil removed during construction.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>- | -1 (low) | 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. |
| **Soil**<br>Construction activities that pose a risk of contaminating soil. | ***Direct impacts:***<br>Soil contamination from poor construction practices.<br>***Indirect impacts:***<br>Indirect impacts from polluted soil.<br>***Cumulative impacts:***<br>Cumulative impacts from polluted soil. | -1 (low)<br>-<br>- | *See mitigation measures below related to hazardous substances and waste.* |
| **Air Quality**<br>Construction activities that pose a risk of causing dust. | ***Direct impacts:***<br>Increased dust levels as a result of construction activities, which may impact on workers and the surrounding community, as well as on crop production.<br>***Indirect impacts:***<br>Nuisance to surrounding communities.<br>***Cumulative impacts:***<br>Nuisance to surrounding communities. | -1 (low) | • 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.<br>• Speed limits on site to be strictly adhered to.<br>• Acceptable reinstatement and rehabilitation of disturbed areas, outside development footprint. |
| **Air Quality**<br>Operation of components such as the Head of Works, emergency storage dam, and dewatering facility at the K-WWTW that may serve as potential sources of malodour. | ***Direct impacts:***<br>Air emissions from wastewater treatment operations, which are a nuisance to workers and the surrounding community.<br>***Indirect impacts:***<br>Nuisance to surrounding communities.<br>***Cumulative impacts:***<br>Nuisance to surrounding communities. | -1 (low) | • Implement effective odour control at the K-WWTW.<br>• 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. |
| **Air Quality**<br>Biogas, containing high methane concentrations, will be produced as a result of the treatment of the wastewater. | ***Direct impacts:***<br>• Contribution of methane emissions to the greenhouse gas footprint of the K-WWTW.<br>• Methane gas is combustible and poses a safety risk.<br>***Indirect impacts:***<br>Safety risks to workers and surrounding communities.<br>***Cumulative impacts:***<br>Overall increase in the greenhouse gas footprint of the K-WWTW. | -1 (low) | • 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. |
| **Surface Water**<br>Construction activities that pose a risk of contaminating surface water. | ***Direct impacts:***<br>• Sedimentation through silt-laden runoff, caused by inadequate stormwater management.<br>• Surface water pollution due to spillages and poor construction practices.<br>***Indirect impacts:***<br>Indirect impacts to downstream water users, including irrigation, recreational uses and the overall aquatic environment (amongst others). | -1 (low) | • Implement suitable stormwater measures on the construction site to trap silt-laden runoff.<br>• Ensure proper storage and careful handling of material that could cause water pollution.<br>• *See mitigation measures below related to hazardous substances and waste.* |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | ***Cumulative impacts:*** Cumulative impacts to downstream water users and the aquatic environment. | | |
| **Surface Water** Encroachment of construction activities into regulated area of the Orange River and non-perennial drainage line (running adjacent to the north-western perimeter fence). | ***Direct impacts:*** Impacts to the resource quality (i.e. flow, habitat, water quality and aquatic biota) of the affected watercourses caused by encroachments.<br>***Indirect impacts:*** Influence to the hydrology of the Orange River.<br>***Cumulative impacts:*** Influence to the hydrology of the Orange River. | -1 (low) | The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence. |
| **Surface Water** The proposed Project aims to ensure that the K-WWTW discharges compliant effluent. | ***Direct impacts:*** Positive impacts to the resource quality (i.e. flow, habitat, water quality and aquatic biota) of the Orange River, and to downstream water users.<br>***Indirect impacts:*** Prevent risks of agricultural products not complying with market requirements in terms of quality of irrigation water.<br>***Cumulative impacts:*** 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. | +3 (high) | • Implement monitoring programme that includes inter alia the effluent quality and receiving aquatic environment.<br>• Comply with conditions of the WUL. |
| **Surface Water** Operational activities that pose a risk of contaminating surface water. | ***Direct impacts:*** Sedimentation and contamination of the Orange River caused by:<br>• Inadequate stormwater management on the site;<br>• Inadequate storage and handling of dangerous goods (e.g. chlorine);<br>• Poor management of sewage, effluent and waste.<br>***Indirect impacts:*** Indirect impacts to downstream water users and the aquatic environment.<br>***Cumulative impacts:*** Cumulative impacts to downstream water users and the aquatic environment. | -1 (low) | • 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.<br>• Develop an emergency response plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.<br>• See mitigation measures below related to hazardous substances and waste. |
| **Surface Water** Encroachment of operational activities into regulated area of the Orange River. | ***Direct impacts:*** Damage to the K-WWTW from major flood events.<br>***Indirect impacts:*** Influence to the hydrology of the Orange River.<br>***Cumulative impacts:*** Influence to the hydrology of the Orange River. | -2 (medium) | • Determine the 1:100 year floodline of the Orange River in relation to the K-WWTW.<br>• Safeguard the K-WWTW from major floods.<br>• Develop an emergency response plan for K-WWTW to deal with floods.<br>• Elevate electrical equipment and essential systems and equipment above the 1:100 year floodline of the Orange River.<br>• Provide flood barriers around essential systems and equipment.<br>• Secure or elevate chemical and other tanks. |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | | | • Adequate design of stormwater system at K-WWTW to cater minor and major flood events.<br>• Flood damaged structures to be promptly repaired by the Dawid Kruiper Municipality. |
| **Noise**<br>Localised increase in noise caused by construction activities. | ***Direct impacts:***<br>Nuisance to workers and the surrounding community.<br>***Indirect impacts:***<br>Nuisance to surrounding communities.<br>***Cumulative impacts:***<br>Nuisance to surrounding communities. | -1 (low) | • Provisions of SANS 10103:2008 to apply to construction areas within audible distance of residents.<br>• Working hours to be agreed upon with the Engineer, so as to minimise noise disturbance.<br>• Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed, where necessary. |
| **Existing Structures and Infrastructure**<br>All construction activities that may affect existing structures and infrastructure. | ***Direct impacts:***<br>• Risk of damaging existing services, infrastructure and structures during construction.<br>• Disruptions caused to operations at the K-WWTW.<br>***Indirect impacts:***<br>Disruptions to services and the operation of the K-WWTW.<br>***Cumulative impacts:***<br>Disruptions to services. | -1 (low) | • Identify and record existing services and infrastructure. Safeguard / deviate existing services to accommodate construction activities, as necessary.<br>• Conform to requirements of relevant service providers and infrastructure custodians.<br>• Accommodate existing operations at the K-WWTW. Cordon off works area.<br>• Adequate reinstatement and rehabilitation of affected environment. |
| **Traffic**<br>Use of surrounding road network by construction vehicles. | ***Direct impacts:***<br>• Disruptions to existing road users during construction.<br>• Impacts to road conditions.<br>***Indirect impacts:***<br>Indirect impacts to other road users.<br>***Cumulative impacts:***<br>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, where the N14 and other roads in Upington will be used. | -1 (low) | • Adhere to SANRAL's requirements in terms of access to the site from the N14 and traffic management measures.<br>• Clearly demarcate all construction access roads and maintain access control to site.<br>• Strict adherence to speed limits by construction vehicles on public roads and access roads. Appropriate speed limits shall be posted on all construction roads.<br>• Implement appropriate safety and traffic calming measures (e.g. flag men, speed reductions and warning signage). |
| **Traffic**<br>Accessing the K-WWTW via the N14 during the operational phase. | ***Direct impacts:***<br>Traffic hazards associated with accessing the K-WWTW via the N14.<br>***Indirect impacts:***<br>Indirect impacts to other road users.<br>***Cumulative impacts:***<br>Cumulative impacts to other road users. | -1 (low) | • Ensure safe access to the K-WWTW, taking into consideration the high-speed environment along the N14.<br>• Adhere to SANRAL's requirements in terms of access to the site from the N14. |
| **Aesthetic Qualities**<br>Construction activities within Project site. | ***Direct impacts:***<br>Visual impacts caused by construction activities.<br>***Indirect impacts:***<br>-<br>***Cumulative impacts:***<br>Cumulative impacts to tourism along the Orange River. | -1 (low) | • Lighting must not constitute an eyesore / hazard to users of the surrounding road network nor the surrounding community.<br>• Lighting will be sufficient to ensure security but will not constitute 'light pollution' to the surrounding areas.<br>• The site will be shielded / screened to minimise the visual impact, where practicable. |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | | | • On-going housekeeping to maintain a tidy construction site.<br>• After the construction phase, the areas disturbed by construction activities that are not part of the permanent development footprint must be suitably rehabilitated. |
| **Hazardous Substances & Waste**<br>Storage and use of hazardous substances, as well as generation of waste, during construction. | ***Direct impacts:***<br>Environmental pollution caused by improper management of hazardous substances and waste.<br>***Indirect impacts:***<br>Indirect impacts to human health as well as fauna and flora (loss of biodiversity) caused by the contamination of the biophysical environment.<br>***Cumulative impacts:***<br>Cumulative impacts to human health as well as fauna and flora (loss of biodiversity) caused by the contamination of the biophysical environment. | -1 (low) | • 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), Occupational Health and Safety 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.<br>• Record details and quantities of hazardous substances on the construction site.<br>• 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.<br>• 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.<br>• 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.<br>• All waste (general and hazardous) generated during the construction phase shall be disposed of at an appropriately licenced waste disposal facility.<br>• 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.<br>• Wastewater to be properly disposed of. |
| **Hazardous Substances & Waste**<br>Storage and use of hazardous substances (e.g. chlorine or other compounds used for disinfection), as well | ***Direct impacts:***<br>Environmental pollution caused by improper management of hazardous substances and waste.<br>***Indirect impacts:***<br>Indirect impacts to human health as well as fauna and flora (loss of biodiversity) caused | -1 (low) | • 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), Occupational |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| as generation of waste, associated with the operation of the K-WWTW. | by the contamination of the biophysical environment.<br>***Cumulative impacts:***<br>Cumulative impacts to human health as well as fauna and flora (loss of biodiversity) caused by the contamination of the biophysical environment. | | Health and Safety 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.<br>• Record the details and quantities of hazardous substances at the K-WWTW.<br>• 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.<br>• 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.<br>• Prevent uncontrolled releases of hazardous materials to the environment.<br>• Implement engineering controls (such as containment, automatic alarms, and shut-off systems) for storage areas of hazardous substances.<br>• 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.<br>• All waste (general and hazardous) generated during the operational phase shall be disposed of at an appropriately licenced waste disposal facility.<br>• Ensure adequate disposal of wastewater. Contaminated water will not be discharged to the environment.<br>• Comply with the conditions of the WML regarding sludge management. |
| **<u>Socio-Economic Environment</u>**<br>Disturbances to the socio-economic environment arising from construction activities. | ***Direct impacts:***<br>• Influx of workers.<br>• Worker Health and Safety.<br>• Worker Behaviour & Crime.<br>• Communicable Diseases.<br>• Grievances.<br>***Indirect impacts:***<br>Indirect adverse impacts to socio-economic environment caused by construction (e.g. impacts to local health services due to spread of diseases). | -1 (low) | • 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.<br>• People in search of work may move into the area, however, the Project will create a limited number of job |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | ***Cumulative impacts:***<br>Cumulative impacts to socio-economic environment caused by construction (e.g. disruptions to community structures). | | opportunities. Locally based people should be given an opportunity.<br>• No staff accommodation should be allowed on site.<br>• The Contractor should establish an HIV/AIDs awareness programme.<br>• Induction will be mandatory for all workers.<br>• Develop a Code of Conduct in terms of behaviour of construction staff.<br>• During construction, the working areas should be fenced to prevent trespassing and expansion of the working footprint.<br>• All the Contractor's staff should be easily identifiable through their uniforms.<br>• Develop a security policy for the Contractor's staff.<br>• Define and implement pre-employment medical requirements for all workers.<br>• Provide adequate hygiene and sanitation facilities to workers.<br>• Implement all necessary measures to contain the spread of COVID-19 and to safeguard workers and the local communities from this virus.<br>• The Contactor will develop and implement a formal grievance redress mechanism to record, investigate and resolve any complaints from communities.<br>• See mitigation measures below related to health and safety. |
| **Socio-Economic Environment**<br>Economic opportunities arising from construction. | ***Direct impacts:***<br>• Opportunities for SMME's.<br>• Job Creation and Skills Development.<br>• Indirect Employment Impacts.<br>***Indirect impacts:***<br>Indirect benefits to local communities caused by economic opportunities created by the Project.<br>***Cumulative impacts:***<br>Cumulative benefits to local communities caused by economic opportunities created by multiple projects. | +2 (medium) | • Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.<br>• The main contractor should employ non-core labour from the sub-places as far as possible during the construction phase.<br>• The principles of Expanded Public Works Programme can be used during construction.<br>• Spaza shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the Local Municipality – Informal Trading By-Laws, are complied with. |
| **Health and Safety**<br>All construction activities that pose a risk to health and safety. | ***Direct impacts:***<br>Health and safety related incidents during construction.<br>***Indirect impacts:***<br>Indirect impacts to local health services.<br>***Cumulative impacts:***<br>Cumulative impacts to local health services. | -1 (low) | • Dedicated Occupational Health and Safety system to be implemented by the Contractor.<br>• Undertake a hazard identification and risk assessment and identify preventive and protective measures.<br>• Conduct basic safety awareness training with construction workers. |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | | | • Provide all workers with the necessary PPE.<br>• Prevent environmental contamination.<br>• Provide potable water and sanitation services to workers.<br>• All workers shall be clearly identifiable.<br>• Prepare an Emergency Preparedness and Response Plan.<br>• Ensure adequate control of communicable diseases.<br>• Maintain access control to construction domain. |
| **Health and Safety**<br>All operation and maintenance activities that pose a risk to health and safety. | ***Direct impacts:***<br>Health and safety related incidents caused by operation and maintenance activities.<br>***Indirect impacts:***<br>Indirect impacts to local health services.<br>***Cumulative impacts:***<br>Cumulative impacts to local health services. | -1 (low) | • Dedicated Occupational Health and Safety system to be implemented during the operational phase.<br>• 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.<br>• Provide and require use of suitable PPE and equipment to prevent contact with wastewater.<br>• Temporary Contractors to adhere to Occupational Health and Safety requirements.<br>• Maintain good housekeeping in sewage processing and storage areas.<br>• Provide potable water and sanitation services to operational staff.<br>• Prepare an Emergency Preparedness and Response Plan.<br>• Control access to the K-WWTW. |
| **Terrestrial Ecology**<br>All construction and operational activities that pose a risk to terrestrial ecology. | ***Direct impacts:***<br>• Loss and fragmentation of vegetation communities and CBA 1 areas in the vicinity of the Project Area (including watercourses).<br>• Loss and disturbance of faunal species and community (including occurring and potentially occurring species of conservation concern).<br>***Indirect impacts:***<br>Indirect impacts to terrestrial ecology, such as edge effects, disruption of fauna and flora communities and vehicle strikes.<br>***Cumulative impacts:***<br>The areas earmarked for the upgrade and expansion works have been historically transformed/disturbed. The Project's contribution to cumulative impacts to terrestrial biodiversity are not anticipated to be significant. | -1 (low) | *Refer to the list of mitigation measures contained in Appendix F related to terrestrial ecology, as identified as part of the Terrestrial Ecology Compliance Statement.* |
| **Aquatic Ecology**<br>All construction and operational activities that pose a risk to aquatic ecology. | ***Direct impacts:***<br>Impacts to aquatic ecology caused during construction, including:<br>• Clearing associated with upgrades and expansion; | -1 (low) | *Refer to the list of mitigation measures contained in Appendix F related to aquatic ecology, as identified as part of the Freshwater Assessment.* |

| Activity | Impact summary | Significance | Proposed mitigation |
|---|---|---|---|
| | • Operation of equipment and machinery near watercourses (emergency overflow dam);<br>• Demolition and reconstruction of existing infrastructure;<br>• Soil and building material stockpile management;<br>• Contamination due to improper storage of chemicals, construction materials, fuel and machinery leaks;<br>• Eutrophication and contamination from infrastructure waste; and<br>• Final landscaping and post-construction rehabilitation.<br><br>Impacts to aquatic ecology caused during operational phase, including:<br>• Leaks and spills from facility;<br>• Contamination, dumping of solid wastes and input associated with WWTW facility; and<br>• Establishment of alien plants on disturbed areas. | | |
| | ***Indirect impacts:***<br>Indirect impacts to downstream water users and the aquatic environment. | | |
| | ***Cumulative impacts:***<br>Cumulative impacts to downstream water users and the aquatic environment. | | |

| **Alternative 2** | | | |
|---|---|---|---|
| | ***Direct impacts:*** | | |
| | ***Indirect impacts:*** | | |
| | ***Cumulative impacts:*** | | |
| **Alternative 3** | | | |
| | ***Direct impacts:*** | | |
| | ***Indirect impacts:*** | | |
| | ***Cumulative impacts:*** | | |

| **No-go option** | | | |
|---|---|---|---|
| Not proceeding with the proposed upgrade and expansion works. | ***Direct impacts:***<br>If the Project does not proceed, the objectives of the proposed upgrade and expansion, which include improving the operational efficiency of the K-WWTW and ensuring that the plant complies with the relevant standards in terms of effluent quality and sludge management, will not materialise. | +3 | Undertake the proposed upgrade and expansion works at the K-WWTW. |
| | ***Indirect impacts:***<br>The K-WWTW will remain in non-compliance with prevailing standards governing the effluent quality and sludge management. The plant will continue to operate inefficiently and will not be able to adequately treat wastewater and will not be able to cater for future developments in the works' drainage area. | | |

| | | | |
|---|---|---|---|
| | Downstream water users will be adversely affected, including impacts to agriculture (irrigation) and recreational use of the Orange River. | | |
| | ***Cumulative impacts:***<br>Build-up of pollutants in the Orange River and depletion of dissolved oxygen, with associated impacts to the aquatic environment and downstream water users. | | |

A complete impact assessment in terms of Regulation 19(3) of GN 733 must be included as Appendix F.

## 2. ENVIRONMENTAL IMPACT STATEMENT

Taking the assessment of potential impacts into account, please provide an environmental impact statement that summarises the impact that the proposed activity and its alternatives may have on the environment after the management and mitigation of impacts have been taken into account, with specific reference to types of impact, duration of impacts, likelihood of potential impacts actually occurring and the significance of impacts.

**Alternative A (preferred alternative)**

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 Dawid Kruiper Municipality'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 following key tasks were undertaken during the Basic Assessment Process to date for the proposed Project:

- Specialist studies were undertaken and the findings were incorporated into the BAR in terms of understanding the environmental status quo and sensitive features, assessing the potential impacts and establishing concomitant mitigation measures;
- Issues raised during public participation to date were considered;
- 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 Project were considered; and
- Authorities and I&APs were identified and notified of the review of the Draft BAR.

Some of the sensitive and significant environmental features and aspects that are associated with the Project's receiving environment include the following, for which mitigation measures are included in the BAR and EMPr (as relevant):

- The proposed Project infrastructure is located within the K-WWTW's existing perimeter fence 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 K-WWTW facility has a treated effluent discharge point on the Orange tributary which drains into the Orange River.
- 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*) were observed occurring at random within and around the Project Area.
- The existing access road to the K-WWTW, which is a gravel road, is directly from the N14.

The table to follow lists the significance ratings of potential impacts that may be caused by the Project activities during the construction and operational phases, prior to and after having taken into consideration the identified mitigation measures. Based on the assessment, the potentially significant adverse impacts can be mitigated to a satisfactory level, and the residual impacts (where relevant) would also be considered acceptable.

| Activity | Significance rating before mitigation | Significance rating after mitigation |
|---|---|---|
| **Land Use & Planning**<br>Construction and operational activities with an influence beyond the boundaries of the K-WWTW | -2 (medium) | -1 (low) |
| **Climate**<br>All construction activities that emit greenhouse gasses (GHG). | Unknown | Unknown |
| **Climate**<br>All operational activities that emit GHG. | Unknown | Unknown |
| **Climate**<br>Influence of climate change to the operation of the K-WWTW. | -3 (high) | -2 (medium) |
| **Geology**<br>Site preparations and earthworks during construction, as well as the operation of the K-WWTW. | Unknown | Unknown |
| **Groundwater**<br>Construction activities that pose a risk of contaminating groundwater. | -3 (high) | -1 (low) |
| **Groundwater**<br>Operational activities that pose a risk of contaminating groundwater. | Unknown | Unknown |
| **Soil**<br>Site clearing, earthworks, stockpiling and general construction activities within Project site. | -2 (medium) | -1 (low) |
| **Soil**<br>Encountering historically contaminated soil during construction. | -2 (medium) | -1 (low) |
| **Soil**<br>Construction activities that pose a risk of contaminating soil. | -2 (medium) | -1 (low) |
| **Air Quality**<br>Construction activities that pose a risk of causing dust. | -2 (medium) | -1 (low) |
| **Air Quality**<br>Operation of components such as the Head of Works, emergency storage dam, and dewatering facility at the K-WWTW that may serve as potential sources of malodour. | -2 (medium) | -1 (low) |
| **Air Quality**<br>Biogas, containing high methane concentrations, will be produced | -2 (medium) | -1 (low) |

| | | | | |
|---|---|---|---|---|
| | as a result of the treatment of the wastewater. | | | |
| | **Surface Water** Construction activities that pose a risk of contaminating surface water. | -3 (high) | -1 (low) | |
| | **Surface Water** Encroachment of construction activities into regulated area of the Orange River and non-perennial drainage line (running adjacent to the north-western perimeter fence). | -3 (high) | -1 (low) | |
| | **Surface Water** The proposed Project aims to ensure that the K-WWTW discharges compliant effluent. | +3 (high) | +3 (high) | |
| | **Surface Water** Operational activities that pose a risk of contaminating surface water. | -3 (high) | -1 (low) | |
| | **Surface Water** Encroachment of operational activities into regulated area of the Orange River. | -3 (high) | -2 (medium) | |
| | **Noise** Localised increase in noise caused by construction activities. | -2 (medium) | -1 (low) | |
| | **Existing Structures and Infrastructure** All construction activities that may affect existing structures and infrastructure. | -3 (high) | -1 (low) | |
| | **Traffic** Use of surrounding road network by construction vehicles. | -2 (medium) | -1 (low) | |
| | **Traffic** Accessing the K-WWTW via the N14 during the operational phase. | -2 (medium) | -1 (low) | |
| | **Aesthetic Qualities** Construction activities within Project site. | -2 (medium) | -1 (low) | |
| | **Hazardous Substances & Waste** Storage and use of hazardous substances, as well as generation of waste, during construction. | -3 (high) | -1 (low) | |
| | **Hazardous Substances & Waste** 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. | -3 (high) | -1 (low) | |
| | **Socio-Economic Environment** Disturbances to the socio-economic environment arising from construction activities. | -2 (medium) | -1 (low) | |
| | **Socio-Economic Environment** Economic opportunities arising from construction. | +1 | +2 (medium) | |
| | **Health and Safety** All construction activities that pose a risk to health and safety. | -3 (high) | -1 (low) | |
| | **Health and Safety** | -3 (high) | -1 (low) | |

| | | |
|---|---|---|
| All operation and maintenance activities that pose a risk to health and safety. | | |
| **Terrestrial Ecology** All construction and operational activities that pose a risk to terrestrial ecology. | -3 (high) | -1 (low) |
| **Aquatic Ecology** All construction and operational activities that pose a risk to aquatic ecology. | -2 (medium) | -1 (low) |

With the adoption of the mitigation measures included in the BAR and 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 Environmental Authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

**Alternative B**

[redacted]

**Alternative C**

[redacted]

**No-go alternative (compulsory)**

If the Project does not proceed, the objectives of the proposed upgrade and expansion, which include improving the operational efficiency of the K-WWTW and ensuring that the plant complies with the relevant standards in terms of effluent quality and sludge management, will not materialise.

Conversely, should the proposed Project not go ahead, any potentially significant environmental issues associated with the development would be irrelevant and the status quo of the local receiving environment would not be affected by the project-related activities.

As no environmental fatal flaws were identified through the specialist studies for the Project, and the assessment found that potentially significant impacts could be satisfactorily mitigated, the no-go option is not deemed favourable.

## SECTION E. RECOMMENDATION OF PRACTITIONER

| | | |
|---|---|---|
| Is the information contained in this report and the documentation attached hereto sufficient to make a decision in respect of the activity applied for (in the view of the environmental assessment practitioner)? | YES | [redacted] |

If "NO", indicate the aspects that should be assessed further as part of a Scoping and EIA process before a decision can be made (list the aspects that require further assessment).

[redacted]

If "YES", please list any recommended conditions, including mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application.

- Appoint an Environmental Control Officer to monitor compliance with the Environmental Authorisation and the approved EMPr during the construction phase.
- Excavated soil to be tested for contamination levels and to be handled and disposed of accordingly.
- Determine the 1:100 year floodline of the Orange River in relation to the K-WWTW. Safeguard the plant from major floods.
- Undertake geotechnical investigations and implement recommendations.
- Undertake hydrogeological investigations and implement recommendations.
- 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 the following:
  - Effluent quality;
  - Groundwater;
  - Sludge; and
  - Air quality.
- 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.

| | | |
|---|---|---|
| Is an EMPr attached? | YES | [redacted] |

The EMPr must be attached as Appendix G.

The details of the EAP who compiled the BAR and the expertise of the EAP to perform the Basic Assessment process must be included as Appendix H.

If any specialist reports were used during the compilation of this BAR, please attach the declaration of interest for each specialist in Appendix I.

Any other information relevant to this application and not previously included must be attached in Appendix J.

Donavan Henning

NAME OF EAP

SIGNATURE OF EAP

20 August 2021

DATE

## SECTION F: APPENDIXES

The following appendixes must be attached:

Appendix A: Maps

Appendix B: Photographs

Appendix C: Facility illustration(s)

Appendix D: Specialist reports (including terms of reference)

Appendix E: Public Participation

Appendix F: Impact Assessment

Appendix G: Environmental Management Programme (EMPr)

Appendix H: Details of EAP and expertise

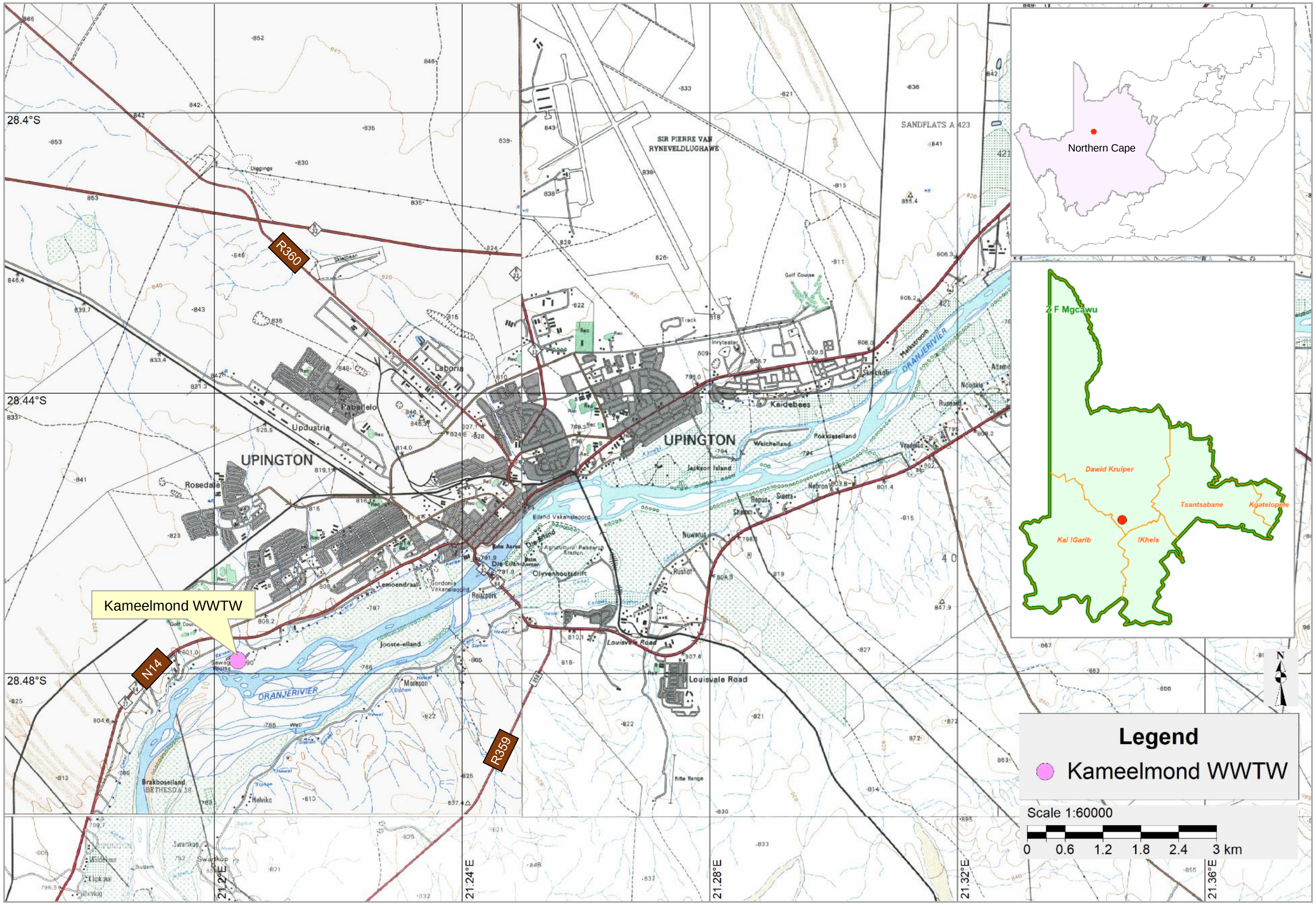
Appendix I: Specialist's declaration of interest

Appendix J: Additional Information

# APPENDIX A

## MAPS

# APPENDIX A




| PREPARED FOR: | Proposed Upgrade and Expansion of the Kameelmond Wastewater Treatment Works in Upington, Northern Cape |
|---|---|
| PREPARED BY: | LOCALITY MAP |

# APPENDIX B

## PHOTOGRAPHS

North-West

North

North-East

West

East

South-West

South

South-East

# APPENDIX C

## FACILITY ILLUSTRATIONS


**LEGEND:**

REFURBISHED STRUCTURES

**NOTE:**

LAYOUT SUBJECT TO CHANGE BASED ON FINALISATION OF THE PRELIMINARY DESIGN.

SURVEY DATUM:

**VERSION / AMENDMENTS**

| No. | DATE | DESCRIPTION | AUTH. BY |
|---|---|---|---|
| | | | |

DAWID KRUIPER Munisipaliteit | Municipality

PROJECT TITLE:

**REFURBISHMENT AND UPGRADING OF KAMEELMOND WASTEWATER TREATMENT WORKS**

DRAWING TITLE:

**INFRASTRUCTURE TO REFURBISH**

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Bellville

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capetown@bigengroup.com

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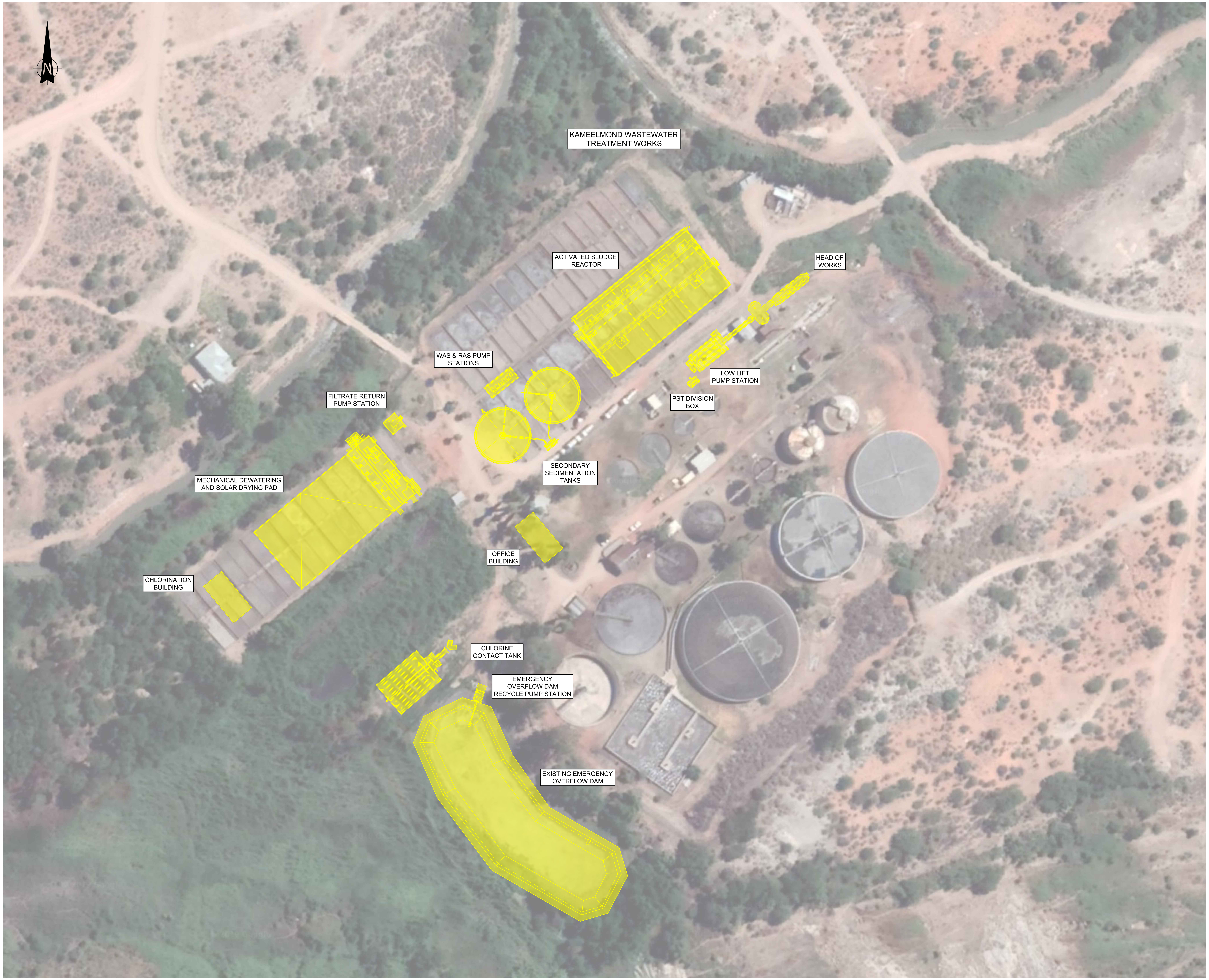
| DRAWN | J DU TOIT | CHECKED | M SLABBERT |
| COORD SYSTEM | N/A | DATE | SEPTEMBER 2019 |

APPROVED ON BEHALF OF BIGEN:

DRAWING No.: **3287.00.00.AAA.10.U001**

VERSION: **A.0**




**LEGEND:**

NEW STRUCTURES - MODULE 1

**NOTE:**

LAYOUT SUBJECT TO CHANGE BASED ON FINALISATION OF THE PRELIMINARY DESIGN.

SURVEY DATUM:

**VERSION / AMENDMENTS**

| No. | DATE | DESCRIPTION | AUTH. BY |
|---|---|---|---|
| | | | |

DAWID KRUIPER Munisipaliteit | Municipality

PROJECT TITLE:

**REFURBISHMENT AND UPGRADING OF KAMEELMOND WASTEWATER TREATMENT WORKS**

DRAWING TITLE:

**PROPOSED SITE LAYOUT**

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| COORD SYSTEM | N/A | DATE | FEBRUARY 2021 |

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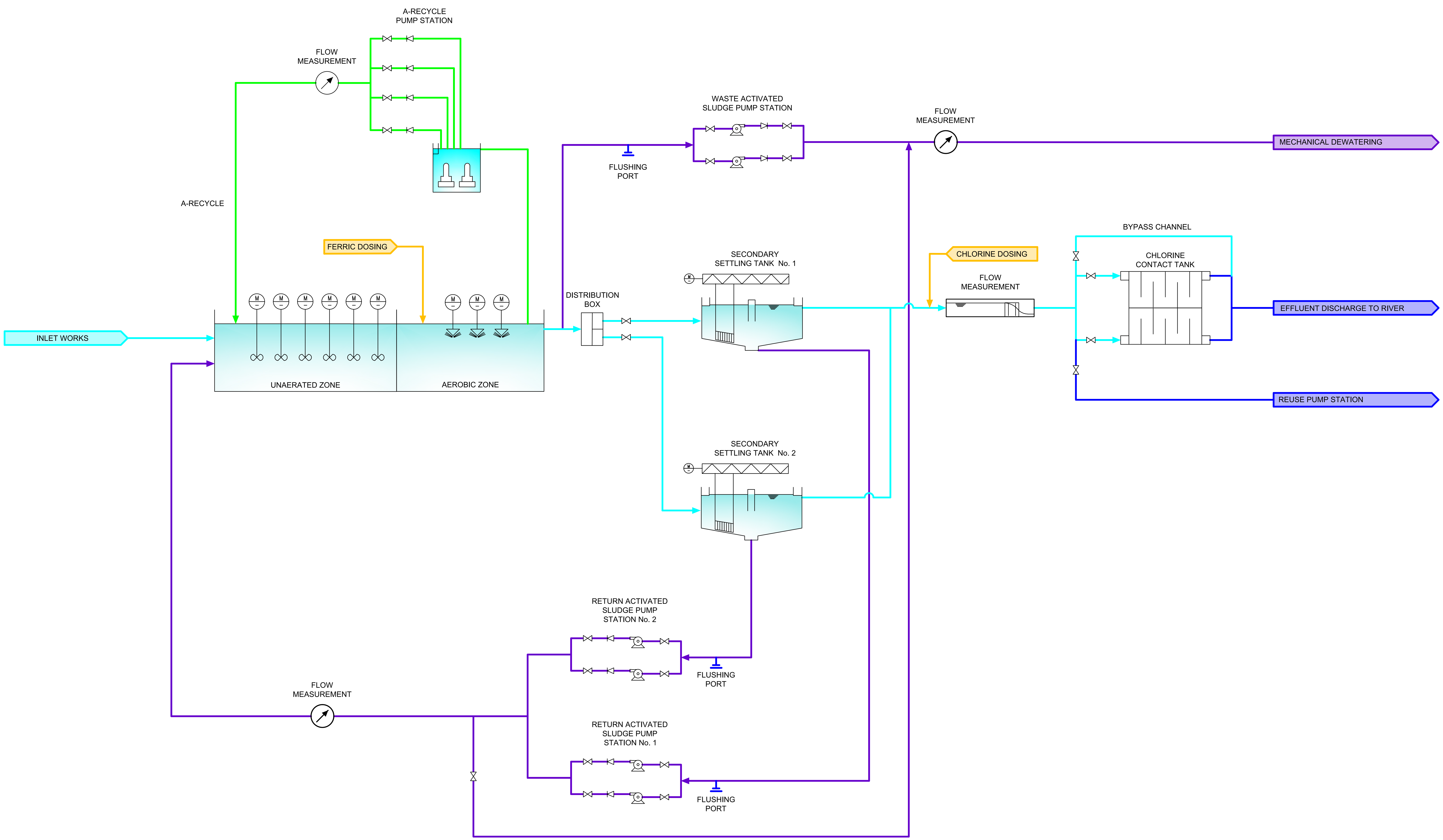
DRAWING No.: 3287.00.00.AAA.10.U002

VERSION: A.0




**LEGEND:**

- MAIN PROCESS STREAM
- SLUDGE PROCESS STREAM
- RECYCLE STREAM
- CLEAN EFFLUENT STREAM
- DOSING STREAM

SURVEY DATUM:

**VERSION / AMENDMENTS**

| No. | DATE | DESCRIPTION | AUTH. BY |
|---|---|---|---|

PROJECT TITLE:

**REFURBISHMENT AND UPGRADING OF KAMEELMOND WASTEWATER TREATMENT WORKS**

DRAWING TITLE:

**MECHANICAL FLOW DIAGRAM ACTIVATED SLUDGE TRAIN**

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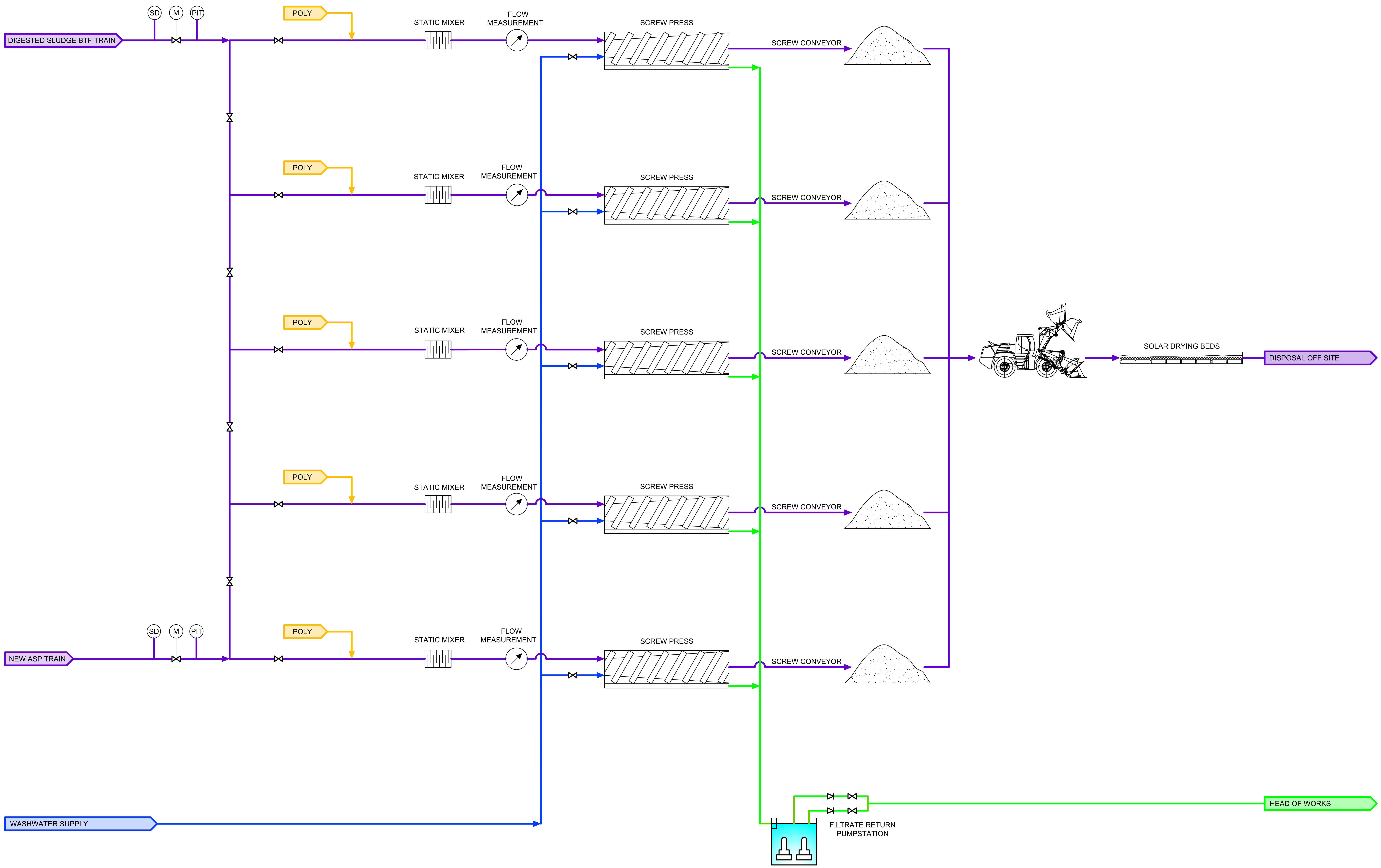
| DRAWN | J DU TOIT | CHECKED | G DE VILLIERS |
| COORD SYSTEM | N/A | DATE | FEBRUARY 2021 |

APPROVED ON BEHALF OF BIGEN:

DRAWING No.: **3287.00.00.AAA.13.A002**

VERSION: **A.0**




**LEGEND:**

- SLUDGE PROCESS STREAM
- WASHWATER STREAM
- DOSING STREAM
- RECYCLE STREAM

SURVEY DATUM:

**VERSION / AMENDMENTS**

| No. | DATE | DESCRIPTION | AUTH. BY |
|---|---|---|---|
| | | | |

PROJECT TITLE:

**REFURBISHMENT AND UPGRADING OF KAMEELMOND WASTEWATER TREATMENT WORKS**

DRAWING TITLE:

**MECHANICAL FLOW DIAGRAM SLUDGE MANAGEMENT TRAIN**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| DRAWN | J DU TOIT | CHECKED | G DE VILLIERS |
| COORD SYSTEM | N/A | DATE | JANUARY 2021 |

APPROVED ON BEHALF OF BIGEN:

DRAWING No.: **3287.00.00.AAA.13.A003**

VERSION: **A.0**

# APPENDIX D

## SPECIALIST REPORTS

## APPENDIX D1: Terrestrial Ecology Compliance Statement

# Terrestrial Ecology Compliance Statement for the proposed Kameelmond Waste Water Treatment Works Upgrade and Expansion

# Upington, Northern Cape

May 2021

**CLIENT**


**Prepared by:**

**The Biodiversity Company**

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

# Table of Contents

# Tables



# Figures

# 1 Introduction

The Biodiversity Company was commissioned to provide a terrestrial ecology compliance statement (or opinion) for the proposed upgrade and expansion of the existing Kameelmond Wastewater Treatment Works (K-WWTW) (the Project). The Project is located on the banks of the Orange River in Upington, Northern Cape Province, South Africa (Figure 1-1).

A survey was conducted in April 2021, across the whole development footprint hereafter referred to as the "project area". Furthermore, identification and description of any sensitive receptors were recorded across the project area, and the manner in which these sensitive receptors may be affected by the proposed development were also investigated.

The approach has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 30 October 2020: "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". The National Web based Environmental Screening Tool has characterised the terrestrial biodiversity theme as "very high".

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the proposed project.

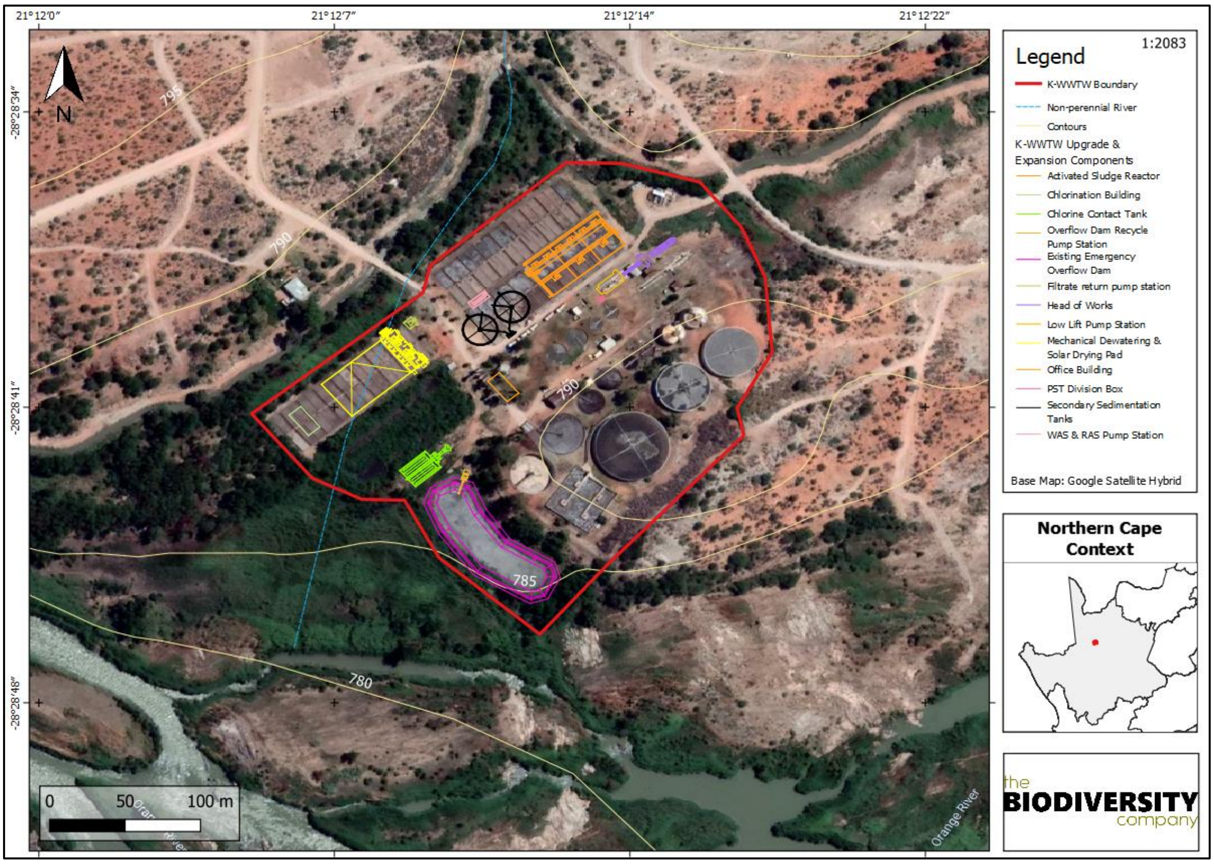


*Figure 1-1 The project area in a site context*

## 2 Specialist Details

| | |
|---|---|
| **Report Name** | **Terrestrial Ecology Compliance Statement for the proposed Kameelmond Waste Water Treatment Works Upgrade and Expansion** |
| **Submitted to** | |
| **Report writer** | **Martinus Erasmus**<br><br>Martinus Erasmus obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has been conducting EIAs, basic assessments and assisting specialists in field during his studies since 2015. |
| **Report reviewer** | **Andrew Husted**<br><br>Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant. |
| **Declaration** | The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science. |

# 3 Terms of Reference

The Terms of Reference (ToR) included the following:

- 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;
- Identify 'significant' ecological, botanical features within the proposed project areas;
- 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;
- Provide outcomes to be included in the Management plan.

# 4 Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 4-1).

*Table 4-1 A list of key legislative requirements relevant to biodiversity and conservation in Northern Cape.*

| Region | Legislation |
|---|---|
| International | Convention on Biological Diversity (CBD, 1993) |
| | The Convention on Wetlands (RAMSAR Convention, 1971) |
| | The United Nations Framework Convention on Climate Change (UNFCC,1994) |
| | The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973) |
| | The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979) |
| National | Constitution of the Republic of South Africa (Act No. 108 of 2006) |
| | The National Environmental Management Act (NEMA) (Act No. 107 of 1998) |
| | The National Environmental Management Protected Areas Act (Act No. 57 of 2003) |
| | The National Environmental Management Biodiversity Act (Act No. 10 of 2004) |
| | The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 42946 (January 2020) |
| | The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 43110 (March 2020) |
| | The National Environmental Management: Waste Act, 2008 (Act 59 of 2008); |
| | The Environment Conservation Act (Act No. 73 of 1989) and associated EIA Regulations |
| | National Protected Areas Expansion Strategy (NPAES) |
| | Environmental Conservation Act (Act No. 73 of 1983) |

| | |
|---|---|
| | Natural Scientific Professions Act (Act No. 27 of 2003) |
| | National Biodiversity Framework (NBF, 2009) |
| | National Forest Act (Act No. 84 of 1998) |
| | National Veld and Forest Fire Act (101 of 1998) |
| | National Spatial Biodiversity Assessment (NSBA) |
| | World Heritage Convention Act (Act No. 49 of 1999) |
| | National Heritage Resources Act, 1999 (Act 25 of 1999) |
| | Municipal Systems Act (Act No. 32 of 2000) |
| | Alien and Invasive Species Regulations, 2014 |
| | South Africa's National Biodiversity Strategy and Action Plan (NBSAP) |
| | Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) |
| | Sustainable Utilisation of Agricultural Resources (Draft Legislation). |
| | White Paper on Biodiversity |
| **Provincial** | Northern Cape Nature Conservation Act No. 9 of 2009 |

# 5 Methods

## 5.1 Botanical Assessment

The botanical assessment encompassed an assessment of all the vegetation units and habitat types within the project area. The focus was on an ecological assessment of habitat types as well as identification of any Red Data species within the known distribution of the project area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA), to access distribution records on southern African plants. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree square (QDS) resolution. The Red List of South African Plants website (SANBI, 2017) was utilized to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- Field Guide to the Wild Flowers of the Highveld (Van Wyk & Malan, 1997);
- A field guide to Wild flowers (Pooley, 1998);
- Guide to Grasses of Southern Africa (Van Oudtshoorn, 1999);
- Orchids of South Africa (Johnson & Bytebier, 2015);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Mesembs of the World (Smith *et al.,* 1998);
- Medicinal Plants of South Africa (Van Wyk *et al.,* 2013);
- Freshwater Life: A field guide to the plants and animals of southern Africa (Griffiths & Day, 2016); and

- Identification guide to southern African grasses. An identification manual with keys, descriptions and distributions (Fish *et al.,* 2015).

Additional information regarding ecosystems, vegetation types, and Species of Conservation Concern (SCC) included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2012); and
- Red List of South African Plants (Raimondo *et al.,* 2009; SANBI, 2016).

The field work methodology included the following survey techniques:

- Timed meanders;
- Sensitivity analysis based on structural and species diversity; and
- Identification of floral red-data species.

## 5.2 Floristic Analysis

The fieldwork and sample sites were placed within targeted areas (i.e. target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork. The focus of the fieldwork was therefore to maximise coverage and navigate to each target site in the field in order to perform a rapid vegetation and ecological assessment at each sample site. Emphasis was placed on sensitive habitats, especially those overlapping with the proposed project area.

Homogenous vegetation units were subjectively identified using satelite imagery and existing land cover maps. The floristic diversity and search for flora SCC were conducted through timed meanders within representative habitat units delineated during the scoping fieldwork. Emphasis was placed mostly on sensitive habitats overlapping with the proposed project areas.

The timed random meander method is a highly efficient method for conducting floristic analysis, specifically in detecting flora SCC and maximising floristic coverage. In addition, the method is time and cost effective and highly suited for compiling flora species lists and therefore gives a rapid indication of flora diversity. The timed meander search was performed based on the original technique described by Goff *et al.* (1982). Suitable habitat for SCC were identified according to Raimondo *et al.* (2009) and targeted as part of the timed meanders.

At each sample site notes were made regarding current impacts (e.g. mining, erosion etc.), subjective recording of dominant vegetation species and any sensitive features (e.g. wetlands, outcrops etc.). In addition, opportunistic observations were made while navigating through the project area.

## 5.3 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into a GIS to establish how the proposed development might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- National Biodiversity Assessment 2018 (Skowno *et al*, 2019) - The purpose of the National Biodiversity Assessment (NBA) is to assess the state of South Africa's biodiversity based on best available science, with a view to understanding trends over time and informing policy and decision-making across a range of sectors. The NBA deals with all three components of biodiversity: genes, species and ecosystems; and assesses biodiversity and ecosystems across terrestrial, freshwater, estuarine and marine environments. The two headline indicators assessed in the NBA are:
    - Ecosystem Threat Status – indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition.
    - Ecosystem Protection Level – indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, Poorly Protected or Moderately Protected ecosystem types are collectively referred to as under-protected ecosystems.
- Protected areas:
    - South Africa Protected Areas Database (SAPAD) (DEA, 2020) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
    - National Protected Areas Expansion Strategy (NPAES) (SANBI, 2010) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection.
- Critical Biodiversity Areas (Northern Cape Department of Environment and Nature Conservation, 2008) – Critical Biodiversity Areas (CBAs) are natural or near-natural features, habitats or landscapes that include terrestrial, aquatic and marine areas that are considered critical for:
    - meeting national and provincial biodiversity targets and thresholds;
    - safeguarding areas required to ensure the persistence and functioning of species and ecosystems, including the delivery of ecosystem services; and/or
    - conserving important locations for biodiversity features or rare species.

## 5.4 Site Ecological Importance (SEI)

The different habitat types within the assessment area were delineated and identified based on observations during the field assessment as well as available satellite imagery. These habitat types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts) as follows.

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 5-1 and Table 5-2, respectively.

*Table 5-1 Summary of Conservation Importance (CI) criteria*

| Conservation Importance | Fulfilling Criteria |
|---|---|
| Very High | Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare or Critically Rare species that have a global EOO of < 10 $km^2$.<br>Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type.<br>Globally significant populations of congregatory species (> 10% of global population). |
| High | Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 $km^2$. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A.<br>If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining.<br>Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.<br>Presence of Rare species.<br>Globally significant populations of congregatory species (> 1% but < 10% of global population). |
| Medium | Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals.<br>Any area of natural habitat of threatened ecosystem type with status of VU.<br>Presence of range-restricted species.<br>> 50% of receptor contains natural habitat with potential to support SCC. |
| Low | No confirmed or highly likely populations of SCC.<br>No confirmed or highly likely populations of range-restricted species.<br>< 50% of receptor contains natural habitat with limited potential to support SCC. |
| Very Low | No confirmed and highly unlikely populations of SCC.<br>No confirmed and highly unlikely populations of range-restricted species.<br>No natural habitat remaining. |

*Table 5-2 Summary of Functional Integrity (FI) criteria*

| Functional Integrity | Fulfilling Criteria |
|---|---|
| Very High | Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. |

| | |
|---|---|
| | High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.<br>No or minimal current negative ecological impacts with no signs of major past disturbance. |
| High | Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types.<br>Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches.<br>Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential. |
| Medium | Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types.<br>Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.<br>Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential. |
| Low | Small (> 1 ha but < 5 ha) area.<br>Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area.<br>Low rehabilitation potential.<br>Several minor and major current negative ecological impacts. |
| Very Low | Very small (< 1 ha) area.<br>No habitat connectivity except for flying species or flora with wind-dispersed seeds.<br>Several major current negative ecological impacts. |

BI can be derived from a simple matrix of CI and FI as provided in Table 5-3

*Table 5-3 Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)*

| Biodiversity Importance (BI) | | Conservation Importance (CI) | | | | |
|---|---|---|---|---|---|---|
| | | **Very high** | **High** | **Medium** | **Low** | **Very low** |
| **Functional Integrity (FI)** | **Very high** | Very high | Very high | High | Medium | Low |
| | **High** | Very high | High | Medium | Medium | Low |
| | **Medium** | High | Medium | Medium | Low | Very low |
| | **Low** | Medium | Medium | Low | Low | Very low |
| | **Very low** | Medium | Low | Very low | Very low | Very low |

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor as summarised in Table 5-4.

*Table 5-4 Summary of Resource Resilience (RR) criteria*

| Resilience | Fulfilling Criteria |
|---|---|
| **Very High** | Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed. |
| **High** | Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even |

| | |
|---|---|
| | when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed. |
| **Medium** | Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed. |
| **Low** | Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed. |
| **Very Low** | Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed. |

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 5-5.

*Table 5-5 Matrix used to derive Site Ecological Importance (SEI) from Receptor Resilience (RR) and Biodiversity Importance (BI)*

| **Site Ecological Importance (SEI)** | | **Biodiversity Importance (BI)** | | | | |
|---|---|---|---|---|---|---|
| | | **Very high** | **High** | **Medium** | **Low** | **Very low** |
| **Receptor Resilience (RR)** | **Very Low** | Very high | Very high | High | Medium | Low |
| | **Low** | Very high | Very high | High | Medium | Very low |
| | **Medium** | Very high | High | Medium | Low | Very low |
| | **High** | High | Medium | Low | Very low | Very low |
| | **Very High** | Medium | Low | Very low | Very low | Very low |

Interpretation of the SEI in the context of the proposed development activities is provided in Table 5-6.

*Table 5-6 Guidelines for interpreting Site Ecological Importance (SEI) in the context of the proposed development activities*

| **Site Ecological Importance (SEI)** | **Interpretation in relation to proposed development activities** |
|---|---|
| Very High | Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains. |
| High | Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities. |
| Medium | Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities. |
| Low | Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities. |
| Very Low | Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required. |

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa.

# 6 Limitations

The following limitations should be noted for the assessment:

- Only a single season survey was conducted for the respective studies, this would constitute a wet season survey; and
- This assessment has not assessed any temporal trends for the project.

# 7 Results

## 7.1 Desktop Spatial Assessment

The following features describes the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and the SANBI. The desktop analysis and their relevance to this project are listed in Table 7-1.

*Table 7-1 Desktop spatial features examined.*

| Desktop Information Considered | Relevant/Not relevant |
|---|---|
| **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 (SAPAD & SACAD)** | 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) |

## 7.2 Field Assessment

A summary of the terrestrial field assessment regarding the vegetation component is provided in Table 7-2. The project area was surveyed as the aim of the fieldwork was to assess the overall condition of the vegetation within the area and to determine if any floral or faunal species of conservation concern were present or may occur. Any sensitive habitat features were also assessed.

*Table 7-2 Summary of the field assessment*

| Site photo | | | | |
|---|---|---|---|---|
|  | | | | |
|  | | | | |
| **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** | According to the National Forests Act, 1998 (Act No.84 of 2014) in terms of section 15 (1) of the Forests Act,1998 (DAFF, 2014), 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 license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Contravention of this declaration is regarded as a first category offence. Camel thorn (*Vachellia erioloba*) was observed in the project area, it is pertinent that these trees are not harmed whatsoever unless a permit to do so has been obtained. Several individuals of Camel thorn were observed occurring at random within and around the project area. |

*Figure 7-1 Camel Thorn (Vachellia erioloba) from the project area, characteristics illustrated.*

## 7.3 Habitat assessment and Sensitivity

### 7.3.1 Site Ecological Importance (SEI)

The National Web based Environmental Screening Tool has characterised the terrestrial biodiversity for the project area as mostly “high-sensitivity” and the plant species “low sensitivity”. The high terrestrial biodiversity sensitivity within the project area of the screening tool (Figure 7-2) 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 7-2 Map depicting relative terrestrial biodiversity theme sensitivity of the project (National Environmental Screening Tool, 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 project area 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.

One habitat type was delineated within the project areas. This habitat was found within the project area. Based on the criteria provided in Section 5.4 of this report, the habitat within the project area was allocated a sensitivity category (Table 7-3).

*Table 7-3 Summary of habitat types delineated within the project area.*

| Habitat | Conservation Importance | Functional Integrity | Biodiversity Importance | Receptor Resilience | Site Ecological Importance |
|---|---|---|---|---|---|
| **Transformed** | Low | Low | Low | Very Low | Low |

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# 8 Proposed Impact Management Outcomes

The aim of the management outcomes is to present the mitigations in such a way that the can be incorporated into the Environmental Management Programme (EMPr), allowing for more successful implementation and auditing of the mitigations and monitoring guidelines. Table 8-1 presents the recommended mitigation measures and the respective timeframes, targets and performance indicators for the biodiversity study.

The focus of mitigation measures is to reduce the significance of potential impacts associated with the development and thereby to:

- Prevent the further loss and fragmentation of vegetation communities and the CBA 1 areas in the vicinity of the project area (including wetland and watercourse areas);
- As far as possible, reduce the negative fragmentation effects of the development and enable safe movement of faunal species; and
- Prevent the direct and indirect loss and disturbance of faunal species and community (including occurring and potentially occurring species of conservation concern).

*Table 8-1 Specialist Management Outcomes*

| Impact Management Actions | Implementation | | Monitoring | |
|---|---|---|---|---|
| | Phase | Responsible Party | Aspect | Frequency |
| **Management outcome: Vegetation and Habitats** | | | | |
| 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. | Life of operation | Project manager, Environmental Officer | Areas of indigenous vegetation | Ongoing |
| All river and riparian areas should be considered as areas that should not be developed any further. Any developments should be realigned to prioritise development within the already existing WWTW areas. | Construction Phase | Project manager, Environmental Officer | Development footprint | During phase |
| Where possible, existing access routes and walking paths must be made use of. | Construction/Operational Phase | Environmental Officer & Design Engineer | Roads and paths used | Ongoing |
| All laydown etc. should be restricted to already bare areas within the project area. 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. No storage of vehicles or equipment will be allowed outside of the designated project areas. | Construction/Operational Phase | Environmental Officer & Design Engineer | Laydown areas | Ongoing |
| 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. | Operational phase | Environmental Officer & Contractor | Assess the state of rehabilitation and encroachment of alien vegetation | Quarterly for up to two years after the closure |
| Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion. | Operational and Decommissioning phase | Environmental Officer & Contractor | Woody material around footprint | During Phase |
| A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment. | Life of operation | Environmental Officer & Contractor | Spill events, Vehicles dripping. | Ongoing |
| Storm Water run-off & Discharge Water Quality monitoring | Life of operation | Environmental Officer & Design Engineer | Water Quality and presence of erosion | Ongoing |
| It should be made an offence for any staff to take/ bring any plant species into/out of any portion of the project area. No plant species whether | Life of operation | Project manager, Environmental Officer | Any instances | Ongoing |

| | | | | |
|---|---|---|---|---|
| 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. | Life of operation | Environmental Officer & Contractor | Fire Management | During Phase |
| Rocks removed in the construction phased may not be dumped, but can be used in areas where erosion control needs to be performed | Operational phase | Environmental Officer & Contractor | Rock piles | During Phase |
| Any individual of the protected trees that was observed needs a relocation or destruction permit in order for any individual that may be removed or destroyed due to the development. If left undisturbed the sensitivity and importance of these species needs to be part of the environmental awareness program. | Life of operation | Project manager, Environmental Officer Lodge Manager | Protected Tree/Plant species | Ongoing |

**Management outcome: Fauna**

| Impact Management Actions | Implementation | | Monitoring | |
|---|---|---|---|---|
| | **Phase** | **Responsible Party** | **Aspect** | **Frequency** |
| The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments, i.e., the wetlands and river;<br>• Signs must be put up to enforce this | Construction/Operational Phase | Project manager, Environmental Officer | Infringement into these areas | Ongoing |
| Noise must be kept to an absolute minimum during the evenings and at night to minimize all possible disturbances to amphibian species and nocturnal mammals | Construction/Operational Phase | Environmental Officer | Noise levels | Ongoing |
| No trapping, killing, or poisoning of any wildlife is to be allowed.<br>• Signs must be put up to enforce this; | Life of operation | Environmental Officer | Evidence of trapping etc | Ongoing |
| 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. Baffles, hoods or louvres to also be used to reduce light spill | Construction Phase | Environmental Officer & Design Engineer | Light pollution | Ongoing |
| Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (green/red) lights should be used wherever possible. | Construction/Operational Phase | Project manager, Environmental Officer & Design Engineer | Light pollution and period of light. | Ongoing |
| 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. | Life of operation | Health and Safety Officer | Compliance to the training. | Ongoing |
| Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons. | Life of operation | Project manager, Environmental Officer & Design Engineer | Activities should take place during the day in the case. | Ongoing |

| | | | | |
|---|---|---|---|---|
| Any holes/deep excavations must be dug and planted in a progressive manner.<br>Should the holes overnight they must be covered temporarily to ensure no small fauna species fall in. | Planning and construction | Environmental Officer & Contractor, Engineer | Presence of trapped animals and open holes | Ongoing |
| Use environmentally friendly cleaning and dust suppressant products | Construction and operation | Environmental Officer & Contractor, Engineer | Presence of chemicals in and around the project area | Ongoing |
| **Management outcome: Alien species** | | | | |
| **Impact Management Actions** | **Implementation** | | **Monitoring** | |
| | **Phase** | **Responsible Party** | **Aspect** | **Frequency** |
| The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprint of the roads must be kept to prescribed widths. | Construction/Operational Phase | Project manager, Environmental Officer & Contractor | Footprint Area | Life of operation |
| An alien management plan must be implemented quarterly for 3 years after phase | Construction phase and Decommissioning phase | Project manager, Environmental Officer & Contractor | Assess presence and encroachment of alien vegetation | Quarterly for 3 years after phase |
| **Management outcome: Dust** | | | | |
| **Impact Management Actions** | **Implementation** | | **Monitoring** | |
| | **Phase** | **Responsible Party** | **Aspect** | **Frequency** |
| Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces.<br>• No non environmentally friendly suppressants may be used as this could result in pollution of water sources | Life of operation | Contractor | Dustfall | Dust monitoring program. |
| **Management outcome: Waste management** | | | | |
| **Impact Management Actions** | **Implementation** | | **Monitoring** | |
| | **Phase** | **Responsible Party** | **Aspect** | **Frequency** |
| Waste management must be a priority and all waste must be collected and stored effectively. | Life of operation | Environmental Officer & Contractor | Waste Removal | Weekly |
| Litter, spills, fuels, chemicals and human waste in and around the project area. | Construction/Closure Phase | Environmental Officer & Health and Safety Officer | Presence of Waste | Daily |
| A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area. | Life of operation | Environmental Officer & Health and Safety Officer | Number of toilets per staff member. Waste levels | Daily |
| The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility | Life of operation | Environmental Officer & Health and Safety Officer | Availability of bins and the collection of the waste. | Ongoing |

| Impact Management Actions | Implementation | | Monitoring | |
|---|---|---|---|---|
| | Phase | Responsible Party | Aspect | Frequency |
| Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site | Life of operation | Environmental Officer, Contractor & Health and Safety Officer | Collection/handling of the waste. | Ongoing |
| Refuse bins will be emptied and secured Temporary storage of domestic waste shall be in covered waste skips. Maximum domestic waste storage period will be 10 days. | Life of operation | Environmental Officer, Contractor & Health and Safety Officer | Management of bins and collection of waste | Ongoing, every 10 days |

**Management outcome: Environmental awareness training**

| Impact Management Actions | Implementation | | Monitoring | |
|---|---|---|---|---|
| | Phase | Responsible Party | Aspect | Frequency |
| All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area to inform contractors and site staff of the presence of Red / Orange List species, their identification, conservation status and importance, biology, habitat requirements and management requirements the Environmental Authorisation and within the EMPr. The avoidance and protection of the wetland areas must be included into a site induction. Contractors and employees must all undergo the induction and made aware of the “no-go” to be avoided. | Life of operation | Health and Safety Officer | Compliance to the training. | Ongoing |

**Management outcome: Erosion**

| Impact Management Actions | Implementation | | Monitoring | |
|---|---|---|---|---|
| | Phase | Responsible Party | Aspect | Frequency |
| Speed limits must be put in place to reduce erosion.<br>• Reducing the dust generated by the listed activities above, especially the earth moving machinery, through wetting the soil surface and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds;<br>• Signs must be put up to enforce this. | Life of operation | Project manager, Environmental Officer | Water Runoff from road surfaces | Ongoing |
| Where possible, existing access routes and walking paths must be made use of. | Life of operation | Project manager, Environmental Officer | Routes used within the area | Ongoing |
| Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events and strong winds. | Life of operation | Project manager, Environmental Officer | Re-establishment of indigenous vegetation | Progressively |
| A stormwater management plan must be compiled and implemented. | Life of operation | Project manager, Environmental Officer | Management plan | Before construction phase: Ongoing |

# 9 Conclusion

The project area has been transformed/disturbed from its original state by the WWTW. The direct footprint area does not support any SCCs, nor does it represent the sensitivities as identified in the screening tool. The project area has an overall low sensitivity. Although no sensitive species were found in the project area it is still likely that such species could occur nearby or access / forage in the areas surrounding the project area. It is thus important that the management outcomes be adhered to in order to mitigate an indirect impact that might stem from the development.

The "very high" terrestrial biodiversity sensitivity within the project area, of the screening tool is due to the CBA classification of the area, 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.

It is the specialist opinion that the project area is still 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.

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# 11 Appendices

***Appendix A Specialist declarations***

**DECLARATION**

I, Martinus Erasmus, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Martinus Erasmus

Terrestrial Ecologist

The Biodiversity Company

May 2020

**DECLARATION**

I, Andrew Husted, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Andrew Husted

Terrestrial Ecologist

The Biodiversity Company

May 2020

# Martinus Erasmus

## B-Tech Nature Conservation (*Cand Sci Nat*)

*Cell: +27 82 448 1667*

*Email: martinus@thebiodiversitycompany.com*

*Identity Number: 9209035136082*

*Date of birth: 03 September 1992*

**Profile Summary**

Working experience throughout South Africa as well as West Africa.

Specialist experience in exploration, mining, engineering, hydropower, private sector and renewable energy.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements, and international lenders.

Specialist expertise includes Botany and Terrestrial Ecology.

**Areas of Interest**

Mining, Oil & Gas, Renewable Energy & Bulk Services Infrastructure Development, Sustainability and Conservation

**Key Experience**

- Familiar with World Bank and the International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Rehabilitation Plans and Monitoring
- Botany, especially in the Limpopo, Mpumalanga, Gauteng and North-West provinces in South-Africa.
- Veld management and Veld condition

**Country Experience**

Guinea

Lesotho

Liberia

Mozambique

Nigeria

South Africa

Swaziland

Zambia

**Nationality**

South African

**Languages**

English – Proficient

Afrikaans – Proficient l

**Qualifications**

- B-Tech in Nature Conservation, Tshwane University of Technology, Pretoria, South Africa.
- National Diploma in Nature Conservation, Tshwane University of Technology, Pretoria, South Africa.
- Cand Sci Nat (118630)

**SELECTED PROJECT EXPERIENCE**

**Project Name: Veld Condition Assessments (VCA), Plant Diversity Assessments (PDA) And Grazing Assessments on Selected SAFCOL Plantations**

Client: SAFCOL

Personal position / role on project: Project Lead and Botanist

Location: Limpopo and Mpumalanga (2020)

Main project features: Compile a VCA, PDA and grazing assessments on selected SAFCOL plantations.

**Project Name: Alien Vegetation Management Plan for The Goedgevonden Mine**

Client: Glencore

Personal position / role on project: Botanist

Location: Mpumalanga (2020)

Main project features: Compile an Alien Vegetation Management Plan and monitor the progress over a wet season.

**Project Name: Biodiversity baseline, impact review and offset for the proposed Lanseria waste water treatment works**

Client: Zitholele

Personal position / role on project: Terrestrial Ecologist

Location: Lanseria Gauteng (2020)

Main project features: Conduct fieldwork in order to compile a Biodiversity offset plan for the proposed development.

**Project Name: A terrestrial specialist baseline and impact assessment for the Beitbridge Border Crossing upgrade, in the Beitbridge Town, Zimbabwe.**

Client: Kongiwe.

Personal position / role on project: Terrestrial Ecologist (Botany Lead)

Location: Zimbabwe (Beitbridge) – October 2019

Main project features: To conduct a dry season (winter) ecological baseline and impact assessment for the proposed project. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: Biodiversity baseline assessment for the Kingline Gas Power Project**

Personal position / role on project: Terrestrial Ecologist (Botany Lead)

Location: Nigeria (2019)

Main project features: To conduct a wet season terrestrial and aquatic ecological baseline assessment for the proposed project. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed Nondvo Dam**

Personal position / role on project: Terrestrial Ecologist (Botany Lead)

Location: Swaziland (2019)

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed solar photovoltaic facility and transmission in Cuamba**

Personal position / role on project: Terrestrial Ecologist (Botany Lead)

Location: Mozambique

Main project features: To conduct a single season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Siguiri Gold Mine Project, in Kankan Province, Guinea.**

Personal position / role on project: Terrestrial Ecologist

Location: Siguiri, Guinea, West-Africa (2018/2019).

Main project features: To conduct a dual season ecological baseline assessment for the expected impact footprint area. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Pavua Hydropower Project, in Sofala Province, Central Mozambique.**

Personal position / role on project: Assistant Botanist

Location: Sofala Province, Mozambique (2017).

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the expected impact footprint area, including Gorongosa National. The study was required to meet national and IFC requirements, including a Critical Habitat assessment. The study also contributed to prescribing Instream Flow Requirements for the system.

**Project Name: A biodiversity baseline and impact assessment for the proposed Umsimbithi Emakhazeni Coal Mining Project, in Mpumalanga Province, South Africa.**

Personal position / role on project: Terrestrial Ecologist.

Location: Mpumalanga Province, South Africa (2017).

Main project features: To conduct a dual season terrestrial ecology baseline and impact assessment for the expected impact footprint area.

**Project Name: Biodiversity Assessment associated with eThembeni Integrated Mixed-use Housing Development, KwaZulu-Natal province.**

Personal position / role on project: Terrestrial Ecologist

Location: South Africa (2017).

Main project features: Conduct a detailed terrestrial ecology basic assessment for the expected impact footprint area.

**Project Name: A biodiversity baseline and impact assessment for the proposed Gold Mine Project, in Grand Cape Mt Province, Liberia.**

Personal position / role on project: Assistant to specialist/ field technician

Location: Grand Cape Mt Province, Liberia (2015).

Main project features: To conduct a dual season ecological baseline assessment for the expected impact footprint area. The study was required to meet national and IFC (International Finance Corporation) requirements, including a Critical Habitat assessment.

**OVERVIEW**

An overview of the specialist technical expertise includes the following:

- Terrestrial Ecological Assessments.
- Faunal surveys which include mammals, birds, amphibians and reptiles.
- Floral surveys
- Rehabilitation Plans and Monitoring for the terrestrial component.
- Botany, especially in the Limpopo, Mpumalanga, Gauteng and North-West provinces in South-Africa.

- Veld management
- Environmental Control Officer (ECO) experience

**EMPLOYMENT EXPERIENCE**

**CURRENT EMPLOYMENT: The Biodiversity Company (August 2017 – Present)**

The team at The Biodiversity Company have conducted stand-alone specialist studies and provided overall guidance of studies with a pragmatic approach for the management of biodiversity that takes into account all the relevant stakeholders, most importantly the environment that is potentially affected. We manage risks to the environment to reduce impacts with practical, relevant and measurable methods.

Roles include:

- Manager of the Terrestrial Unit;
- Faunal and Floral surveys for baseline, basic or impact assessments;
- Floral surveys for vegetation verifications, veld condition assessment, management plans and alien invasive species control;
- Report writing;
- Equipment management;
- Technical assistant for fieldwork for the aquatics and wetland departments; and
- Specialist inputs to the above mention services.

**EMPLOYMENT: Enviro-Insight (January 2015 – July 2017)**

Enviro-Insight assigned me to the role of general and field assistant. I assisted most specialists in field but also had administrative duties:

- The processing and uploading of several organisms to the ADU (Animal Demography Unit) virtual museum, which assists in obtaining spatial data concerning those species.
- Assisted with the generation of the companies' DNA database which distributes the DNA samples to the South African National Biodiversity Institute (SANBI).
- Assisted with field work involving all the different specialist work which includes mammalogy, herpetology and botany.

**ACADEMIC QUALIFICATIONS**

**B-Tech in Nature Conservation, Tshwane University of Technology, Pretoria, South Africa**:

**Title:** The expansion of the distribution of *Xenopus muelleri.*

**National Diploma in Nature Conservation, Tshwane University of Technology, Pretoria, South Africa**

**SELECTED PROJECT EXPERIENCE**

**Project Name: A biodiversity baseline and impact assessment for the proposed Umsimbithi Emakhazeni Coal Mining Project, in Mpumalanga Province, South Africa.**

Personal position / role on project: Terrestrial Ecologist.

Location: Mpumalanga Province, South Africa (2017).

Main project features: To conduct a dual season terrestrial ecology baseline and impact assessment for the expected impact footprint area.

**Project Name: Biodiversity Assessment associated with eThembeni Integrated Mixed-use Housing Development, KwaZulu-Natal province.**

Personal position / role on project: Terrestrial Ecologist

Location: South Africa (2017).

Main project features: Conduct a detailed terrestrial ecology basic assessment for the expected impact footprint area.

**Project Name: A biodiversity baseline and impact assessment for the proposed Pavua Hydropower Project, in Sofala Province, Central Mozambique.**

Personal position / role on project: Assistant Botanist

Location: Sofala Province, Mozambique (2017).

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the expected impact footprint area, including Gorongosa National. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Gold Mine Project, in Grand Cape Mt Province, Liberia.**

Personal position / role on project: Assistant to specialist/ field technician

Location: Grand Cape Mt Province, Liberia (2015).

Main project features: To conduct a dual season ecological baseline assessment for the expected impact footprint area. The study was required to meet national and IFC (International Finance Corporation) requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Siguiri Gold Mine Project, in Kankan Province, Guinea.**

Personal position / role on project: Terrestrial Ecologist

Location: Siguiri, Guinea, West-Africa (2018)

Main project features: To conduct a dual season terrestrial ecological baseline and impact assessment for the expected impact footprint area. The study was required to meet national and IFC (International Finance Corporation) requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Nondvo Dam Project in Eswatini, Southern Africa**

Personal position / role on project: Terrestrial Ecologist (Botany)

Location: Swaziland (2019)

Main project features: To conduct a dual season terrestrial ecological baseline and impact assessment for the expected impact footprint area. The study was required to meet national and IFC (International Finance Corporation) requirements, including a Critical Habitat assessment.

**Project Name**: **Biodiversity Baseline & Impact Assessment for the proposed Cuamba 15MW Solar PV Plant, Cuamba, Mozambique**

Personal position / role on project: Terrestrial Ecologist (Botany)

Location: Mozambique (2019)

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the proposed development.

**OVERVIEW**

An overview of the specialist technical expertise includes the following:

- Terrestrial Ecological Assessments.
- Faunal surveys which includes mammals, birds, amphibians and reptiles.
- Floral surveys
- Rehabilitation Plans and Monitoring for the terrestrial component.
- Botany, especially in the Limpopo, Mpumalanga, Gauteng and North-West provinces in South-Africa.
- Veld management
- Environmental Control Officer (ECO) experience

**EMPLOYMENT EXPERIENCE**

**CURRENT EMPLOYMENT: The Biodiversity Company (August 2017 – Present)**

I started working at The Biodiversity Company in mid-2017.

The team at The Biodiversity Company have conducted stand-alone specialist studies and provided overall guidance of studies with a pragmatic approach for the management of biodiversity that takes into account all the relevant stakeholders, most importantly the environment that is potentially affected. We manage risks to the environment to reduce impacts with practical, relevant and measurable methods.

My roles include:

- Faunal and Floral surveys for baseline, basic or impact assessments;
- Floral surveys for vegetation verifications, management plans and alien invasive species control;
- Report writing;
- Equipment management;
- Technical assistant for fieldwork for the aquatics and wetland departments; and
- Specialist inputs to the above mention services.

**EMPLOYMENT: Enviro-Insight (January 2015 – July 2017)**

Enviro-Insight assigned me to the role of general and field assistant. I assisted most specialists in field but also had administrative duties:

- The processing and uploading of several organisms to the ADU (Animal Demography Unit) virtual museum, which assists in obtaining spatial data concerning those species.
- Assisted with the generation of the companies' DNA database which distributes the DNA samples to the South African National Biodiversity Institute (SANBI).
- Assisted with field work involving all the different specialist work which includes mammalogy, herpetology and botany.

**ADDITIONAL EXPERIENCE**

| | |
|---|---|
| ***Compliance audits*** | Conducting site investigations in order to determine the level of compliance attained, ensuring that the client maintains an appropriate measure of compliance with environmental regulations by means of a legislative approach |
| ***Control officer*** | Acting as an independent Environmental Control Officer (ECO), acting as a quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts |
| ***Public consultation*** | The provision of specialist input in order to communicate project findings as well as assist with providing feedback if and when required. |
| ***Closure*** | Primarily the review of closure projects, with emphasis on the closure cost calculations. Support was also provided by assisting with the measurements of structures during fieldwork. |

**ACADEMIC QUALIFICATIONS**

**B-Tech in Nature Conservation, Tshwane University of Technology, Pretoria, South Africa**:

**Title:** The expansion of the distribution of *Xenopus muelleri.*

**National Diploma in Nature Conservation , Tshwane University of Technology, Pretoria, South Africa**

# Andrew Husted

## M.Sc Aquatic Health (*Pr Sci Nat*)

*Cell: +27 81 319 1225*

*Email: andrew@thebiodiversitycompany.com*

*Identity Number: 7904195054081*

*Date of birth: 19 April 1979*

**Profile Summary**

Working experience throughout South Africa, West and Central Africa and also Armenia.

Specialist experience in exploration, mining, engineering, hydropower, private sector and renewable energy.

Experience with project management for national and international multi-disciplinary projects.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements, and international lenders.

Specialist expertise include Instream Flow and Ecological Water Requirements, Freshwater Ecology, Terrestrial Ecology and also Ecosystem Services.

**Areas of Interest**

Sustainability and Conservation.

Instream Flow and Ecological Water Requirements.

**Key Experience**

- Familiar with World Bank, Equator Principles and the International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Ecological Water Requirement determination experience
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Fish population structure assessments
- The use of macroinvertebrates to determine water quality
- Aquatic Ecological Assessments
- Aquaculture

**Country Experience**

Botswana, Cameroon

Democratic Republic of Congo

Ghana, Ivory Coast, Lesotho

Liberia, Mali, Mozambique

Nigeria, Republic of Armenia,

Senegal, Sierra Leone, South Africa

Tanzania

**Nationality**

South African

**Languages**

English – Proficient

Afrikaans – Conversational

German - Basic

**Qualifications**

- MSc (University of Johannesburg) – Aquatic Health.
- BSc Honours (Rand Afrikaans University) – Aquatic Health
- BSc Natural Science
- Pr Sci Nat (400213/11)
- Certificate of Competence: Mondi Wetland Assessments
- Certificate of Competence: Wetland WET-Management
- SASS 5 (Expired) – Department of Water Affairs and Forestry for the River Health Programme
- EcoStatus application for rivers and streams

Publication of scientific journals and articles.

**SELECTED PROJECT EXPERIENCE**

**Project Name: Biodiversity baseline assessment for the Kingline Gas Power Project**

Personal position / role on project: Project Manager/ Mammal Lead

Location: Nigeria

Main project features: To conduct a wet season terrestrial and aquatic ecological baseline assessment for the proposed project. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed Nondvo Dam**

Personal position / role on project: Project Manager.

Location: Swaziland

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: The Lower Mara Environmental Flow Assessment**

Personal position / role on project: Specialist Ichthyologist.

Location: Tanzania

Main project features: To determine and prescribe environmental flows (eflows) for the Mara River system, with specific consideration for the Mara Wetland.

**Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed solar photovoltaic facility and transmission in Cuamba**

Personal position / role on project: Project Manager.

Location: Mozambique

Main project features: To conduct a single season terrestrial and aquatic ecological baseline and impact assessment for the proposed facility. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Siguiri Gold Mine Project, in Kankan Province, Guinea.**

Personal position / role on project: Project Manager.

Location: Siguiri, Guinea, West-Africa (2018/2019).

Main project features: To conduct a dual season ecological baseline assessment for the expected impact footprint area. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

**Project Name: A biodiversity baseline and impact assessment for the proposed Lesotho Bulk Water Supply Scheme, Lesotho.**

Personal position / role on project: Wetland & Aquatic Ecologist, PROBFLO and Project Manager.

Location: Mohale's Hoek, Lesotho (2018).

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the pipeline route and proposed weir. The study was required to meet national and IFC requirements, including a Critical Habitat assessment. The study also contributed to prescribing Instream Flow Requirements using PROBFLO for the system.

**Project Name: A biodiversity baseline and impact assessment for the proposed Pavua Hydropower Project, in Sofala Province, Central Mozambique.**

Personal position / role on project: Project Manager.

Location: Sofala Province, Mozambique (2017).

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the expected impact footprint area, including Gorongosa National. The study was required to meet national and IFC requirements, including a Critical Habitat assessment. The study also contributed to prescribing Instream Flow Requirements for the system.

**Project Name: An aquatic and wetland specialist baseline and impact assessment for the proposed Onshore 2D seismic Survey in Block P5-A, in Maputo and Gaza Provinces.**

Personal position / role on project: Wetland / Aquatic Specialist.

Location: Maputo & Gaza Provinces, Mozambique (2016).

Main project features: To conduct a dry season (Winter) ecological baseline and impact assessment of the watercourses for the proposed Delonex Energy project.

**Project Name: The ecological constraints mapping and Critical Habitat re-evaluation for the Anadarko LNG project: Specialist Consultant to conduct Ecological Studies (Fauna and Habitat) and the delineation of wetland systems.**

Personal position / role on project: Wetland Specialist.

Location: Afungi, Mozambique (2015).

Main project features: To identify and map the ecological constraints is to support contractor activities. To redefine the critical habitats within the project area

**Project Name: A Joint Basin Survey of the Upper Orange, Lower Orange and Vaal catchments to determine the current status of the systems: Specialist Consultants to conduct Ecological Studies (Fish, Macroinvertebrate, Diatoms, Water Quality and Habitat) and report on the current status (defining system trends).**

Personal position / role on project: Specialist Ichthyologist.

Location: South Africa (including Namibia, Botswana & Lesotho) (2015).

Main project features: To determine the current status of the catchments and to discuss the temporal and spatial trends of the monitoring reaches.

**Project Name: Ecological baseline assessment of local river systems for the Ntem Iron Ore Mine: Specialist Consultants to Undertake Baseline Studies (Fish, Macroinvertebrate, Water Quality and Habitat).**

Personal position / role on project: Senior Ichthyologist.

Location: Cameroon (2013).

Main project features: Establishment of the ecological baseline status and functioning assessment of the local river systems.

**Project Name: Instream Flow Requirement determination study for the Kibali River hydropower project: Specialist Consultants to Undertake Baseline Studies (Flow, Water Quality and Geomorphology) and Instream Flow Requirement (IFR) Assessment.**

Personal position / role on project: Ichthyologist and IFR.

Location: DRC (2012).

Main project features: Establishment of the ecological flow requirements of fishes within the Kibali River.

**Project Name: Cost analysis, including the current and potential earing potential of an aquaculture facility: Specialist Consultants to determine the Cost (Current & Potential Earnings) and the Construction of an identical facility (Physical Costs).**

Personal position / role on project: Ichthyologist.

Location: Ghana (2012).

Main project features: Conduct a detailed costs analysis of an aquaculture facility for the compensation for the removal of the operation.

**Project Name: Instream Flow Requirement determination study for the Nzoro River hydropower project: Specialist Consultants to Undertake Baseline Studies (Flow, Water Quality and Geomorphology) and Instream Flow Requirement (IFR) Assessment.**

Personal position / role on project: Ichthyologist and IFR.

Location: DRC (2011).

Main project features: Establishment of the ecological flow requirements of fishes within the Nzoro River.

**Project Name: Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam.**

Personal position / role on project: Ichthyologist.

Location: Selebi-Phikwe, Botswana (2007 - 2009).

Main project features: Evaluation of the existing fish communities within the Letsibogo Man-made lake with specific consideration of the threats of alien invasive fishes in the lake. The study resulted in the publication of two peer-reviewed papers titled: Comparative behavioural assessment of an established and a new Tigerfish *Hydrocynus vittatus* population in two man-made lakes in the Limpopo (O'Brien et al., 2013) and First observation of Africa Tigerfish (*Hydrocynus vittatus*) predating on Barn Swallows (*Hirundo rustica*) in flight (O'Brien et al., in press).

**Project Name: Environmental and Social Impact Assessment of the Kazungula Bridge, Zambezi River.**

Personal position / role on project: Ichthyologist.

Location: Botswana, Zambia, Namibia and Zimbabwe (2009-2010).

Main project features: Evaluation of the current ecological integrity status of various living and non-living components of the Zambezi River ecosystem and the potential ecological and social consequences of the construction and use of the Kazungula Bridge. The study showed that although water quality and habitat modification impacts will occur as a result of the construction and use of the bridge the long term impacts associated with the operation of the bridge should not result in any major impacts to the local aquatic ecosystem.

**OVERVIEW**

An overview of the specialist technical expertise include the following:

- Aquatic ecological state and functional assessments of rivers and dams.

- Instream Flow Requirement or Ecological Water Requirement using PROBFLO studies for river systems.
- Ecological wetland assessment studies, including the integrity (health) and functioning of the wetland systems.
- Wetland offset strategy designs.
- Wetland rehabilitation plans.
- Monitoring plans for rivers and other wetland systems.
- Toxicity and metal analysis of water, sediment and biota.
- Bioaccumulation assessment of fish communities.
- Fish telemetry assessment that included the translocation of fish as well as the monitoring of fish in order to determine the suitability of the hosting system.
- Faunal surveys which includes mammals, birds, amphibians and reptiles.
- The design, compilation and implementation of Biodiversity and Land Management Plans and strategies.

**TRAINING**

Some of the more pertinent training undergone includes the following:

- Wetland and Riparian Delineation Course for Consultants (Certificate of Competence) – DWAF 2008
- The threats and impacts posed on wetlands by infrastructure and development: Mitigation and rehabilitation thereof – Gauteng Wetland Forum 2010
- Ecological State Assessment of Lentic Systems using Fish Population Dynamics – University of Johannesburg/Rivers of Life 2010
- Soil Classification and Wetland Delineation – Terra Soil Science 2010
- Wetland Rehabilitation Methods and Techniques - Gauteng Wetland Forum 2011
- Application of the Fish Response Assessment Index (FRAI) and Macroinvertebrate Response Assessment Index (MIRAI) for the River Health Programme 2011
- Tools for a Wetland Assessment (Certificate of Competence) – Rhodes University 2011
- PROBFLO for conducting Ecological Flow Assessments – 2018/19

**EMPLOYMENT EXPERIENCE**

**The Biodiversity Company (January 2015 – Present)**

Director / Ecologist.

**Digby Wells Environmental (August 2008 – December 2014)**

Freshwater & Terrestrial Ecologist

**PREVIOUS EMPLOYMENT: Econ@UJ (University of Johannesburg)**

Freshwater Ecologist

**ACADEMIC QUALIFICATIONS**

**University of Johannesburg, Johannesburg, South Africa (2009):** MAGISTER SCIENTIAE (MSc) - Aquatic Health:

**Title:** *Aspects of the biology of the Bushveld Smallscale Yellowfish (Labeobarbus polylepis): Feeding biology and metal bioaccumulation in five populations.*

**Rand Afrikaans University (RAU), Johannesburg, South Africa (2004):** BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

**Rand Afrikaans University (RAU), Johannesburg, South Africa (2001 - 2004):** BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

**PUBLICATIONS**

Desai M., Husted A., Fry C., Downs C.T., & O'Brien G.C. 2019. Spatial shifts and habitat partitioning of ichthyofauna within the middle–lower region of the Pungwe Basin, Mozambique. *Journal of Freshwater Ecology*, 34(1), 685–702. doi: 10.1080/02705060.2019.1673221

Tate R.B. and Husted, A. 2015. Aquatic Biomonitoring in the upper reaches of the Boesmanspruit, Carolina, Mpumalanga, South Africa. African Journal of Aquatic Science.

Tate R.B. and Husted A. 2013. Bioaccumulation of metals in *Tilapia zillii* (Gervai, 1848) from an impoundment on the Badeni River, Cote D'Iviore. African Journal of Aquatic Science.

O'Brien G.C., Bulfin J.B., Husted A. and Smit N.J. 2012. Comparative behavioural assessment of an established and new Tigerfish (*Hydrocynus vittatus*) population in two manmade lakes in the Limpopo catchment, Southern Africa. African Journal of Aquatic Science.

Tomschi H., Husted A., O'Brien G.C., Cloete Y., Van Dyk C., Pieterse G.M., Wepener V., Nel A. and Reisinger U. 2009. Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam near Selebi Phikwe, Botswana. EC Multiple Framework Contract Beneficiaries.8 ACP BT 13 – Mining Sector (EDMS). Specific Contract N° 2008/166788. Beneficiary Country: Botswana. By: HPC HARRESS PICKEL CONSULT AG

Husted A. 2009. Aspects of the biology of the Bushveld Smallscale Yellowfish (*Labeobarbus polylepis*): Feeding biology and metal bioaccumulation in five populations. The University of Johannesburg (Thesis).

## <u>APPENDIX D2:</u> Freshwater Assessment

# Freshwater Assessment for the proposed Kameelmond Waste Water Treatment Works Upgrade and Expansion

## Upington, Northern Cape

May 2021

**CLIENT**

**Prepared by:**

**The Biodiversity Company**

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

| | | |
|---|---|---|
| **Report Name** | Freshwater Assessment for the proposed Kameelmond Waste Water Treatment Works Upgrade and Expansion | |
| **Submitted to** | NEMAI CONSULTING | |
| **Report Reviewer** | **Andrew Husted** | |
| | Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant. | |
| **Report Writer & Fieldwork** | **Dale Kindler** | |
| | Dale Kindler is Pr. Sci. Nat. registered (114743) in aquatic science and completed his M. Sc. in Aquatic Health at the University of Johannesburg. He has eight (8) years' experience in conducting Aquatic Specialist Assessments and is SASS 5 Accredited with the Department of Water and Sanitation (DWS). Dale has completed numerous specialist studies locally and internationally, ranging from basic assessments to Environmental Impact Assessments (EIAs) following IFC standards. | |
| **Declaration** | The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science. | |

## EXECUTIVE SUMMARY

| GNR 326 | Appendix 6 (n): Specialist Opinion |
|---|---|

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. It is essential that the contractors practice responsible management of the watercourse and associated immediate catchment during the implementation of the proposed upgrades and expansions.

The Biodiversity Company was commissioned to conduct a freshwater ecology baseline and supporting impact (risk) assessment for the proposed upgrade and expansion of the existing Kameelmond Wastewater Treatment Works (K-WWTW) (the Project) on local freshwater resources. The purpose of the specialist studies is to provide relevant input into the authorisation process and to provide a report for the Project.

The Kameelmond WWTW is located on the south western outskirts of the city of Upington, and falls under the Dawid Kruiper municipality, Northern Cape, South Africa. The Kameelmond WWTW is located on the northern banks of the Orange River on the N14 highway between Upington and Keimoes. The proposed Project will upgrade and expand the current WWTW facility to improve capacity and water quality standards from current conditions. It will also improve the prospects of future development of surrounding areas and will form an important link in catchment-based water quality management of the Orange River system.

The watercourses associated with the project are located in the D73F quaternary catchment, within the Orange Water Management Area and the Nama Karoo - Lower ecoregion. The relevant Sub-Quaternary Reach is the D73F-3032, which is a reach of the Orange River. The K-WWTW facility has a treated effluent discharge point on the Orange tributary which drains into the Orange River. The water quality in the Orange River downstream towns of Louisvale, Keimoes, Kakamas and Augrabies, amongst others, is in-part subject to influence from the quality of treated effluent discharge from the K-WWTW facility.

A total of three aquatic sampling sites were selected to establish baseline riverine conditions for the proposed K-WWTW upgrades and expansions. 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. Desktop information indicated that the Orange River catchment associated with the Project was largely modified. The 2021 Ecostatus determination indicated similar conditions to the desktop information for the Orange River with a largely modified status attained from the data collected.

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 landuse, 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 where influence was present, however 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 landuse 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 reach providing an indication of the misuse and mismanagement of the river and riparian areas.

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.

**Impact Assessment and Statement**

Under the current layout supplied, 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.

# Table of Contents

## Tables

## Figures

# 1 Introduction & Background

The Biodiversity Company was commissioned to conduct a freshwater ecology baseline and supporting impact (risk) assessment for the proposed upgrade and expansion of the existing Kameelmond Wastewater Treatment Works (K-WWTW) (the Project) on local freshwater resources. The Project is located on the banks of the Orange River in Upington, Northern Cape Province, South Africa.

The purpose of this specialist studies is to provide environmental sensitivity information for the Environmental Impact Assessment (EIA) process and to provide a report for the proposed activities associated with the upgrades and expansions. This report, after taking into consideration the findings and recommendations provided by the specialists herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological risks, and potential mitigation measures for the proposed Project with regards to the freshwater resources.

This baseline assessment has taken cognisance of the recently published Government Notice 320 in terms of NEMA dated 20 March 2020: “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” (DWS, 2020). The findings and information herein are in terms of Appendix 6 of the 2014 NEMA EIA Regulations (amended in 2017). This project was also completed in accordance with the requirements of the Water Use Licence Application (WULA) in terms of the National Water Act (Act No. 36 of 1998) for historical and new water uses associated with the K-WWTW. The water uses associated with the Project are as follows:

| Water Use Type | | Project-related Activities |
|---|---|---|
| Section 21(e) | Engaging in a controlled activity | The reuse of some of the treated effluent from the works for irrigation purposes |
| 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 to the Orange River |
| 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 | |

The K-WWTW facility has been operating since the 1970’s is under ever increasing pressure to enhance serviceability of new residential and, to a lesser extent, industrial runoff located within the facilities planned drainage area. The facility was last upgraded during the 1990’s. The aim of the upgrade and expansion is to increase the capacity of the K-WWTW from 16 to 24 Megalitres per day, with the potential reuse of the facilities effluent, while improving the current treatment efficiency to meet the Department of Water and Sanitation (DWS) effluent quality standards. It is important to note that the aforementioned standards are likely to increase beyond the current treatment efficiency that the facility is able to achieve motivating the requirement of the upgrade and expansion of the K-WWTW. The upgrade and expansion of the K-WWTW will take place within the confines of the existing perimeter fence. Below is an image from the Background Information Document (Nemai, 2021) illustrating the proposed infrastructure:

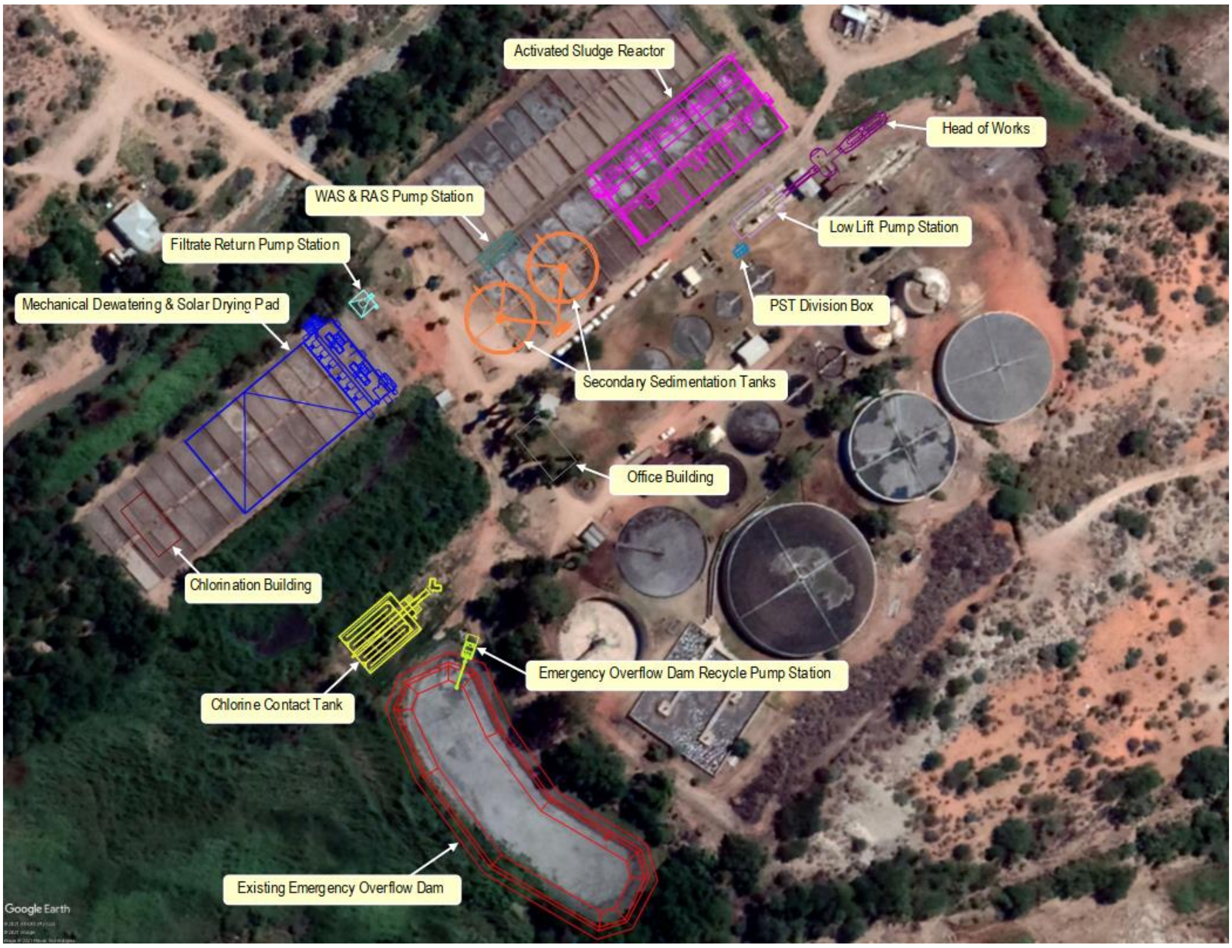


*Figure 1-1 Proposed K-WWTW Upgrade and Expansion works (BID doc, Nemai, 2021)*

According to the National Web based Environmental Screening Tool the combined aquatic biodiversity for the project area is classified as having a very high sensitivity. Therefore, the riverine assessment presented in this study for the minimum report content requirements for a very high sensitivity rating.

A single riverine survey was conducted of the watercourses associated with the Project. The survey was conducted on the 26th of April 2021 which would constitute a high flow / wet season assessment.

## 2 Document Structure

The table below provides the NEMA (2014) Requirements for Ecological Assessments, and also the relevant sections in the reports where these requirements are addressed:

| GNR 326 | Description | Section |
|---|---|---|
| **Appendix 6 (a)** | A specialist report prepared in terms of these Regulations must contain—<br>details of—<br>i. the specialist who prepared the report; and<br>ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; | Page ii.<br>Appendix A |
| **Appendix 6 (b)** | A declaration that the specialist is independent in a form as may be specified by the competent authority; | Appendix A |
| **Appendix 6 (c)** | An indication of the scope of, and the purpose for which, the report was prepared; | Section 1 & 3 |
| **Appendix 6 (cA)** | An indication of the quality and age of base data used for the specialist report; | None |
| **Appendix 6 (cB)** | A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 8 & 10 |
| **Appendix 6 (d)** | The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Section 1 & 7 |
| **Appendix 6 (e)** | A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 7 |
| **Appendix 6 (f)** | Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a, site plan identifying site alternatives; | Section 4, 8, 9 & 10 |
| **Appendix 6 (g)** | An identification of any areas to be avoided, including buffers; | Section 9, 10 & 11 |
| **Appendix 6 (h)** | A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Section 9 |
| **Appendix 6 (i)** | A description of any assumptions made and any uncertainties or gaps in knowledge; | Section 6 |
| **Appendix 6 (j)** | A description of the findings and potential implications of such findings on the impact of the proposed activity [including identified alternatives on the environment] or activities; | Section 8, 9, 10 & 11 |
| **Appendix 6 (k)** | Any mitigation measures for inclusion in the EMPr; | Section 10 & 11 |
| **Appendix 6 (l)** | Any conditions for inclusion in the environmental authorisation; | Section 11 |
| **Appendix 6 (m)** | Any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 10.2 & 11 |
| **Appendix 6 (n)** | A reasoned opinion—<br>i. [as to] whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | Section 11 & 12 |
| **Appendix 6 (o)** | A description of any consultation process that was undertaken during the course of preparing the specialist report; | None |
| **Appendix 6 (p)** | A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | None |
| **Appendix 6 (q)** | Any other information requested by the competent authority. | None |

## 3 Terms of Reference

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

- Review of existing desktop information and literature (where available);
- Determining the Present Ecological Status (PES) of the local watercourses;
- Determine the Environmental Importance and Sensitivity (EIS) of watercourses;
- An impact assessment for the proposed activities; and

- The prescription of mitigation measures, and recommendations for identified risks.

# 4 Project Area and Hydrological Setting

The Kameelmond WWTW is located on the south western outskirts of the city of Upington, and falls under the Dawid Kruiper municipality, Northern Cape, South Africa. The Kameelmond WWTW is located on the northern banks of the Orange River on the N14 highway between Upington and Keimoes. The proposed Project will upgrade and expand the current WWTW facility to improve capacity and water quality standards from current conditions. It will also improve the prospects of future development of surrounding areas and will form an important link in catchment-based water quality management of the Orange River system. Locality maps illustrating the extent of the proposed K-WWTW infrastructure and associated watercourses are presented in Figure 4-1 and Figure 4-2.

The watercourses associated with the project are located in the D73F quaternary catchment, within the Orange Water Management Area (WMA 6) (NWA, 2016) and the Nama Karoo - Lower ecoregion (Dallas, 2007). The relevant Sub-Quaternary Reach (SQR) is the D73F-3032, which is a reach of the Orange River. As presented in Figure 4-2, the proposed Project infrastructure is located within the existing perimeter fence 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. The K-WWTW facility 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 water quality in the Orange River downstream towns of Louisvale, Keimoes, Kakamas and Augrabies, amongst others, is in-part subject to influence from the quality of treated effluent discharge from the K-WWTW facility.

The land uses surrounding the project area includes agricultural activities, urban and industrial development and limited solar activities between natural (open) land situated between the aforementioned watercourses (Figure 4-3). Land use within a catchment influences the ecological integrity of the associated watercourses. Due to the extensive land use modification within the Orange River catchment, the SQR is considered largely modified at a desktop level (DWS, 2021).

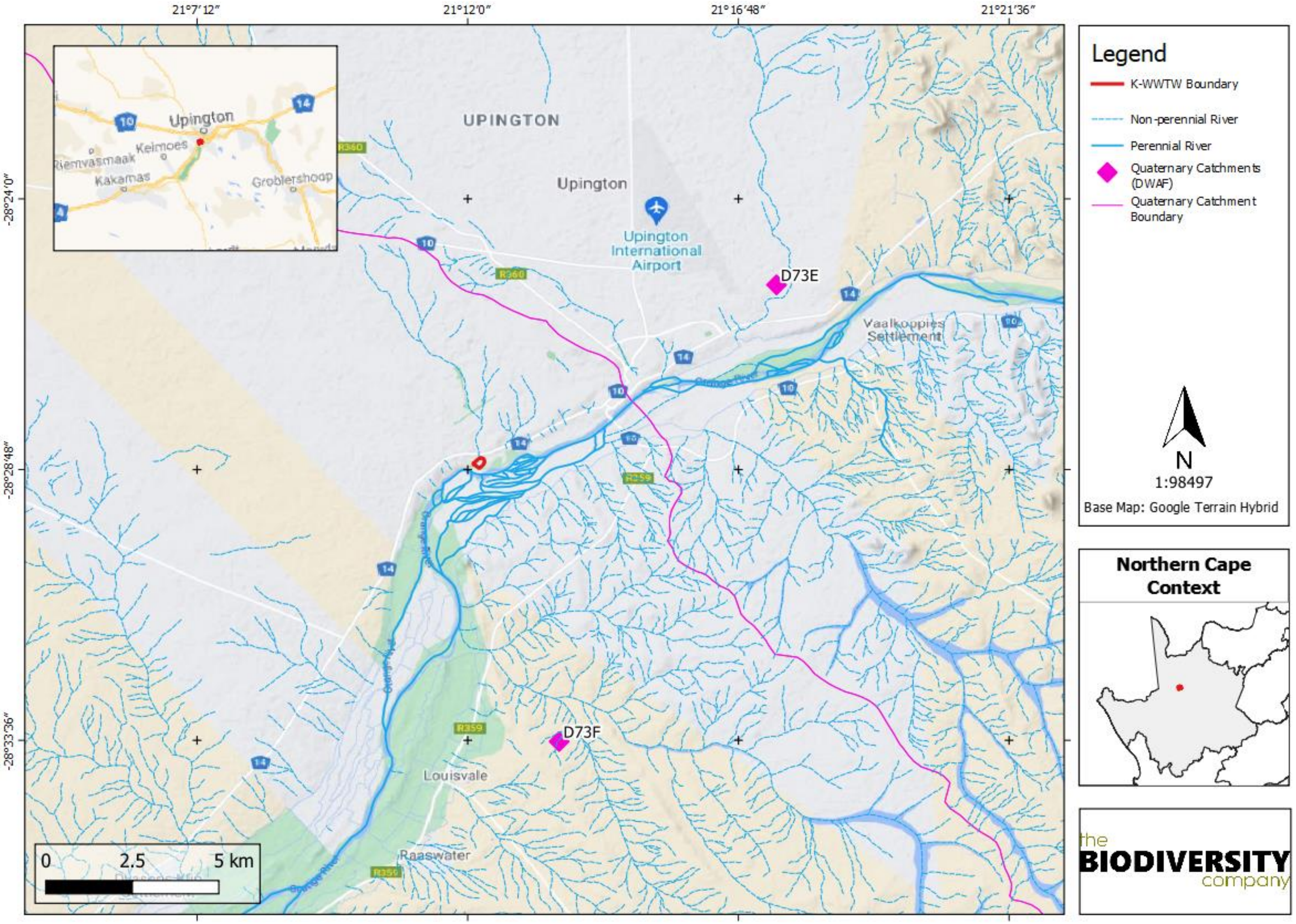


*Figure 4-1 Locality map of the Project area*

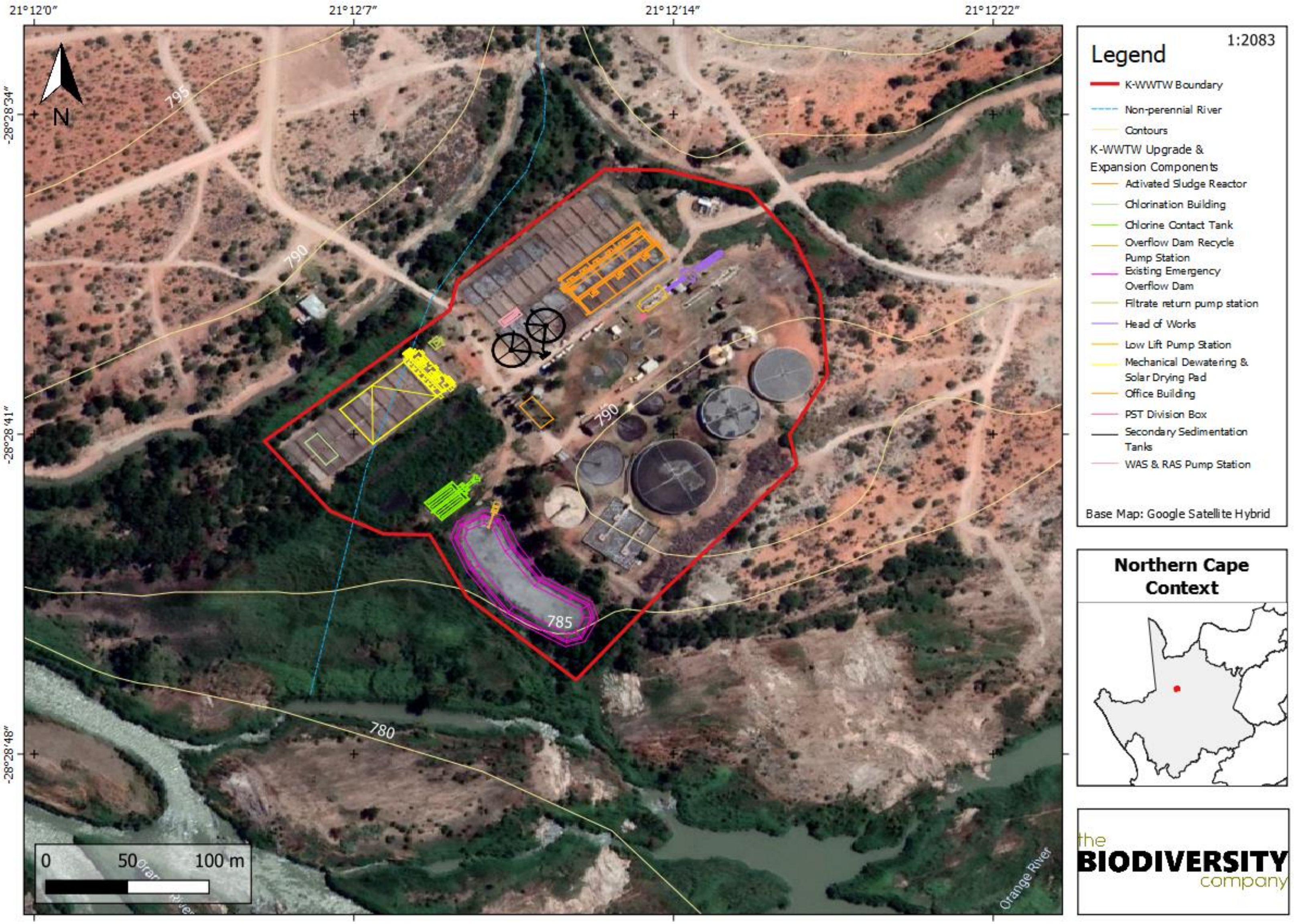


*Figure 4-2 Watercourses and proposed project infrastructure associated with the Kameelmond - WWTW*

the BIODIVERSITY company

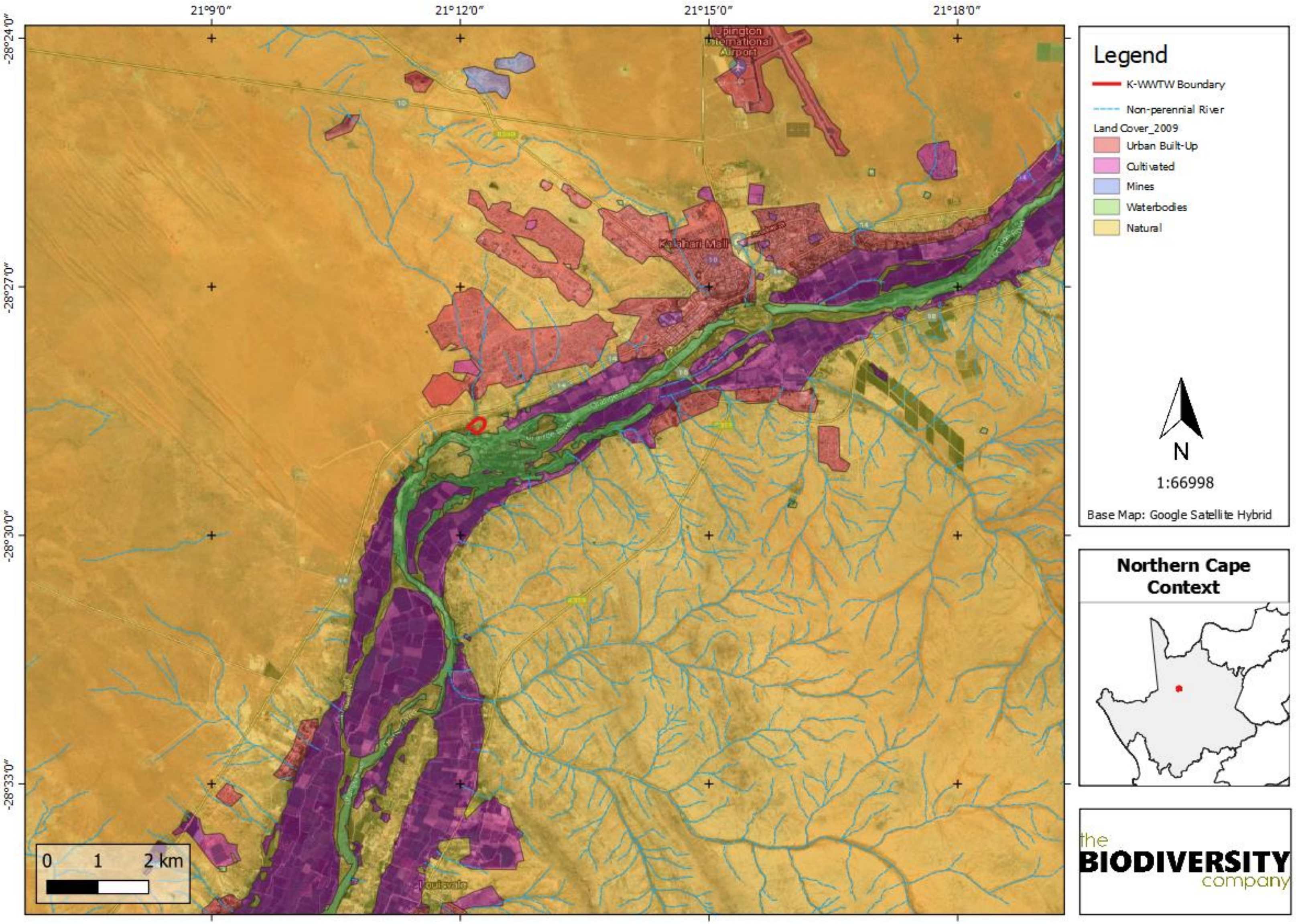


*Figure 4-3 Land use associated with the Project area*

# 5 Legislative and Policy Framework

## 5.1 National Water Act (Act No. 36 of 1998)

The Department of Water & Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (NWA) (Act No. 36 of 1998) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

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

The NWA recognises that the entire ecosystem, and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS.

For the purposes of this project, a wetland area is defined according to the NWA (Act No. 36 of 1998): "Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".

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

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

## 5.2 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the EIA process depending on the scale of the impact.

## 5.3 Biodiversity

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 5-1):

*Table 5-1 A list of key legislative requirements relevant to biodiversity and conservation in Northern Cape*

| Region | Legislation |
|---|---|
| International | Convention on Biological Diversity (CBD, 1993) |
| | The Convention on Wetlands (RAMSAR Convention, 1971) |
| | The United Nations Framework Convention on Climate Change (UNFCC,1994) |
| | The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973) |
| | The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979) |
| National | Constitution of the Republic of South Africa (Act No. 108 of 2006) |
| | The National Environmental Management Act (NEMA) (Act No. 107 of 1998) |
| | The National Environmental Management Protected Areas Act (Act No. 57 of 2003) |
| | The National Environmental Management Biodiversity Act (Act No. 10 of 2004) |
| | The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 42946 (January 2020) |
| | The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 43110 (March 2020) |
| | The National Environmental Management: Waste Act, 2008 (Act 59 of 2008); |
| | The Environment Conservation Act (Act No. 73 of 1989) and associated EIA Regulations |
| | National Protected Areas Expansion Strategy (NPAES) |
| | Environmental Conservation Act (Act No. 73 of 1983) |
| | Natural Scientific Professions Act (Act No. 27 of 2003) |
| | National Biodiversity Framework (NBF, 2009) |
| | National Forest Act (Act No. 84 of 1998) |
| | National Veld and Forest Fire Act (101 of 1998) |
| | National Spatial Biodiversity Assessment (NSBA) |
| | World Heritage Convention Act (Act No. 49 of 1999) |
| | National Heritage Resources Act, 1999 (Act 25 of 1999) |
| | Municipal Systems Act (Act No. 32 of 2000) |
| | Alien and Invasive Species Regulations, 2014 |
| | South Africa's National Biodiversity Strategy and Action Plan (NBSAP) |
| | Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) |
| | Sustainable Utilisation of Agricultural Resources (Draft Legislation). |
| | White Paper on Biodiversity |
| Provincial | Northern Cape Nature Conservation Act No. 9 of 2009 |

# 6 Assumptions, Uncertainties and Gaps in Knowledge

The following aspects were considered as limitations:

- Only a single season survey was conducted for the respective studies, this would constitute a late summer wet season survey;
- This assessment has not assessed any temporal trends for the project;
- Sampling was limited to the wadeable margins of the river both upstream and downstream of the 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 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 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. A number of assumptions have been made through the compilation of the activity list; and
- The impact assessments only considered the construction and operational phases of the proposed Project as per the details and shapefiles provided by the client.

# 7 Methods

A single riverine survey was conducted of the watercourses associated with the Project. The survey was conducted on the 26th of April 2021 which would constitute a late high flow / wet season assessment. Method descriptions employed for the study are provided below.

## 7.1 Aquatic Ecology Assessment

Standard methodologies applied in the River Eco-Status Monitoring Programme (REMP) of South Africa were applied during the study to establish the PES of the watercourses. The study included the assessment of water quality, habitat integrity and suitability, and macroinvertebrate and fish assemblages. A summary of assessments conducted during the study is illustrated in Table 7-1, followed by full methodology descriptions below.

*Table 7-1 Methodologies applied during the study*

| Aspect | Analyses |
|---|---|
| **Water Quality** | *In situ* (DWAF, 1996) |
| **Habitat** | Intermediate Habitat Integrity Assessment (Kleynhans, 1998)<br>Biotope assessment (Tate and Husted, 2015) |
| **Biotic indices** | SASS5 (Dickens and Graham, 2002);<br>The Average Score Per Taxon (ASPT);<br>Macroinvertebrate Response Assessment Index (MIRAI); (Thirion,2007)<br>Qualitative Fish Assessment |

### 7.1.1 *In Situ* Water Quality

During the survey a portable Exstick 2 multimeter was used to measure the following parameters *in situ* pH, conductivity, Dissolved Oxygen (DO), and water temperature.

Water quality has a direct influence on aquatic life forms. Although these measurements only provide a "snapshot", they can provide valuable insight into the characteristics and interpretation of a specific sample site at the time of the survey.

### 7.1.2 Habitat Assessment

Habitat availability and diversity are major attributes for the biota found in a specific ecosystem, and thus knowledge of the quality of habitats is important in an overall assessment of ecosystem health. Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour *et al*. 1996). Both the quality and quantity of available habitat affect the structure and composition of resident biological communities (USEPA, 1998). Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason, habitat evaluation is conducted simultaneously with biological evaluations to facilitate the interpretation of results.

#### 7.1.2.1 Intermediate Habitat Integrity Assessment

The aim of the Intermediate Habitat Integrity Assessment (IHIA) is to make an intermediate assessment of the habitat integrity of rivers according to a modified Habitat Integrity approach which can be applied in intermediate determination of the ecological Reserve for rivers in South Africa (DWS, 1999). The methodology is based on the qualitative assessment of a number of pre-weighted criteria which indicate the integrity of the in-stream and riparian habitats available for use by riverine biota.

The criteria considered indicative of the habitat integrity of the river were selected on the basis that anthropogenic modification of their characteristics can generally be regarded as the primary causes of degradation of the integrity of the river (Table 7-2) (DWS, 1999). The study assessed 5 km of the assessed watercourses making use of latest Google Earth imagery of the catchment (desktop) together with visual assessments (ground truthing) at the associated monitoring sites.

*Table 7-2 Criteria used in the assessment of habitat integrity (from Kleynhans, 1996)*

| Criterion | Relevance |
|---|---|
| Water abstraction | Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water. |
| Flow modification | Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of high flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season. |
| Bed modification | Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment (Gordon *et al*., 1993 in: DWS, 1999). Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation (Hilden & Rapport, 1993 in: DWS, 1999) is also included. |
| Channel modification | May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included. |

| Criterion | Relevance |
|---|---|
| Water quality modification | Originates from point and diffuse point sources. Measured directly or agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions. |
| Inundation | Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments (Gordon *et al*., 1992 in DWS, 1999). |
| Exotic macrophytes | Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation. |
| Exotic aquatic fauna | The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance. |
| Solid waste disposal | A direct anthropogenic impact which may alter habitat structurally. Also a general indication of the misuse and mismanagement of the river. |
| Indigenous vegetation removal | Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing. |
| Exotic vegetation encroachment | Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochtonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced. |
| Bank erosion | Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment. |

The assessment of the severity of impact of modifications is based on six descriptive categories which are described in Table 7-3.

*Table 7-3 Descriptive classes for the assessment of modifications to habitat integrity (from Kleynhans, 1996)*

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

The habitat integrity assessment takes into account the riparian zone and the instream channel of the river. Assessments are made separately for both aspects, but data for the riparian zone are primarily interpreted in terms of the potential impact on the instream component (Table 7-4). The relative weighting of criteria remain the same as for the assessment of habitat integrity (DWS, 1999).

*Table 7-4 Criteria and weights used for the assessment of habitat integrity and habitat integrity (from Kleynhans, 1996)*

| Instream Criteria | Weight | Riparian Zone Criteria | Weight |
|---|---|---|---|
| Water abstraction | 14 | Indigenous vegetation removal | 13 |
| Flow modification | 13 | Exotic vegetation encroachment | 12 |
| Bed modification | 13 | Bank erosion | 14 |

| Instream Criteria | Weight | Riparian Zone Criteria | Weight |
|---|---|---|---|
| Channel modification | 13 | Channel modification | 12 |
| Water quality | 14 | Water abstraction | 13 |
| Inundation | 10 | Inundation | 11 |
| Exotic macrophytes | 9 | Flow modification | 12 |
| Exotic fauna | 8 | Water quality | 13 |
| Solid waste disposal | 6 | | |
| **Total** | **100** | **Total** | **100** |

The negative weights are added for the instream and riparian facets respectively and the total additional negative weight subtracted from the provisionally determined intermediate integrity to arrive at a final intermediate habitat integrity estimate. The eventual total scores for the instream and riparian zone components are then used to place the habitat integrity in a specific intermediate habitat integrity category (DWS, 1999). These categories are indicated in Table 7-5.

*Table 7-5 Intermediate habitat integrity categories (From Kleynhans, 1996)*

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

### 7.1.3 Aquatic Macroinvertebrates

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al.,* 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al.,* 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

#### 7.1.3.1 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g.

Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS5 score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the "Aquatic Invertebrates of South African Rivers" Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion *et al.,* 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

Reference conditions reflect the best conditions that can be expected in rivers and streams within a specific area and reflect natural variation over time. These reference conditions are used as a benchmark against which field data can be compared. Modelled reference conditions (biological bands) for the Nama Karoo - Lower Ecoregions were obtained from the SASS5 Data Interpretation Guidelines (Dallas, 2007). The biological bands as presented in Figure 7-1, illustrate ecological categories for the Ecoregion based on SASS5 scores (total sensitivity score) and ASPT value (average macroinvertebrate sensitivity for the sampled site). Ecological categories based on biological banding are presented in Table 7-6.

*Table 7-6 Biological Bands / Ecological categories for interpreting SASS data (adapted from Dallas, 2007)*

| Class | Ecological Category | Description |
|---|---|---|
| A | Natural | Unimpaired. High diversity of taxa with numerous sensitive taxa. |
| B | Largely natural | Slightly impaired. High diversity of taxa, but with fewer sensitive taxa. |
| C | Moderately modified | Moderately impaired. Moderate diversity of taxa. |
| D | Largely modified | Considerably impaired. Mostly tolerant taxa present. |
| E/F | Seriously Modified | Severely impaired. Only tolerant taxa present. |

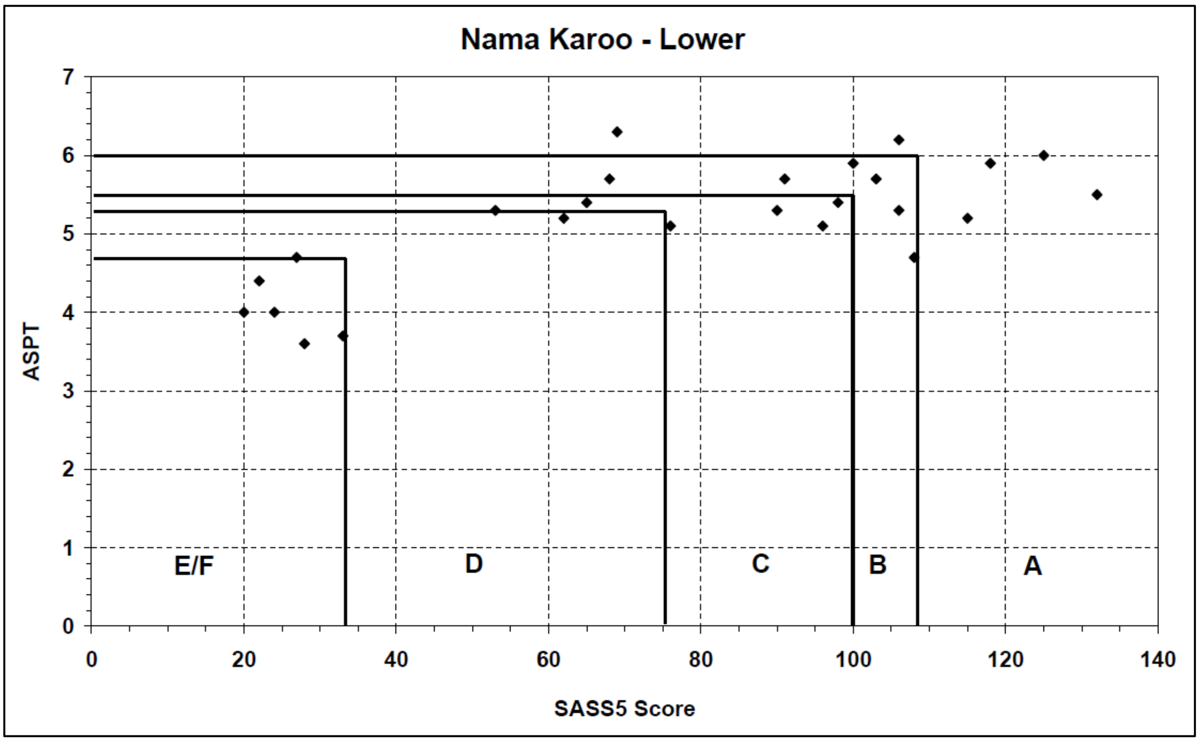


*Figure 7-1 Biological Bands for the Nama Karoo – Lower Ecoregion (Dallas, 2007)*

#### 7.1.3.2 Macroinvertebrate Response Assessment Index

The Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the SQR. This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality; and
- Energy inputs from the watershed in the form of allochthonous and instream inputs.

The results of the MIRAI will provide an indication of the current ecological category and therefore assist in the determination of the Present Ecological Status (PES).

### 7.1.4 Fish Assessment

Fish samples were collected by means of a number of different techniques including electrofishing, cast netting, rod and reel and visual observation. These techniques were deployed in a variety of depth and flow classes to sample each habitat to show fish species preferences for each. Electrofishing is the use of electricity to catch fish. The electricity is generated by a system whereby a high voltage potential is applied between two electrodes placed in the water (USGS, 2004). The responses of fish to electricity are determined largely by the type of electrical current and its wave form. These responses include avoidance, electrotaxis (forced swimming), electrotetanus (muscle contraction), electronarcosis (muscle relaxation or stunning) and death (USGS, 2004). Electrofishing was conducted with a Halltech portable electrofishing device (DC 12V pulsating). Electrofishing is regarded as the most effective single method for sampling fish communities in wadeable streams (Plafkin *et al.,* 1989).

Fish were identified in the field, photographed and released at the point of capture. Fish species were identified using the guide Freshwater Fishes of Southern Africa (Skelton, 2001).

#### 7.1.4.1 Expected Fish Species

The list of expected fish species is presented in the table below (Skelton, 2001; DWS, 2021; IUCN, 2021; Specialists experience in project area). Based on this, a total of twelve indigenous (one is indigenous to South Africa but exotic to the Orange River system) and four exotic fish species are expected to occur in the project area. It should be noted that these expected species lists are compiled on a catchment area or Sub-Quaternary Reach (SQR) basis and not on a site-specific basis. It is therefore unlikely that all of the expected species will be present at every site in the SQR with habitat type and availability being the main driver of species present. Therefore, Table 7-7 should be viewed as a list of potential species rather than an expected species list.

*Table 7-7 Expected species list for the sub-quaternary catchment*

| Scientific name | Common name | IUCN Status | Habitat preference (Skelton, 2001; IUCN, 2021) |
|---|---|---|---|
| *Austroglanis sclateri* | Rock catfish | LC | Prefers rocky habitat in mainstream areas of major rivers. Omnivorous, feeding on invertebrates especially from rock surfaces with larger specimens also feeding on small fish (Skelton, 2001). |
| *Clarias gariepinus* | Sharptooth Catfish | LC | Widespread and abundant and occurs in a wide variety of habitats. Omnivorous. |
| *Enteromius anoplus* | Chubbyhead Barb | LC | Prefers cooler waters, occurring in a wide variety of habitats from small streams to large rivers and lakes. Omnivorous, feeding on insects, zooplankton, seeds, green algae and diatoms. Preyed on by larger fish and birds. |
| *Enteromius paludinosus* | Straightfin Barb | LC | It occupies a wide range of habitats, including large rivers, both vegetated and rocky, lagoons both connected to and isolated from main river channels, and small and large streams. |
| *Enteromius trimaculatus* | Threespot Barb | LC | Commonly occurs in a wide variety of habitats, especially where there is vegetation. It occurs in main channels of large rivers, it penetrates high into some tributary systems and may also be present in isolated floodplain pools. It feeds on insects and other small organisms, and seeds of plants. |
| *Labeo capensis* | Orange River Labeo | LC | Prefers running water of large rivers, but also occurs in large impoundments. |
| *Labeo umbratus* | Moggel | LC | Prefers slow flowing or standing water. Feeds on detritus. |
| *Labeobarbus aeneus* | Smallmouth Yellowfish | LC | It prefers sandy and rocky substrates of clear and flowing water of large rivers, but also tolerates turbid rivers. Omnivorous with benthic invertebrates, bivalve molluscs. |
| *Labeobarbus kimberleyensis* | Largemouth Yellowfish | NT | Favours deeper pools (deeper than 2 m) with an abundance of cover in the form of reefs, weed beds and over hanging vegetation. Primarily a predator with fishes above 30 cm being almost exclusively piscivorous. |
| *Pseudocrenilabrus philander* | Southern mouthbrooder | LC | Occurs in a widely diverse habitat; it favours areas where plant cover exists along the edges of rivers, lakes or swamps and prefers shallow sheltered waters. |
| *Tilapia sparrmanii* | Banded Tilapia | LC | Occurs in a widely diverse habitat; it favours areas where plant cover exists along the edges of rivers, lakes or swamps and prefers shallow sheltered waters. |
| *Oreochromis mossambicus* | Mozambique Tilapia | NT | Occurs in a widely diverse habitat; it favours areas where plant cover exists along the edges of rivers, lakes or swamps and prefers shallow sheltered waters. |
| *Cyprinus carpio* | Carp | EX | Widespread exotic species in South African waters and is a known habitat modifier stirring up sediments increasing turbidity of water bodies. |
| *Ctenopharyngodon idella* | Grass Carp | EX | Widespread exotic species in South African waters and is a known habitat modifier feeding on aquatic and marginal vegetation consuming large volumes daily. |
| *Gambusia affinis* | Mosquito Fish | EX | Widespread in slower flowing margin of rivers and dams |
| *Micropterus salmoides* | Largemouth Bass | EX | Predatory fish feeding on most animals including fish and crustaceans. Invader. |
| **Total number of expected indigenous species** | | | **12** |
| **Total number of expected exotic species** | | | **4** |

LC - Least Concern;NT – Near Threatened; Blue – Translocated indigenous; EX – Exotic

#### 7.1.4.2 Presence of Species of Conservation Concern

The conservation status of the indigenous fish species was assessed in terms of the IUCN Red List of Threatened Species (IUCN, 2021). Based on this assessment 10 of the expected fish species are currently listed as Least Concern (LC), 4 species as exotic to South Africa, and 2 species as Near Threatened (NT) (Table 7-7). Species that are listed as LC are considered to be widespread and abundant with no immediate threat of extinction. A species is listed as NT when it does not currently qualify for a Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) status but is close to qualifying or is expected to qualify in the near future (IUCN, 2021). The most notable species of special concern which occurs within the project area is *Labeobarbus kimberleyensis.*

*Labeobarbus kimberleyensis* (Largemouth yellowfish) is currently listed as Near Threatened (NT). The major threat to *L. kimberleyensis* is decreased water quality in the Vaal River below Vaal Dam and from tributaries which receive treated effluent water. Instream dams and weirs are not a problem if suitable spawning habitat is present above the dam. River regulation and destruction of different habitat types may be contributing further to the decline of this species (IUCN, 2021).

*Oreochromis mossambicus* (Mozambique tilapia) is currently listed as Near Threatened (NT). The most serious threat facing *O. mossambicus* is hybridization with the rapidly spreading introduced species *Oreochromis niloticus* (Nile tilapia) (IUCN, 2021). Hybridization has already been documented throughout the northern part of the species' range, with most of the evidence coming from the Limpopo River catchment (IUCN, 2021). Given the rapid spread of *O. niloticus* it is anticipated that *O. mossambicus* will qualify as threatened under Criterion A due to rapid population decline through hybridization (IUCN, 2021). *Oreochromis mossambicus* occurs in all but fast flowing waters and is tolerant of high salinities. It feeds on algae and invertebrates. The clearest morphological indicator of hybridization between *O. mossambicus* and *O. niloticus* is barring on the caudal fin.

*Ctenopharyngodon idella* is currently Unlisted and has not been assessed (IUCN, 2021). This an exotic species in South African waters and is a known habitat modifier. *Ctenopharyngodon idella* was originally stocked as a form of weed control in farm dams due to its exclusive and ravenous vegetarian diet. This species has escaped from the stocked farm dams and is now found throughout the Orange-Vaal River system posing risk to aquatic and marginal vegetation habitats that are used as cover and breeding grounds by many indigenous fish species. This species should be eradicated if caught.

*Cyprinus carpio* (Carp) is currently listed as Vulnerable (VU). It should be noted that although *C. carpio* is listed as vulnerable (in its native waters), it remains an exotic species in South African waters. *Cyprinus carpio* is known to be a habitat modifier through its feeding methods that involve stirring up the sediment in search of plant roots and other sources of protein, often increasing the turbidity of the water body (IUCN, 2021).

### 7.1.5 Present Ecological Status

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007). For the purpose of this study ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river ecoclassification manual by Kleynhans and Louw (2007).

# 8 Receiving Environment

## 8.1 Desktop Spatial Assessment

The following features describes the general area and associated freshwater resources, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI. The desktop analysis and their relevance to this project are listed in Table 8-1.

*Table 8-1 Desktop spatial features considered for the study*

| Desktop Information Considered | Features | Section |
|---|---|---|
| **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) | 8.1.1 |
| **SQR** | Located in quaternary reach D73F and SQR 3032 (Orange) | 4 & 8.1.2 |
| **Strategic Water Source Areas (SWSA)** | The project area is not located within or near any SWSAs | 8.1.3 |
| **Conservation Plan Aquatic** | The project area overlaps with the following aquatic features: River NFEPA: Fish Support Area, CBA 1 with adjacent CBA 2 | 8.1.4 |
| **Ecosystem Threat Status** | The project area is situated within river ecosystems that were not assessed for Ecosystem Threat Status | 8.1.5 |
| **Ecosystem Protection Level** | The project area is situated within river ecosystems that were not assessed for Ecosystem Protection Level | 8.1.6 |

### 8.1.1 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. This directly applies to the NWA, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al*. 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (Act No.10 of 2004) (NEM:BA), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al*., 2011). 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) as presented in Table 8-2 and Figure 8-1.

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.

*Table 8-2 NFEPAs listed for the D73F-3032 SQR*

| Type of FEPA map category | Biodiversity features |
|---|---|
| Fish Support Area | Fish sp. *Enteromius anoplus* |

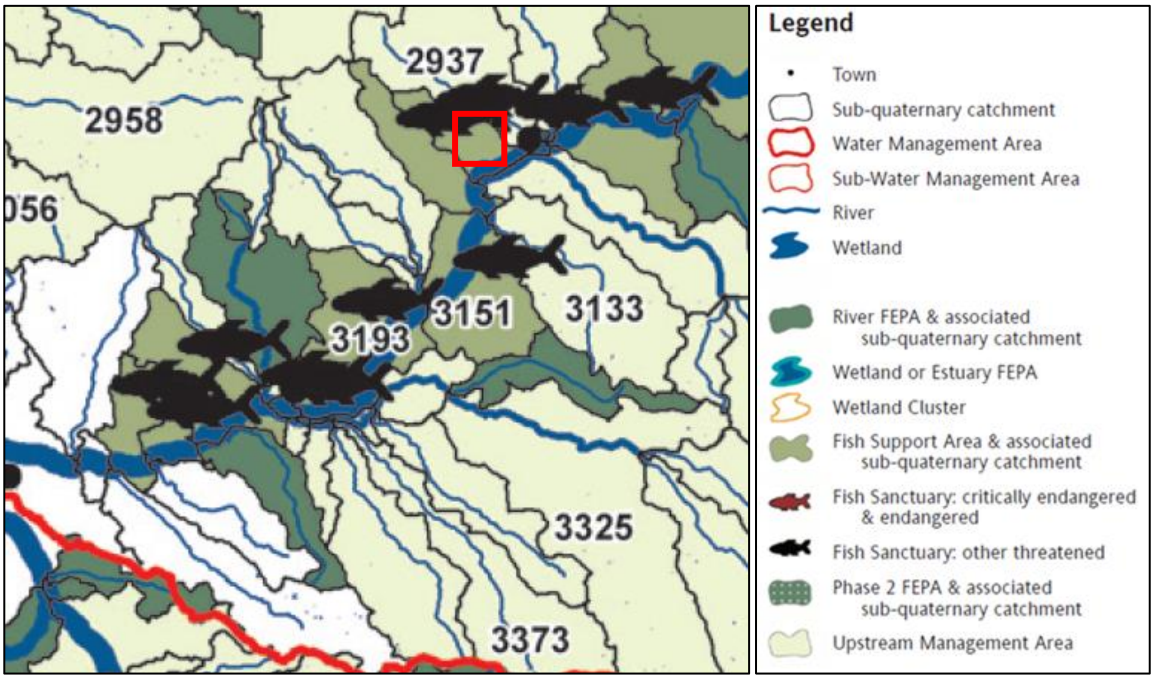


*Figure 8-1 Illustration of NFEPAs within the project area (indicated by red square)*

#### 8.1.1.1 River FEPA and associated sub-quaternary catchment

River FEPAs achieve biodiversity targets for river ecosystems and threatened/near threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition to contribute to national biodiversity goals and support sustainable use of water resources.

For river FEPAs the whole sub-quaternary catchment is shown in dark green, although FEPA status applies to the actual river reach within such a sub-quaternary catchment. The shading of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach (Nel *et al*, 2011).

It is important to note that river FEPAs currently in an A or B ecological category may still require some rehabilitation effort, e.g. clearing of invasive alien plants and/or rehabilitation of river banks. From a biodiversity point of view, rehabilitation programmes should therefore focus on securing the ecological structure and functioning of FEPAs before embarking on rehabilitation programmes in Phase 2 FEPAs or other areas (see below).

#### 8.1.1.2 Fish sanctuary and associated sub-quaternary catchment

Fish sanctuaries are rivers that are essential for protecting threatened and near-threatened freshwater fish that are indigenous to South Africa. The associated sub-quaternary catchment is marked with a red or black fish symbol on the map. A red fish indicates that there is at least one population of a critically endangered or endangered fish species within that sub-quaternary catchment. A black fish indicates the presence of vulnerable or near-threatened fish populations. Some fish sanctuaries are FEPAs, with their associated sub-quaternary catchments shown in dark green; others are Fish Support Areas, with their associated sub-quaternary catchments shown in medium green (see explanation of Fish Support Areas below).

A goal of NFEPA is to keep further freshwater species from becoming threatened and to prevent those fish species that are already threatened or near threatened from going extinct. To achieve this, there should be no further deterioration in river condition in fish sanctuaries and no new permits should be issued for stocking invasive alien fish in farm dams in the associated sub-quaternary catchment. Fish management plans need to be developed for all fish sanctuaries to protect the fish they contain, with priority given to those fish sanctuaries containing critically endangered or endangered fish species (indicated by the red fish symbol on the map). These plans should address issues such as management of a particular stretch of river habitat within the sub-quaternary catchment, the construction of weirs to keep invasive alien fish species to a minimum (following an environmental impact assessment), and managing aquaculture and angling to ensure no further introduction of invasive alien fish species (Nel *et al,* 2011).

#### 8.1.1.3 Fish Support Area and associated sub-quaternary catchment

Fish sanctuaries in a good condition (A or B ecological category) were identified as FEPAs, and the whole associated sub-quaternary catchment is shown in dark green. The remaining fish sanctuaries in lower than an A or B ecological condition were identified as Fish Support Areas, and the associated sub-quaternary catchment is shown in medium green. Fish Support Areas also include sub-quaternary catchments that are important for migration of threatened or near threatened fish species – these are not marked with a fish symbol (Nel *et al*, 2011).

### 8.1.2 Desktop Present Ecological State

This section provides further desktop information regarding the project related SQR(s) with regards to the PES including the Ecological Importance, Ecological Sensitivity and anthropogenic impacts within the SQR.

The Orange tributary reach has not been individually assessed for PES and falls within the Orange SQR. Therefore, desktop PES information for the Orange SQR was obtained from DWS (2021) and is summarised in Table 8-3. 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 sensitivity of the river reach were 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 includes: Irrigation – which includes on riverine islands, urban areas (Upington & surroundings), road crossing infrastructure, abstraction for dryland irrigation, indigenous vegetation removal, Waste Water Treatment Works 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 Kameelmond WWTW and contaminated (pesticides and fertilizers) return water from the extensive agricultural activities within the riparian zones.

*Table 8-3 The desktop data pertaining to the ecological condition and classification of the reach(es) assessed*

| 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 |

### 8.1.3 Strategic Water Source Areas

According to the Strategic Water Source Areas (SWSAs) of South Africa, Lesotho and Swaziland, the project area is not located within the SWSAs (Figure 8-2). The project area is considered a desert climate that receives limited rainfall (annual 219 mm) with an average annual temperature in Upington of 21.6°C (climate-data.org, 2021). Strategic Water Source Areas are areas that supply a disproportionate amount of mean annual runoff to a geographical region of interest. The areas supplying ≥ 50% of South Africa's water supply (which were represented by areas with a mean annual runoff of ≥ 135 mm/year) represent national Strategic Water Source Areas (SANBI, 2013).

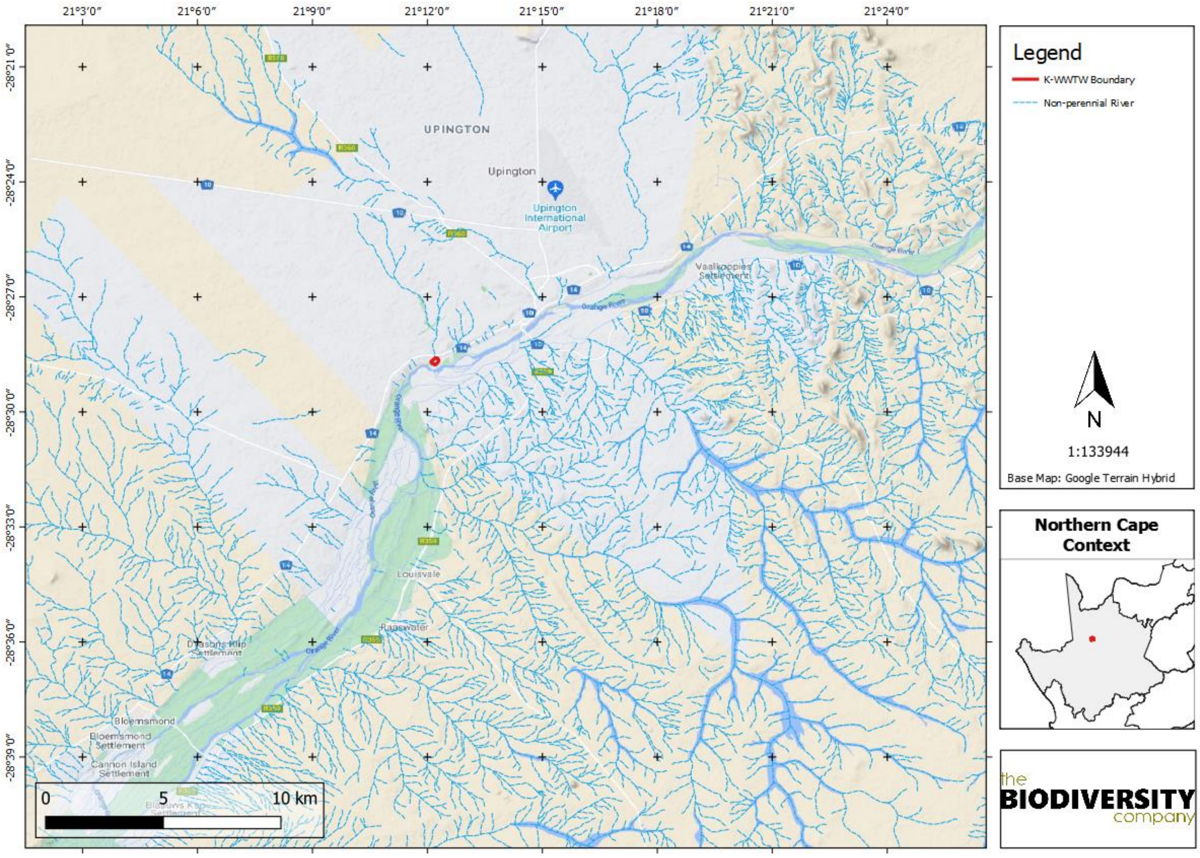


*Figure 8-2 Illustration of the Strategic Water Source Areas of the project area*

### 8.1.4 Freshwater Critical Biodiversity Area

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 Critical Biodiversity Area 1 (CBA 1) while the adjacent areas which includes the Orange tributary was categorised as Critical Biodiversity Area 2 (CBA 2) (Figure 8-3).

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. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI, 2017).

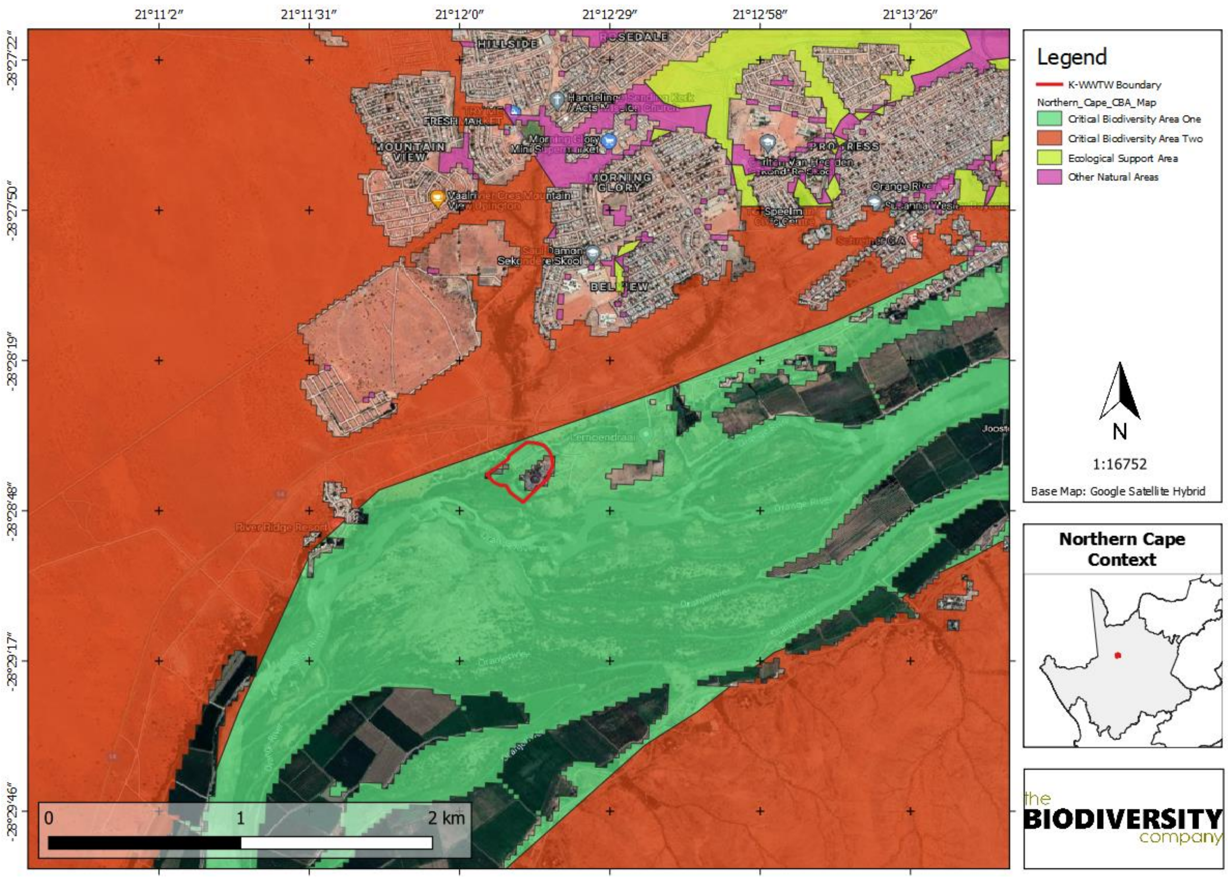


*Figure 8-3 Illustration of the Freshwater Critical Biodiversity Areas within the project area (SANBI, 2008)*

### 8.1.5 Ecosystem Threat Status

The Ecosystem Threat Status (ETS) of each river assessed was based on the extent to which the system had been modified from its natural condition (SANBI, 2018). According to the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) released with the National Biodiversity Assessment (NBA) of rivers, the rivers within the project area were not categorised (Figure 8-44).

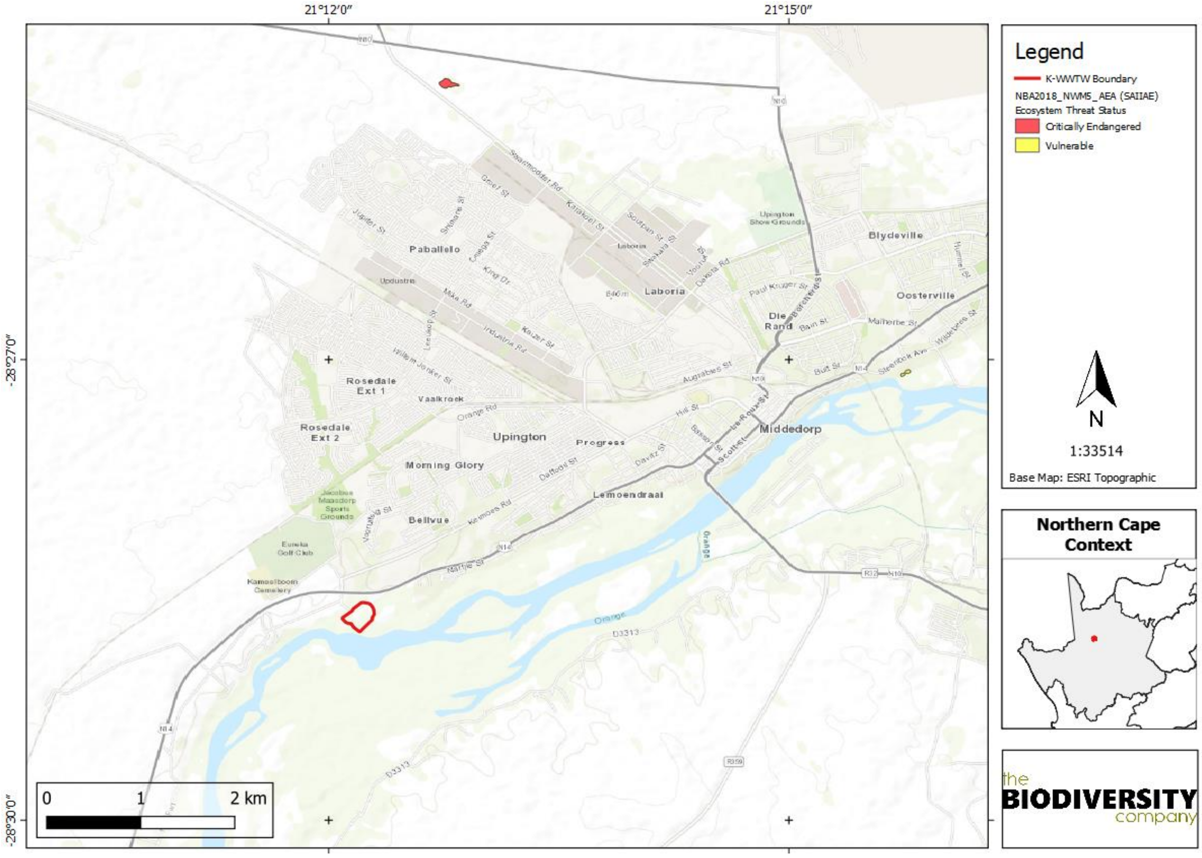


*Figure 8-44 Illustration of the Ecosystem Threat Status of the project area (SANBI, 2018)*

### 8.1.6 Ecosystem Protection Level

According to the NBA of rivers, the rivers within the project area were not categorised (Figure 8-5). The Ecosystem Protection Level (EPL) of each river assessed was based on the extent (expressed as a percentage) to which the system has their biodiversity target located within protected areas and are in a natural or near-natural ecological condition. Rivers in protected areas need to be in good condition (A or B ecological category) to be considered as protected. Well protected rivers have 100% located within protected areas, while moderately protected and poorly protected river ecosystem types have at least 50% and 5% of their biodiversity target in protected areas, respectively. Not protected rivers form less than 5% (SANBI, 2018).

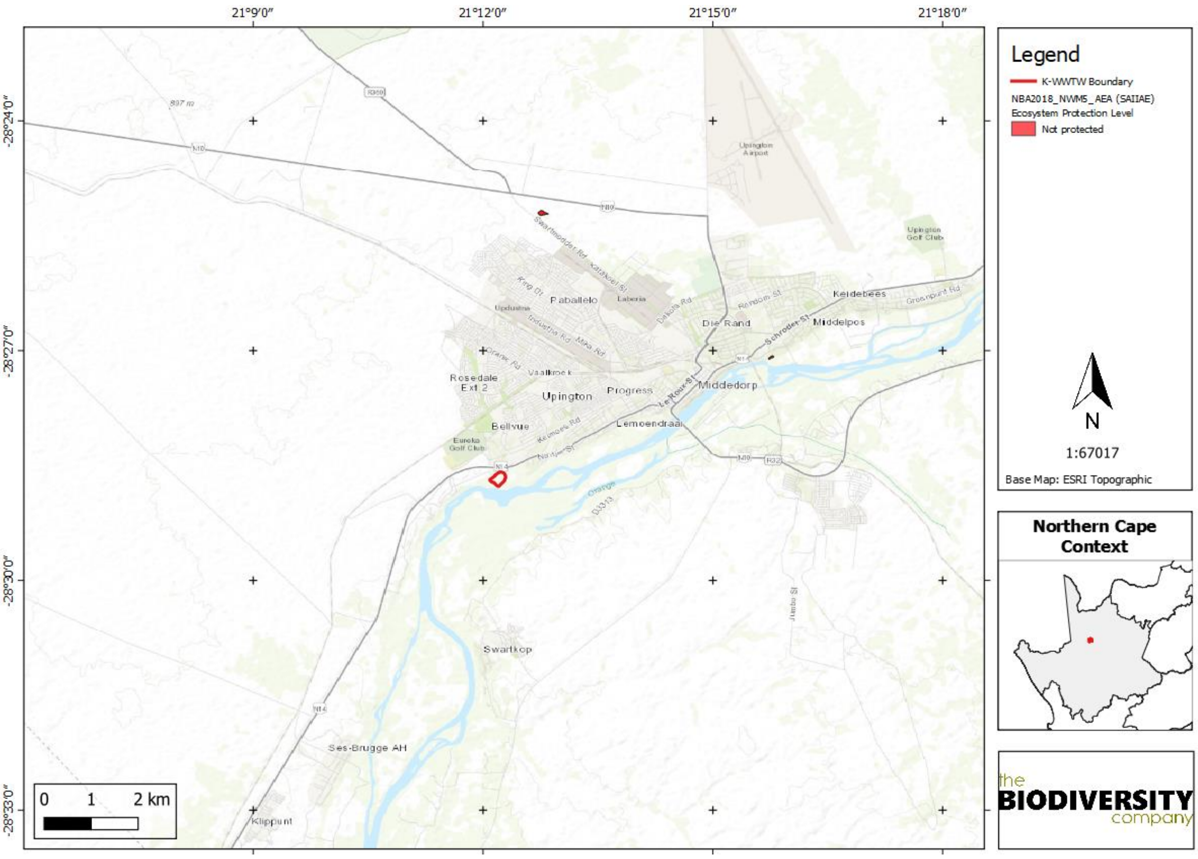


*Figure 8-5 Illustration of the Ecosystem Protection Level of the project area (SANBI, 2018)*

### 8.1.7 Spatially Sensitive Mapping

According to the National Web based Environmental Screening Tool the combined aquatic biodiversity for the area is classified as having a Very High sensitivity rating (Table 8-5 and Figure 8-6) requiring a water resources study of the project area.

*Table 8-5 Sensitivity features associated with Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)*

| Sensitivity | Features |
|---|---|
| **Low** | Low sensitivity |
| **Very High** | Wetlands and Estuaries |

The freshwater ecology of the immediate project area and further downstream is sensitive to disturbance from a hydrological and biological perspective.

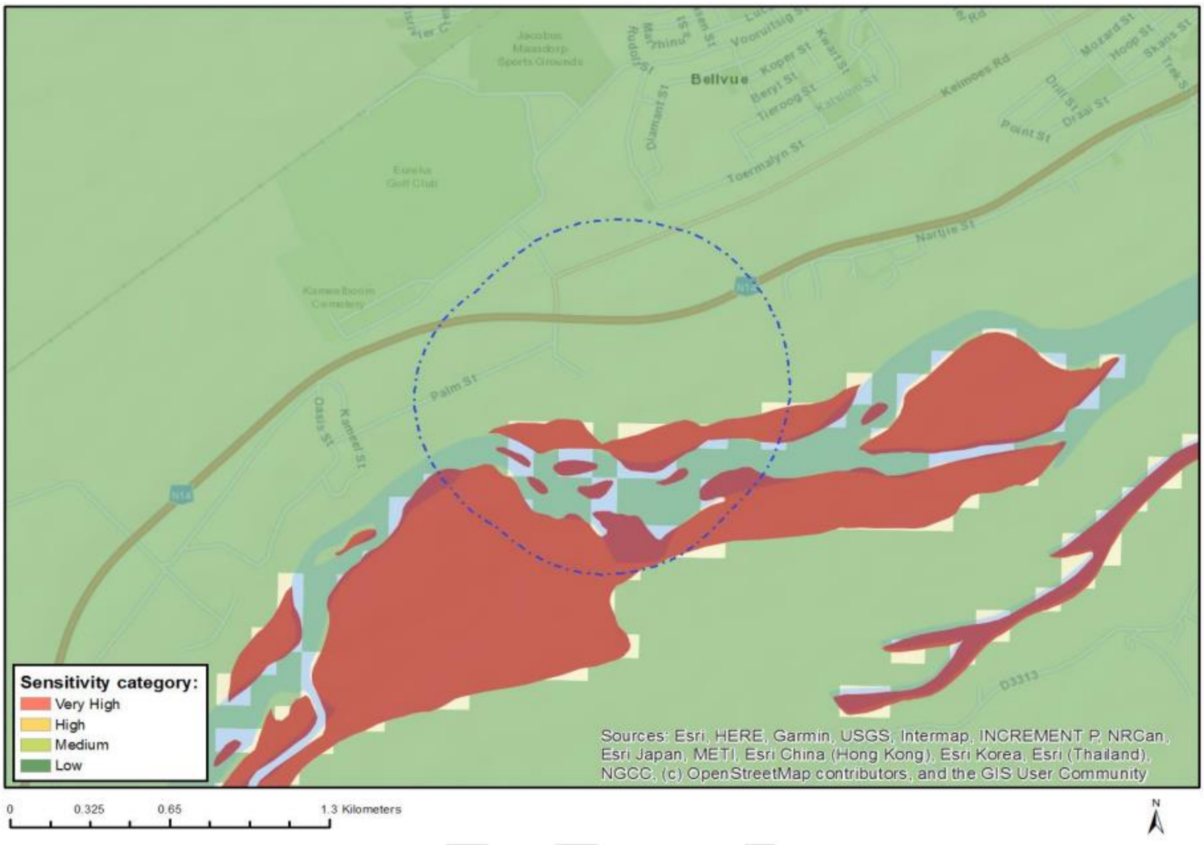


*Figure 8-6 Aquatic Biodiversity Combined Sensitivity (National Web based Environmental Screening Tool)*

## 8.2 Aquatic Ecology Assessment

In line with the minimum requirements for aquatic biodiversity, an in-field specialist assessment is required to confirm or dispute site sensitivity. A total of three aquatic sampling sites were selected to establish baseline riverine conditions for the Project (Figure 8-7). *In situ* water quality analysis was conducted at all sites, while macroinvertebrate and fish sampling was conducted at suitable sites only.

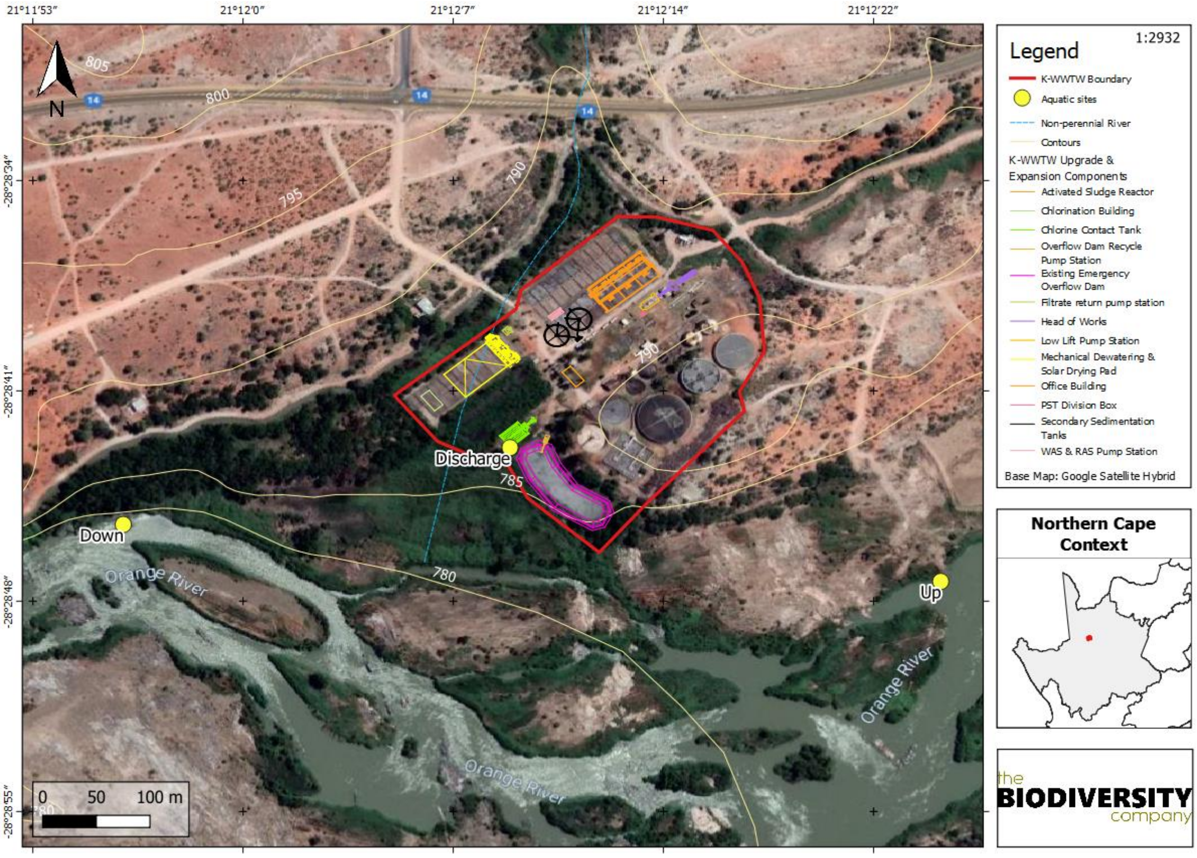


*Figure 8-7 Aquatic sampling points for the Kameelmond - WWTW*

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. Site photographs, Global Positioning System (GPS) coordinates and site descriptions for the sampling sites are presented in Table 8-6.

*Table 8-6 Photographs and GPS coordinates for the sites sampled (photos taken April 2021)*

| Site | Upstream | Downstream |
|---|---|---|
| | **Orange River** | |
| **Up** |  |  |
| **GPS** | 28°28'47.34"S; 21°12'23.92"E | |
| **Site description** | The upstream site (Up) located on the Orange River was characterised by slow deep waters. The site characterised mostly deep unwadable waters. The wadable margins comprised of bedrock, limited lose stones between gravel and sand with some areas of mud substrate. Ample marginal vegetation was present, however was predominantly reeds and shoots with limited leaf cover available. The site is located approximately 300 m upstream of the K-WWTW discharge point and 4.2 km downstream of the N10 road bridge in Upington. The site served as water quality and biological monitoring point. | |
| **Down** |  |  |
| **GPS** | 28°28'45.39"S; 21°11'55.90"E | |
| **Site description** | The downstream site (Down) is located on the Orange River approximately 440 m downstream of the K-WWTW discharge point. The site characterised mostly deep unwadable waters. The wadable margins comprised of bedrock, limited lose stones between gravel and sand with some areas of mud substrate. Limited marginal vegetation was present, in the form of reeds and shoots with limited leaf cover available. The site served as water quality and biological monitoring point. | |
| **Discharge** |  |  |
| **GPS** | 28°28'42.75"S; 21°12'9.16"E | |
| **Site description** | The K-WWTW treated effluent discharge point served as an in-situ water quality monitoring point. The site was located at the outlet of the chlorine contact tank where the treated effluent is released into the Orange River. | |

### 8.2.1 *In situ* Water Quality

*In situ* water quality analyses was conducted at all sites with adequate surface water during the survey. These results are important to assist in the interpretation of biological results due to the direct influence water quality has on aquatic life forms. The results as presented in Table 8-7, were compared to Target Water Quality Range (TWQR) for aquatic ecosystems (DWAF, 1996).

*Table 8-7 In situ water quality results*

| Site | pH | Conductivity (µS/cm) | Dissolved Oxygen (mg/l) | Temperature (°C) |
|---|---|---|---|---|
| **TWQR*** | **6.5-9.0** | **-** | **>5.00** | **5-30** |
| | | **Orange River** | | |
| **Up** | 8.29 | 676 | 6.7 | 20.1 |
| **Discharge** | 7.22 | 1534 | 7.3 | 21 |
| **Down** | 7.72 | 682 | 6.2 | 20.4 |

*TWQR-Target Water Quality Range

Findings from the *in situ* water quality results indicate modified water quality conditions within the Orange River system with pH, dissolved oxygen and water temperature falling with the TWQR. The recorded electrical conductivity (dissolved solid) levels were considered moderately high and deemed modified when compared to rainwater which typically has a low conductivity of approximately 100 µS/cm. The recorded levels indicate an influx of dissolved solids from catchment related landuse which includes residential and agricultural activities. The water within the Orange River at Up and Down would not present critical adverse conditions to local aquatic biota. No major differences in parameters were noted between the up- and downstream sites, indicating limited influence from the Discharge at the time of the survey. 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 where influence was present, however 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.

### 8.2.2 Habitat Assessment

The gradient of the Orange river reach has been classified as a class F geoclass, which places both reaches as lowland river reach (Rountree *et al.,* 2000). Typically, lowland river reaches are associated with a moderately gentle gradient comprising pools, runs and riffles within a wide channel and an associated floodplain and riparian area. The instream habitat composition includes a scattered diversity of stones, bedrock with gravel, sand and mud substrates due to the flow characteristics associated with the aforementioned gradient. Typically, lowland systems offer a host of ecosystems services which includes purification of water quality through phytoremediation by the instream, marginal and riparian vegetation. The river system assessed in this study is expected to provide cleansing effects from discharged treated effluent associated with the proposed K-WWTW upgrades and expansions and must be maintained and protected during the proposed Project activities.

#### 8.2.2.1 Intermediate Habitat Integrity Assessment

The results for the instream and riparian habitat integrity assessment for the Orange River is presented in Table 8-8. The reach includes 5 km of the aquatic system assessed during the study and integrated into the IHIA assessment.

*Table 8-8 Results for the habitat integrity assessment for the Orange River*

| Instream Habitat | Impact Score | Weighted Score |
|---|---|---|
| Water abstraction | 17 | 9.5 |
| Flow modification | 11 | 5.7 |
| Bed modification | 8 | 4.2 |
| Channel modification | 4 | 2.1 |
| Water quality | 16 | 9.0 |
| Inundation | 8 | 3.2 |
| Exotic macrophytes | 0 | 0.0 |
| Exotic fauna | 10 | 3.2 |
| Solid waste disposal | 12 | 2.9 |
| **Total Instream** | **60.3** | |
| **Category** | **C** | |
| **Riparian Habitat** | **Impact Score** | **Weighted Score** |
| Indigenous vegetation removal | 19 | 6.2 |
| Exotic vegetation encroachment | 17 | 3.8 |
| Bank erosion | 9 | 6.2 |
| Channel modification | 4 | 6.7 |
| Water abstraction | 15 | 5.2 |
| Inundation | 6 | 5.3 |
| Flow modification | 13 | 8.2 |
| Water quality | 12 | 7.8 |
| **Total Riparian** | **52.1** | |
| **Category** | **D** | |

According to the IHIA results instream habitat integrity in the reach is considered to be a class C, or moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged. The riparian habitat integrity in the reach is considered to be a class D, or largely modified. A large loss of natural habitat, biota and basic ecosystem function has occurred.

Impacts to the bed, channel, flow and water quality modification and exotic encroachment in the catchment are large to serious. The agricultural activities in the reach have resulted in large scale modification of the Orange River banks with some eutrophication of the reach. The residential areas and associated road network and increased hardened surfaces have generated unnatural levels of surface runoff during rainfall events, which have contributed to erosion and sedimentation of instream areas. The addition of a canal used for water abstraction for agriculture has contributed to water quality and flow modifications. The residential and agricultural activities have resulted in solid waste disposal in instream areas and an influx of contaminants as observed in the water quality analyses. The indiscriminate disposal of solid waste provides a general indication of the misuse and mismanagement of the river and riparian areas. Several exotic fish species are known habitat modifiers. Carp feed in sediment increasing turbidity, while grass carp consume large amounts of instream, aquatic and marginal vegetation changing plant communities. These perturbations have cumulatively reduced the overall instream habitat and riparian integrity of the Orange River reach (Figure 8-8).

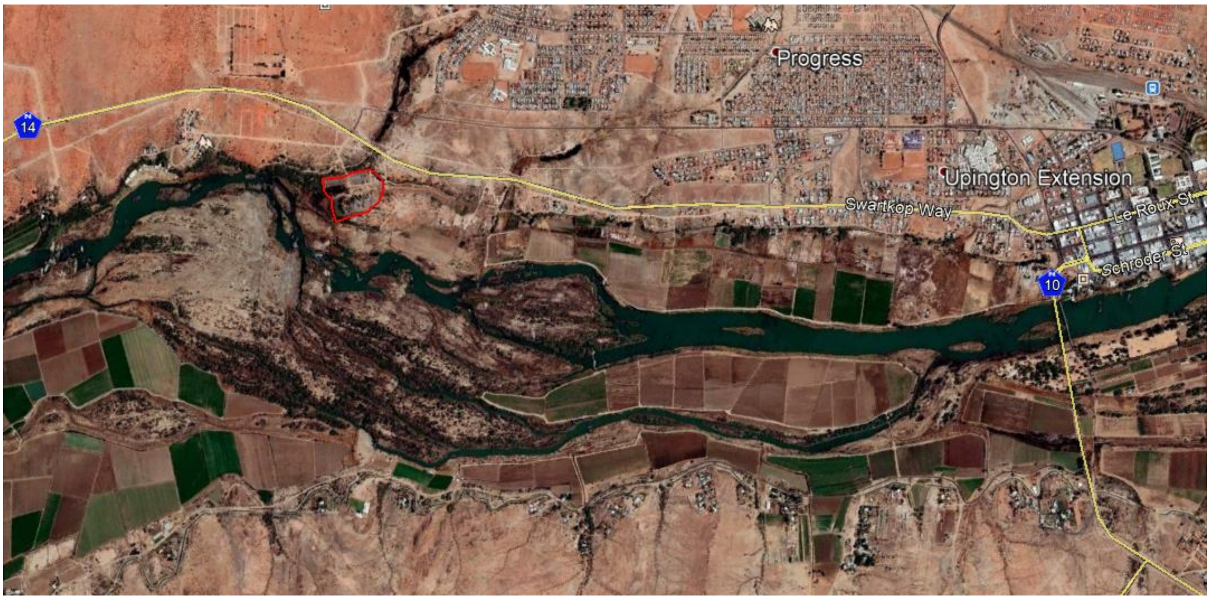


*Figure 8-8 Altered land use within the Orange River catchment (Google Earth Imagery, 8/2020)*

#### 8.2.2.2 Macroinvertebrate Habitat and Biotope Assessments

A biotope rating of available habitat was conducted at each site assessed to determine the suitability of habitat to macroinvertebrate communities. The Orange River system within the project area was classed as a lowland river reach at a desktop level presenting typical riverine characteristics. Each geoclass has different weightings for the various biotopes according to importance value as presented in Table 8-9. The categories were calculated according to the biotope rating assessment as applied in Tate and Husted (2015). The results of the biotope assessment are presented in Table 8-10. A rating system of 0 to 5 was applied, 0 being not available and 5 being abundant and diverse.

*Table 8-9 Biotope weightings for geoclasses*

| Biotope | Lowland River |
|---|---|
| Stones in current (SIC) | 15 |
| Stones out of current (SOOC) | 12 |
| Bedrock | 2 |
| Aquatic vegetation | 0.5 |
| Marginal vegetation in current | 2 |

| Biotope | Lowland River |
|---|---|
| Marginal vegetation out of current | 2 |
| Gravel | 0.5 |
| Sand | 4 |
| Mud | 1.5 |

*Table 8-10 Biotope scores at each site during the survey*

| Biotope | Up | Down |
|---|---|---|
| Stones in current | 2 | 2 |
| Stones out of current | 4 | 2 |
| Bedrock | 3 | 3 |
| Aquatic Vegetation | 0 | 0 |
| Marginal Vegetation in Current | 1 | 2 |
| Marginal Vegetation Out of Current | 1 | 2 |
| Gravel | 2 | 3 |
| Sand | 1 | 4 |
| Mud | 3 | 4 |
| **Biotope Score** | 17 | 21 |
| **Weighted Biotope Score (%)** | **43** | **41** |
| **Biotope Category (Tate and Husted, 2015)** | **D (Moderate)** | **D (Moderate)** |

Habitat diversity and subsequent availability for aquatic macroinvertebrates was Moderate at both sites. The sites characterised mostly deep unwadeable waters limiting sampling a variety of habitats. The wadable margins comprised various flow classes ranging from slow to fast flowing waters over bedrock, boulders, stones, gravel, sand and mud. Limited diversity of marginal vegetation was present on the accessible river edges. Habitat diversity at both sites would sustain a moderate diversity of macroinvertebrate taxa.

### 8.2.3 Macroinvertebrate Assessment

#### 8.2.3.1 South African Scoring System

The aquatic macroinvertebrate results for the study are presented in Table 8-11.

*Table 8-11 Macroinvertebrate assessment results*

| Site | Up | Down |
|---|---|---|
| **SASS5 Score** | 92 | 60 |
| **No. of Taxa** | 14 | 12 |
| **ASPT*** | 6.6 | 5 |
| **Ecological Category (Dallas, 2007)**** | **A** | **D** |

*ASPT: Average score per taxon; **Nama Karoo - Lower Ecoregion

Biotic integrity at the upstream site was categorised as natural (class A). This indicates that the macroinvertebrate assemblage is in an unimpacted state. The low diversity taxa collected (14 families) and low diversity of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies) taxa (EPT taxa) indicates limited instream habitat diversity, availability, and altered habitat quality. This was indicated in the biotope scores, reflecting moderate habitat diversity. The sampling limitations likely underestimated habitat diversity and subsequent lowered macroinvertebrate diversity. The ASPT (average sensitivity) score of 6.6

indicates a diversity of tolerant (50%) and sensitive (50%) taxa were recorded. The macroinvertebrate assemblage indicates that the biotic integrity of the upstream site is largely natural rather than natural.

Biotic integrity at the downstream site was categorised as largely modified (class D). A similar number of taxa was sampled at the downstream site (12 families) with a similar sensitive portion (50%) sampled, however the sensitive taxa were more tolerant of modified conditions as reflected by lower ASPT of 5. Despite the similarity in habitat sampled, fewer EPT taxa were present at the downstream site. This together with the lowered ASPT score indicated that the macroinvertebrate assemblage is in an impacted state which is indicative of water quality impacts associated with altered land use within the catchment. The K-WWTW is the major contributing impact located on the northern banks of the Orange River between the two sites and the discharges from this facility are likely contributing to the impacted macroinvertebrate community at the downstream site (Figure 8-9).

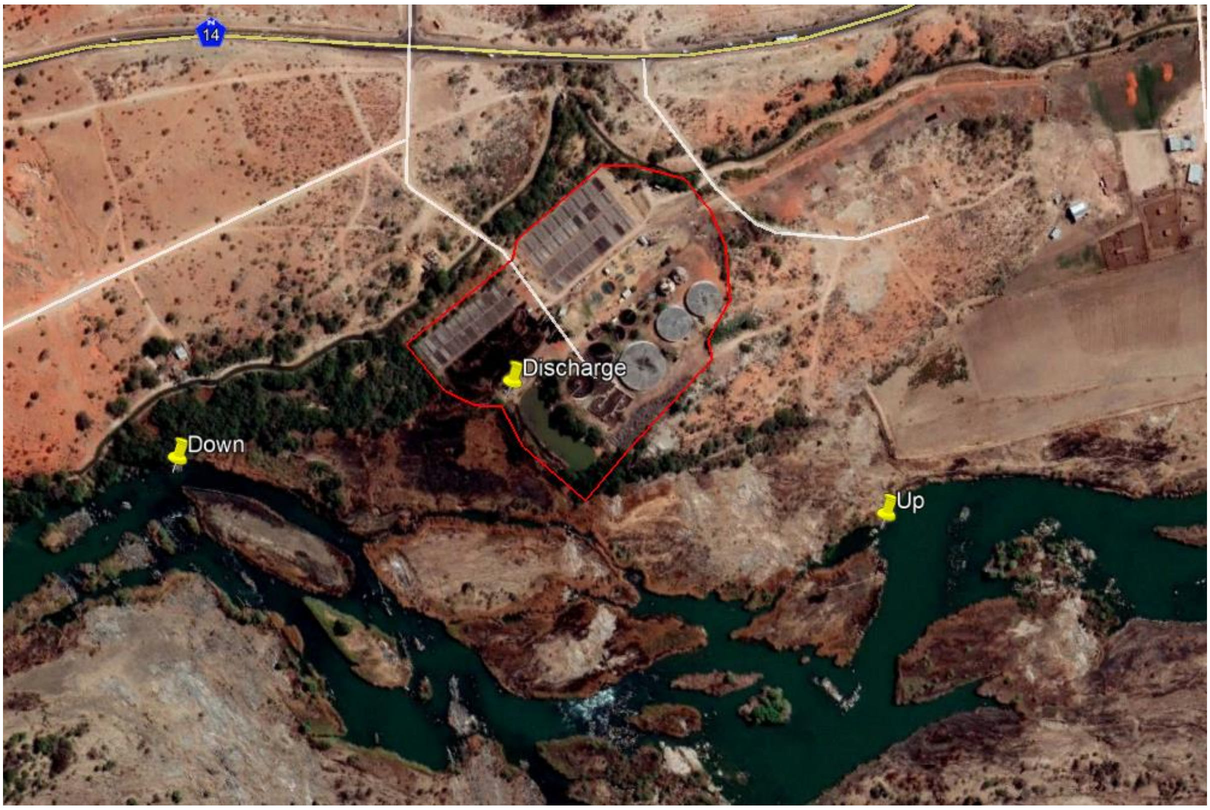


*Figure 8-9 K-WWTW in relation to the sampling sites (Google Earth Imagery, 8/2020)*

#### 8.2.3.2 Macroinvertebrate Response Assessment Index

The MIRAI methodology was conducted according to Thirion (2007). Data collected from the SASS5 method was applied to the MIRAI model. Data from sites Up and Down was used to determine the ecological category of the Orange River. The MIRAI model provides a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community (assemblage) from the reference condition (unmodified river). A low impact score indicates a large portion of the macroinvertebrate community is missing due to altered riverine conditions. A high impact score indicates the macroinvertebrate community is largely intact as a result of an unmodified driver. Results for the assessed Orange River reach are presented in Table 8-12. It should be noted that 50 taxa are expected under reference conditions generated for the Nama Karoo - Lower ecoregion. It is unlikely that all expected taxa would be present in the reach at the same time due to species rarity and associated abundances, habitat preferences and seasonal emergences. Sampling of invertebrates was limited by deep water likely underestimating the taxa present in the reach at the time of sampling.

The MIRAI results indicate a moderately to largely modified (class C/D) macroinvertebrate community. The drivers predominantly contributing to the modified state was water quality impairment followed by flow modification within the reach. The habitat diversity although adequate for aquatic biota 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.

*Table 8-12 MIRAI Score for the Orange River reach*

| Invertebrate Metric Group | Orange River |
|---|---|
| Flow Modifications | 60.3 |
| Habitat | 67.2 |
| Water Quality | 47.5 |
| **Ecological Score** | **58.8** |
| **Category** | **C/D** |

### 8.2.4 Fish Assessment

Fish sampling was conducted at sites Up and Down to assess the integrity of the fish community within the Orange River reach associated with the Project. Fish were collected using electrofishing, cast netting and visual observation techniques in all available biotopes. Biotopes sampled were predominantly slow to fast-moving water over bedrock, stones, gravel, sand and mud biotopes. Cover features included bedrock, stones, marginal vegetation, undercut banks and the water column. Sampling was limited to the wadeable margins of the river both upstream and downstream of the WWTW, which limited the sampling effort across available habitat, underestimating the full fish assemblages present at the two sampling sites.

*Table 8-13 Fish data collected during the survey (April 2021)*

| Scientific name | Common name | IUCN Status (IUCN, 2021) | Probability of Occurrence | Collected | | Sensitivity | |
|---|---|---|---|---|---|---|---|
| | | | | Up | Down | No-flow | Phys-chem |
| *Austroglanis sclateri* | Rock catfish | LC | Medium | No | Yes | 3.2 | 2.6 |
| *Clarias gariepinus* | Sharptooth Catfish | LC | High | Yes | Yes | 1.7 | 1.0 |
| *Enteromius anoplus* | Chubbyhead Barb | LC | Medium | No | No | 2.3 | 2.6 |
| *Enteromius paludinosus* | Straightfin Barb | LC | Medium | No | No | 2.1 | 1.8 |
| *Enteromius trimaculatus* | Threespot Barb | LC | High | Yes | Yes | 2.7 | 1.8 |
| *Labeo capensis* | Orange River Labeo | LC | High | Yes | Yes | 3.5 | 2.8 |
| *Labeo umbratus* | Moggel | LC | Medium | No | No | 2.7 | 1.6 |
| *Labeobarbus aeneus* | Smallmouth Yellowfish | LC | High | Yes | Yes | 3.3 | 2.5 |
| *Labeobarbus kimberleyensis* | Largemouth Yellowfish | NT | Medium | No | No | 3.8 | 3.6 |
| *Pseudocrenilabrus philander* | Southern mouthbrooder | LC | High | Yes | No | 1.0 | 1.4 |

| Scientific name | Common name | IUCN Status (IUCN, 2021) | Probability of Occurrence | Collected | | Sensitivity | |
|---|---|---|---|---|---|---|---|
| | | | | Up | Down | No-flow | Phys-chem |
| *Tilapia sparrmanii* | Banded Tilapia | LC | High | Yes | No | 0.9 | 1.4 |
| *Oreochromis mossambicus* | Mozambique Tilapia | NT | Medium | No | No | 0.9 | 1.3 |
| *Cyprinus carpio* | Carp | Exotic | High | No | No | 2.1 | 1.1 |
| *Ctenopharyngodon idella* | Grass Carp | Exotic | Medium | No | No | 3.3 | 1.5 |
| *Gambusia affinis* | Mosquito Fish | Exotic | High | Yes | Yes | 2 | 2 |
| *Micropterus salmoides* | Largemouth Bass | Exotic | Low | No | No | 1.1 | 2.3 |
| **Total Indigenous Species** | | | **12** | **6** | **5** | **2.2** | **1.9** |
| **Total Exotic Species** | | | **4** | **1** | **1** | **2** | **2** |
| LC: Least Concern<br>NT: Near Threatened | | | | | | | |

Fish have different sensitivities or levels of tolerance to various aspects that they are subjected to within the aquatic environment. These tolerance levels are rated with a sensitivity score as presented in Table 8-14. These tolerance levels are scored to show each fish species sensitivity to flow and physico-chemical modifications. The fish species collected during the survey ranged from tolerant (*Clarias gariepinus*) to moderately intolerant (*Labeobarbus aeneus*) of flow and physico-chemical (water quality) modifications. The average sensitivity of the sampled fish community was moderately tolerant indicating acceptable water quality conditions and habitat conditions at both sampled sites (Table 8-13).

*Table 8-14 Intolerance rating and sensitivity of fish species*

| Sensitivity Score | Tolerance/Sensitivity Level |
|---|---|
| **1-2** | Tolerant = Low/very low sensitivity |
| **2-3** | Moderately tolerant = Moderate sensitivity |
| **3-4** | Moderately intolerant = High sensitivity |
| **4-5** | Intolerant = Very high sensitivity |

Seven of the twelve expected indigenous fish species were collected in the project area during the survey (Table 8-13). A single additional, yet exotic (alien invasive) fish species, namely *Gambusia affinis* (Mosquito Fish) was collected during the survey. Images of fish species collected are presented in Table 8-15. 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. The survey results did not reflect this 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 provided other techniques such as gill netting and the use of a boat be employed. Although not sampled during the survey, the specialist can confirm the presence of Carp and Grass Carp in the project area, as local fisherman were fishing for them in the project area, while Upington is popular destination for recreational fisherman to target Largemouth Yellowfish. The current sampled community indicated a largely modified community.

*Table 8-15 Photographs of fish species collected during the survey*

| | |
|---|---|
|  *Austroglanis sclateri* |  *Clarias gariepinus* |
|  *Barbus trimaculatus* |  *Labeo capensis* |
|  *Labeobarbus aeneus* |  *Pseudocrenilabrus philander* |
|  *Tilapia sparrmanii* |  *Gambusia affinis* (Exotic) |

### 8.2.5 Present Ecological State

The PES of the Orange River reach is presented in Table 8-16.

The results indicate that the Orange River reach was in a largely modified state during the 2021 study. The modified state of the system was attributed to modifications to ecological drivers comprising water quality deterioration and flow modification which were directly related to catchment related land use. Further, instream and riparian habitat modifications were observed during the study, which have reduced habitat diversity and integrity. Cumulatively, the modified water quality, flow and habitat drivers have 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. The Orange River catchment has been altered from reference conditions, which is expected due to its location within an urban and agricultural setting. The misuse and mismanagement of the river has resulted in its degraded ecological state, indicating the need for rehabilitation efforts and strict water quality guideline for K-WWTW and Orange River Catchment. Despite the current levels of degradation, the Orange River does express sensitivity to further degradation.

*Table 8-16 The PES of the sampled watercourse reach*

| Category | Orange River |
|---|---|
| Instream Assessment | C |
| Riparian Assessment | D |
| Macroinvertebrate Response Assessment Index | C/D |
| Fish | D |
| EcoStatus | Largely Modified (class D) |

# 9 Buffer/ Sensitivity Assessment

For the purposes of this study a 32 m regulation area/ buffer was included from a watercourse edge for developments under GNR 324 Activity 14 (Development with a footprint of greater than 10 square meters, where the development has no development setback within 32 meters from the edge of a watercourse). Typically, this type of development is associated with several key impacts which include increased inputs of treated effluent (contaminated water) that is likely to shift the current hydrological regime and alter the physico-chemical makeup of the receiving watercourse. Figure 9-1 illustrates the proximity of the perimeter fences to the Orange River with the southern corner of the boundary located within 1 m of the watercourse edge. The final effluent is directly discharged into the Orange River and 32 m buffer zone and is considered unavoidable. The Orange River must be considered as having a High sensitivity, while the 32 m buffer zone has Moderate sensitivity. All other non-aquatic areas within the Project area were assigned a Low sensitivity from a water resource perspective.

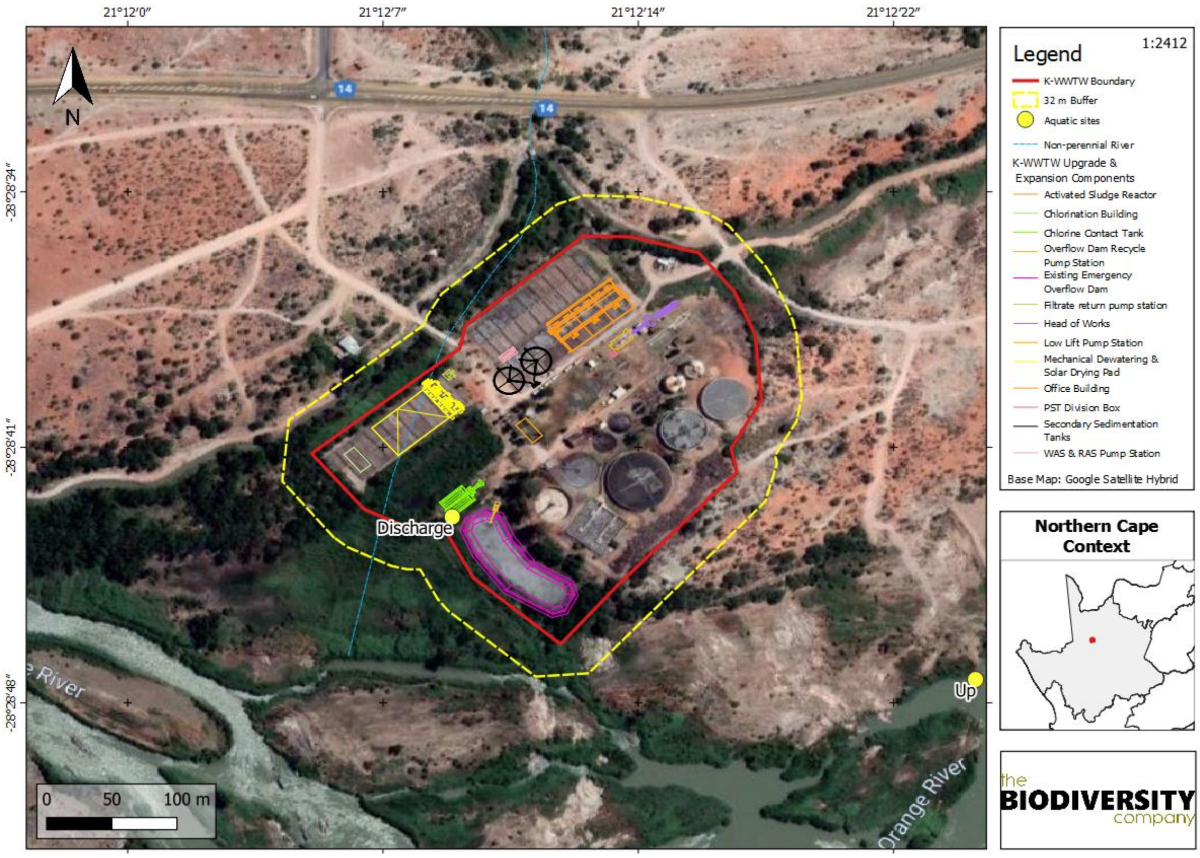


*Figure 9-1 Water resource sensitivity map illustrating 32 m buffer*

The non-perennial drainage line 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 as presented in Figure 9-2. The reedbed in the south western area associated with the discharge area is comprised of *Phragmites sp* and it is expected that the reedbed offers some phytoremediation capacity to the treated effluent (Figure 9-3). The flow paths and the association of the reedbed would need ground truthing provided alien vegetation removal take place to facilitate access. This reedbed is dominated by common widespread *Phragmites sp* that are tolerant of altered physico-chemical conditions and is considered to have a low sensitivity to the Project. The reedbed would fall within the riparian area associated with the Orange River.

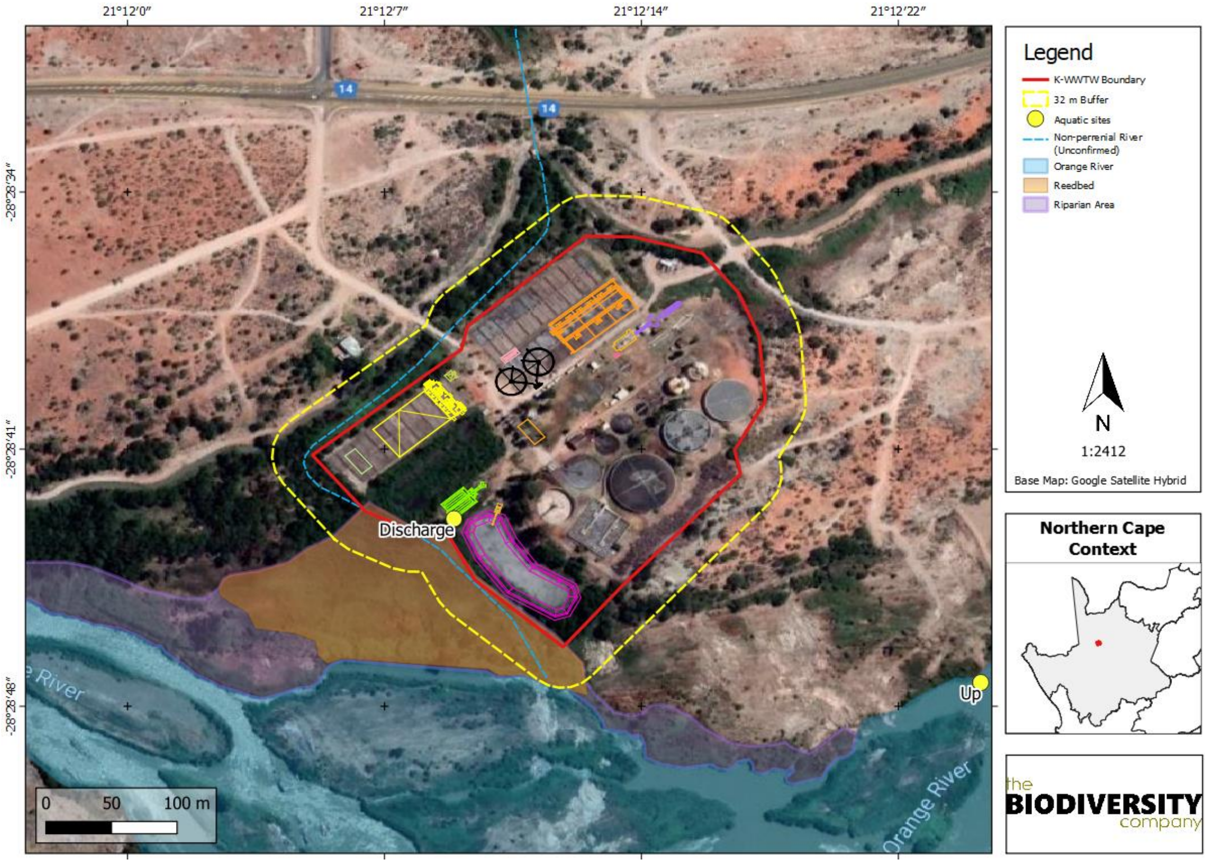


*Figure 9-2 Water resource sensitivity map illustrating updated drainage line and riparian areas*

*Figure 9-3 Phragmites sp dominating reedbed and overgrown access gate to drainage line*

# 10 Risk / Impact Assessment

This section represents the risk / impact assessment for the proposed K-WWTW upgrades and expansions. The upgrade and expansion of the K-WWTW will take place within the confines of the existing perimeter fence. The proposed upgrade and expansion are to increase the capacity of the K-WWTW from 16 to 24 Megalitres per day, with the potential reuse of the facilities effluent, while improving the current treatment efficiency to meet the DWS effluent quality standards.

The findings of this water resource assessment reveals that under the current layout, the Project is located on the northern bank of the Orange River, with an associated discharge of treated effluent into the adjacent river. The proposed upgrades are necessary and are located within an existing area of impact with limited impacts expected beyond the project footprint. Therefore, majority of the anticipated impacts would largely be restricted to within the permitter fence. This is apart from the discharge of treated effluent into the Orange River and associated impacts on this system.

The various risks anticipated for the different aspects and activities associated with the proposed project are detailed in Table 10-1 and Table 10-2. As per the Department of Environmental Affairs (2013) mitigation hierarchy (Figure 10-1), these risks should be minimised through the implementation of the various mitigation measures as outlined below.

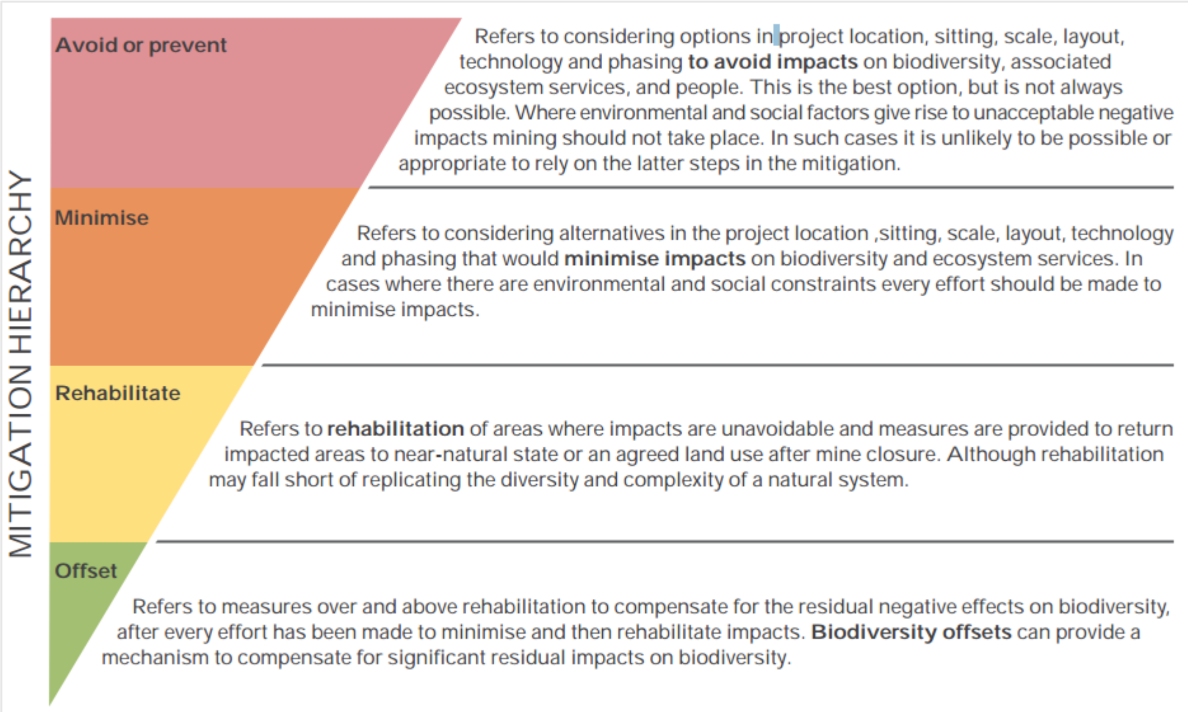


*Figure 10-1 The mitigation hierarchy as described by the DEA (2013)*

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.

For the operational activities, mitigation is limited, and direct degradation of aquatic habitat and associated community structures is inevitable. Consequently, following the DEA mitigation hierarchy the adverse effects to the receiving watercourses will need to be ameliorated through the implementation of watercourse rehabilitation. This could involve rehabilitation of disturbed river banks in the general project area to improve the phytoremediation capacity of the system. Furthermore, the proposed project requires a full water use licence as the associated water use activities trigger sections 21 (c) Impeding or diverting the flow of water in a watercourse, (f) discharging waste or water containing waste into a water resource, and (i) Altering the bed, banks, courses or characteristics of a watercourse.

*Table 10-1 Impacts assessed for the proposed project*

| 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 |
| **Compiled by** | **Dale Kindler (Pr. Sci. Nat. 114743)** | |

*Table 10-2 DWS Risk Impact Matrix for the proposed project*

| 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 "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

## 10.1 Mitigation Measures

The prescribed mitigation measures for the project include the following:

### 10.1.1 Mitigation for Altered Surface Flow, & Hydrological Regime

The following water quality specific mitigation measures are provided:

- The recommended buffer zones (32 m) 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;
- 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;
- 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; and
- 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.

### 10.1.2 Mitigation for Impaired Water Quality

The following water quality specific mitigation measures are provided:

- 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 too 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;
- 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;
- 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;
- 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 pre-fabricated 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, these should be serviced off-site;
- Adequate sanitary facilities and ablutions on the servitude 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; and
- 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 operation 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 water courses;
- 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 personnel 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 National Water Act for both discharge and irrigation (downstream users).

### 10.1.3 Mitigation for Erosion & Sedimentation

The following water quality specific mitigation measures are provided:

- All removed soil and material must not be stockpiled within the system. 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 the system;
- 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; and

- 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; and
- Landscape and re-vegetate all cleared areas as soon as possible to limit erosion potential.

### 10.1.4 Mitigation for Alien Vegetation Establishment

The following alien vegetation establishment specific mitigation measures are provided:

- Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the project footprint; and
- 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.

## 10.2 Recommendations

The following are recommendations made in support of the water resource assessment:

- 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 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 od 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 brought about by the effluent discharges. Table 10-3 highlights some important aspects to monitor in reference to aquatic biota for the life of the K-WWTW facility.

*Table 10-3 Aquatic Ecology Monitoring Plan*

| Location | Monitoring objectives | Frequency of monitoring | Parameters to be monitored |
|---|---|---|---|
| **Current sites used in this assessment** | Overall Aquatic PES. | Biannual (high and low flow) | Standard River Ecosystem Monitoring Programme (Ecostatus) methods. |
| **Current sites used in this assessment** | Determine if water quality deterioration is occurring. | Biannual (high and low flow) | SASS5 and ASPT scores should not decrease. |
| | | Bi-monthly (operation phase) | Chemical parameters used for National WWTW discharge standards. |
| **Current sites used in this assessment** | Determine if water/habitat quality deterioration is occurring. | Biannual (high and low flow) | Monitor for presence of fish. |

# 11 Conclusion

A total of three aquatic sampling sites were selected to establish baseline riverine conditions for the proposed K-WWTW upgrades and expansions. 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. Desktop information indicated that the Orange River catchment associated with the Project was largely modified. The 2021 Ecostatus determination indicated similar conditions to the desktop information for the Orange River with a largely modified status attained from the data collected.

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 landuse, 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 where influence was present, however 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 landuse 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 reach providing an indication of the misuse and mismanagement of the river and riparian areas.

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.

## 11.1 Impact Assessment and Statement

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.

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# 13 Appendix A: Specialist Expertise & Declarations

**Dale Kindler**

Dale Kindler is Pr. Sci. Nat. registered (114743) in aquatic science and completed his M. Sc. in Aquatic Health at the University of Johannesburg. He has eight (8) years' experience in conducting Aquatic Specialist Assessments and is SASS 5 Accredited with the Department of Water and Sanitation (DWS). Dale has completed numerous specialist studies locally and internationally, ranging from basic assessments to Environmental Impact Assessments (EIAs) following IFC standards.

I, **Dale Kindler**, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Dale Kindler

Aquatic Specialist

The Biodiversity Company

May 2021

**<u>APPENDIX D3:</u> Phase 1 Cultural Heritage Impact Assessment**

**Phase 1 Cultural Heritage Impact Assessment:**

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

**Prepared for:**

Nemai Consulting: Mr D Henning

- Postal Address: P O Box 1673, Sunninghill, 2157; Tel: 011 781 1730; E-mail: donavanh@nemai.co.za

**Prepared by:**

J A van Schalkwyk (D Litt et Phil),

- Heritage Consultant: ASAPA Registration No.: 164 - Principal Investigator: Iron Age, Colonial Period, Industrial Heritage.
- Postal Address: 62 Coetzer Avenue, Monument Park, 0181; Tel: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

**Report No:** 2021/JvS/036

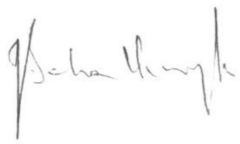
- Status: Final
- Date: May 2021
- Revision No: -
- Date: -

**Submission of the report:**

It remains the responsibility of the client to submit the report to the South African Heritage Resources Agency (SAHRA) or relevant Provincial Heritage Resources Agency (PHRA) by means of the online SAHRIS System.

**Specialist competency:**

Johan A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 40 years. Originally based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape Province, Northern Cape Province, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. Based on this work, he has curated various exhibitions at different museums and has published more than 70 papers, most in scientifically accredited journals. During this period, he has done more than 2000 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.



J A van Schalkwyk
Heritage Consultant
May 2021

**SPECIALIST DECLARATION**

I, J A van Schalkwyk, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist

J A van Schalkwyk
May 2021

## EXECUTIVE SUMMARY

**Phase 1 Cultural Heritage Impact Assessment:**
**THE PROPOSED UPGRADE AND EXPANSION OF THE KAMEELMOND WASTEWATER TREATMENT WORKS IN UPINGTON, NORTHERN CAPE PROVINCE**

It is proposed to upgrade and expand the existing Kameelmond Wastewater Treatment Works (K-WWTW) located on the south western outskirts of Upington, Northern Cape Province. The K-WWTW have been in operation since the 1970s, with the last upgrade and expansion having taken place in the 1990s.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Nemai Consulting* to conduct a cultural heritage assessment to determine if the proposed upgrade and expansion of the K-WWTW would have an impact on any sites, features or objects of cultural heritage significance.

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. The HIA consisted of a desktop study (archival sources, database survey, maps and aerial imagery) and a physical survey that included the interviewing of relevant people. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

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.

<u>Identified sites</u>

After reviewing the K-WWTW facility, the following can be said about it:

- 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;
- No precolonial or early historical features were identified within the boundary of the project area.

<u>Impact assessment and proposed mitigation measures</u>

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

<u>Legal requirements</u>

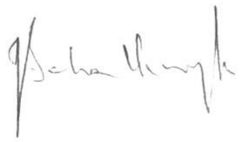
The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the project area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that project area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological assessment is required.
- 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. The appropriate steps to take are indicated in Section 9 of the report, as well as in the **Management Plan: Burial Grounds and Graves, with reference to general heritage sites**, in the Addendum, Section 12.4.



J A van Schalkwyk
Heritage Consultant
May 2021

## TECHNICAL SUMMARY

| **Project description** | |
|---|---|
| Description | Repair and upgrade of the Kameelmond Wastewater Treatment Works, Upington region |
| Project name | Kameelmond Wastewater Treatment Works Upgrade |

| **Applicant** |
|---|
| - |

| **Environmental assessors** |
|---|
| Mr D Henning |
| Nemai Consulting |

| **Property details** | |
|---|---|
| Province | Northern Cape |
| Magisterial district | Upington |
| Local municipality | Dawid Kruiper |
| Topo-cadastral map | 2821AC |
| Farm name | Upington Commonage |
| Closest town | Upington |
| Coordinates | Centre point (approximate) |

| No | Latitude | Longitude | No | Latitude | Longitude |
|---|---|---|---|---|---|
| 1 | S 28,47761 | E 21,20381 | | | |
| .kml files[1] | | | | | |

| **Development criteria in terms of Section 38(1) of the NHR Act** | Yes/No |
|---|---|
| Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length | No |
| Construction of bridge or similar structure exceeding 50m in length | No |
| Development exceeding 5000 sq m | Yes |
| Development involving three or more existing erven or subdivisions | No |
| Development involving three or more erven or divisions that have been consolidated within past five years | No |
| Rezoning of site exceeding 10 000 sq m | No |
| Any other development category, public open space, squares, parks, recreation grounds | No |

| **Land use** | |
|---|---|
| Previous land use | Vacant |
| Current land use | Wastewater treatment works |

[1] Left click on the icon to open the file in Google Earth, if installed on the computer. Alternatively, right click on the icon. In dialog box, select "Save Embedded File to Disk" and save to folder of choice.

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## GLOSSARY OF TERMS AND ABBREVIATIONS

### TERMS

**Bioturbation:** The burrowing by small mammals, insects and termites that disturb archaeological deposits.

**Cumulative impacts:** "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 existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

**Debitage:** Stone chips discarded during the manufacture of stone tools.

**Factory site:** A specialised archaeological site where a specific set of technological activities has taken place – usually used to describe a place where stone tools were made.

**Historic Period**: Since the arrival of the white settlers - c. AD 1830 - in this part of the country.

**Holocene:** The most recent time period, which commenced c. 10 000 years ago.

**Iron Age** (also referred to as **Early Farming Communities**)**:** Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

| | |
|---|---|
| Early Iron Age | AD 200 - AD 900 |
| Middle Iron Age | AD 900 - AD 1300 |
| Later Iron Age | AD 1300 - AD 1830 |

**Midden:** The accumulated debris resulting from human occupation of a site.

**Mitigation**, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

**National Estate:** The collective heritage assets of the Nation.

**Pleistocene:** Geological time period of 3 000 000 to 20 000 years ago.

**Stone Age:** The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

| | |
|---|---|
| Early Stone Age | 2 500 000 - 250 000 Before Present |
| Middle Stone Age | 250 000 - 40 000 - 25 000 BP |
| Later Stone Age | 40-25 000 - until c. AD 200 |

**Tradition:** As used in archaeology, it is a seriated sequence of artefact assemblages, particularly ceramics.

### ACRONYMS and ABBREVIATIONS

| | |
|---|---|
| AD | Anno Domini (the year 0) |
| ASAPA | Association of Southern African Professional Archaeologists |

| | |
|---|---|
| BC | Before the Birth of Christ (the year 0) |
| BCE | Before the Common Era (the year 0) |
| BP | Before Present (calculated from 1950 when radio-carbon dating was established) |
| CE | Common Era (the year 0) |
| CRM | Cultural Resources Management |
| CS-G | Chief Surveyor-General |
| EAP | Environmental Assessment Practitioner |
| EIA | Early Iron Age |
| EMPr | Environmental Management Programme |
| ESA | Early Stone Age |
| HIA | Heritage Impact Assessment |
| I & AP's | Interested and Affected Parties |
| ICOMOS | International Council on Monuments and Sites |
| LIA | Late Iron Age |
| LSA | Later Stone Age |
| MIA | Middle Iron Age |
| MSA | Middle Stone Age |
| NASA | National Archives of South Africa |
| NHRA | National Heritage Resources Act |
| PHRA | Provincial Heritage Resources Agency |
| SAHRA | South African Heritage Resources Agency |
| SAHRIS | South African Heritage Resources Information System |
| WUL | Water Use Licence |

## COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

| **Requirements of Appendix 6 – GN R982** | **Addressed in the Specialist Report** |
|---|---|
| 1. (1) A specialist report prepared in terms of these Regulations must contain-<br>a) details of-<br>i. the specialist who prepared the report; and<br>ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; | <br><br>Front page<br>Page i<br>Addendum Section 5 |
| b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Page ii |
| c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 1 |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 4 |
| (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 7 |
| d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Section 4 |
| e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 4 |
| f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | Section 7<br>Figure 14 |
| g) an identification of any areas to be avoided, including buffers; | Section 8 |
| h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Figure 14<br>Section 7 |
| i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 2 |
| j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities; | Section 7 |
| k) any mitigation measures for inclusion in the EMPr; | Section 8 & 10 |
| l) any conditions for inclusion in the environmental authorisation; | Section 10 |
| m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 9 |
| n) a reasoned opinion-<br>i. whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | <br>Section 10<br><br><br>Section 8, 10 |
| o) a description of any consultation process that was undertaken during the course of preparing the specialist report; | - |
| p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | - |
| q) any other information requested by the competent authority. | - |
| (2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | - |

**Phase 1 Cultural Heritage Impact Assessment:**
**THE PROPOSED UPGRADE AND EXPANSION OF THE KAMEELMOND WASTEWATER TREATMENT WORKS IN UPINGTON, NORTHERN CAPE PROVINCE**

## 1. INTRODUCTION

### 1.1 Background

It is proposed to upgrade and expand the existing Kameelmond Wastewater Treatment Works (K-WWTW) located on the south western outskirts of Upington, Northern Cape Province. The K-WWTW have been in operation since the 1970s, with the last upgrade and expansion having taken place in the 1990s.

The K-WWTW is under ever increasing pressure to enhance serviceability of new residential, and to a lesser extent, industrial runoff located, located in the works runoff located in the Works' planned drainage area.

*Nemai Consulting* was contracted as independent environmental consultant to undertake the Basic Assessment for the development of the upgrade and expansion of the K-WWTW. All technical descriptions and details regarding the proposed project was obtained from the *Nemai Consulting* Background Information Document dated March 2021.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. However, according to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Nemai Consulting* to conduct a cultural heritage assessment to determine if the proposed upgrade and expansion of the K-WWTW would have an impact on any sites, features or objects of cultural heritage significance.

This report forms part of the Basic Assessment Process as required by the EIA Regulations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended and is intended for submission to the South African Heritage Resources Agency (SAHRA).

### 1.2 Terms and references

*The aim of a full HIA investigation is to provide an informed heritage-related opinion about the proposed development by an appropriate heritage specialist. The objectives are to identify heritage resources (involving site inspections, existing heritage data and additional heritage specialists if necessary); assess their significances; assess alternatives in order to promote heritage conservation issues; and to assess the acceptability of the proposed development from a heritage perspective.*

*The result of this investigation is a heritage impact assessment report indicating the presence/ absence of heritage resources and how to manage them in the context of the proposed development.*

*Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, on condition of successful implementation of proposed mitigation measures.*

1.2.1 *Scope of work*

The aim of this study is to determine if the proposed upgrade and expansion of the K-WWTW would have an impact on any sites, features or objects of cultural heritage significance. This included:

- Conducting a desk-top investigation of the project area;
- A visit to the proposed project area.

The objectives were to:

- 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;
- Provide guideline measures to manage any impacts that might occur during the construction phase as well as the implementation phase.

1.2.2 *Assumptions and Limitations*

The investigation has been influenced by the following factors:

- It is assumed that the description of the proposed project, provided by the client, is accurate;
- It is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (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;
- 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.

## 2. LEGISLATIVE FRAMEWORK

### 2.1 Background

Heritage Impact Assessments are governed by national legislation and standards and International Best Practise. These include:

- South African Legislation
    - National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA);
    - Mineral and Petroleum Resources Development Act, 2002 (Act No. 22 of 2002) (MPRDA);
    - National Environmental Management Act 1998 (Act No. 107 of 1998) (NEMA); and
    - National Water Act, 1998 (Act No. 36 of 1998) (NWA).
- Standards and Regulations
    - South African Heritage Resources Agency (SAHRA) Minimum Standards;
    - Association of Southern African Professional Archaeologists (ASAPA) Constitution and Code of Ethics;
    - Anthropological Association of Southern Africa Constitution and Code of Ethics.
- International Best Practise and Guidelines
    - ICOMOS Standards (Guidance on Heritage Impact Assessments for Cultural World Heritage Properties); and

- The UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (1972).

### 2.2 Heritage Impact Assessment Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, Section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority.

The National Heritage Resources Act (Act No. 25 of 1999, Section 38) provides guidelines for Cultural Resources Management and prospective developments:

*"38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:*

*(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
*(b) the construction of a bridge or similar structure exceeding 50m in length;*
*(c) any development or other activity which will change the character of a site:*
*(i) exceeding 5 000 $m_2$ in extent; or*
*(ii) involving three or more existing erven or subdivisions thereof; or*
*(iii) involving three or more erven or divisions thereof which have been consolidated within he past five years; or*
*(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;*
*(d) the re-zoning of a site exceeding 10 000 $m_2$ in extent; or*
*(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."*

And:

*"38 (3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:*

*(a) The identification and mapping of all heritage resources in the area affected;*
*(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;*
*(c) an assessment of the impact of the development on such heritage resources;*
*(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;*
*(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;*
*(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and*
*(g) plans for mitigation of any adverse effects during and after the completion of the proposed development."*

## 3. HERITAGE RESOURCES

### 3.1 The National Estate

The National Heritage Resources Act (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including-
    - ancestral graves;
    - royal graves and graves of traditional leaders;
    - graves of victims of conflict;
    - graves of individuals designated by the Minister by notice in the Gazette;
    - historical graves and cemeteries; and
    - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
    - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
    - objects to which oral traditions are attached or which are associated with living heritage;
    - ethnographic art and objects;
    - military objects;
    - objects of decorative or fine art;
    - objects of scientific or technological interest; and
    - books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

### 3.2 Cultural significance

In the NHRA, Section 2 (vi), it is stated that ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;

- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix (see Section 2 of Addendum) was developed whereby the above criteria were applied for the determination of the significance of each identified site. This allowed some form of control over the application of similar values for similar identified sites.

## 4. PROJECT DESCRIPTION

### 4.1 Site location

The project area is located in an area referred to as Kameelmond, on the located on the righthand bank of the Orange River, in the south western outskirts of Upington (Fig. 1). For more information, see the Technical Summary on p. V above.

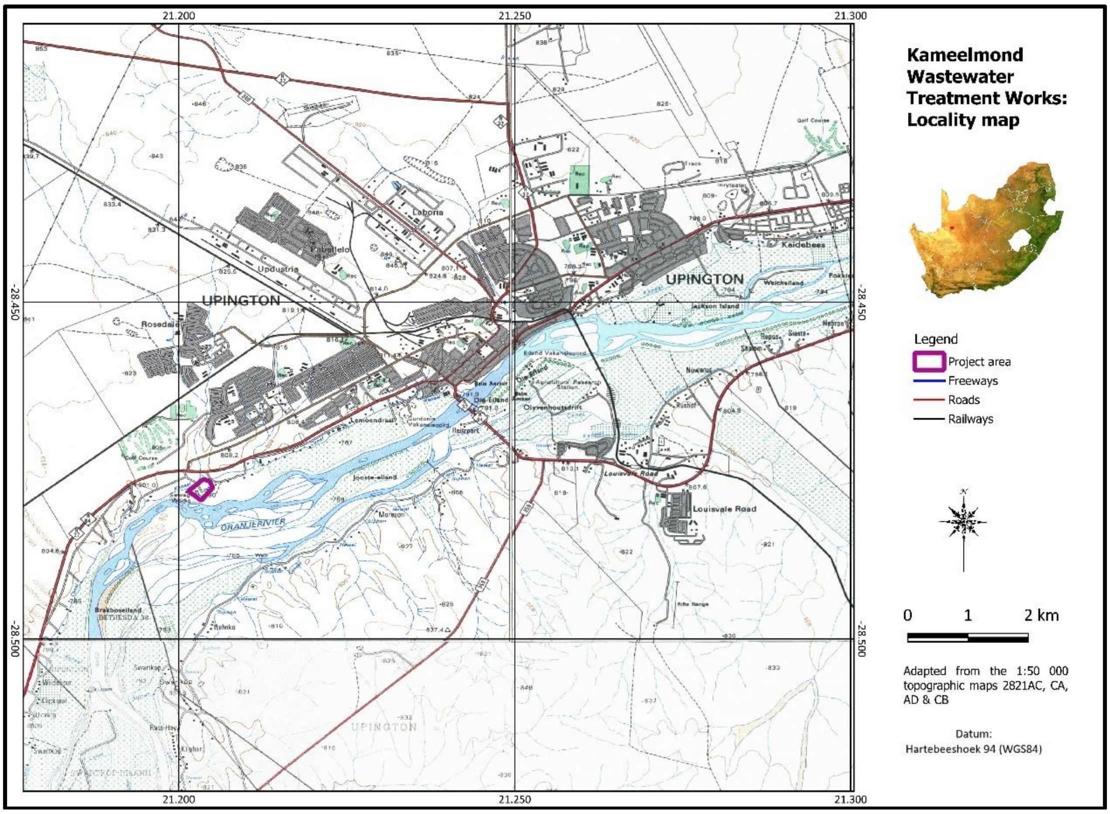



Figure 1. Location of the project area in regional context

### 4.2 Development proposal

The aim of the project is to increase the capacity of the K-WWTW from 16 to 24 Megalitres per day. The upgrade and expansion on the K-WWTW will take place within the confines of the existing perimeter fence (Fig. 2).

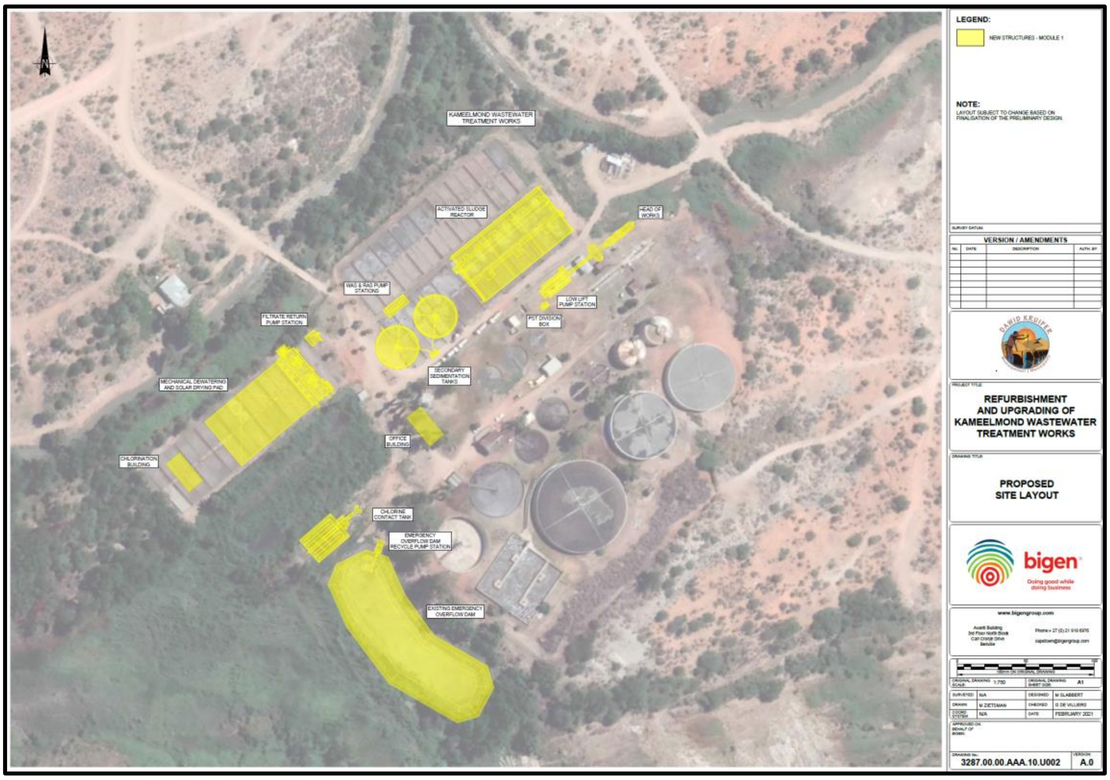



Figure 2. Layout of the project area
(Map supplied by Nemai)

The following description was taken *ad verbum* form the Background Information Document supplied by Nemai (2021).

Based on the Preliminary Design Report, which was compiled by Bigen Africa Services (Pty) Ltd in February 2021, the following components of the K-WWTW are to be upgraded and expanded:

**1) Head of Works**

A mothballed structure, previously used as the inlet works 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 Average Dry Weather Flow (ADWF) of 24 Megalitres per day and an Hourly Peak Flow (HPF) of 84 Megalitres per day (3 500 m3/hr).

A diesel-fired incinerator is currently used for the disposal of screenings at the K -WWTW. The incinerator will be discontinued as part of the upgrade and expansion works.

**2) Emergency Storage**

An existing emergency overflow pond, 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 m3. Based on this volume and a design emergency overflow rate of 500 m3/hr, the pond can provide a retention period of ±8 hrs during a peak influent event of 3500 m3/hr.

Based on the engineering investigations, it appears that a significant amount of sludge has accumulated in the pond. This sludge needs to be removed to create additional capacity.

A new recycle pump station will be installed to supply the content of the storage tank over an 8-hour period.

**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.

**4) Activated Sludge Train**
A new 12 Megalitres per day (ADWF) Activated Sludge Process (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 for solids separation and multiple internal recycles.

The ASP design is based on 3 main objectives, namely (1) substrate removal; (2) conversion of ammonia to nitrate; and (3) Biological Nitrogen Removal (specifically nitrogen and phosphate).

**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. 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.

**6) Sludge Stabilisation & Dewatering**
Sludge will be produced from two sludge trains, namely the existing Biological Trickling Filter 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 are:

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

K-WWTW currently has 96 drying beds, which 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.

An option evaluation 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:

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

## 5. STUDY APPROACH AND METHODOLOGY

### 5.1 Extent of the Study

This survey and impact assessment cover all facets of cultural heritage located in the project area as presented in Section 4 above and illustrated in Figures 1 & 2.

### 5.2 Methodology

*5.2.1 Pre-feasibility assessment*

The objectives of this review were to:

- Gain an understanding of the cultural landscape within which the project is located;
- Inform the field survey.

5.2.1.1 Survey of the literature
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 – see list of references in Section 11.

- Information on events, sites and features in the larger region were obtained from these sources.

5.2.1.2 Survey of heritage impact assessments (HIAs)
A survey of HIAs done for projects in the region by various heritage consultants was conducted with the aim of determining the heritage potential of the area – see list of references in Section 11.

- Information on sites and features in the larger region were obtained from these sources.

5.2.1.3 Data bases
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.

5.2.1.4 Other sources
Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature were obtained from these sources.

5.2.1.5 Comparative analysis
Previous experience in the documenting of Wastewater Treatment Works was drawn on to assist in assessing the significance of the K-WWTW (Van Schalkwyk 2007, 2011a, 2011b, 20111c, 2011d, 2012b, 2020). 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 repairs and 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 was 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 plant would have destroyed any such material. In addition, the dense riverine vegetation occurring on some sections obscured ground visibility.

5.2.1.6 Results

The results of the above investigation are presented in Figure 3 below – see list of references in Section 11 – and can be summarised as follows:

- Stone Age tools, dating to the MSA and LSA 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.
- Formal and informal burial sites occur sporadically throughout the region.

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**.*

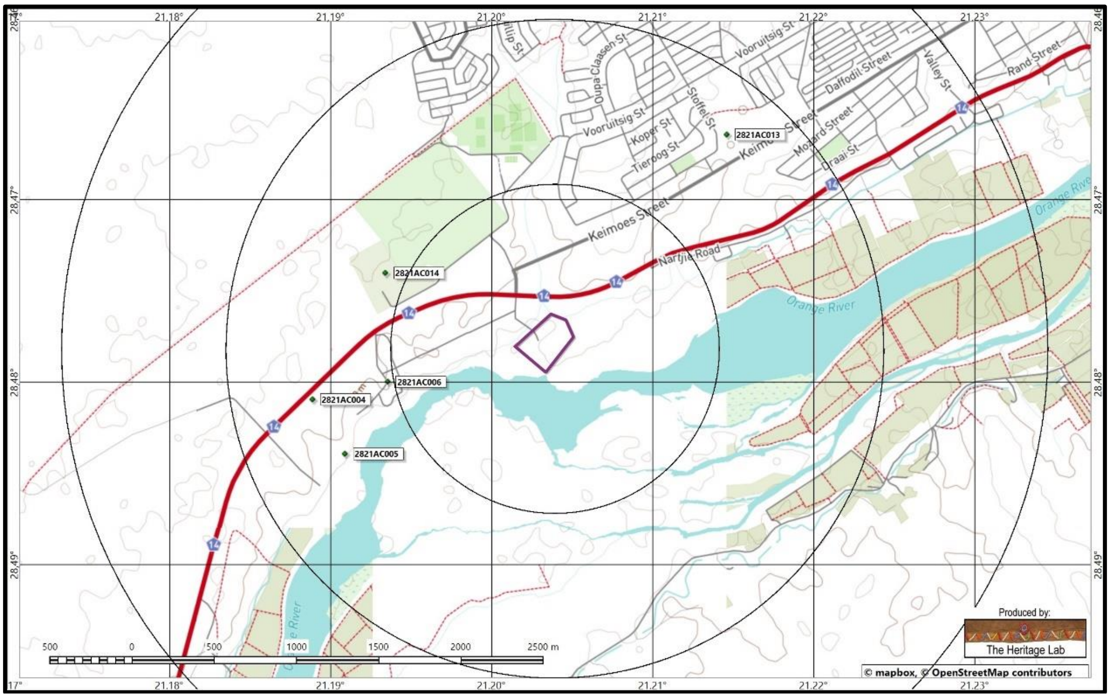



Figure 3. Location of known heritage sites and features in relation to the project area
(Circles spaced at a distance of 1km: heritage sites = coded green dots)

5.2.2 *Field survey*

The field survey was done according to generally accepted archaeological practices, and was aimed at locating all possible sites, objects and structures. The area that had to be investigated was identified by the *Nemai* by means of maps and .k*ml* files indicating the development area. This was loaded onto a Samsung digital device and used in Google Earth during the field survey to access the area.

The project area was visited on 19 May 2021 and was investigated by walking some transects across it – see Fig. 4 below.

- The transects were determined by the location of the various structures making up the treatment plant.

5.2.3 *Documentation*

All sites, objects and structures that are identified are documented according to the general minimum standards accepted by the archaeological profession. Coordinates of individual localities are determined by means of the *Global Positioning System* (GPS) and plotted on a map. This information is added to the description in order to facilitate the identification of each locality. Map datum used: Hartebeeshoek 94 (WGS84).

The track log and identified sites were recorded by means of a Garmin Oregon 550 handheld GPS device. Photographic recording was done by means of a Canon EOS 550D digital camera. Geo-rectifying of the aerial photographs and historic maps was done by means of a professional software package: ExpertGPS.


Figure 4. Map indicating the track log of the field survey.
(Site = purple polygon; track log = green line)

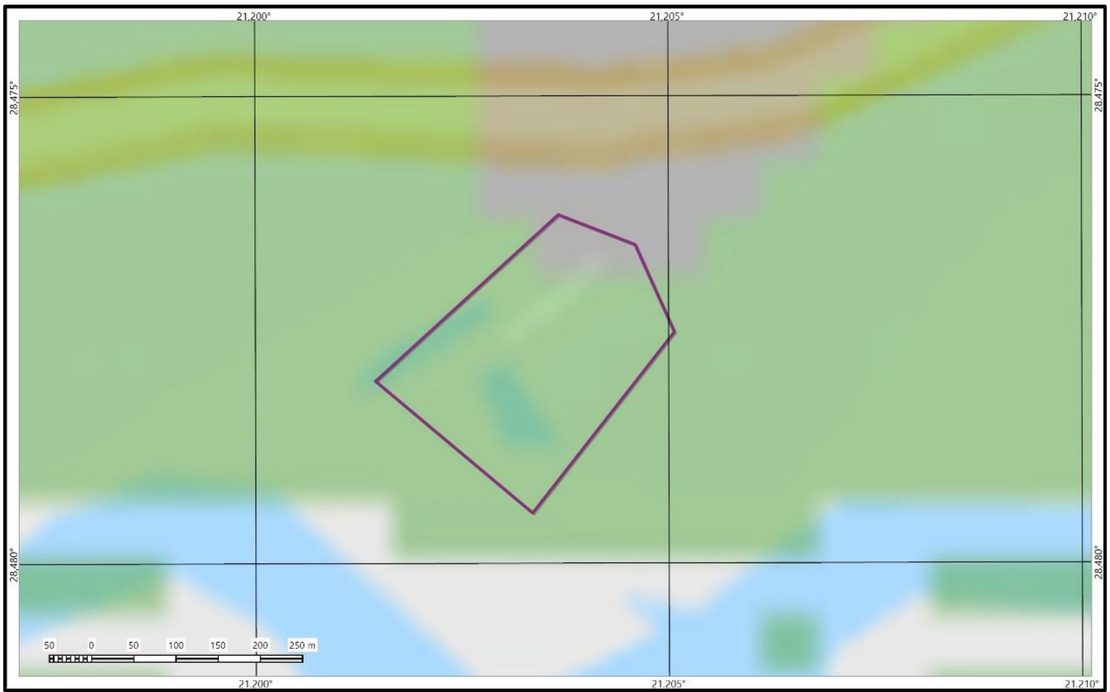
## 6. DESCRIPTION OF THE AFFECTED ENVIRONMENT

### 6.1 Physical Environment

The project area is located in a highly transformed infrastructural environment. The original vegetation is classified as Lower Gariep Alluvial Vegetation (Muncina & Rutherford 2006).

The geology of the region is made up of amphibolite, amphibole gneiss, subordinate biotite, quartz-feldspar and pelitic gneisses, calc-silicate rocks and mica schist. The topography is described as lowlands and hills. The Orange River forms the southern boundary of the project area.

The Palaeontological Sensitivity Map (SAHRIS) indicate that project area (Fig. 5) has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological assessment is required.




| Colour | Sensitivity | Required Action |
|---|---|---|
| RED | VERY HIGH | field assessment and protocol for finds is required |
| ORANGE/YELLOW | HIGH | desktop study is required and based on the outcome of the desktop study, a field assessment is likely |
| GREEN | MODERATE | desktop study is required |
| BLUE | LOW | no palaeontological studies are required however a protocol for finds is required |
| GREY | INSIGNIFICANT/ZERO | no palaeontological studies are required |
| WHITE/CLEAR | UNKNOWN | these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map. |

Figure 5. The Palaeontological sensitivity of the project area

**6.2 Cultural Landscape**

*The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the project area, within the context of their historic, aesthetic, scientific and social value, rarity and representivity.*

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.

6.2.1 Stone Age

Surveys done for example by Sampson (1985) to the south-east of the study area indicated a rich legacy in Stone Age sites in the Karoo. However, the region of the study area seems to have been a bit more marginal as no major sites or traditions have been identified in the region.

Occupation by early humans would probably date to the Middle Stone Age and would consist of open sites in the vicinity of stream beds or hills and outcrops. Population density might have increased during the Later Stone Age and people would have occupied rock shelters where available as well as open sites. During this later period they also produced rock engravings, although none are known from the immediate region.

Recently Parsons (2007, 2008) demonstrated that the so-called Swartkop and Dornfontein industries possibly relate to different socio-economies – those of hunter-gatherers and stock keepers. Based on an analysis of material recovered from five sites in the Northern Cape Province, all dating to the last two millennia, she compare variability between assemblages attributed to the Swartkop and Doornfontein industries and identify areas of overlap and difference.

6.2.2 *Historic period*

The town of Upington, originally known as Olijvenhoutsdrift, was founded in 1871 as part of a mission station by the German missionary Rev Schröder. The town was renamed in 1884 after Sir Thomas Upington, who was the Prime Minister of the Cape Colony and who visited the town in 1884.

An irrigation canal was started by Rev Schröder in 1883. It was completed in 1885. By 1884 there were already 77 irrigation farms. Nowadays, it is disputed that Schröder was the original builder of the canal, and it is claimed that he only carried on with an idea that was started by a local inhabitant by the name of Abraham September.

**6.3 Site specific review**

*Although landscapes with cultural significance are not explicitly described in the NHRA, they are protected under the broad definition of the National Estate (Section 3): Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate.*

*The examination of historical maps and aerial photographs help us to reconstruct how the cultural landscape has changed over time as is show how humans have used the land.*

From the official topographic map (Fig. 6), 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 (Fig. 7 & 8).

The 1971 version of the 1:50 000 topographic map (Fig. 9) shows a number of structures located all along the canal on the righthand bank of the river, with at least to located inside the project area.

- 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 (Fig. 10). 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.

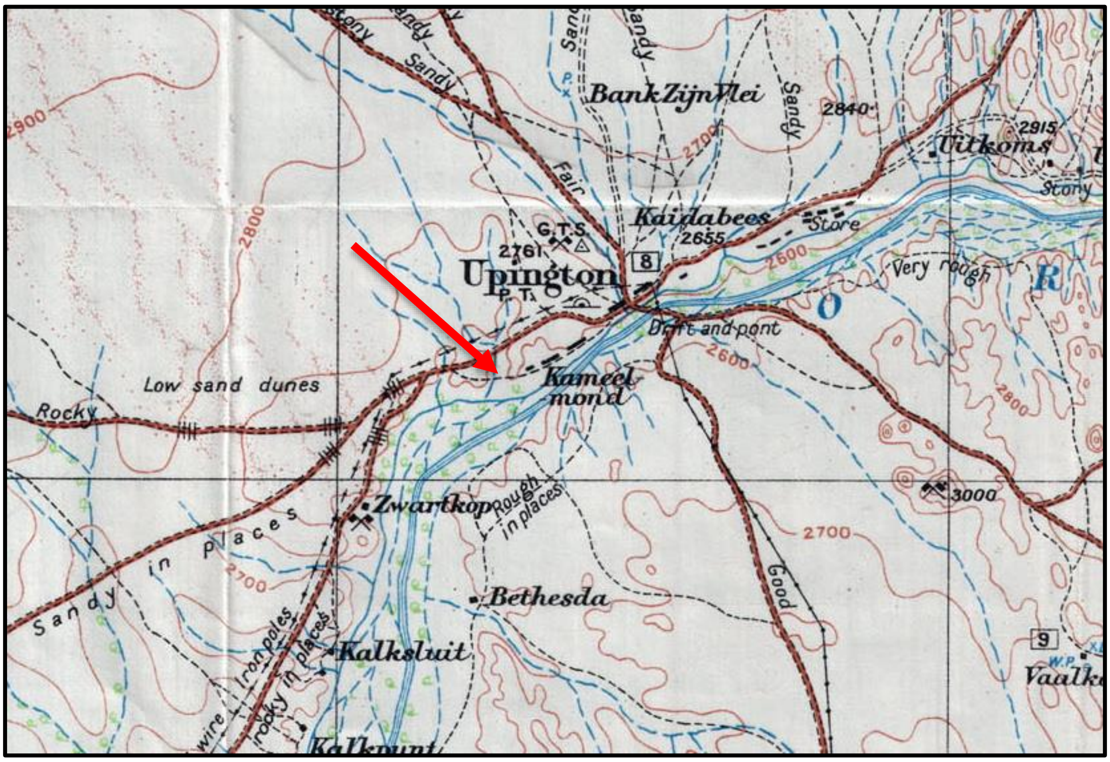



Figure 6. Section of the 1:250 000 topographic map dating to 1913
(Map: Cape of Good Hope: Upington (South-HD34/D))

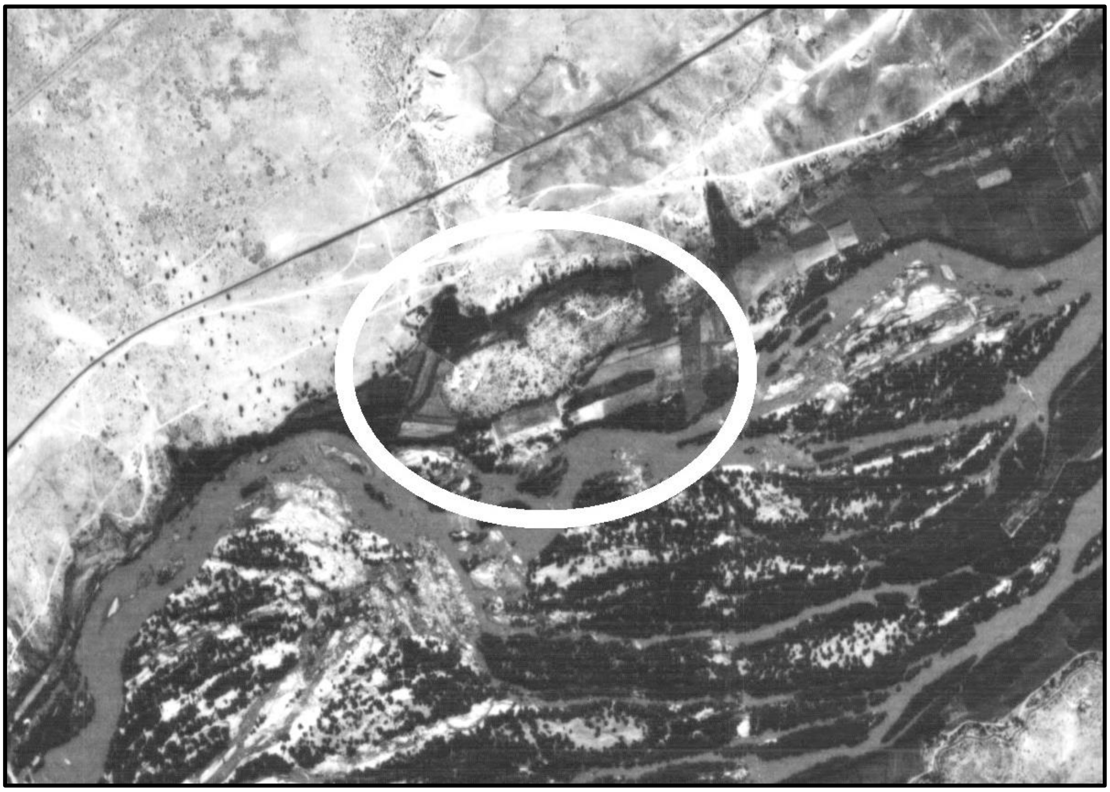


Figure 7. Aerial view of the project region dating to 1957
(CS-G photograph: 388_013_06805)

Figure 8. Aerial view of the project area dating to 1967
(CS-G photograph: 589_006_00882)

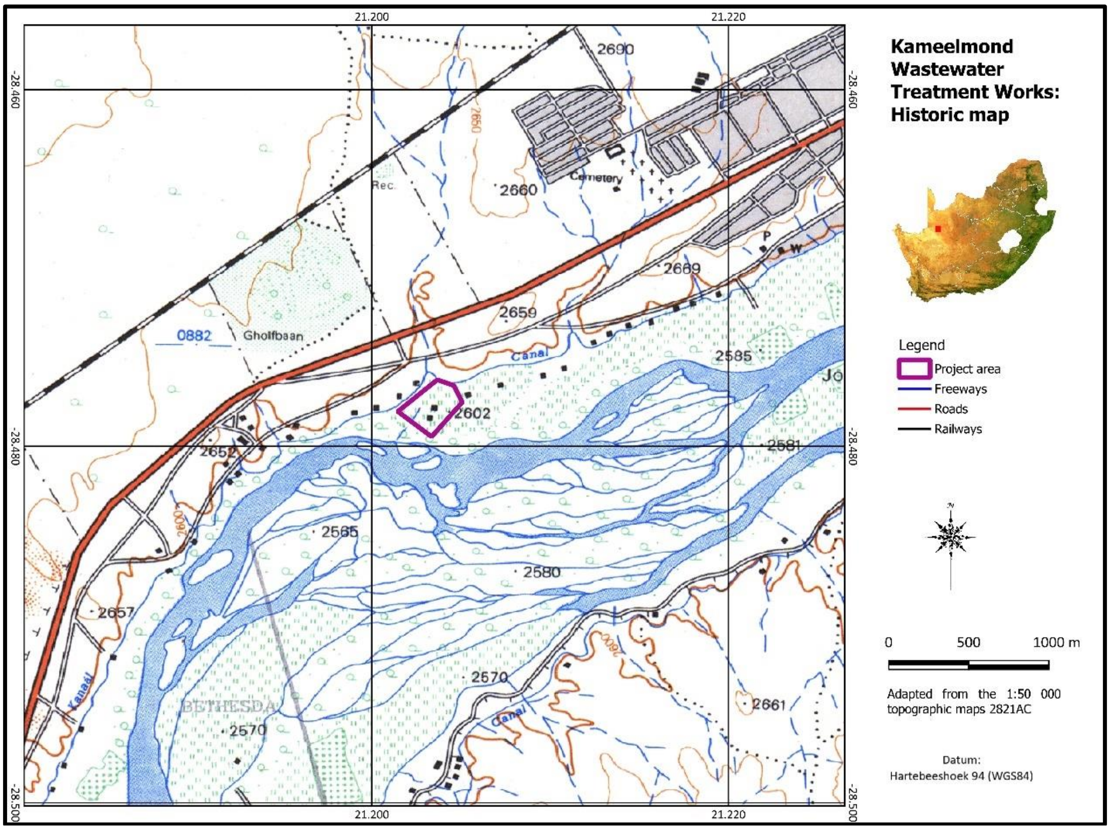



Figure 9. The project area on the 1973 version of the 1:50 000 topographic map

Figure 10. Aerial view of the project area dating to 1976
(CS-G photograph: 771_006_01690)


Figure 11. Aerial view of the project area dating to 2004
(Image: Google Earth)


Figure 12. Aerial view of the project area dating to 2021
(Image: Google Earth)


Access road


Monumental water feature, abandoned


Office building


Inlet pump station


Aeration tank


Primary settling tanks


Sludge digesters


Bio-Trickling filters

| | |
|---|---|
| <br>Sludge drying beds | <br>Emergency overflow dam |
| <br>Chlorine contact tank | <br>Eastern access road |

Figure 13. Views over the project area

## 7. SURVEY RESULTS

During the physical survey, the following sites, features and objects of cultural significance were identified in the project area (Fig. 14).

### 7.1 Stone Age

- No sites, features or objects of cultural significance dating to the Stone Age were identified in the project area.

### 7.2 Iron Age

- No sites, features or objects of cultural significance dating to the Iron Age were identified in the project area.

### 7.3 Historic period

- No sites, features or objects of cultural significance dating to the historic period were identified in the project area.

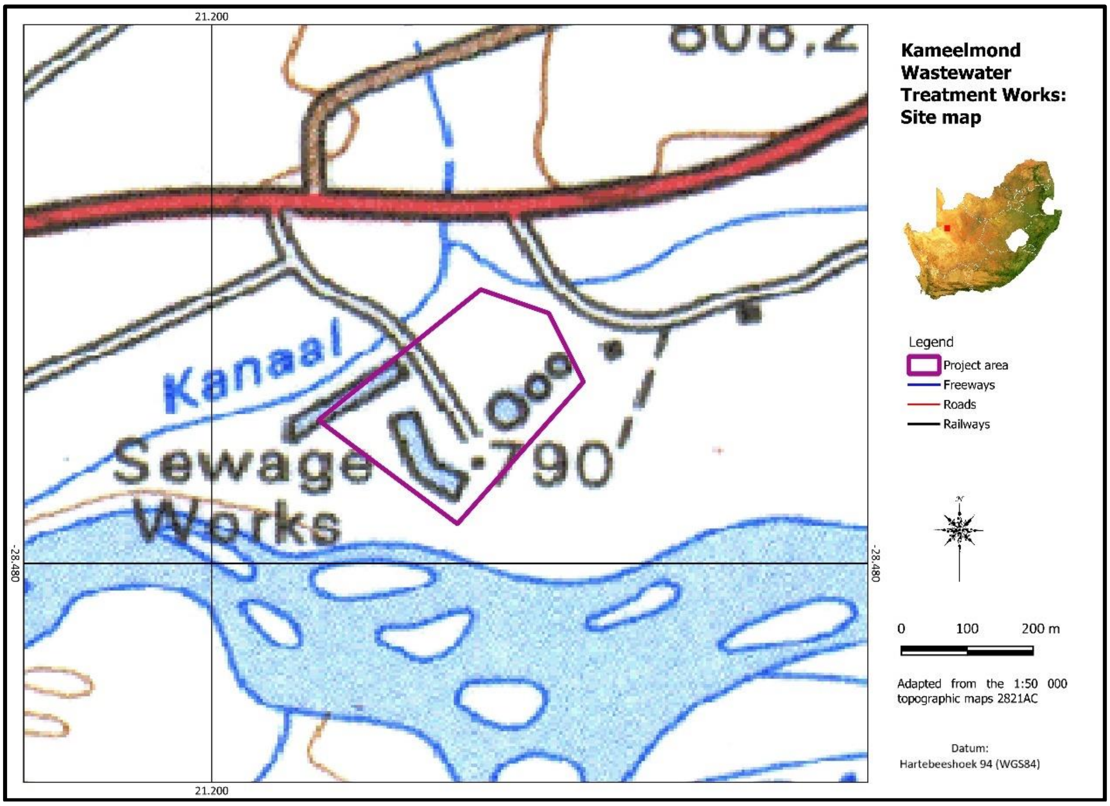



Figure 14. Location of heritage sites in the project area
(Please note that, as no sites or features were identified, nothing is shown on the map)

## 8. IMPACT ASSESSMENT RATINGS AND MITIGATION MEASURES

### 8.1 Impact assessment

Heritage impacts are categorised as:

- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries;
- Indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment;
- Cumulative impacts that are combinations of the above.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development and is summarised in Table 2 below:

**Table 1: Calculation of the impact on the identified heritage features**

| Kameelmond Wastewater Treatment Works | | |
|---|---|---|
| **Impact assessment** | | |
| As no sites, features or objects of cultural heritage significance were identified on the project area, there would be no impact as a result of the proposed development | | |
| | Without mitigation | With mitigation |
| Extent | Site (1) | Site (1) |
| Duration | Permanent (5) | Permanent (5) |
| Intensity | Minor (2) | Minor (2) |

| | | |
|---|---|---|
| Probability | Very improbable (1) | Very improbable (1) |
| Significance | Low (8) | Low (8) |
| Status (positive or negative) | Neutral | Neutral |
| Reversibility | n/a | n/a |
| Irreplaceable loss of resources? | No | No |
| Can impacts be mitigated | n/a | |
| Mitigation: Avoidance of site | | |
| Cumulative impact: None | | |

### 8.2 Mitigation measures

*Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.*

- For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

## 9. MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

Sources of risk were considered with regards to development activities defined in Section 2(viii) of the NHRA that may be triggered and are summarised in Table 2A and 2B below. These issues formed the basis of the impact assessment described. The potential risks are discussed according to the various phases of the project below.

### 9.1 Objectives

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and

- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

### 9.2 Control

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

**Table 2A: Construction Phase: Environmental Management Programme for the project**

| **Action required** | Protection of heritage sites, features and objects | | |
|---|---|---|---|
| **Potential Impact** | The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area. | | |
| **Risk if impact is not mitigated** | Loss or damage to sites, features or objects of cultural heritage significance | | |
| **Activity / issue** | **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
| 1. Removal of Vegetation<br>2. Construction of required infrastructure, e.g. access roads, water pipelines | See discussion in Section 9.1 above | Environmental Control Officer | During construction only |
| **Monitoring** | See discussion in Section 9.2 above | | |

**Table 2B: Operation Phase: Environmental Management Programme for the project**

| **Action required** | Protection of heritage sites, features and objects | | |
|---|---|---|---|
| **Potential Impact** | It is unlikely that the negative impacts identified for pre-mitigation will occur if the recommendations are followed. | | |
| **Risk if impact is not mitigated** | Loss or damage to sites, features or objects of cultural heritage significance | | |
| **Activity / issue** | **Mitigation: Action/control** | **Responsibility** | **Timeframe** |
| 1. Construction of additional required infrastructure, e.g. access roads, water pipelines | See discussion in Section 9.1 above | Environmental Control Officer | During construction only |
| **Monitoring** | See discussion in Section 9.2 above | | |

## 10. CONCLUSIONS AND RECOMMENDATIONS

It is proposed to upgrade and expand the existing Kameelmond Wastewater Treatment Works (K-WWTW) located on the south western outskirts of Upington, Northern Cape Province. The K-WWTW have been in operation since the 1970s, with the last upgrade and expansion having taken place in the 1990s.

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. The HIA consisted of a desktop study (archival sources, database survey, maps and aerial imagery) and a physical survey that included the interviewing of relevant people. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

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.

<u>Identified sites</u>

After reviewing the K-WWTW facility, the following can be said about it:
- 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;
- No precolonial or early historical features were identified within the boundary of the project area.

<u>Impact assessment and proposed mitigation measures</u>

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

<u>Legal requirements</u>

The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the project area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

<u>Reasoned opinion as to whether the proposed activity should be authorised</u>:

- From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the conditions proposed below.

<u>Conditions for inclusion in the environmental authorisation</u>:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that project area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological assessment is required.
- 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. The appropriate steps to take are indicated in Section 9 of the report, as well as in the **Management Plan: Burial Grounds and Graves, with reference to general heritage sites**, in the Addendum, Section 12.4.

## 11. REFERENCES

### 11.1 Data bases

Chief Surveyor General
Environmental Potential Atlas, Department of Environmental Affairs and Tourism.
Heritage Atlas Database, Pretoria
National Archives of South Africa
SAHRA Archaeology and Palaeontology Report Mapping Project (2009)
SAHRIS Database

### 11.2 Literature


Humphreys, A.J.B. 1976. Note on the southern limits of Iron Age settlement in the Northern Cape. *South African Archaeological Bulletin* 31(121/122):54-57

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Van Schalkwyk, J.A. 2007. *Heritage impact assessment for the planned development on the farm Hansmoeskraal, George Municipal District, Western Province*. Pretoria: Unpublished report 2007/KH/048.

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Van Schalkwyk, J.A. 2011a. *Heritage impact assessment for the proposed upgrade of the Baviaanspoort Wastewater Treatment Works, north of Mamelodi, Gauteng Province*. Pretoria: Unpublished report 2011/JvS/004.

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Van Schalkwyk, J.A. 2011c. Heritage impact assessment for the proposed expansion of the Sebokeng Wastewater Treatment Works, Sedibeng District Municipality, Gauteng Province. Pretoria: Unpublished report 2011/JvS/067.

Van Schalkwyk, J.A. 2011d. *Heritage impact assessment for the proposed expansion of the Rietspruit Wastewater Treatment Works, Sedibeng District Municipality, Gauteng Province*. Pretoria: Unpublished report 2011/JvS/068.

Van Schalkwyk, J.A. 2011e. *Heritage impact assessment report for the proposed establishment of the Inca Solar PV Power Plant, Kakamas region, Northern Cape Province*. Unpublished report 2011/JvS/030.

Van Schalkwyk, J.A. 2012a. *Heritage impact assessment for the proposed development of an agri-estate on the farm Melkstroom east of Upington, Gordonia magisterial district, Northern Cape Province*. Unpublished report 2012/JvS/012.

Van Schalkwyk, J.A. 2012b. *Heritage impact assessment for the proposed flood remedial measures at the Daspoort Wastewater Treatment works, City of Tshwane*. Pretoria: Unpublished report 2012/JvS/046.

Van Schalkwyk, J.A. 2020. *Phase 1 Cultural Heritage Impact Assessment: The proposed Msholi/Phumlani sewer pipeline and expansion of the Wastewater Treatment Works (WWTW) in the Rocky Drift region north of Mbombela, Mpumalanga Province*. Pretoria: Unpublished report 2020/JvS/083.

**11.3 Archival sources, maps and aerial photographs**

Google Earth
Aerial Photographs: Chief Surveyor-General
http://artefacts.co.za
https://csg.esri-southafrica.com
https://screening.environment.gov.za/screeningtool
https://sahris.sahra.org.za/map/palaeo
http://*vmus*.adu.org.za

## 12. ADDENDUM

### 1. Indemnity and terms of use of this report

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

Although all possible care is taken to identify all sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. The author of this report will not be held liable for such oversights or for costs incurred as a result of such oversights.

Although the author exercises due care and diligence in rendering services and preparing documents, he accepts no liability and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

## 2. Assessing the significance of heritage resources and potential impacts

A system for site grading was established by the NHRA and further developed by the South African Heritage Resources Agency (SAHRA 2007) and has been approved by ASAPA for use in southern Africa and was utilised during this assessment.

2.1 *Significance of the identified heritage resources*

According to the NHRA, Section 2(vi) the **significance** of a heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

**Matrix used for assessing the significance of each identified site/feature**

| | | | |
|---|---|---|---|
| **1. SITE EVALUATION** | | | |
| **1.1 Historic value** | | | |
| Is it important in the community, or pattern of history | | | |
| Does it have strong or special association with the life or work of a person, group or organisation of importance in history | | | |
| Does it have significance relating to the history of slavery | | | |
| **1.2 Aesthetic value** | | | |
| It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group | | | |
| **1.3 Scientific value** | | | |
| Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage | | | |
| Is it important in demonstrating a high degree of creative or technical achievement at a particular period | | | |
| **1.4 Social value** | | | |
| Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons | | | |
| **1.5 Rarity** | | | |
| Does it possess uncommon, rare or endangered aspects of natural or cultural heritage | | | |
| **1.6 Representivity** | | | |
| Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects | | | |
| Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class | | | |
| Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality. | | | |
| **2. Sphere of Significance** | High | Medium | Low |
| International | | | |
| National | | | |
| Provincial | | | |
| Regional | | | |
| Local | | | |
| Specific community | | | |

| | | |
|---|---|---|
| 3. Field Register Rating | | |
| 1. | National/Grade 1: High significance - No alteration whatsoever without permit from SAHRA | |
| 2. | Provincial/Grade 2: High significance - No alteration whatsoever without permit from provincial heritage authority. | |
| 3. | Local/Grade 3A: High significance - Mitigation as part of development process not advised. | |

| | | |
|---|---|---|
| 4. | Local/Grade 3B: High significance - Could be mitigated and (part) retained as heritage register site | |
| 5. | Generally protected 4A: High/medium significance - Should be mitigated before destruction | |
| 6. | Generally protected 4B: Medium significance - Should be recorded before destruction | |
| 7. | Generally protected 4C: Low significance - Requires no further recording before destruction | |

2.2 *Significance of the anticipated impact on heritage resources*

All impacts identified during the HIA stage of the study will be classified in terms of their significance. Issues would be assessed in terms of the following criteria:

**Nature of the impact**
A description of what causes the effect, what will be affected and how it will be affected.

**Extent**
The physical **extent**, wherein it is indicated whether:
- 1 - The impact will be limited to the site;
- 2 - The impact will be limited to the local area;
- 3 - The impact will be limited to the region;
- 4 - The impact will be national; or
- 5 - The impact will be international.

**Duration**
Here it should be indicated whether the lifespan of the impact will be:
- 1 - Of a very short duration (0–1 years);
- 2 - Of a short duration (2-5 years);
- 3 - Medium-term (5–15 years);
- 4 - Long term (where the impact will persist possibly beyond the operational life of the activity); or
- 5 - Permanent (where the impact will persist indefinitely).

**Magnitude (Intensity)**
The magnitude of impact, quantified on a scale from 0-10, where a score is assigned:
- 0 - Small and will have no effect;
- 2 - Minor and will not result in an impact;
- 4 - Low and will cause a slight impact;
- 6 - Moderate and will result in processes continuing but in a modified way;
- 8 - High, (processes are altered to the extent that they temporarily cease); or
- 10 - Very high and results in complete destruction of patterns and permanent cessation of processes.

**Probability**
This describes the likelihood of the impact actually occurring and is estimated on a scale where:
- 1 - Very improbable (probably will not happen);
- 2 - Improbable (some possibility, but low likelihood);
- 3 - Probable (distinct possibility);
- 4 - Highly probable (most likely); or
- 5 - Definite (impact will occur regardless of any prevention measures).

**Significance**
The significance is determined through a synthesis of the characteristics described above (refer to the formula below) and can be assessed as low, medium or high:

S = (E+D+M) x P; where
S = Significance weighting

E = Extent
D = Duration
M = Magnitude
P = Probability

| **Significance of impact** | | |
|---|---|---|
| Points | Significant Weighting | Discussion |
| < 30 points | Low | Where this impact would not have a direct influence on the decision to develop in the area. |
| 31-60 points | Medium | Where the impact could influence the decision to develop in the area unless it is effectively mitigated. |
| > 60 points | High | Where the impact must have an influence on the decision process to develop in the area. |

**Confidence**

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

**Status**

- The status, which is described as either positive, negative or neutral.

**Reversibility**

- The degree to which the impact can be reversed.

**Mitigation**

- The degree to which the impact can be mitigated.

| **Nature**: | | |
|---|---|---|
| | Without mitigation | With mitigation |
| **Construction Phase** | | |
| Probability | | |
| Duration | | |
| Extent | | |
| Magnitude | | |
| Significance | | |
| Status (positive or negative) | | |
| **Operation Phase** | | |
| Probability | | |
| Duration | | |
| Extent | | |
| Magnitude | | |
| Significance | | |
| Status (positive or negative) | | |
| Reversibility | | |
| Irreplaceable loss of resources? | | |
| Can impacts be mitigated | | |

**3. Mitigation measures**

- *Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.*

Impacts can be managed through one or a combination of the following mitigation measures:

- Avoidance
- Investigation (archaeological)
- Rehabilitation
- Interpretation
- Memorialisation
- Enhancement (positive impacts)

For the current study, the following mitigation measures are proposed, to be implemented only if any of the identified sites or features are to be impacted on by the proposed development activities:

- (1) Avoidance/Preserve: This is viewed to be the primary form of mitigation and applies where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources. The site should be retained *in situ* and a buffer zone should be created around it, either temporary (by means of danger tape) or permanently (wire fence or built wall). Depending on the type of site, the buffer zone can vary from
    - o 10 metres for a single grave, or a built structure, to
    - o 50 metres where the boundaries are less obvious, e.g. a Late Iron Age site.

- (2) Archaeological investigation/Relocation of graves: This option can be implemented with additional design and construction inputs. This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated. Mitigation is to excavate the site by archaeological techniques, document the site (map and photograph) and analyse the recovered material to acceptable standards. This can only be done by a suitably qualified archaeologist.
    - o This option should be implemented when it is impossible to avoid impacting on an identified site or feature.
    - o This also applies for graves older than 60 years that are to be relocated. For graves younger than 60 years a permit from SAHRA is not required. However, all other legal requirements must be adhered to.
        - ▪ Impacts can be beneficial – e.g. mitigation contribute to knowledge

- (3) Rehabilitation: When features, e.g. buildings or other structures are to be re-used. Rehabilitation is considered in heritage management terms as an intervention typically involving the adding of a new heritage layer to enable a new sustainable use.
    - o The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
    - o Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
        - ▪ Conservation measures would be to record the buildings/structures as they are (at a particular point in time). The records and recordings would then become the ‘artefacts’ to be preserved and managed as heritage features or (movable) objects.
        - ▪ This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (4) Mitigation is also possible with additional design and construction inputs. Although linked to the previous measure (rehabilitation) a secondary though 'indirect' conservation measure would be to use the existing architectural 'vocabulary' of the structure as guideline for any new designs.
    - The following principle should be considered: **heritage informs design**.
        - This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (5) No further action required: This is applicable only where sites or features have been rated to be of such low significance that it does not warrant further documentation, as it is viewed to be fully documented after inclusion in this report.
    - Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage/remains are destroyed.

## 4. Management Plan: Burial Grounds and Graves, with reference to general heritage sites

### 1. Background

Burial grounds and graves are viewed as having high emotional and sentimental value and accordingly always carry a high cultural heritage significance rating. Best practice principles dictate that they should preferably be preserved *in situ*. It is only when it is unavoidable and the site cannot be retained, that the graves should be exhumed and relocated after all due processes had been successfully implemented.

For retaining the burial sites and graves, the SAHRA Burial Grounds and Graves (BGG) unit requires a detailed Heritage Management Plan (HMP) clearly outlining a grave management plan that provides details of grave management and access protocols. In addition, the HMP should also provide detailed change finds protocol or procedures in the case of the identification human remains.

The primary aim of the Burial Grounds and Graves Management Plan therefore is to assist in the implementation of mitigation measures to reduce potential negative impacts through the modification of the proposed project development design.

### 2. Legal Implications

South Africa's unique and non-renewable archaeological and palaeontological heritage sites, inclusive of burial grounds and graves, are 'generally' protected in terms various laws and by-laws:

- Nationally: National Heritage Resources Act, No. 25 of 1999;
- Provincially: KwaZulu-Natal Heritage Act, No. 4 of 2008.

In addition, the following also refer specifically to burial grounds and graves:
- Human Tissue Act, No. 65 of 1983;
- Section 46 of the National Health Act, No. 61 of 2003;
- Removal of Graves and Dead Bodies Ordinance (Ordinance No. 7 of 1925)
- By-laws:
  - R363 of 2013: Regulations Relating to the Management of Human Remains
  - Local Authorities Notice 34 of 2017, Cemeteries, Crematoria and Funeral Undertakers By-Laws as per Provincial Gazette of 7 April 2017 No. 2800.

In terms of the National Heritage Resources Act, No. 25 of 1999, graves and burial grounds are divided into the following categories:
- Ancestral graves;
- Royal graves and graves of traditional leaders;
- Graves of victims of conflict;
- Graves of individuals designated by the Minister by notice in the Gazette;
- Historical graves and cemeteries; and
- Other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);

For KwaZulu-Natal, the KwaZulu-Natal Heritage Act No. 4 of 2008, graves and burial grounds are divided into the following categories:
- Clause 34: Clause 34 seeks to generally protect, against damage or alteration, graves of victims of conflict.
- Clause 35: Clause 35 seeks to generally protect, against damage or alteration, traditional burial places.

- Clause 40: Clause 40 seeks to give special protection to graves of members of the Royal Family listed in the schedule.

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:
- Destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- Destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- Bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Marked graves younger than 60 years do not fall under the protection of the NHRA (Act No. 25 of 1999) with the result that exhumation, relocation and reburial can be conducted by a register undertaker. This will include logistical aspects such as social consultation, purchasing of plots in cemeteries, procurement of coffins, etc.

Marked graves older than 60 years are protected by the NHRA (Act No. 25 of 1999) an as a result an archaeologist must be in attendance to assist with the exhumation and documentation of the graves. Unmarked graves are by default regarded as older than 60 years and therefore also falls under the NHRA (Act No. 25 of 1999, Section 36).

For graves in KwaZulu-Natal permission is required as follows:
- Clause 34: Approval of the Council must first be sought;
- Clause 35: Approval of the Council must first be sought;
- Clause 40: Nothing is stated in the Act.

## 3. Management Plan

### 3.1 *Definitions*

*Heritage Site Management:* Heritage site management is the control of the elements that make up physical and social environment of a site, its physical condition, land use, human visitors, interpretation, etc. Management may be aimed at preservation or, if necessary, at minimizing damage or destruction or at presentation of the site to the public. A site management plan is designed to retain the significance of the place. It ensures that the preservation, enhancement, presentation and maintenance of the place/site is deliberately and thoughtfully designed to protect the heritage values of the place (from: *SAHRA Site management plans: guidelines for the development of plans for the management of heritage sites or places*).

*Mitigation:* means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

### 3.2 *Heritage management plan (HMP)*

#### 3.2.1 Phase 1: Site identification and verification

***This part of the process usually take place during the Phase 1 heritage impact assessment and is discussed in Section 7 of the main body of the HIA.***

Locality and identification:
- The location of the identified site (e.g. farm name, GPS coordinates) is given;

- Determination of the number of graves and the date range of the burials.

The physical condition of the site is also described in terms of:

- The condition of the burial grounds and graves, e.g. has the headstones been pushed over;
- The approximate number of graves and the date range of the graves;
- Is the site fenced off;
- Is there access to the site, in the case it is fenced off;
- Has the site recently been visited by next of kin or other individuals;
- The status of the vegetation cover on the site.

### 3.2.2 Phase 2: Determination of the potential impact on the identified sites

***Identified impacts on the graves and burial sites are calculated and discussed in Section 8.1 of the main body of the HIA.***

The second phase consists of information that should be collected in order to develop the conservation management plan. This includes:

- The needs of the client;
- External needs, i.e. the next of kin;
- Requirements for the maintenance of the cultural significance.

From the above an evaluation is made of the impact of the proposed development project on the status of each of the identified burial grounds and graves.

### 3.2.3 Phase 3: Mitigation measures

***Proposed mitigation measures for each identified burial ground or graves are developed and is discussed in the main body of the HIA (Section 8.2).***

The main aim of the mitigation measures, as far as is feasible, is to remove any physical, direct impacts on the burial grounds and graves.

- A minimum buffer of 20m must be established around known burial grounds and graves for the duration of the mining/construction phase. This is relevant where the burial site has been static for a considerable period of time and has already been fenced off;
- In cases the burial site is still in use and might expand in the future and is not fenced off, a minimum buffer of 100m should be implemented;
- In the case where blasting takes place during mining activities, the buffers should increase correspondingly to 200m;
- The buffers must be clearly demarcated, and signage placed during the construction/mining period;
- Access to the graves should be allowed to the descendants. However, they should adhere to the managing authorities' conditions regarding permissions, appointments, health, environment and safety.
- The areas with graves should be kept clean and the grass short so that visitors may enter it without any concerns.
    - However, this might create problems as in many cases not all graves are well-marked, carrying the possibility that they might inadvertently be damaged and therefore contractors/land-owners might not be will to accept this responsibility. The descendants should therefore be held responsible for the maintenance of the site.

- Sites that are located close to access/haul roads might need additional mitigation. All personnel and especially drivers of heavy haul vehicles should be informed where these sites are, and they should keep to the speed limits (usually 30km/h on mining sites);
- Any change in the development layout, future development plans, condition of the grave sites and individual graves should immediately be reported to the heritage inspector/SAHRA for guidance;
- Relevant strategies should be put in place for the managing of the burial grounds and graves after the closure of the mine or the completion of the project. It needs to be stated that the land-owner or developer always will be responsible for the preservation of the site. Therefore, measures should be put in place to ensure that the site is handled appropriately after closure, which, in essence would entail the continuation measures already put in place;

3.3 *Management strategy*

***A general approach to this is set out in Section 9 of the main body of the HIA report and is equally applicable to general heritage sites and feature as well as to burial grounds and graves.***

A strategy for the implementation of the conservation plan is developed:

- A heritage practitioner should be appointed to develop a heritage induction program and conduct training for the ECO, as well as team leaders, in the identification of heritage resources and artefacts;
- Known sites must be demarcated and fenced off and signage placed during the construction/mining period;
- This management strategy should be applicable to the construction, operation as well as the post operation phases of the development/mining activities.
- Relevant strategies should be put in place for the managing of the burial grounds and graves after the closure of the mine or the completion of the project. It needs to be stated that the land-owner or developer always will be responsible for the preservation of the site. Therefore, measures should be put in place to ensure that the site is handled appropriately after closure, which, in essence would entail the continuation measures already put in place;
- The managing authority should be able to regularly inspect the sites in order to ensure that construction and other such activities do not damage the graves;
    - SAHRA and the relevant PHRA are the competent authorities responsible for the regulation of the HMP in terms of the national legislative framework. The NHRA states:

        36(1) *Where it is not the responsibility of any other authority, SAHRA must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make the necessary arrangement for their conservation as they see fit.*

**4. Relocation of graves**

Once it has been decided to relocate particular graves, the following steps should be taken:

- Notices of the intention to relocate the graves need to be put up at the burial site for a period of 60 days. This should contain information where communities and family members can contact the developer/archaeologist/public-relations officer/undertaker. All information pertaining to the identification of the graves needs to be documented for the application of a SAHRA permit. The notices need to be in at least 3 languages, English, and two other languages. This is a requirement by law.
- Notices of the intention needs to be placed in at least two local newspapers and have the same information as the above point. This is a requirement by law.
- Local radio stations can also be used to try contact family members. This is not required by law, but is helpful in trying to contact family members.
- During this time (60 days) a suitable cemetery need to be identified close to the development area or otherwise one specified by the family of the deceased.

- An open day for family members should be arranged after the period of 60 days so that they can gather to discuss the way forward, and to sort out any problems. The developer needs to take the families requirements into account. This is a requirement by law.
- Once the 60 days has passed and all the information from the family members have been received, a permit can be requested from SAHRA. This is a requirement by law.
- Once the permit has been received, the graves may be exhumed and relocated.
- All headstones must be relocated with the graves as well as any items found in the grave.

Information needed for the SAHRA permit application:

- The permit application needs to be done by an archaeologist.
- A map of the area where the graves have been located.
- A survey report of the area prepared by an archaeologist.
- All the information on the families that have identified graves.
- If graves have not been identified and there are no headstones to indicate the grave, these are then unknown graves and should be handled as if they are older than 60 years. This information also needs to be given to SAHRA.
- A letter from the landowner giving permission to the developer to exhume and relocate the graves.
- A letter from the new cemetery confirming that the graves will be reburied there.
- Details of the farm name and number, magisterial district and GPS coordinates of the gravesite.

**5. Defining next of kin**

An extensive Burial Grounds and Graves Consultation process must be implemented in accordance with NHRA Regulations to identify bona fide next of kin and reach agreement regarding relocation of graves.

Anthropologically speaking three type of kin are distinguished: patrilineal (called *agnates*), maternal (*uterine* kin) and kin by marriage (*affines*). All three categories have their important part to play in social life.

In terminologies used in the west the close-knit group of family members is clearly marked off from other kin - family terms, such as 'father', 'mother', 'brother' and 'sister' are never used for aunts, uncles and cousins.

In many non-western societies this is not the case and the family is merged with the wider group of kin and the family terms are applied much more widely. Next of kin for the Southern Bantu-language speakers is based on a classificatory system where a man uses a term to refer to three significant relatives – his father, his father's brother and his mother's brother.

For example, a man (A) may call his father's brother (i.e. uncle) also a father. All of that latter person's children will then also be called his (A) brothers and sisters, prohibiting him from marrying any of them (however, *vide* preferred marriages). In Anthropology this system is referred to as the Iroquois system (with reference to the North American Indian tribe where it was first described). When a man calls his father's brother 'father' a suffix is usually added to indicate whether he is an elder or junior brother (e.g. (*ra)mogolo* = elder brother; (*ra)ngwane* = junior brother; also (*ra)kgadi* = younger sister; (*ma)lome* = mother's brother)(SePedi terminology is used).

Consultants having to relocate graves might find it confusing if they do not have insight into this complex system of kinship, where, for example a single individual can have more than one father or mother.

**5. Chance find procedures**

***A general approach to this is set out in Section 9 of the main body of the HIA report and is equally applicable to general heritage sites and features as to burial grounds and graves.***

- A heritage practitioner should be appointed to develop a heritage induction program and conduct training for the ECO, as well as team leaders, in the identification of heritage resources and artefacts;
- An appropriately qualified heritage consultant should be identified to be called upon if any possible heritage resources or artefacts are identified;
- Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities be halted;
- The qualified archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and impact on the heritage resource;
- The contractor therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered;
- Should the heritage consultant conclude that the find is a heritage resource protected in terms of the NHRA (1999) Sections 34, 35, 37 and NHRA (1999) Regulations (Regulation 38, 39, 40), he or she should notify SAHRA and/or the relevant PHRA;
- Based on the comments received from SAHRA and/or the PHRA, the heritage consultant would present the relevant terms of reference to the client for implementation;
- Construction/Operational activities can commence as soon as the site has been cleared and signed off by the archaeologist.

**6. Curriculum vitae**

**Johan Abraham van Schalkwyk**

**Personal particulars**

| | |
|---|---|
| Date of birth: | 14 April 1952 |
| Identity number: | 520414 5099 08 4 |
| Marital status: | Married; one daughter |
| Nationality: | South African |

**Current address: home**

62 Coetzer Ave, Monument Park, Pretoria, 0181
Mobile: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

**Qualifications**

1995 DLitt et Phil (Anthropology), University of South Africa
1985 MA (Anthropology), University of Pretoria
1981 BA (Hons), Anthropology, University of Pretoria
1979 Post Graduate Diploma in Museology, University of Pretoria
1978 BA (Hons), Archaeology, University of Pretoria
1976 BA, University of Pretoria

**Non-academic qualifications**

12th HSRC-School in Research Methodology - July 1990
Dept. of Education and Training Management Course - June 1992
Social Assessment Professional Development Course - 1994
Integrated Environmental Management Course, UCT - 1994

**Professional experience**

Private Practice
2017 - current: Professional Heritage Consultant

National Museum of Cultural History
1992 - 2017: Senior researcher: Head of Department of Research. Manage an average of seven researchers in this department and supervise them in their research projects. Did various projects relating to Anthropology and Archaeology in Limpopo Province, Mpumalanga, North West Province and Gauteng. Headed the Museum's Section for Heritage Impact Assessments.
1978 - 1991: Curator of the Anthropological Department of the Museum. Carried out extensive fieldwork in both anthropology and archaeology

Department of Archaeology, University of Pretoria
1976 - 1977: Assistant researcher responsible for excavations at various sites in Limpopo Province and Mpumalanga.

**Awards and grants**

1. Hanisch Book Prize for the best final year Archaeology student, University of Pretoria - 1976.
2. Special merit award, National Cultural History Museum - 1986.
3. Special merit award, National Cultural History Museum - 1991.
4. Grant by the Department of Arts, Culture, Science and Technology, to visit the various African countries to study museums, sites and cultural programmes - 1993.
5. Grant by the USA National Parks Service, to visit the United States of America to study museums, sites, tourism development, cultural programmes and impact assessment programmes - 1998.
6. Grant by the USA embassy, Pretoria, under the Bi-national Commission Exchange Support Fund, to visit cultural institutions in the USA and to attend a conference in Charleston - 2000.
7. Grant by the National Research Foundation to develop a model for community-based tourism - 2001.

8. Grant by the National Research Foundation to develop a model for community-based tourism - 2013. In association with RARI, Wits University.

**Publications**
Published more than 70 papers, mostly in scientifically accredited journals, but also as chapters in books.

**Conference Contributions**
Regularly presented papers at conferences, locally as well as internationally, on various research topics, ranging in scope from archaeology, anthropological, historical, cultural historical and tourism development.

**Heritage Impact Assessments**
Since 1992, I have done more than 2000 Phase 1 and Phase 2 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.

# APPENDIX E

## PUBLIC PARTICIPATION

**APPENDIX E1:** **Newspaper Advertisements**

*Proof of newspaper advertisements that were placed as notification of the review of the draft Basic Assessment Report will be included in the final Basic Assessment Report.*

**<u>APPENDIX E2:</u> Proof of Written Notification**

| |
|---|
| *Proof of written notification of the review of the draft Basic Assessment Report will be included in the final Basic Assessment Report.* |

**<u>APPENDIX E3:</u> Comments and Responses Report**

| |
|---|
| *The Comments and Responses Report will be included in the final Basic Assessment Report.* |

## COMMENTS AND RESPONSES – ANNOUNCEMENT PHASE

To date, the Announcement Phase of the Public Participation Process was undertaken in March 2021, which served to obtain upfront comments regarding the proposed Project to understand potential concerns and to guide the Basic Assessment. The comments received during the Announcement Phase, as well as the responses from the project team, are captured below.

| No. | COMMENT / QUERY / ISSUE | RAISED BY | SOURCE | RESPONSE BY | RESPONSE |
|---|---|---|---|---|---|
| 1. | Transnet pipeline servitudes are not affected by the proposed work / installations / excavations / connections / construction / road upgrade / development / etc. as depicted on your Locality and/or Project/Site Layout Plans. This wayleave authorisation is valid for thirty six (36) months from today's date – 25 March 2021. | T. Hadebe (Transnet Pipelines) | Email (25-03-21) | Nemai Consulting | The Applicant will need to apply for all relevant wayleaves.<br><br>Provision is made in the BAR and Environmental Management Programme (EMPr) to manage impacts to existing infrastructure, as relevant. |
| 2. | Sasol Gas is not affected. | M.D. Kgagara (Sasol) | Email (26-03-21) | Nemai Consulting | No response needed, as Sasol Gas infrastructure is not affected according to the comment received. |
| 3. | Please be informed that Transnet will NOT be affected by this proposal as the property in question is approximately 1.4km from Transnet Land. | Z. Pama (Transnet Property) | Email (29-03-21) | Nemai Consulting | No response needed, as the railway line is not affected according to the comment received. |
| 4. | Please provide me with the property description of the WWTW. | R. de Kock (SANRAL) | Email (24-05-21) | Nemai Consulting | Erf Number 18896, Upington Township. The kmz file was also provided. |

## APPENDIX E4: Stakeholders' Database

## AUTHORITIES

| Organisation | Name |
|---|---|
| Department of Forestry, Fisheries and the Environment (DFFE) | Samkelisiwe Dlamini |
| DFFE: IEA | Masina Litsoane |
| DFFE: Waste | Linda Poll-Jonker |
| DEFF: Waste | Lucas Mahlangu |
| DFFE: Biodiversity Conservation | Stanley Tshitwamulomoni |
| DFFE: Biodiversity Conservation | Mmatlala Rabothata |
| DFFE: Biodiversity Conservation | Seoka Lekota |
| DFFE: Biodiversity Conservation | Aulicia Maifo |
| Department of Water & Sanitation (DWS) | Piet Ackerman |
| DWS | Roets Wietsche |
| Department of Agriculture | Anneliza Collett |
| South African Heritage Resource Agency (SAHRA) | Lynette Sbongile Van Damme |
| SAHRA | Mary Leslie |
| SAHRA | Dr Ragna Redelstorff |
| SAHRA | Natasha Higgitt |
| SAHRA | Phillip Hine |
| McGregor Museum | Colin Fortune |
| McGregor Museum | Dr D. Morris |
| McGregor Museum | Annemarie van Heerden |
| South African National Roads Agency SOC Ltd | Nicole Abrahams |
| South African National Roads Agency SOC Ltd | S. Dyers |
| South African National Roads Agency SOC Ltd | Rene de Kock |
| National Dept of Tourism | Palesa Kadi |
| National Dept of Tourism | Kingsley Makhubela |
| Water Institution Of Southern Africa (WISA) | Evelyn |
| Dept of Land Affairs | Mr Eddie Mohoebi |
| Department of Cooperative Governance | Elroy Africa |
| Department of Rural Development and Land Reform | Mr. S. Ogunronbi |
| South African National Biodiversity Institute (SANBI) | Kristal Maze |
| SANParks | Paul Daphney |
| Dept of Trade and Industry | Mrs M. Sebotse |
| Chamber of Mines | Mr Niks Lesufi |
| South African Local Government Association (SALGA) | William Moraka |
| SALGA | I Chauke |
| Northern Cape Department of Environment and Nature Conservation (DENC) | B Fisher |
| DENC | Ms. Martha Molokwane |
| DENC | Ms. Thandeka Mlatha |
| DENC | Olebile Seshupo |
| DENC | Naomi Mokonopi |
| DENC | Dineo Moleko |
| DENC | Dineo Kgosi |
| DENC | Elsabe Swart |
| DENC | Peter Cloete |
| DENC | Conrad Geldenhuys |
| DENC | Enrico Oosthuyzen |
| DENC | G. Letimela |
| DENC | JC Kalakgosi |
| DWS: Northern Cape Region | Abe Abrahams |
| DWS: Northern Cape Region | Alexia Hlengani |
| DWS: Northern Cape Region | Shaun Cloete |
| DWS: Northern Cape Region | Abenathi Mthintelwa |
| DWS: Northern Cape Region | Gawie van Dyk |
| DWS: Northern Cape Region | Feni Ntombizanele |

| Organisation | Name |
|---|---|
| DWS: Northern Cape Region | Mokhoantle Lerato |
| DWS: Northern Cape Region | Kgaphola Mashudu |
| Department of Mineral Resources & Energy (DMRE): Northern Cape | Pieter Swart |
| DMR: Northern Cape Region | Johannes Nematatani |
| DMR: Northern Cape Region | Vincent Muila |
| Department of Agriculture, Forestry and Fisheries (DAFF) | Jacoline Mans |
| DAFF | Mashudu Marubini |
| DAFF | Christo Smit |
| Department of Agriculture | Cynthia Fortune |
| Department of Agriculture, Land Reform & Rural Development | Dimakatso Viljoen Mothibi |
| Department of Agriculture & Land Reform | Dr. P Kegakilwe |
| Department of Agriculture & Land Reform | Nico Toerien |
| Department of Agriculture & Land Reform | Nadia Goltz |
| Northern Cape Provincial Heritage Resources (Ngwao-Boswa Jwa Kapa Bokone) | R Timothy |
| Department of Cooperative Governance, Human Settlement & Traditional Affairs | Gladys Botha |
| COGHSTA | Mantefeleng Booysen |
| Department of Roads & Public Works | M Sithole |
| Department of Roads & Public Works | Kholekile Nogwili |
| Department of Roads & Public Works | Sylvia Moholo |
| Department of Health Services | Gugulethu Matlaopane |
| Department of Transport, Safety and Liaison | Lesego Wolfe |
| Northern Cape Department of Health | Danie Stander |
| Northern Cape Office of the Premier | Z. Langeveldt |
| Northern Cape Office of the Premier | Cynthia Joseph |
| ZF Mgcawu District Municipality | Gilbert Lategan |
| ZF Mgcawu District Municipality | Tinus Galloway |
| ZF Mgcawu District Municipality | Godfrey Kuun |
| ZF Mgcawu District Municipality | Thalita Skei |
| ZF Mgcawu District Municipality | Frikkie Ruppen |
| ZF Mgcawu District Municipality | Technical Manager |
| Dawid Kruiper Local Municipality (DKLM) | E Ntoba |
| DKLM | Suzzelle Coetzee |
| DKLM | Jeremy du Plessis |
| DKLM | Conrad Geldenhuys |
| DKLM | Leoné Sago |
| DKLM | Mduduzi Mnganga |
| DKLM | Hendry Christians |
| DKLM | Simon May |
| DKLM | Padwald Jonker |
| DKLM | Elize Mnyaka |
| DKLM | Gaylene Schreiner |
| DKLM | Muriel Sishuba |
| DKLM | Nombulelo Mhlaba |
| DKLM | Lizelle Adams |
| DKLM | Ina Engelbrecht |
| DKLM | Mr Smith |

## GENERAL

| Organisation / Affiliation | Name |
|---|---|
| Eskom | John Geeringh |
| Eskom | Justine Wyngaardt |
| Eskom | M Mabitsi |
| Eskom | Nondwe Nongauza |
| Transnet | Andre Bodenstein |
| Transnet Pipelines | Thami Hadebe |
| Transnet | Raymond Lehloma |
| Transnet Corporate | Vincent Matabane |
| Transnet Freight Rail | Maureen Kunene |
| Transnet Freight Rail | Nsumbulana Mtsenga |
| Transnet Freight Rail | Zanoxolo Pama |
| Transnet Freight Rail | Patric Segone |
| Telkom | Wayleaves |
| Openserve | Greg Green |
| South African National Roads Agency SOC Ltd | Rene De Kock |
| South African National Roads Agency SOC Ltd | Nicole Abrahams |
| South African National Roads Agency SOC Ltd | Thobile Duma |
| South African National Roads Agency SOC Ltd | Victoria Botha |
| Sasol | Wayleaves |
| Lemoendraai Agricultural Cooperative | Rudolph Saal |
| Lemoendraai Agricultural Cooperative | James Esterhuizen |
| Upington Irrigation Board | Barend Louw |
| AgriWatch | Ferdi Botha |
| Gariep Watch | Fritz Bekker |
| Orange River Cellars | Charl du Plessis |
| Orange River Cellars | Chris Venter |
| Agri SA | |
| Agri Northern Cape | Wilco Fourie |
| Agri Northern Cape | Henning Myburgh |
| Agri Northern Cape | Dirk Krapohl |
| Agri Northern Cape | Wiaan van Rensburg |
| Agri Northern Cape | H. de Wet |
| OWK | Chris Venter |
| The Endangered Wildlife Trust (EWT) | Constant Hoogstad |
| WESSA | Delana Eksteen |
| WESSA | Morgan Griffiths |
| WESSA | Suzanne Erasmus |
| Birdlife South Africa | Hanneline Smit-Robinson |
| Birdlife South Africa | Daniel Marnewick |
| Birdlife South Africa | Simon Gear |
| Water Research Commission | Wandile Nomquphu |
| Water Research Commission | Bonani Madikizela |
| Water Research Commission | Eberhard Braune |
| Kalahari-West | J.C. Nel |
| Brackbosheiland IB | R.S. Brink |
| Friersdale IB | Frikkie de Wet |
| Friersdale IB | Lizelle Loxton |
| Upington IB | K. Bekker |
| Keimoes IB | Awie van Wyk |
| Kousas IB | J.J. Hanekom |
| Malanshoek IB | D.J Malan |
| Malanshoek IB | Koos Brink |
| Neilersdrift IB | W.J. Hanekom |
| Olyvenhoutsdrift IB | S.A Chamberlain |
| Onderstekomseiland IB | Mariette van Zyl |
| Rooikopeiland IB | Nico Visser |
| Skanskopeiland IB | GP du Plessis |
| Straussburg IB | Sterling Strauss |
| Swartkop IB | J.A. Luttig |
| Adjacent Landowner (Erf 21888) | DJW Gilbert |
| Adjacent Landowner (Erf 3100 & 3101) | JL Julie Boerdery BK |
| Adjacent Landowner (Erf 3100 & 3101) | JL Julie Boerdery BK |
| Adjacent Landowner (Olyvenhoudtsdrift 452) | REP VAN SUID-AFRIKA |

**APPENDIX E5: Copies of Correspondence Received & Minutes of Meetings**

| |
|---|
| *Copies of any correspondence received with regards to the draft Basic Assessment Report, as well as minutes of any meetings held, will be included in the final Basic Assessment Report.* |

# APPENDIX F

## IMPACT ASSESSMENT

# 1 INTRODUCTION

This document assesses the pertinent environmental impacts that could potentially be caused during the pre-construction, construction and operational phases of the proposed upgrade and expansion of the Kameelmond Wastewater Treatment Works (K-WWTW) in Upington, Northern Cape (the Project).

# 2 IMPACT ASSESSMENT METHODOLOGY

An overview of the methodology employed to quantify the potential impacts is provided below.

## 2.1 Impact Rating

The impacts are quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance. The aforementioned criteria and the ratings considered are provided in **Table 1** below.

**Table 1: Quantitative Impact Assessment Methodology**

| | |
|---|---|
| **Nature (/Status)** | The project could have the following impacts to the environment:<br>• **Positive**;<br>• **Negative**; or<br>• **Neutral**. |
| **Extent** | • **Local** - extend to the site and its immediate surroundings.<br>• **Regional** - impact on the region but within the province.<br>• **National** - impact on an interprovincial scale.<br>• **International** - impact outside of South Africa. |
| **Magnitude** | Degree to which impact may cause irreplaceable loss of resources, based on the following ratings:<br>• **Low** - natural and social functions and processes are not affected or minimally affected.<br>• **Medium** - affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.<br>• **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.<br>• **Medium term** - 5-11 years.<br>• **Long term** - impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.<br>• **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.<br>• **Likely** - the event will probably occur in most circumstances.<br>• **Moderate** - the event should occur at some time.<br>• **Unlikely** - the event could occur at some time.<br>• **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:<br>**0 -** Impact will not affect the environment. No mitigation necessary.<br>**1 -** No impact after mitigation.<br>**2 -** Residual impact after mitigation (e.g. some loss of populations and habitats of non-threatened species).<br>**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. |

Where applicable, the impact assessments and significance ratings provided by the respective specialists were included. Some of the impact assessment methodologies used by the specialists deviated from the approach shown in **Table 1** above. However, the quantitative basis for these specialist evaluations of the impacts to specific environmental features still satisfied the intention of the Environmental Impact Assessment (EIA).

## 3 IMPACT MITIGATION

Impacts associated with the Project are to be managed by assigning suitable mitigation measures. 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 strives to abide by the following hierarchy (1) prevent; (2) reduce; (3) rehabilitate; and/or (4) compensate for the environmental impacts.

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.

## 4 ENVIRONMENTAL ACTIVITIES, ASPECTS AND IMPACTS

### 4.1 Introduction

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.

Impacts were identified as follows:

- Impacts associated with activities triggered by the Project in terms of the Listing Notices of the EIA Regulations of 2014, as amended, for which Environmental Authorisation were applied for;
- An appraisal of the Project's activities and components;
- An assessment of the receiving biophysical, social, economic and built environments;
- Findings from specialist studies;
- Issues highlighted by environmental authorities; and
- Comments received during public participation from Interested and Affected Parties (I&APs).

### 4.2 Environmental Activities

In order to understand the impacts, it is necessary to unpack the activities associated with the Project's life-cycle, as done in the sub-sections to follow. The decommissioning of the overall K-WWTW is not included, and this part of the life-cycle will need to comply with the prevailing regulatory requirements at that point time.

#### *4.2.1 Project Phase: Pre-construction*

Some of the main Project activities, as well as high-level environmental activities, to be undertaken during the pre-construction phase are listed in **Table 2** below.

**Table 2: 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. |

| Project Phase: Pre-construction | |
|---|---|
| **High Level Environmental Activities** | |
| • | Diligent compliance monitoring of the Environmental Management Programme (EMPr), Environmental Authorisation (EA), Waste Management Licence (WML), Water Use Licence (WUL) and other relevant environmental legislation. |
| • | On-going consultation with I&APs, stakeholders and authorities (as relevant). |
| • | Other activities as per EMPr. |

### *4.2.2 Project Phase: Construction*

Some of the main Project activities, as well as high-level environmental activities, to be undertaken during the construction phase are listed in **Table 3** below.

**Table 3: 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** | |
| • | Diligent compliance monitoring of the EMPr, EA, 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 |

### *4.2.3 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 4** below.

**Table 4: 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. |

| **Project Phase: Operation** |
|---|
| • 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. |

## 4.3 Environmental Aspects

Environmental aspects are regarded as those components of the Project's activities 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 5** below. Note that only high level aspects are listed.

**Table 5: 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 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, water, visual, noise) caused by construction activities. |
| • Inadequate management of construction camp and laydown area. |

| Project Phase: Pre-construction |
|---|
| • 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 and maintenance works. |
| • Pollution (air, soil, water, visual) caused by operational activities. |
| • Discharge of sub-standard effluent. |
| • Failure to manage sludge and screenings. |
| • 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). |

## 4.4 Potentially Significant Environmental Impacts

The potentially significant environmental impacts associated with the Project are listed in **Table 6** below.

**Table 6: Potentially Significant Environmental Impacts**

| 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.<br>• Setbacks / conditions associated with surrounding land and infrastructure (as relevant). | • Setbacks / conditions associated with surrounding land and infrastructure (as relevant).<br>• Land use requirements and restrictions associated with the buffer zone of the K-WWTW will need to be enforced from a planning perspective.<br>• 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.<br>• Climate change may lead to increased inflows, which can cause more frequent bypassing at the K-WWTW.<br>• 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. |

| Environmental Factor | Construction Phase Potential Issues / Impacts | Operational Phase Potential Issues / Impacts |
|---|---|---|
| **Soil** | • Encountering historically contaminated soil at the K-WWTW.<br>• Soil erosion due to clearance and inadequate stormwater management<br>• Soil compaction.<br>• Soil contamination due to spillages and poor construction practices. | • Soil erosion due to inadequate stormwater management.<br>• Soil contamination due to poor operation and maintenance practices, including inadequate management of sewage, effluent, waste and hazardous substances. |
| **Surface Water** | ▪ Alteration of drainage over the site.<br>▪ Surface water pollution due to spillages and poor construction practices.<br>▪ Encroachment of construction activities into regulated area of the Orange River and non-perennial drainage line.<br>• 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.<br>▪ Damage to the K-WWTW from major flood events.<br>▪ 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.<br>• 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.<br>• Nights lights may affect nocturnal faunal species.<br>• Illegal harvesting and poaching of faunal and floral species by construction workers.<br>• Pollution of the biophysical environment from poor construction practices.<br>• Proliferation of invasive alien species in disturbed areas.<br>• Loss of protected trees (notably the Camel thorn) and species of conservation concern.<br>• Human - animal conflicts. | • Proliferation of invasive alien species in disturbed areas.<br>• Environmental pollution caused by inadequate management of sewage, effluent, waste and hazardous substances.<br>• 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.<br>• Emissions from construction equipment and machinery.<br>• 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).<br>• Safety and security risks to surrounding communities.<br>• Use of local road network.<br>• Nuisance from dust and noise to surrounding communities.<br>• Consideration of local labourers and suppliers in area – stimulation of local economy (*positive impact*).<br>• Transfer of skills (*positive impact*). | • A wastewater treatment plant is an odorous facility that may cause a nuisance to surrounding communities.<br>• The pollution caused to the Orange River from sub-standard effluent quality impacts on agricultural practices of downstream irrigators.<br>• Groundwater contamination from poor waste management practices at the K-WWTW may impact on other groundwater users. |
| **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. | • N/A |

| Environmental Factor | Construction Phase Potential Issues / Impacts | Operational Phase Potential Issues / Impacts |
|---|---|---|
| **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.<br>• Disruptions caused to operations at the K-WWTW. | • N/A |
| **Traffic** | • Transportation of materials and construction personnel to site.<br>• Impacts to road conditions.<br>• Speeding and reckless driving by construction personnel.<br>• Construction vehicles accessing and leaving the site via the N14.<br>• 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).<br>• Inadequate reinstatement and rehabilitation of construction footprint. | • N/A |
| **Health** | • Hazards related to construction work.<br>• Risks posed by working inside an operational wastewater treatment plant.<br>• Increased levels of dust and particulate matter.<br>• Increased levels of noise.<br>• Poor water and sanitation.<br>• Communicable diseases.<br>• Psychosocial disorder (e.g. social disruptions).<br>• Safety and security.<br>• Lack of suitable health services. | • Hazards related to operation and maintenance work. |
| **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).<br>• Ingress of contaminants into stormwater system. |

# 5 IMPACT ASSESSMENT

An assessment of the potentially significant impacts associated with the Project follows. It is noted that the EMPr aims to provide a comprehensive list of mitigation measures, which serve to manage impacts that extend beyond those that form part of the assessment below.

## 5.1 Land Use & Planning

| **Project life-cycle** | Construction & operational phases. |
|---|---|
| **Activities** | • Construction activities with an influence beyond the boundaries of the K-WWTW.<br>• Operation of the K-WWTW. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Impacts to surrounding land uses.<br>2. 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.<br>• The Dawid Kruiper Municipality 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 |

## 5.2 Climate

| Project life-cycle | Construction phase. |
|---|---|
| **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.<br>• Suitable training should be provided to operators to ensure that they maximise the efficiency of the plant and idling is reduced.<br>• In terms of transportation of workers and staff, collective transportation arrangements should be made to reduce individual car journeys.<br>• 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* |

| Project life-cycle | Operational phase. |
|---|---|
| **Activities** | Operation of the K-WWTW. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. GHG emissions from biological processes at the Works.<br>2. Climate change may lead to increased inflows, which can cause more frequent bypassing at the K-WWTW.<br>3. 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.<br>• Improve energy efficiency at the K-WWTW.<br>• *See mitigation measures related to surface water (Section 5.7).* |

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

## 5.3 Geology

| Project life-cycle | Construction & operational phases. |
|---|---|
| **Activities** | • Site preparations and earthworks during construction.<br>• Operation of the K-WWTW. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| Restrictions posed by unsuitable geological conditions. *It is noted that geotechnical investigations still need to be undertaken and this impact can thus not be quantified at this stage.* | • Undertake geotechnical investigations and implement recommendations. |

| | +/- Impacts | Extent | Magnitude | Duration | Probability | Significance |
|---|---|---|---|---|---|---|
| **Before Mitigation** | - | local | *unknown* | *unknown* | *unknown* | *unknown* |
| **After Mitigation** | - | local | *unknown* | *unknown* | *unknown* | *unknown* |

## 5.4 Groundwater

| Project life-cycle | Construction phase. |
|---|---|
| **Activities** | Activities that may affect groundwater. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| Contamination of groundwater from poor construction practices. | • Provide sufficient and suitable sanitation facilities, which conform to all relevant health and safety standards and codes.<br>• Reduce sediment loads in water from dewatering operations. All dewatering shall be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales).<br>• Suitable protection of groundwater during excavations. Implement mitigation measures suggested as part of the geotechnical investigations for managing groundwater.<br>• *See mitigation measures related to hazardous substances and waste (Section 5.12).* |

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

| Project life-cycle | Operational phase. |
|---|---|
| **Activities** | Activities that may affect groundwater. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Contamination of groundwater from poor operation and maintenance practices.<br>2. Discharge of non-compliant effluent.<br><br>*It is noted that hydrogeological investigations still need to be undertaken and this impact can thus not be quantified at this stage.* | • Undertake hydrogeological investigations and implement recommendations. Determine vulnerability of groundwater to pollution incidents at the K-WWTW.<br>• Develop an emergency response plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.<br>• Implement adequate stormwater management at the K-WWTW.<br>• Implement monitoring programme that includes *inter alia* the effluent quality and groundwater.<br>• *See mitigation measures related to hazardous substances and waste (Section 5.12).* |

| | +/- Impacts | Extent | Magnitude | Duration | Probability | Significance |
|---|---|---|---|---|---|---|
| **Before Mitigation** | - | *unknown* | *unknown* | *unknown* | *unknown* | *unknown* |
| **After Mitigation** | - | *unknown* | *unknown* | *unknown* | *unknown* | *unknown* |

## 5.5 Soil

| Project life-cycle | Construction phase. |
|---|---|
| **Activities** | Site clearing, earthworks, stockpiling and general construction activities within Project site. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Soil erosion. | • 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.<br>• Control drainage over the site to minimise erosion.<br>• 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 |

| Potential Aspects & Impacts | Proposed Management Objectives / Mitigation Measures |
|---|---|
| 2. 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 |

| Potential Aspects & Impacts | Proposed Management Objectives / Mitigation Measures |
|---|---|
| 3. Soil contamination from poor construction practices. | *See mitigation measures related to hazardous substances and waste (Section 5.12).* |

| | +/- 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 |

## 5.6 Air Quality

| **Project life-cycle** | Construction phase. |
|---|---|
| **Activities** | Construction activities within 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.<br>• Speed limits on site to be strictly adhered to.<br>• 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. |
|---|---|
| **Activities** | • Operation of components such as the Head of Works, emergency storage dam, and dewatering facility at the K-WWTW that may serve as potential sources of malodour.<br>• 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.<br>• 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 greenhouse gas 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 |

## 5.7 Surface Water

| Project life-cycle | Construction phase. |
|---|---|
| **Activities** | Construction activities within Project site. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Sedimentation through silt-laden runoff, caused by inadequate stormwater management. | • Implement suitable stormwater measures on the construction site to trap silt-laden runoff. |
| 2. Surface water pollution due to spillages and poor construction practices. | • Ensure proper storage and careful handling of material that could cause water pollution.<br>• *See mitigation measures related to hazardous substances and waste (Section 5.12).* |
| 3. 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. |
|---|---|
| **Activities** | Operation of the K-WWTW. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Discharge of -compliant effluent. | • Implement monitoring programme that includes *inter alia* the effluent quality and receiving aquatic environment.<br>• Comply with conditions of the WUL. |

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

| Potential Aspects & Impacts | Proposed Management Objectives / Mitigation Measures |
|---|---|
| 2. Sedimentation and contamination of the Orange River caused by:<br>• Inadequate stormwater management on the site;<br>• Inadequate storage and handling of dangerous goods (e.g. chlorine);<br>• 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.<br>• Develop an emergency response plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.<br>• *See mitigation measures related to hazardous substances and waste (Section 5.12).* |

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

| Potential Aspects & Impacts | Proposed Management Objectives / Mitigation Measures |
|---|---|
| 3. 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.<br>• Safeguard the K-WWTW from major floods.<br>• Develop an emergency response plan for K-WWTW to deal with floods.<br>• Elevate electrical equipment and essential systems and equipment above the 1:100 year floodline of the Orange River.<br>• Provide flood barriers around essential systems and equipment.<br>• Secure or elevate chemical and other tanks.<br>• Adequate design of stormwater system at K-WWTW to cater minor and major flood events.<br>• Flood damaged structures to be promptly repaired by the Dawid Kruiper Municipality. |

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

## 5.8 Noise

| **Project life-cycle** | Construction phase. |
|---|---|
| **Activities** | Construction activities within 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.<br>• Working hours to be agreed upon with the Engineer, so as to minimise noise disturbance.<br>• 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 |

## 5.9 Existing Structures and Infrastructure

| **Project life-cycle** | Construction phase. |
|---|---|
| **Activities** | All construction activities that may affect existing structures and infrastructure. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Risk of damaging existing services, infrastructure and structures during construction.<br>2. Disruptions caused to operations at the K-WWTW. | • Identify and record existing services and infrastructure. Safeguard / deviate existing services to accommodate construction activities, as necessary.<br>• Conform to requirements of relevant service providers and infrastructure custodians.<br>• Accommodate existing operations at the K-WWTW. Cordon off works area.<br>• Adequate reinstatement and rehabilitation of affected environment. |

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

## 5.10 Traffic

| **Project life-cycle** | Construction phase. |
|---|---|
| **Activities** | Use of surrounding road network by construction vehicles. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Disruptions to existing road users during construction.<br>2. Impacts to road conditions. | • Adhere to SANRAL's requirements in terms of access to the site from the N14 and traffic management measures.<br>• Clearly demarcate all construction access roads and maintain access control to site.<br>• Strict adherence to speed limits by construction vehicles on public roads and access roads. Appropriate speed limits shall be posted on all construction roads.<br>• 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 |

| Project life-cycle | Operational phase. |
|---|---|
| **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.<br>• 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 |

## 5.11 Aesthetic Qualities

| Project life-cycle | Construction phase. |
|---|---|
| **Activities** | Construction activities within Project site. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| Visual impacts caused by construction activities. | • Lighting must not constitute an eyesore / hazard to users of the surrounding road network nor the surrounding community.<br>• Lighting will be sufficient to ensure security but will not constitute 'light pollution' to the surrounding areas.<br>• The site will be shielded / screened to minimise the visual impact, where practicable.<br>• On-going housekeeping to maintain a tidy construction site.<br>• After the construction phase, the areas disturbed by construction activities that are not part of the permanent development footprint must be suitably rehabilitated. |

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

## 5.12 Hazardous Substances & Waste

| Project life-cycle | Construction phase. |
|---|---|
| **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), Occupational Health and Safety 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.<br>• Record details and quantities of hazardous substances on the construction site.<br>• 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.<br>• 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.<br>• 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.<br>• All waste (general and hazardous) generated during the construction phase shall be disposed of at an appropriately licenced waste disposal facility.<br>• 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.<br>• 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. |
|---|---|
| **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), Occupational Health and Safety 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.<br>• Record the details and quantities of hazardous substances at the K-WWTW.<br>• 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.<br>• 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.<br>• Prevent uncontrolled releases of hazardous materials to the environment.<br>• Implement engineering controls (such as containment, automatic alarms, and shut-off systems) for storage areas of hazardous substances.<br>• 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.<br>• All waste (general and hazardous) generated during the operational phase shall be disposed of at an appropriately licenced waste disposal facility.<br>• Ensure adequate disposal of wastewater. Contaminated water will not be discharged to the environment.<br>• Comply with the conditions of the WML regarding 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 |

## 5.13 Socio-Economic Environment

| Project life-cycle | Construction phase. |
|---|---|
| **Activities** | Disturbances arising from construction activities. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. 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.<br>• 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.<br>• No staff accommodation should be allowed on site. |
| 2. Worker Health and Safety. | • The Contractor should establish an HIV/AIDs awareness programme.<br>• *See mitigation measures related to health and safety (Section 5.14).* |
| 3. Worker Behaviour & Crime. | • Induction will be mandatory for all workers.<br>• Develop a Code of Conduct in terms of behaviour of construction staff.<br>• During construction, the working areas should be fenced to prevent trespassing and expansion of the working footprint.<br>• All the Contractor's staff should be easily identifiable through their uniforms.<br>• Develop a security policy for the Contractor's staff. |
| 4. Communicable Diseases. | • Define and implement pre-employment medical requirements for all workers.<br>• Provide adequate hygiene and sanitation facilities to workers.<br>• Implement all necessary measures to contain the spread of COVID-19 and to safeguard workers and the local communities from this virus. |
| 5. 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 |

| | |
|---|---|
| **Project life-cycle** | Construction phase. |
| **Activities** | Economic opportunities arising from construction. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| 1. Opportunities for SMME's. | • Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment. |
| 2. Job Creation and Skills Development. | • The main contractor should employ non-core labour from the sub-places as far as possible during the construction phase.<br>• The principles of Expanded Public Works Programme can be used during construction. |
| 3. Indirect Employment Impacts. | • Spaza shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the Local Municipality – Informal Trading By-Laws, are complied with. |

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

## 5.14 Health and Safety

| | |
|---|---|
| **Project life-cycle** | Construction phase. |
| **Activities** | All construction activities that pose a risk to health and safety. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| Health and safety risks during construction. | • Dedicated Occupational Health and Safety system to be implemented by the Contractor.<br>• Undertake a hazard identification and risk assessment and identify preventive and protective measures.<br>• Conduct basic safety awareness training with construction workers.<br>• Provide all workers with the necessary PPE.<br>• Prevent environmental contamination.<br>• Provide potable water and sanitation services to workers.<br>• All workers shall be clearly identifiable.<br>• Prepare an Emergency Preparedness and Response Plan.<br>• Ensure adequate control of communicable diseases.<br>• 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. |
| **Activities** | All operation and maintenance activities that pose a risk to health and safety. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| Health and safety risks posed by operation and maintenance activities. | • Dedicated Occupational Health and Safety system to be implemented during the operational phase.<br>• 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.<br>• Provide and require use of suitable PPE and equipment to prevent contact with wastewater.<br>• Temporary Contractors to adhere to Occupational Health and Safety requirements.<br>• Maintain good housekeeping in sewage processing and storage areas.<br>• Provide potable water and sanitation services to operational staff.<br>• Prepare an Emergency Preparedness and Response Plan.<br>• 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 |

## 5.15 Terrestrial Ecology

The following impact assessment is based on the Terrestrial Ecology Compliance Statement (contained in **Appendix D1** of the Basic Assessment Report).

| **Project life-cycle** | Construction and operational phases. |
|---|---|
| **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 Critical Biodiversity Area (CBA) 1 areas in the vicinity of the Project Area (including watercourses).<br>• 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.<br>• The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence.<br>• All watercourses and riparian areas are no-go areas. Signs must be put up to enforce this.<br>• Where possible, existing access routes and walking paths must be made use of.<br>• 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.<br>• 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.<br>• 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.<br>• A fire management plan needs to be complied and implemented to restrict the impact fire might have on the surrounding areas.<br>• 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 National Forests Act (Act No. 84 of 1998). 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.<br>• Noise must be kept to an absolute minimum during the evenings to minimize all possible disturbances to amphibian species and nocturnal mammals.<br>• No trapping, killing, or poisoning of any wildlife is to be allowed. Signs must be put up to enforce this.<br>• 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.<br>• 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).<br>• 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.<br>• Use environmentally friendly cleaning and dust suppressant products.<br>• An alien management plan must be implemented quarterly for 3 years after construction.<br>• 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 |

## 5.16 Aquatic Ecology

The following impact assessment, as well as the mitigation measures to follow, were extracted from the Freshwater Assessment (contained in **Appendix D2** of the Basic Assessment Report).

**Table 7: 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 National Water Act (Act No. 36 of 1998) 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.

## 5.17 Historical and Cultural Features

The following impact assessment was extracted from the Phase 1 Cultural Heritage Impact Assessment Report (contained in **Appendix D3** of the Basic Assessment Report).

**Table 8: Calculation of the impact on the identified heritage features (van Schalkwyk, 2021)**

| **Impact assessment** | | |
|---|---|---|
| As no sites, features or objects of cultural heritage significance were identified on the Project Area, there would be no impact as a result of the proposed development | | |
| | | |
| **Nature**: Loss of or damage to sites, features or objects of cultural significance | | |
| | Without mitigation | With mitigation |
| Extent | Site (1) | Site (1) |
| Duration | Permanent (5) | Permanent (5) |
| Intensity | Minor (1) | Minor (2) |
| Probability | Very improbable (1) | Very improbable (1) |
| Significance | Low (8) | Low (8) |
| Status (positive or negative) | Neutral | Neutral |
| Reversibility | n/a | n/a |
| Irreplaceable loss of resources? | No | No |
| Can impacts be mitigated | n/a | |
| Mitigation: No further action required | | |
| Cumulative impact: None | | |

## 5.18 "No-Go" Option

| **Project life-cycle** | All phases of Project life-cycle. |
|---|---|
| **Activities** | Activities associated with the proposed upgrade and expansion works. |
| **Potential Aspects & Impacts** | **Proposed Management Objectives / Mitigation Measures** |
| If the Project does not proceed, the objectives of the proposed upgrade and expansion, which include improving the operational efficiency of the K-WWTW and ensuring that the plant complies with the relevant standards in terms of effluent quality and sludge management, will not materialise. | • Undertake the proposed upgrade and expansion works at the K-WWTW. |

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

## 5.19 Cumulative Impacts

### *5.19.1 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 characterization 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.

Cumulative impacts are discussed below.

### *5.19.2 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.

The Dawid Kruiper Municipality's Spatial Development Framework (SDF) of 2017 (shown in **Figure 1** below) designates the area encompassed by the K-WWTW as a 'sewage plant' 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.

### *5.19.3 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 provided in Section 5.5 above and are also included in the EMPr (contained in **Appendix G** of the Basic Assessment Report).

### *5.19.4 Cumulative Water Resources Impacts*

Although the focus of the Basic Assessment is not on the quality of the effluent, which is addressed through the Water Use Licence Application, 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.

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.

### *5.19.5 Cumulative Terrestrial Biodiversity Impacts*

The areas earmarked for the upgrade and expansion works have been historically transformed/disturbed. Based on the Terrestrial Ecology Compliance Statement (contained in **Appendix D1** of the Basic Assessment Report), the Project's contribution to cumulative impacts to terrestrial biodiversity are not anticipated to be significant.

### *5.19.6 Cumulative Heritage Impacts*

Due to the disturbed nature of the areas where the upgrade and expansion works are planned at the existing K-WWTW, and according to the findings of the Phase 1 Cultural Heritage Impact Assessment Report (contained in

**Appendix D3** of the Basic Assessment Report), the Project's contribution to cumulative heritage impacts are not anticipated to be significant.

#### *5.19.7 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, where the N14 and other roads in Upington will be used.

Measures are included in the EMPr (contained in **Appendix G** of the Basic Assessment Report) to manage traffic-related impacts that may be caused by the Project.

#### *5.19.8 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.

Measures are included in the EMPr (contained in **Appendix G** of the Basic Assessment Report) to manage air quality impacts that may be caused by the Project.

Odour control measures at the K-WWTW will be identified during detail design phase, which will serve to manage cumulative air quality impacts.

#### *5.19.9 Cumulative Noise Impacts*

Construction associated with the Project along with construction activities of other developments in the greater area could potentially increase noise impacts on surrounding land uses. However, this is unlikely, due to the nature of the proposed upgrade and expansion works at the K-WWTW as well as the rural nature of the surrounding land. This impact will also 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 5.19.8** above.

The Project's contribution to cumulative noise impacts are thus not anticipated to be significant. Measures are included in the EMPr (contained in **Appendix G** of the Basic Assessment Report) to manage noise impacts that may be caused by the Project.

#### *5.19.10 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 Dawid Kruiper Municipality and Eskom.

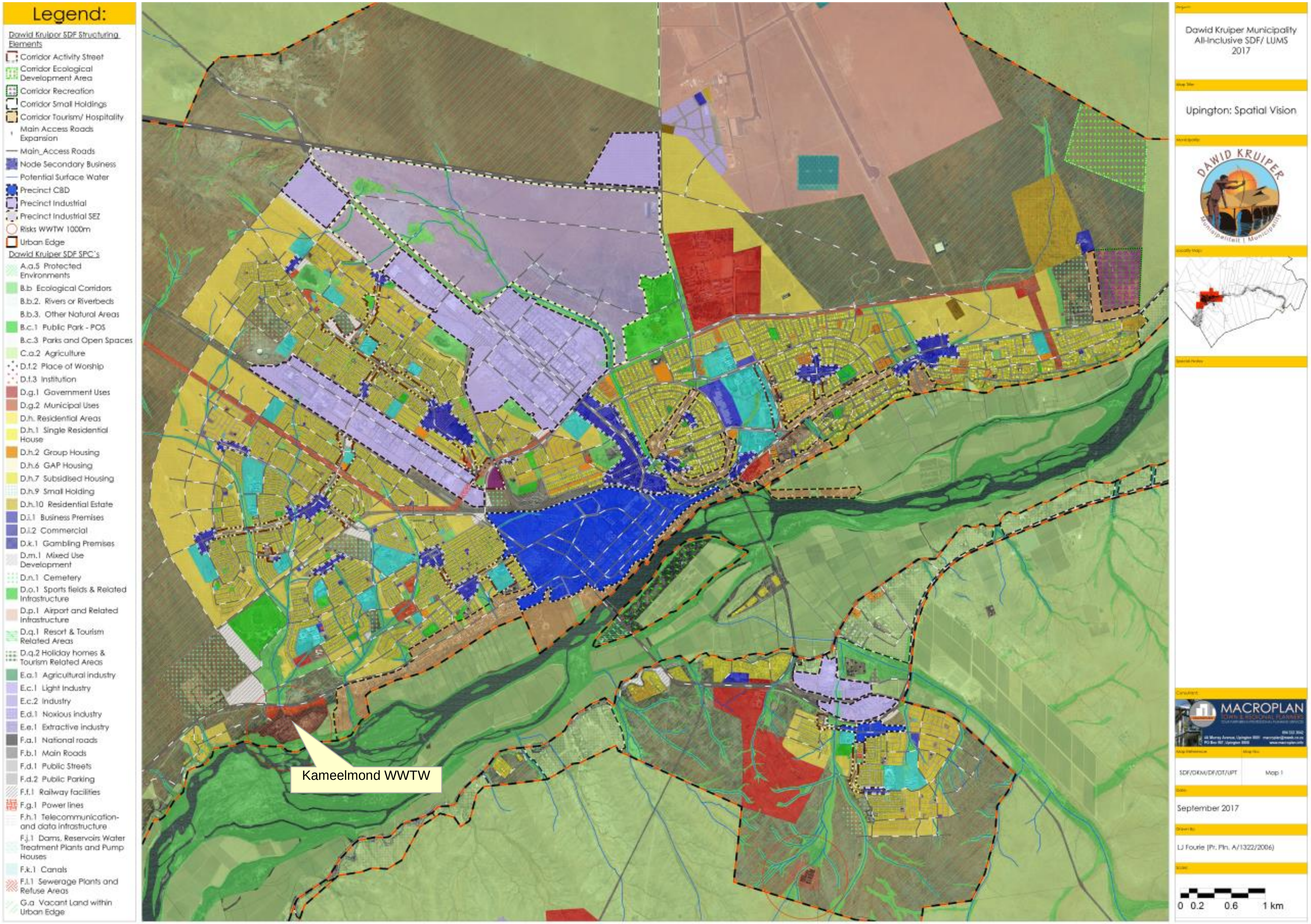


**Figure 1: Dawid Kruiper Municipality's SDF of 2017**

# Proposed Upgrade and Expansion of the Kameelmond Wastewater Treatment Works in Upington, Northern Cape

## Environmental Management Programme & Closure Plan

**Draft**

August 2021

Applicant: Dawid Kruiper Municipality


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# Title and Approval Page

| | |
|---|---|
| Project Name: | Proposed Upgrade and Expansion of the Kameelmond Wastewater Treatment Works in Upington, Northern Cape |
| Report Title: | Environmental Management Programme & Closure Plan |
| Authority Reference: | *To be assigned* |
| Report Status: | Draft |

| | |
|---|---|
| Applicant: | Dawid Kruiper Municipality |

| | | | | |
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| Report Reference: | 10709-20210820-EMPr & Closure Plan | | | R-PRO-REP\|20170216 |

| | Name | Date |
|---|---|---|
| Authors: | D. Henning | 20/08/2021 |
| Reviewed By: | N. Naidoo | 20/08/2021 |

# Amendments Page

| Date: | Nature of Amendment | Amendment Number: |
|---|---|---|
| 20/08/2021 | Draft for Client Submission | 0 |
| | | |
| | | |
| | | |
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| | | |

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# LIST OF ACRONYMS & ABBREVIATIONS

| | |
|---|---|
| **ADWF** | Average Dry Weather Flow |
| **ASP** | Activated Sludge Process |
| **BTF** | Biological Trickling Filter |
| **DENC** | Department of Environment and Nature Conservation |
| **DFFE** | Department of Forestry, Fisheries and the Environment |
| **DKM** | Dawid Kruiper Municipality |
| **DWS** | Department of Water and Sanitation |
| **EAP** | Environmental Assessment Practitioner |
| **ECO** | Environmental Control Officer |
| **EIA** | Environmental Impact Assessment |
| **EMPr** | Environmental Management Programme |
| **EO** | Environmental Officer |
| **GN** | Government Notice |
| **HoW** | Head of Works |
| **HPF** | Hourly Peak Flow |
| **K-WWTW** | Kameelmond Wastewater Treatment Works |
| **MPRDA** | Minerals and Petroleum Resources Development Act (Act No. 28 of 2002) |
| **MSDS** | Material Safety Data Sheet |
| **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, 2004 (Act No. 10 of 2004) |
| **NEM:WA** | National Environmental Management: Waste Act (Act No. 59 of 2008) |
| **NFA** | National Forests Act (No. 84 of 1998) |
| **NHRA** | National Heritage Resources Act (Act No. 25 of 1999) |
| **NWA** | National Water Act (Act No. 36 of 1998) |
| **OHS** | Occupational Health and Safety |
| **PPE** | Personal Protective Equipment |
| **RAS** | Return Activated Sludge |
| **SAHRA** | South African Heritage Resources Agency |
| **SANRAL** | South African National Roads Agency |
| **SANS** | South African National Standard |
| **SAPS** | South African Police Services |
| **SO** | Social Officer |
| **SST** | Secondary Sedimentation Tanks |
| **WAS** | Waste Activated Sludge |
| **WML** | Waste Management Licence |
| **WUL** | Water Use Licence |
| **WWTW** | Wastewater Treatment Works |

# DEFINITION OF KEY TERMS

| | |
|---|---|
| **Closure Pan** | *A plan of action prepared to manage negative environmental impacts associated with the decommissioning or closure of a facility.* |
| **Environment** | *The surroundings in which humans exist and which comprise:*<br>• *The land, water and atmosphere of the earth.*<br>• *Micro-organisms, plant and animal life.*<br>• *Any part or combination of a) and b) and the interrelationships among and between them.*<br>• *The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that can influence human health and well-being.* |
| **Environmental Aspect** | *Those components of the company's activities, products and services that are likely to interact with the environment.* |
| **Environmental Feature** | *Elements and attributes of the biophysical, economic and social environment.* |
| **Environmental Impact** | *The change to the environment resulting from an environmental aspect, whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.* |
| **Environmental Management Programme (EMPr)** | *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.* |
| **Environmental Objective** | *Overall environmental goal pertaining to the management of environmental features.* |
| **Environmental Target** | *Performance requirement that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.* |
| **Monitoring** | *A systematic and objective observation of an organisation's activities and services conducted and reported on regularly.* |
| **Project Area** | *The greater area within which the project is executed. Extends beyond the construction domain.* |
| **Sensitive environmental features** | *Environmental features protected by legislation (e.g. heritage resources), or identified as sensitive through specialists' findings and input received from Interested and Affected Parties.* |
| **Watercourse** | *A geomorphological feature characterized by the presence of a streamflow channel, a floodplain and a transitional upland fringe seasonally or permanently conveying surface water. According to the National Water Act (Act 36 of 1998), a watercourse constitutes a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which, or from which, water flows, and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.* |

# 1 PURPOSE OF THIS DOCUMENT

Nemai Consulting was appointed by Bigen, on behalf of 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 process is being undertaken according to the process prescribed in Government Notice (GN) No. R. 982 of 4 December 2014 (as amended) (the EIA Regulations), promulgated in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA).

This document serves as the draft **Environmental Management Programme (EMPr)** and provides performance criteria required to address potential environmental impacts during the pre-construction, construction and operational phases of the Project. In addition, this document also contains the **Closure Plan** to manage potential environmental impacts associated with the decommissioning of certain components of the K-WWTW. This report must be read in conjunction with the Basic Assessment Report.

The scope of the EMPr and Closure Plan includes the following:

- To provide the environmental legislative framework that governs the Project.
- To outline institutional structures and roles required to implement the EMPr and Closure Plan;
- To provide environmental monitoring requirements;
- To establish management objectives associated with the Project's activities, in order to enhance benefits and manage (i.e. prevent, reduce, rehabilitate and/or compensate) adverse environmental impacts;
- To provide targets for management objectives, in terms of desired performance; and
- To describe actions required to achieve management objectives and targets.

# 2 DOCUMENT ROADMAP

As a minimum, this document aims to satisfy the following requirements:

- EMPr - Appendix 4 of the EIA Regulations; and
- Closure Plan - Appendix 5 of the EIA Regulations.

**Table 1** below presents the document's composition in terms of the abovementioned regulatory requirements.

**Table 1: Document Roadmap**

| Chapter | Title | Appendix 4 of the EIA Regulations | | Appendix 5 of the EIA Regulations | |
|---|---|---|---|---|---|
| 1 | **Purpose of this Document** | N/A | | N/A | |
| 2 | **Document Roadmap** | N/A | | N/A | |
| 3 | **Project Overview** | N/A | | N/A | |
| 4 | **Environmental Assessment Practitioner** | 1(a) | Details of –<br>(i) the Environmental Assessment Practitioner (EAP) who prepared the EMPr; and<br>(ii) the expertise of that EAP to prepare an EMPr, including curriculum vitae. | 1(a) | Details of –<br>(i) the EAP who prepared the closure plan; and<br>(ii) the expertise of that EAP. |
| 5 | **Legislation and Guidelines Considered** | N/A | | N/A | |
| 6 | **Roles & Responsibilities** | 1(i) | An indication of the persons who will be responsible for the implementation of the impact management actions. | - | |
| 7 | **Monitoring** | 1(g) | The method of monitoring the implementation of the impact management actions contemplated in paragraph (f). | - | |
| | | 1(h) | The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f). | - | |
| | | 1(k) | The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f). | 1(c) | proposed mechanisms for monitoring compliance with and performance assessment against the closure plan and reporting thereon. |
| | | 1(l) | A programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations. | - | |
| 8 | **Environmental Training &** | 1(m) | An environmental awareness plan describing the manner in which - | - | |

| Chapter | Title | Appendix 4 of the EIA Regulations | | Appendix 5 of the EIA Regulations | |
|---|---|---|---|---|---|
| | **Awareness Creation** | | (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and<br>(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment. | | |
| 9 | **EMPr & Closure Plan Review** | N/A | | N/A | |
| 10 | **Environmental Aspects and Impacts** | 1(b) | A detailed description of the aspects of the activity that are covered by the final environmental management plan. | - | |
| 11 | **Sensitive Environmental Features** | 1(c) | A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers. | - | |
| 12 | **Impact Management** | 1(d) | A description of impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including –<br>(i) planning and design;<br>(ii) pre-construction activities;<br>(iii) construction activities;<br>(iv) rehabilitation of the environment after construction and where applicable post closure; and<br>(v) where relevant, operation activities. | 1(b) | Closure objectives. |
| | | | | 1(d) | Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including a handover report, where applicable. |
| | | | | 1(e) | Information on any proposed avoidance, management and mitigation measures that will be taken to address the environmental impacts resulting from the undertaking of the closure activity |
| | | 1(f) | A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to -<br>(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; | 1(f) | A description of the manner in which it intends to—<br>(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation during closure;<br>(ii) remedy the cause of pollution or degradation and migration of pollutants during closure;<br>(iii) comply with any prescribed environmental management standards or practices; and |

| Chapter | Title | Appendix 4 of the EIA Regulations | | Appendix 5 of the EIA Regulations | |
|---|---|---|---|---|---|
| | | | (ii) comply with any prescribed environmental management standards or practices;<br>(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and<br>(iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable. | | (iv) comply with any applicable provisions of the Act regarding closure. |
| | | | | 1(h) | The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of closure/ |
| | | 1(j) | The time periods within which the impact management actions contemplated in paragraph (f) must be implemented. | 1(g) | Time periods within which the measures contemplated in the closure plan must be implemented. |
| | | 1(l) | A programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations. | - | |
| N/A | | 1(n) | Any specific information that may be required by the competent authority | - | |
| N/A | | 2 | Where a government notice gazetted by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply. | - | |
| N/A | | - | | 1(j) | Where applicable, details of any financial provision for the rehabilitation, closure and on-going post decommissioning management of negative environmental impacts. |

It is noted that the information related to the public participation process, as required in terms of section 1(i) of Appendix 5 of the EIA Regulations for the Closure Plan, is contained in the Basic Assessment Report.

# 3 PROJECT OVERVIEW

## 3.1 Details of the Applicant

**Project Applicant:** Dawid Kruiper Municipality
**Postal address:** Private Bag X6003, UPINGTON, 8800
**Tel No:** 054 338 7001
**Fax No:** 054 338 7350
**E-mail address:** manager@dkm.gov.za

## 3.2 Project Background and Motivation

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,

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.

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

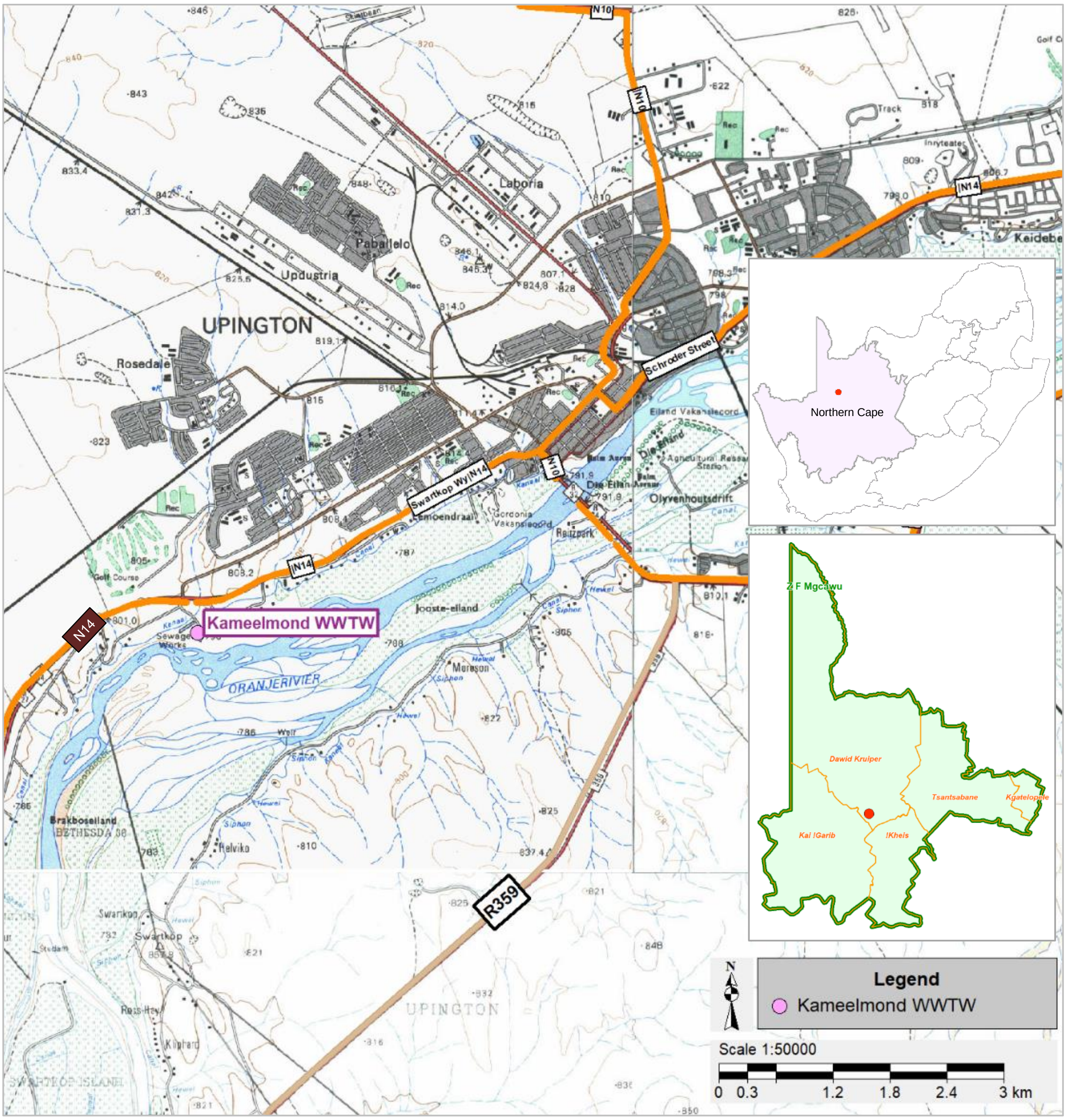


**Figure 1: Locality map**

## 3.3 K-WWTW'S Status Quo Treatment Process

The schematic process diagram showing the inter-relationship between the process units at the K-WWTW is provided in **Figure 2** below.

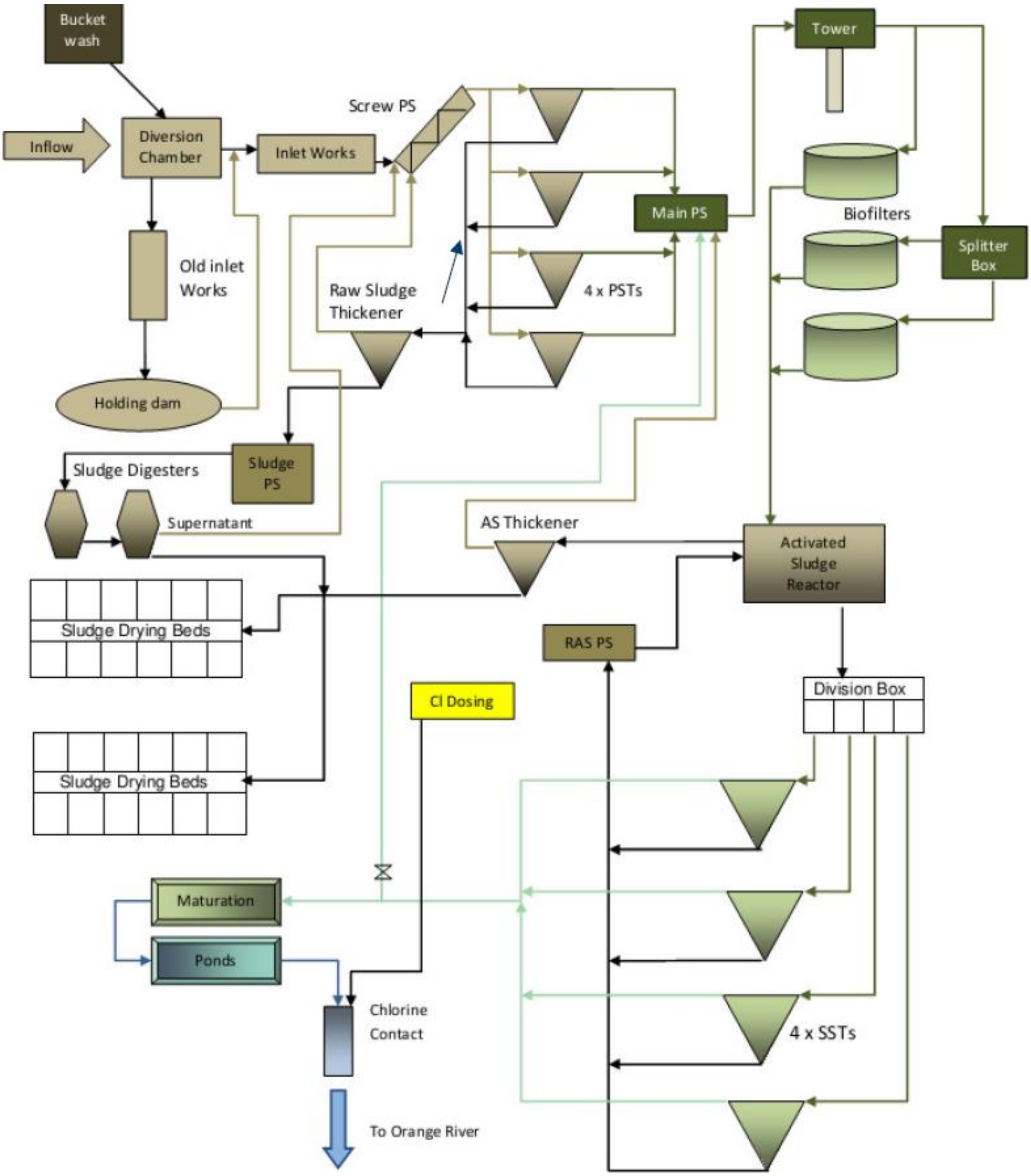


**Figure 2: Schematic diagram of works**

## 3.4 Project Description

### *3.4.1 Introduction*

A map of the general layout of the upgrade and expansion works is shown in **Figure 3** below.

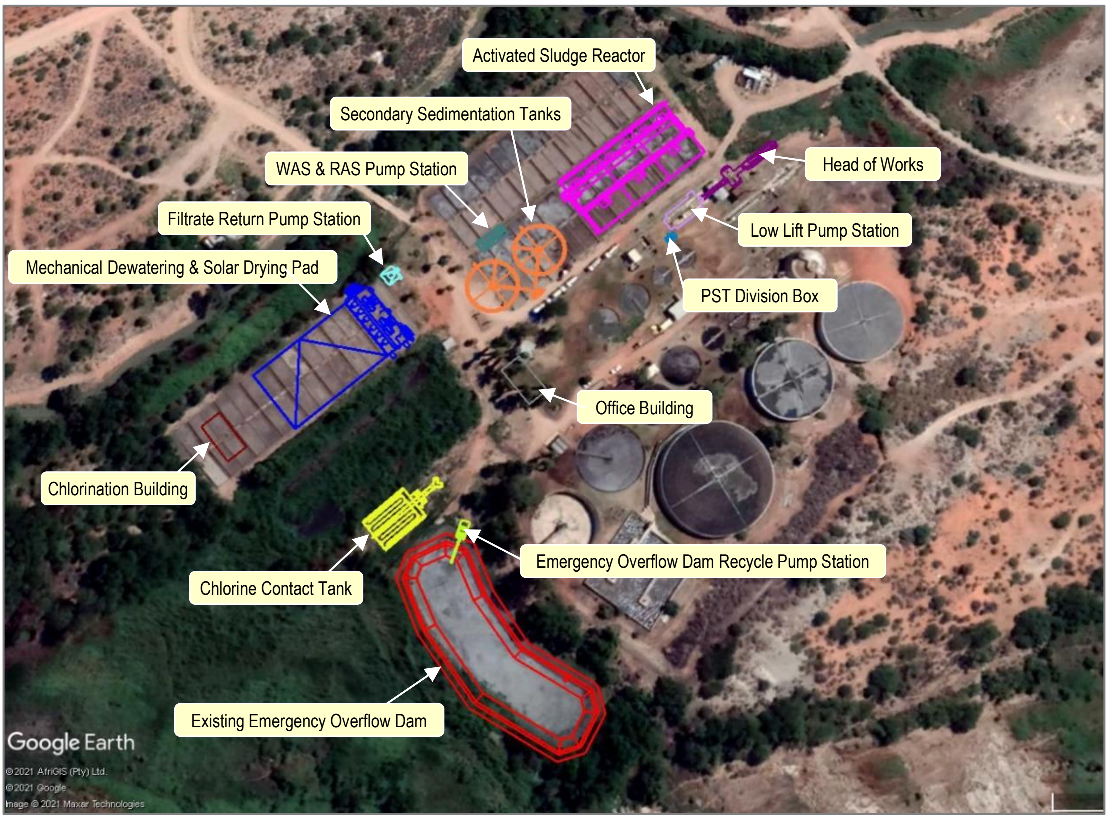


**Figure 3: K-WWTW Upgrade and expansion works (Google Earth image)**

An overview of the key components of the K-WWTW associated with the upgrade and expansion works is provided in the sub-sections to follow. Additional information is provided in the Basic Assessment Report.

### *3.4.2 Head of Works*

A mothballed structure, previously used as the inlet works 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 Average Dry Weather Flow (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 (50mm aperture); and
- One (1) Parshall flume for flow measurement downstream of degritters.

A diesel-fired incinerator is currently used for the disposal of screenings at the K-WWTW. The incinerator will be discontinued as part of the upgrade and expansion works.

### *3.4.3 Emergency Storage*

An existing emergency overflow pond, 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.

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.

### *3.4.4 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.

### *3.4.5 Activated Sludge Train*

A new 12 Ml/d (ADWF) Activated Sludge Process (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.

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

- Substrate removal;
- Conversion of ammonia to nitrate;
- 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. 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.

### *3.4.6 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.

### *3.4.7 Sludge Stabilisation & Dewatering*

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 are:

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

K-WWTW currently has 96 drying beds, which 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.

An option evaluation 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:

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

# 4 ENVIRONMENTAL ASSESSMENT PRACTITIONER

The details of the Environmental Assessment Practitioner (EAP) are as follows:

| | |
|---|---|
| **Name of EAP:** | Donavan Henning from Nemai Consulting (Pty) Ltd |
| **Postal address:** | PO Box 1673, SUNNINGHILL, 2157 |
| **Tel No:** | 011 781 1730 |
| **Fax No:** | 011 781 1731 |
| **E-mail address:** | donavanh@nemai.co.za |

The core members of Nemai Consulting that were involved with compiling this EMPr and Closure Plan are captured in **Table 2** below. The Curricula Vitae of these persons are contained in the Basic Assessment Report.

**Table 2: EMPr & and Closure Plan - Core Team Members**

| Name | Qualifications | Experience |
|---|---|---|
| Mr D. Henning | MSc (River Ecology) | • 20 years' experience.<br>• EAP for various bulk sewer and WWTW related projects, including:<br>o Expansion of the Sunderland Ridge WWTW, Gauteng.<br>o Zandspruit Pump Station and Bulk Sewer Rising Main, Gauteng.<br>o Sewer inspection programme and the replacement of damaged sewer pipes, Gauteng.<br>o Realignment of a sub-outfall sewer, Gauteng.<br>o Remedial measures to eliminate sewer surcharging at Leeukop Prison, Gauteng.<br>o Upgrade of undersize collector sewer in Bryanston, Gauteng.<br>o Sewer upgrade in the Klipspruit Sewer Basin, Gauteng. |
| Ms D. Naidoo | BSc Eng (Chem) | • 24 years' experience.<br>• Project Manager for various bulk sewer and WWTW related projects, including:<br>o Development of a new 150 Mℓ/d WWTW in Lanseria, Gauteng.<br>o Development of a new WWTW on the Hennops River, Gauteng.<br>o Construction of Northern WWTW: Unit 5, Gauteng.<br>o Empangeni Bulk Outfall Sewer, 40 km pipeline, KZN.<br>o Increase in sludge treatment capacity including a new lime dosing plant at the Northern WWTW, Gauteng.<br>o Construction of sludge thickeners at Goudkoppies WWTW, Gauteng. |

# 5 LEGISLATION AND GUIDELINES CONSIDERED

## 5.1 Overview of Legislation

Activities during the pre-construction, construction and operational phases will be undertaken according to the measures prescribed within this EMPr and Closure Plan. The EMPr and Closure Plan shall form part of the Contractor's contract documents.

All project activities must comply with all relevant South African legislation and regulations. Some of the pertinent environmental legislation is captured in **Table 3** below.

**Table 3: Environmental legislative Framework**

| Legislation | Description and Relevance |
|---|---|
| Constitution of the Republic of South Africa, (No. 108 of 1996) | ▪ Chapter 2 – Bill of Rights.<br>▪ Section 24 – Environmental Rights. |
| National Environmental Management Act (Act No. 107 of 1998) (NEMA) | ▪ Key sections (amongst others):<br>o Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment).<br>o Section 28 – Duty of care and remediation of environmental damage.<br>▪ Environmental management principles.<br>▪ Authorisation type – Environmental Authorisation.<br>▪ Authorities – Department of Forestry, Fisheries and the Environment (DFFE) (national) and Northern Cape Department of Environment and Nature Conservation (DENC) (provincial). |
| GN No. R 982 of 4 December 2014 (as amended) | ▪ Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.<br>▪ Authorities – DFFE (national) and DENC (provincial). |
| National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) | ▪ Management of waste.<br>▪ Key sections (amongst others):<br>o Section 16 – General duty in respect of waste management.<br>o Chapter 5 – licensing of waste management activities (listed in GN No. R. 921 of 29 November 2013 (as amended)).<br>▪ Authorisation type – Waste Management Licence (WML). A separate process is being undertaken to apply for a WML for the Project under DFFE.<br>▪ Authority – DFFE (national) and DENC (provincial). |
| National Water Act (Act No. 36 of 1998) (NWA) | ▪ Sustainable and equitable management of water resources.<br>▪ Key sections (amongst others):<br>o Chapter 3 – Protection of water resources.<br>o Section 19 – Prevention and remedying effects of pollution.<br>o Section 20 – Control of emergency incidents.<br>o Chapter 4 – Water use.<br>▪ Authorisation type – A separate process is being undertaken to apply for a Water Use Licence for the Project.<br>▪ Authority – Department of Water and Sanitation (DWS). |
| National Environmental Management Air Quality | ▪ Air quality management<br>▪ Key sections (amongst others):<br>o Section 22A – Illegal emissions. |

| Legislation | Description and Relevance |
|---|---|
| Act (Act No. 39 of 2004) (NEM:AQA) | o Section 29 – Pollution prevention plans.<br>o Section 32 – Dust control.<br>o Section 34 – Noise control.<br>o Section 35 – Control of offensive odours.<br>▪ Authorisation type – Atmospheric Emission License.<br>▪ Authority – DFFE (national), DENC (provincial) and municipalities. |
| National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA) | ▪ Management and conservation of the country's biodiversity.<br>▪ Protection of species and ecosystems.<br>▪ Authorisation type – Permit.<br>▪ Authority – DFFE (national) and DENC (provincial). |
| National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA) | ▪ Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes. |
| National Forests Act (Act No. 84 of 1998) (NFA) | ▪ Supports sustainable forest management and the restructuring of the forestry sector, as well as protection of indigenous trees in general.<br>▪ Section 15 – Authorisation required for impacts to protected trees.<br>▪ Authorisation type – Licence.<br>▪ Authority – DFFE. |
| Hazardous Substances Act (Act No. 05 of 1973) | ▪ Provisions for the control of substances which may cause injury or ill-health to or death of human beings. |
| Occupational Health & Safety Act (Act No. 85 of 1993) | ▪ Provisions for Occupational Health & Safety.<br>▪ Authority – Department of Employment and Labour.<br>▪ Relevant regulations, such as Construction Regulations, etc. |
| National Heritage Resources Act (Act No. 25 of 1999) (NHRA) | ▪ Key sections:<br>o Section 34 – protection of structure older than 60 years.<br>o Section 35 – protection of heritage resources.<br>o Section 36 – protection of graves and burial grounds.<br>o Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m$^2$ in extent, etc.<br>▪ Authorisation type – Permit.<br>▪ 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) (CARA) | ▪ Control measures for erosion.<br>▪ Control measures for alien and invasive plant species.<br>▪ Authority – Department of Agriculture. |
| NEM:BA Alien and Invasive Species Regulations (GN No. R 598 of 1 August 2014) | ▪ Prevention the introduction and spread of alien and invasive species across South Africa. |
| Northern Cape Conservation Act (Act No. 9 of 2009) | ▪ Protected and Specially Protected Species.<br>▪ Authorisation type – Permit.<br>▪ Authority – DENC. |

## 5.2 Method Statements

The Contractor shall provide detailed method statements on how the performance criteria in the EMPr and Closure Plan will be met. These methods are to be reviewed and approved by the Engineer to ensure that they are adequate.

The method statements must be project- and site specific and should explain in detail the following:

1. The manner in which the work is to be undertaken;
2. The estimated schedule for the works (timing);
3. The area where the works will be executed (location);
4. The materials and plant / equipment needed for the works;
5. The necessary mitigation measures that need to be implemented to adequately safeguard the environment, construction workers and the public (where applicable);
6. Training requirements for employees;
7. Roles and responsibilities; and
8. Monitoring and reporting requirements.

The list of method statements required to assist in the implementation of this EMPr and Closure Plan includes at least the following (where applicable):

- Method Statement for waste and wastewater management;
- Method Statement for wastewater management;
- Method Statement for decommissioning the existing diesel-fired incinerator, sludge drying beds, obsolete old inlet works and existing screw pump station;
- Method Statement to show procedures for dealing with possible emergencies that can occur, such as fire and accidental leaks and spillage of hazardous substances;
- Method Statement for the storage and handling of hazardous substances;
- Method Statement for rehabilitation of construction footprint; and
- Method Statement for the management of stormwater and erosion.

# 6 ROLES & RESPONSIBILITIES

## 6.1 DENC

The DENC is the mandated authority in terms of NEMA that determines whether Environmental Authorisation can be issued for the Project, following a decision-making process conducted as part of the Basic Assessment Process. Conditions are included in the Environmental Authorisation, which need to be complied with by the Project Applicant (DKM).

The DENC also fulfils a compliance and enforcement role with regards to the Environmental Authorisation. The DENC may perform random inspections to check compliance and will also review the monitoring and auditing reports compiled by the Environmental Control Officer (ECO).

Amendments may be required to the EMPr and Closure Plan or the Environmental Authorisation, based on adaptive management to the site conditions, findings of environmental auditing and the technical requirements of the Project. Amendments will need to be approved by the DENC, in accordance with GN No. R982 of 4 December 2014 (as amended).

## 6.2 DKM

As the Applicant, the DKM is ultimately responsible for the development and implementation of the EMPr and Closure Plan, as well as for ensuring that the conditions in the Environmental Authorisation are adhered to. The liability for non-compliance thus rests with the DKM.

The DKM is further responsible for ensuring that the Project complies with all relevant environmental legislation.

Key responsibilities of DKM include the following:

- To be fully conversant with the conditions of the Environmental Authorisation;
- To ensure that all stipulations within the EMPr and Closure Plan are adhered by the Contractor(s);
- To issue site instructions to the Contractor for corrective actions required;
- To monitor the implementation of the EMPr and Closure Plan throughout the Project; and
- To ensure that periodic environmental performance audits are undertaken.

## 6.3 The Contractor

The Contractor(s) is appointed by the proponent (i.e. DKM) to undertake the upgrade and expansion works, as specified in the Contract. In order to carry out the requirements of this EMPr and Closure Plan, the Contractor must make sure that he/she has a clear understanding of all environmental matters relating to the Project.

The responsibilities of the Contractor will, as a minimum, include the following:

- To implement the EMPr and Closure Plan;
- To employ a suitably qualified person to monitor and report to the DKM's appointed person on the daily activities on-site during the construction period;
- To ensure all sub-contractors under his/her supervision adhere to the EMPr and Closure Plan;
- To report any non-compliance to the Engineer within twelve hours of the event occurring;
- To report any non-compliance event that constitutes an emergency immediately and in line with the protocol applicable to that particular emergency event;
- To ensure that all employees and sub-contractors attend the Environmental Awareness Training and subsequent refresher training, and are familiar with or made aware of the contents of the EMPr and Closure Plan; and
- To conduct any remedial work required in terms of the EMPr and Closure Plan as a result of environmental negligence, mismanagement and/or non-compliance.

## 6.4 The Contractor's Environmental Officer and Social Officer

The Environmental Officer (EO) and Social Officer (SO) are part of the Contractor's staff and are responsible for all activities related to the day-to-day on-site implementation of the EMPr and Closure Plan. They are also responsible for the compilation of regular (daily, weekly and monthly) Monitoring Reports for the Engineer.

The EO and SO must liaise with the Engineer on all environmental and related issues (when necessary) and ensure that any complaints received from the public are recorded and dealt with appropriately and expeditiously.

## 6.5 The Environmental Control Officer

The role of the ECO is primarily to act as an independent monitor for the implementation of the upgrade and expansion works, in accordance with the requirements of the EMPr and Closure Plan. The ECO must be competent to fulfill this duty.

The responsibilities of the ECO include the following:

- To be aware of the findings and conclusions of the environmental assessments undertaken for the Project;
- To be familiar with the environmental management requirements contained in this EMPr and Closure Plan;
- To be conversant with relevant environmental legislation, policies and procedures governing the Project;
- To monitor compliance with the conditions of the Environmental Authorisation;
- To monitor and review the progress towards achieving the specific objectives and performance targets of the EMPr and Closure Plan; and
- To independently verify that mitigation measures in the EMPr and Closure Plan are being applied / implemented.

## 6.6 The Engineer

The Engineer is appointed to design the works and supervise construction. The Engineer carries a direct responsibility for the effective implementation of the environmental management requirements detailed in this EMPr and Closure Plan.

# 7 MONITORING

## 7.1 General

Monitoring is required to ensure that the receiving environment is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the Project.

A document handling system must be established to ensure accurate updating of the EMPr and Closure Plan documents, and availability of all documents required for the effective functioning of the EMPr.

Supplementary documentation to the EMPr and Closure Plan could include:

- Method Statements;
- Site instructions;
- Emergency preparedness and response procedures;
- Record of environmental incidents;
- Non-conformance register;
- Training records;
- Site inspection reports;
- Monitoring reports;
- Public complaints register; and
- Grievance Mechanism/Process for public and contractor/employees.

## 7.2 Baseline Monitoring

### *7.2.1 General*

Baseline monitoring aims to determine the pre-construction state of the receiving environment and serves as a reference to measure the residual impacts of the Project by evaluating the deviation from the baseline conditions and the associated significance of the adverse effects.

### *7.2.2 Preconstruction Survey*

A pre-construction survey needs to be conducted for all areas that are to be affected by construction activities. The survey needs to include the following:

- Site investigations by appropriate members of the Project team and specialists (as relevant);
- Generate records from survey which include site details, photographs, explanatory notes, etc. (as required);
- Record the condition of existing structures and infrastructure on the site; and
- Identify site-specific mitigation measures.

The records from the pre-construction survey must be used to establish and inform the reinstatement and rehabilitation requirements for the affected areas.

#### *7.2.3 Environmental Parameters*

The environmental parameters to be included in the baseline monitoring need to be confirmed in consultation with the Engineer and ECO.

## 7.3 Environmental Monitoring

Environmental monitoring entails checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded. The parameters and sampling localities used during the baseline monitoring will form the basis of the environmental monitoring programme.

The environmental parameters to be included as part of the environmental monitoring programme need to be confirmed in consultation with the Engineer and ECO.

The following requirements need to be incorporated into the programme (as relevant):

- Monitoring during normal operations, abnormal situations and emergency situations (e.g. unexpected spillage of hazardous substance);
- Measuring equipment must be accurately calibrated;
- Adequate quality control of the sampling must be ensured;
- Analysis is to be undertaken at a SANS 17025 certified laboratory;
- Certified methods of testing must be employed;
- Where legal specifications exist for testing and sampling methods, these must be considered; and
- Establish a process for identifying and implementing corrective measures.

## 7.4 Compliance Monitoring and Auditing

Compliance monitoring will commence in the pre-construction phase, where those conditions in the Environmental Authorisation that need to be adhered to prior to project implementation will need to be checked and recorded, as well as to check compliance with the provisions in the EMPr and Closure Plan. Compliance monitoring will be completed at the end of the defects liability period to check the performance of rehabilitation measures and whether the related objectives have been met.

It is recommended that the ECO undertake monthly monitoring and bi-annual full compliance auditing, including an audit at the end of construction and one at the end of the defects notification period.

Auditing of compliance with the Environmental Authorisation, as well as the EMPr and Closure Plan, must be conducted in accordance with Regulation 34 of GN No. R 982 of 4 December 2014 (as amended) in terms of the following:

1. The holder of the Environmental Authorisation must, for the period during which the Environmental Authorisation as well as the EMPr and Closure Plan remain valid -
    a. Ensure that the compliance with the conditions of the Environmental Authorisation, as well as the EMPr and Closure Plan, are audited; and
    b. Submit an environmental audit report to DENC.
2. The environmental audit report must -
    a. Be prepared by an independent person with the relevant environmental auditing expertise;
    b. Provide verifiable findings, in a structured and systematic manner, on-
        i. The level of performance against and compliance of an organization or project with the provisions of the Environmental Authorisation, as well as the EMPr and Closure Plan; and
        ii. The ability of the measures contained in the EMPr and Closure Plan to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity;
    c. Contain the information set out in Appendix 7 of GN No. R. 982 of 4 December 2014 (as amended); and
    d. Be conducted and submitted to DENC at intervals as indicated in the Environmental Authorisation.
3. The environmental audit report must determine-
    a. The ability of the EMPr and Closure Plan to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis; and
    b. The level of compliance with the provisions of Environmental Authorisation, as well as the EMPr and Closure Plan.

# 8 Environmental Training & Awareness Creation

Training aims to create an understanding of environmental management obligations and prescriptive measures governing the execution of the Project. It is generally geared towards project team members that require a higher-level of appreciation of the environmental management context and implementation framework for the Project.

Awareness creation strives to foster a general attentiveness amongst the construction workforce to sensitive environmental features and an understanding of implementing environmental best practices.

The various means of creating environmental awareness during the pre-construction and construction phases of the project may include:

- Induction course for all workers before commencing work on site;
- Refresher courses (as and when required);
- Daily toolbox talks, focusing on particular environmental issues (task- and area specific);
- Courses must be provided by suitably qualified persons and in a language and medium understood by the workers;
- Erect signage and barricading (where necessary) at appropriate points in the construction domain, highlighting sensitive environmental features (e.g. watercourses); and
- Place posters containing environmental information at areas frequented by the construction workers (e.g. eating facilities).

Training and awareness creation will be tailored to the audience, based on their designated roles and responsibilities. Records will be kept of the type of training and awareness creation provided, as well as containing the details of the attendees.

The Contractor must compile a project-specific Environmental Training and Awareness Programme, taking into consideration the abovementioned factors, to be approved by the Engineer.

# 9 EMPR AND CLOSURE PLAN REVIEW

Due to its dynamic nature, this EMPr and Closure Plan will be reviewed and revised when necessary to ensure continued environmental improvement.

Changes to the EMPr and Closure Plan shall be required where the existing system:

- Does not make adequate provision for protecting the environment against the pre-construction and construction activities;
- Needs to be modified to meet conditions of statutory approval;
- It is not achieving acceptable environmental performance;
- Requires changes due to the outcome of a monitoring event or management review;
- Provides redundant, impracticable or ineffective management measures; and
- Based on provisions in Regulation 34 of GN No. R. 982 of 4 December 2014 (as amended), as amended.

The amendment of the EMPr and Closure Plan will be undertaken in terms of Regulation 34 – 37 of GN No. R. 982 of 4 December 2014 (as amended), as applicable.

# 10 Environmental Activities, Aspects and Impacts

## 10.1 Environmental Activities

Some of the main Project activities, as well as high-level environmental activities, to be undertaken during the Project life-cycle are listed in **Table 4** below.

**Table 4: Simplified list of activities associated with the Project life-cycle**

| **Project Phase: Pre-construction** |
|---|
| **Project Activities** |
| ▪ Confirm design features and specifications for WWTW components 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** |
| ▪ Compliance monitoring of the EMPr & Closure Plan, Environmental Authorisation (EA), Waste Management Licence (WML), Water Use Licence (WUL) and other relevant environmental legislation. |
| ▪ On-going consultation with I&APs, stakeholders and authorities (as relevant). |
| ▪ Other activities as per EMPr & Closure Plan. |
| **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** |
| ▪ Compliance monitoring of the EMPr & Closure Plan, EA, WML, WUL & 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 & Closure Plan. |
| **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. |

## 10.2 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 5** below. Note that only high-level aspects are listed.

**Table 5: Environmental aspects associated with the 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 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, water, 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 and maintenance works. |
| ▪ Pollution (air, soil, water, visual) caused by operational activities. |
| ▪ Discharge of sub-standard effluent. |
| ▪ Failure to manage sludge and screenings. |
| ▪ 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). |

## 10.3 Potentially Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. The potentially significant environmental impacts associated with the Project are listed in **Table 6** below.

**Table 6: Potentially significant environmental impacts associated with the Project life-cycle**

| 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.<br>• Setbacks / conditions associated with surrounding land and infrastructure (as relevant). | • Setbacks / conditions associated with surrounding land and infrastructure (as relevant).<br>• Land use requirements and restrictions associated with the buffer zone of the K-WWTW will need to be enforced from a planning perspective.<br>• 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.<br>• Climate change may lead to increased inflows, which can cause more frequent bypassing at the K-WWTW.<br>• 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. |
| **Soil** | • Encountering historically contaminated soil at the K-WWTW.<br>• Soil erosion due to clearance and inadequate stormwater management<br>• Soil compaction.<br>• Soil contamination due to spillages and poor construction practices. | • Soil erosion due to inadequate stormwater management.<br>• Soil contamination due to poor operation and maintenance practices, including inadequate management of sewage, effluent, waste and hazardous substances. |
| **Surface Water** | ▪ Alteration of drainage over the site.<br>▪ Surface water pollution due to spillages and poor construction practices.<br>▪ Encroachment of construction activities into regulated area of the Orange River and non-perennial drainage line.<br>• 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.<br>▪ Damage to the K-WWTW from major flood events.<br>▪ 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.<br>• The proposed upgrade and expansion aim to ensure that the K-WWTW will discharge effluent of |

| Environmental Factor | Construction Phase Potential Issues / Impacts | Operational Phase Potential Issues / Impacts |
|---|---|---|
| | | suitable quality, which will benefit the receiving river and downstream water users, including irrigators (*positive impact*). |
| **Flora & Fauna** | • Noise and vibration impacts to fauna.<br>• Nights lights may affect nocturnal faunal species.<br>• Illegal harvesting and poaching of faunal and floral species by construction workers.<br>• Pollution of the biophysical environment from poor construction practices.<br>• Proliferation of invasive alien species in disturbed areas.<br>• Loss of protected trees (notably the Camel thorn) and species of conservation concern.<br>• Human - animal conflicts. | • Proliferation of invasive alien species in disturbed areas.<br>• Environmental pollution caused by inadequate management of sewage, effluent, waste and hazardous substances.<br>• 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.<br>• Emissions from construction equipment and machinery.<br>• 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).<br>• Safety and security risks to surrounding communities.<br>• Use of local road network.<br>• Nuisance from dust and noise to surrounding communities.<br>• Consideration of local labourers and suppliers in area – stimulation of local economy (*positive impact*).<br>• Transfer of skills (*positive impact*). | • A wastewater treatment plant is an odorous facility that may cause a nuisance to surrounding communities.<br>• The pollution caused to the Orange River from sub-standard effluent quality impacts on agricultural practices of downstream irrigators.<br>• Groundwater contamination from poor waste management practices at the K-WWTW may impact on other groundwater users. |
| **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. | N/A |
| **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.<br>• Disruptions caused to operations at the K-WWTW. | N/A |
| **Traffic** | • Transportation of materials and construction personnel to site.<br>• Impacts to road conditions. | • Safe access, taking into consideration the high-speed environment along the N14. |

| Environmental Factor | Construction Phase Potential Issues / Impacts | Operational Phase Potential Issues / Impacts |
|---|---|---|
| | • Speeding and reckless driving by construction personnel.<br>• Construction vehicles accessing and leaving the site via the N14.<br>• Risks to other road users. | |
| **Aesthetics** | • Visual impacts associated with construction activities (e.g. poor housekeeping).<br>• Inadequate reinstatement and rehabilitation of construction footprint. | N/A |
| **Health** | ▪ Hazards related to construction work.<br>▪ Risks posed by working inside an operational wastewater treatment plant.<br>▪ Increased levels of dust and particulate matter.<br>▪ Increased levels of noise.<br>▪ Poor water and sanitation.<br>▪ Communicable diseases.<br>▪ Psychosocial disorder (e.g. social disruptions).<br>▪ Safety and security.<br>▪ Lack of suitable health services. | ▪ Hazards related to operation and maintenance work. |
| **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).<br>▪ Ingress of contaminants into stormwater system. |

# 11 Sensitive Environmental Features

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.

The K-WWTW is located 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 sensitivity map compiled as part of the Freshwater Assessment is provided in **Figure 4** below.

Surrounding land uses include the residential areas of Lemoendraai and Belview that are located approximately 700m and 580m to the west and north of the site, respectively, as well as commercial agriculture that is located approximately 200m to the east of the site. The safety and security of the public is of paramount importance and shall not be compromised by the activities associated with the construction and operational phases.


Figure 4: Water resource sensitivity map

The existing access road to the K-WWTW, which is a gravel road, is directly from the N14. The same road will be used for construction and operational phases. Measures provided in the EMPr shall be implemented to safeguard all traffic and pedestrians on the public roads.

# 12 IMPACT MANAGEMENT

## 12.1 Introduction

The framework for the subsequent management measures consists of the following:

- **Management objectives** – i.e. desired outcome of management measures for mitigating negative impacts and enhancing the positive impacts related to project activities and aspects (i.e. risk sources);
- **Targets** – i.e. level of performance to accomplish management objectives;
- **Management actions** – i.e. practical actions aimed at achieving management objectives and targets;
- **Responsibilities**; and
- **Monitoring requirements**.

## 12.2 Pre-construction & Construction Phases

### *12.2.1 Administrative Requirements*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure that all administrative measures and arrangements associated with the compliance with the Environmental Authorisation, as well as the EMPr and Closure Plan, are in place. |
| **Targets** | ▪ Administrative measures and arrangements are confirmed, checked and maintained.<br>▪ Document control procedure is in place. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Adequate financial provision is made for the implementation of the conditions of the Environmental Authorisation and the mitigation measures contained in the EMPr and Closure Plan. Differentiate between those requirements that relate to the Proponent, Contractor, environmental team and other responsible parties. | ▪ Proponent & Contractor – administrative provisions for compliance.<br>▪ Engineer and ECO – to monitor compliance. | ▪ Pre-construction & construction phases. | ▪ Financial provisions (e.g. bill of quantities, budgets, etc.). | ▪ Once-off, prior to construction. |
| ▪ Document control procedure shall be provided and adhered to.<br>▪ Filing system shall be provided and maintained. | | ▪ Throughout the duration of the construction period. | ▪ Document control procedure.<br>▪ Filing systems. | ▪ Monthly. |

### *12.2.2 Site Layout and Establishment*

| | |
|---|---|
| **Management Objectives** | ▪ Proper planning and layout of construction domain to ensure protection of receiving environment and to manage impacts.<br>▪ Minimise negative environmental impacts associated with site establishment. |
| **Targets** | ▪ All upgrade and expansion works to take place within the confines of the K-WWTW''s existing perimeter fence.<br>▪ No negative impacts to the receiving environment as a result of poor site planning, layout and establishment.<br>▪ The entire construction footprint shall be included in the pre-construction survey.<br>▪ No damage to the receiving environment outside of the demarcated construction area during site establishment.<br>▪ No access or encroachment into no-go areas.<br>▪ No justifiable complaints regarding general disturbance and nuisance. |

<table>
<tr><th rowspan="2">Management Actions</th><th rowspan="2">Responsibilities</th><th rowspan="2">Implementation Timeframe</th><th colspan="2">Monitoring Requirements</th></tr>
<tr><th>Evidence</th><th>Frequency</th></tr>
<tr><td>▪ Conduct a pre-construction survey of the area to be affected by construction activities. This shall include site investigations with photographic records.</td><td rowspan="2">▪ Contractor to implement management actions.<br>▪ Engineer to approve site layout.<br>▪ Engineer and ECO - to monitor compliance.</td><td rowspan="2">▪ Prior to the establishment of the construction site.</td><td>▪ Pre-construction survey report.</td><td>▪ Once-off, prior to site establishment.</td></tr>
<tr><td>▪ The Contractor shall produce a site plan for the approval of the Engineer prior to the establishment of the site, which aims to identify construction activities, facilities and structures in relation to sensitive environmental features. This plan will serve as a spatial tool that facilitates the execution of the construction phase with due consideration of sensitive environmental features. The plan shall show the following (as relevant):<br>○ Buildings and structures;<br>○ Contractors’ camp and lay down area;<br>○ Site offices;<br>○ Site laboratories;<br>○ Access routes;<br>○ Gates and fences;<br>○ Essential services (permanent and temporary water, electricity and sewage);<br>○ Solid waste storage and disposal sites;<br>○ Site toilets and ablutions;<br>○ Hazardous waste storage and disposal site;<br>○ Firebreak;<br>○ Excavations and trenches;<br>○ Cut and fill areas;<br>○ Topsoil stockpiles;<br>○ Spoil areas;<br>○ Construction material stores;<br>○ Vehicle and equipment stores;<br>○ Workshop;<br>○ Wash bay;<br>○ Fuel stores;</td><td>▪ Approved site plan.<br>▪ Barricading and signage.<br>▪ Records of awareness creation.</td><td>▪ Once-off, prior to site establishment – site plan approval.<br>▪ Monthly – compliance with site plan.</td></tr>
</table>

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ○ Hazardous substance stores;<br>○ Sensitive environmental features (including watercourses and buffer zones); and<br>○ Any other activities, facilities and structures deemed relevant. | | | | |
| ▪ The Contractor shall produce a method statement for site establishment.<br>▪ Locate site camp, lay-down area and storage facilities in areas that are already disturbed.<br>▪ Position the storage and lay-down areas in a manner that minimises visual impacts.<br>▪ Fence off site camp, if deemed necessary.<br>▪ Maintain barricading around sensitive environmental features until the cessation of construction works. | ▪ Contractor to implement management actions.<br>▪ Engineer to approve method statement.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Prior to the establishment of the construction site. | ▪ Approved method statement.<br>▪ Evidence of site establishment in accordance with method statement (photographic records).<br>▪ Adequate fencing and barricading. | ▪ Once-off, prior to site establishment – method statement approval.<br>▪ Monthly – compliance with management actions.<br>▪ Fencing and barricading – monthly. |

### *12.2.3 Environmental Awareness Creation*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure that the Contractor, construction workers and site personnel are aware of the relevant conditions of the Environmental Authorisation and provisions of the EMPr and Closure Plan. |
| **Targets** | ▪ All construction workers and employees are to have completed appropriate environmental training before being allowed to undertake any construction work.<br>▪ A record of environmental training undertaken shall be kept on site. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Environmental Training and Awareness Programme shall be developed, which is to be approved by the Engineer/ECO. | ▪ Contractor to implement management actions. | ▪ From pre-construction and throughout the | ▪ Records of training and awareness | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The Contractor shall arrange that all of his employees and those of his sub-contractors go through the project specific environmental awareness training courses before the commencement of construction and as and when new staff or sub-contractors are brought on site.<br>▪ The environmental training is compulsory for all employees and structured in accordance with their relevant rank, level and responsibility, as they apply to the works and site.<br>▪ Courses must be provided by suitably qualified persons and in a language and medium understood by the workers.<br>▪ Place posters containing environmental information at areas frequented by the construction workers (e.g. eating facilities). | ▪ Engineer and ECO - to monitor compliance. | duration of the construction period. | creation (e.g. training material, training programme, completed attendance registers, etc.) | |

### *12.2.4 Stakeholder Communication*

| | |
|---|---|
| **Management Objectives** | ▪ Maintain adequate communication with stakeholders regarding construction activities.<br>▪ Establish and maintain a record of all complaints and claims against the Project and ensure that these are timeously and effectively verified and responded to.<br>▪ Adhere to agreements made with DKM, SANRAL (access from N14) as well as landowners of adjoining properties (as relevant). |
| **Targets** | ▪ All complaints and claims shall be acknowledged within 5 working days and shall be responded to within 10 working days of receipt, unless additional information and / or clarification are required.<br>▪ No deviations from agreements made with individual landowners and community members. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Establish lines of communications with stakeholders (including authorities, adjoining landowners and community members).<br>▪ Develop a Grievance Redress Mechanism (GRM). | ▪ Contractor to implement management actions. | ▪ From pre-construction and throughout the | ▪ Documented GRM.<br>▪ Proof of communication. | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Make use of established communication channels when engaging with stakeholders.<br>▪ Complaints or liaison with landowners and community members with regard to environmental aspects shall be recorded, reported to the correct person and a record of the response shall be entered in the complaints register.<br>▪ Provide the relevant contact details to landowners and community members for queries / raising of issues or complaints.<br>▪ Provide all information, especially technical findings, in a language that is understandable to the general public. | ▪ Engineer and ECO - to monitor compliance. | duration of the construction period. | ▪ Related entries into Public Complaints Register. | |

### *12.2.5 Management of Security*

| | |
|---|---|
| **Management Objectives** | ▪ The safety and security of the public is of paramount importance and shall not be compromised by the Project's construction activities. |
| **Targets** | ▪ No security related incidents associated with the labour force and construction activities. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Ensure suitable management of the labour force to prevent security-related issues or disturbance to landowners and community members.<br>▪ A security policy shall be developed which amongst others requires that permission be obtained prior to entering any property outside of the construction area, and which make provision for controlling trespassing by construction workers.<br>▪ Only security staff shall be allowed to reside at the construction camp. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction and throughout the duration of the construction period. | ▪ Intact fencing.<br>▪ Contractor's method statement.<br>▪ Related entries into Public Complaints Register. | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The construction camp shall be fenced for the duration of construction.<br>▪ The Contractor shall establish crime awareness programmes at the site camp.<br>▪ *See requirements for Management of Labour Force, Management of Health and Safety, and Management of Access.* | | | | |

### *12.2.6 <u>Site Clearing</u>*

| | |
|---|---|
| **Management Objectives** | ▪ Manage environmental impacts associated with site clearing.<br>▪ Ensure that only areas that are specifically required for the construction purposes are cleared. |
| **Targets** | ▪ All complaints and claims shall be acknowledged within 5 working days and shall be responded to within 10 working days of receipt, unless additional information and / or clarification are required.<br>▪ No deviations from agreements made with individual landowners and community members. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The Contractor shall produce a method statement for site clearing.<br>▪ Restrict site clearing activities to the construction area.<br>▪ No damage shall be caused to sensitive environmental features outside of the demarcated construction area. | ▪ Contractor to implement management actions.<br>▪ Engineer to approve method statement.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction and throughout duration of site clearing activities. | ▪ Approved method statement.<br>▪ Evidence of site clearing in accordance with method statement (photographic records). | ▪ Once-off, prior to site clearing – method statement approval.<br>▪ Monthly – compliance with management actions. |

#### *12.2.7 Management of Existing Services and Infrastructure*

| | |
|---|---|
| **Management Objectives** | ▪ Prevent impacts to existing services and infrastructure (including the operational components of the K-WWTW).<br>▪ Adhere to agreements made with owners/custodians of services and infrastructure. |
| **Targets** | ▪ No unwarranted complaints regarding damages or disturbances to existing services and infrastructure.<br>▪ No damages or disturbances to existing services and infrastructure.<br>▪ All relevant approvals shall be obtained prior to working within existing servitudes. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | **Evidence** | **Frequency** |
| ▪ Identify and record existing services and infrastructure. Safeguard / deviate existing services to accommodate construction activities, as necessary.<br>▪ Conform to requirements of relevant service providers and infrastructure custodians.<br>▪ Accommodate existing operations at the K-WWTW. Cordon off works area.<br>▪ Ensure access to infrastructure is available to service providers at all times.<br>▪ Immediately notify service providers of disturbance to services. Rectify disturbance to services, in consultation with service providers. Maintain a record of all disturbances and remedial actions on site.<br>▪ Notify landowners of any disruptions to essential services.<br>▪ Adequate reinstatement and rehabilitation of affected environment. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction and throughout the duration of the construction period. | ▪ Proof of identification of existing services and infrastructure.<br>▪ Proof of safeguarding / relocation of existing services and infrastructure. | ▪ Monthly. |

### *12.2.8 Management of Access and Traffic*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure that all construction vehicles use only dedicated access routes to construction area.<br>▪ Ensure proper access control.<br>▪ Prevent unlawful access to the construction area.<br>▪ Ensure the safety of all road users by implementing proper signage and traffic control measures.<br>▪ Limit construction-related nuisance. |
| **Targets** | ▪ No reports of construction vehicles using unauthorised routes.<br>▪ No direct harm to third parties due to inadequate access control.<br>▪ No transporting of unsafe loads.<br>▪ No speeding by construction vehicles.<br>▪ No accidents caused by construction activities. |

| **Management Actions** | **Responsibilities** | **Implementation Timeframe** | **Monitoring Requirements** | |
|---|---|---|---|---|
| | | | **Evidence** | **Frequency** |
| ▪ Adhere to SANRAL's requirements in terms of access to the site from the N14 and traffic management measures.<br>▪ Clearly demarcate all construction access roads.<br>▪ Maintain access control to site.<br>▪ Strict adherence to speed limits by construction vehicles on public roads and access roads. Appropriate speed limits shall be posted on all construction roads.<br>▪ Implement appropriate safety and traffic calming measures (e.g. flag men, speed reductions and warning signage).<br>▪ Maintain access roads in a suitable condition.<br>▪ Repair damage to public roads caused by construction vehicles.<br>▪ Permissions to be in place for abnormal loads transporting material to the site. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Visible signage (photographic records)<br>▪ Proof of training.<br>▪ Related entries into Public Complaints Register.<br>▪ Inspection of access roads (photographic records). | ▪ Monthly. |

### 12.2.9 Fencing Arrangements

| | |
|---|---|
| **Management Objectives** | ▪ Maintain adequate fencing for the construction area. |
| **Targets** | ▪ Fencing to be installed prior to commencement of construction activities.<br>▪ Fencing to be kept in good condition.<br>▪ Damaged fencing to be repaired timeously. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Erect fencing around the construction camp, hazardous storage areas, and all access with restricted areas, as relevant.<br>▪ All fences erected for construction purposes shall be inspected to detect whether any damage has occurred. Damaged fences shall be repaired immediately.<br>▪ Maintain access control to the construction area.<br>▪ Remove temporary fencing once construction activities have been completed. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction and throughout the duration of the construction period. | ▪ Inspection of fencing (photographic records).<br>▪ Related entries into Public Complaints Register. | ▪ Monthly. |

### 12.2.10 Management of Labour Force

| | |
|---|---|
| **Management Objectives** | ▪ Ensure suitable management of the labour force to prevent security-related issues or disturbance to landowners and community members.<br>▪ Optimise the use of local labour.<br>▪ Provide a work environment that is conducive to effective labour relations. |
| **Targets** | ▪ No complaints from landowners and community members regarding trespassing or misconduct by construction workers.<br>▪ All unskilled labour to be sourced from local area as far as possible. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Induction will be mandatory for all workers.<br>▪ Develop a Code of Conduct in terms of behaviour of construction staff.<br>▪ Prohibit trespassing of construction workers on private property. | ▪ Contractor to implement management actions. | ▪ Throughout the period that construction labour is required. | ▪ Code of Conduct displayed.<br>▪ Proof of training. | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Workers shall be provided with identity cards and must wear identifiable clothing.<br>▪ Creating nuisances and disturbances in or near communities shall be prohibited.<br>▪ Machine / vehicle operators shall receive clear instructions to remain within demarcated access routes and the construction area.<br>▪ Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly.<br>▪ Designated smoking areas shall be provided, with special bins for discarding of cigarette butts.<br>▪ Promote equal job opportunities for women and men during the construction and operational processes.<br>▪ Develop a grievance procedure, which also needs to address gender matters.<br>▪ Local SMMEs shall be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.<br>▪ Prioritise and articulate gender inclusivity and equity in the project documents by including specific strategies and guidelines for implementation.<br>▪ Where possible use labour-intensive methods of construction.<br>▪ Use local labour as far as possible.<br>▪ Implement applicable training of labour to benefit individuals beyond the completion of the project.<br>▪ Prevent loitering within the vicinity of the construction camp. | ▪ Engineer and ECO - to monitor compliance. | | ▪ Related entries into Public Complaints Register.<br>▪ Labour-related targets. | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Draw up a recruitment policy in conjunction with the Ward Councillor of the area and ensure compliance with this policy.<br>▪ All employment of locally sourced labour shall be controlled on a contractual basis. If possible, and if the relevant Ward Councillor deem it necessary, the employment process must include the affected Ward Councillors.<br>▪ No staff accommodation must be allowed on site (except for security personnel). | | | | |

### *12.2.11 Management of Construction Camp*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise environmental impacts associated with construction camp and eating areas. |
| **Targets** | ▪ No environmental contamination associated with construction camp and eating areas.<br>▪ Minimise visual impact associated with construction camp and eating areas.<br>▪ Prevent socio-economic impacts associated with the construction camp. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Erect suitable fencing around the construction camp.<br>▪ Provide essential services (including showers, appropriate sanitation and drinking water facilities) at the construction camp. Maintain essential services in a functional state.<br>▪ Provide safe potable water for food preparation, drinking and bathing.<br>▪ Provide adequate parking for site staff and visitors.<br>▪ Open uncontrolled fires will be forbidden at the site camp. Rather, 'contained' cooking mechanisms shall be used (e.g. gas stoves or an enclosed braai facility). | ▪ Contractor to implement management actions.<br>▪ Engineer to approve de-establishment plan for construction camp.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Period from when the construction camp is created up to de-establishment. | ▪ Visual inspections construction camp (photographic records).<br>▪ Approved de-establishment plan.<br>▪ Waste disposal certificates. | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The cooking area shall be positioned such that no vegetation is in close proximity thereto, including overhanging trees. An area around the cooking area shall be cleared such that any escaping embers will not start an uncontrolled fire.<br>▪ Eating areas shall be designated and demarcated.<br>▪ Allow areas for social interaction.<br>▪ Sufficient vermin / weatherproof bins shall be present in this area for all waste material.<br>▪ Dish washing facilities shall be provided.<br>▪ Ensure that wastewater is appropriately disposed of.<br>▪ Locate all storage areas and material laydown sites within predetermined zones as per the approved site plan.<br>▪ Keep the camp and all its storage and laydown areas secure and neat at all times.<br>▪ Employ appropriate access control measures.<br>▪ Suitable security shall be provided at the construction camp at all times.<br>▪ Manage stormwater from construction camp to avoid environmental contamination and erosion.<br>▪ Prohibit the felling of trees for firewood.<br>▪ Provide medical and first aid facilities at the construction camp.<br>▪ Prepare de-establishment plan for construction camp for approval by the Engineer.<br>▪ Provide firefighting equipment at the camp area.<br>▪ *See requirements for Management of Waste, Management of Water, Management of Labour Force, Management of Ablution Facilities, Management of Storage and Handling of Non-Hazardous and Hazardous Material, Management of Workshop and Equipment, and Management of Flora and Fauna*. | | | ▪ Agreements with service providers (as relevant).<br>▪ Proof of training.<br>▪ Related entries into Public Complaints Register. | |

### 12.2.12 *Management of Ablution Facilities*

| | |
|---|---|
| **Management Objectives** | ▪ Provide and maintain functional ablution facilities.<br>▪ Minimise environmental impacts associated with ablution facilities. |
| **Targets** | ▪ No environmental contamination associated with ablution facilities.<br>▪ Minimise visual impact associated with ablution facilities. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Provide sufficient ablution facilities (e.g. mobile / portable / VIP toilets) at the construction camp and within the construction area, which shall conform to all relevant health and safety standards and codes.<br>▪ No pit latrines, french drain systems or soak away systems shall be allowed. Install and maintain conservancy tanks for any site offices, which must comply with any relevant local by-laws and must be serviced by a suitable contractor, as appropriate. The location of conservancy tanks shall be approved by the Engineer.<br>▪ A sufficient number of toilets shall be provided to accommodate the number of personnel working in any given area. Toilets may not be further than 100m from any working area. Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers.<br>▪ There must be separate toilets for men and women.<br>▪ All temporary / portable / mobile toilets shall be secured to the ground to prevent them from toppling over due to wind or any other cause.<br>▪ Ensure the proper utilisation, maintenance and management of toilet, wash and waste facilities.<br>▪ The entrances to the toilets shall be adequately screened from public view. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Inspection of ablution facilities (photographic records).<br>▪ Maintenance register for ablution facilities.<br>▪ Waste disposal certificates.<br>▪ Related entries into Public Complaints Register. | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Ablution facilities shall be maintained in a hygienic state and serviced regularly.<br>▪ Toilet paper shall be provided.<br>▪ The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site. Disposal of such waste is only acceptable at a licensed waste disposal facility (proof of disposal to be provided).<br>▪ Should shower facilities be provided for use by staff on site, the following controls shall be imposed:<br>o Proper positioning of the shower, and specifically its discharge point, shall be carried out to ensure that erosion and build-up of detergents does not occur;<br>o All discharge from the shower and other washing facilities shall be managed to prevent environmental contamination; and<br>o Use of the shower facilities shall be limited to staff or authorised persons only. | | | | |

### 12.2.13 Management of Visual Aspects

| | |
|---|---|
| **Management Objectives** | ▪ Ensure that the visual appearance of the construction area is not an eyesore the adjacent areas. |
| **Targets** | ▪ No verified complaints regarding visual impacts caused as a result of construction activities and facilities. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Lighting must not constitute an eyesore / hazard to users of the surrounding road network nor the surrounding community. | ▪ Contractor to implement management actions. | ▪ Throughout the duration of the construction period. | ▪ Inspection of project area | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Lighting will be sufficient to ensure security but will not constitute ‘light pollution’ to the surrounding areas.<br>▪ The site will be shielded / screened to minimise the visual impact, where practicable.<br>▪ On-going housekeeping to maintain a tidy construction site.<br>▪ After the construction phase, the areas disturbed by construction activities that are not part of the permanent development footprint must be suitably rehabilitated. | ▪ Engineer and ECO - to monitor compliance. | | (photographic records).<br>▪ Related entries into Public Complaints Register. | |

### *12.2.14 Management of Climate Change Impacts*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise GHG emissions from construction activities. |
| **Targets** | ▪ Minimise the Project’s carbon footprint. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Materials with a high recycled content should be used where possible and the re-use of site materials should be considered.<br>▪ Suitable training should be provided to operators to ensure that they maximise the efficiency of the plant and idling is reduced.<br>▪ In terms of transportation of workers and staff, collective transportation arrangements should be made to reduce individual car journeys.<br>▪ All vehicles used should be properly maintained and be in good working order. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Inspection of project area (photographic records).<br>▪ Training register.<br>▪ Vehicle maintenance register.<br>▪ Calculated carbon footprint. | ▪ Monthly. |

### 12.2.15 *Management of Water*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise environmental impacts associated with stormwater as well as water services for construction workers. |
| **Targets** | ▪ No visual evidence of erosion caused by wastewater or stormwater practices.<br>▪ No environmental contamination associated with wastewater or stormwater practices.<br>▪ No water wastage (water conservation). |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ All construction activities to comply with the NWA.<br>▪ Any water to be sourced directly from natural watercourses or groundwater will require the necessary authorisation in terms of Section 21 of the NWA, as relevant.<br>▪ Practice water conservation. Prevent leakages from pipes or taps.<br>▪ Establish a dedicated vehicle maintenance area and wash-bay, where suitable stormwater management measures are in place to prevent pollution.<br>▪ Manage stormwater from construction site to avoid environmental contamination and erosion.<br>▪ Stormwater runoff from workshops, vehicle maintenance area, wash-bay and other potential pollution sources shall be collected and treated in hydrocarbon separation pits/tanks before being discharged in to drains and/or waterways.<br>▪ All wastewater discharges shall comply with legal requirements associated with the NWA.<br>▪ Wastewater discharges shall form part of water monitoring programme.<br>▪ Prevent erosion on access roads due to construction traffic.<br>▪ Reduce sediment loads in water from dewatering operations. All dewatering should be done through | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Inspection of project area (photographic records).<br>▪ Water monitoring programme – water use and discharges. | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| temporary sediment traps (e.g. constructed out of geo-textiles and hay bales).<br>▪ Ensure proper storage and careful handling of material that could cause water pollution. | | | | |

### 12.2.16 *Management of Soil*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure suitable removal, storage and transportation of topsoil for re-use during rehabilitation.<br>▪ Minimise erosion of areas cleared by construction activities.<br>▪ Ensure adequate management of potentially contaminated soil that may be encountered on the site due to previous land use practices on and adjacent to the site. |
| **Targets** | ▪ At least 95% of recovered topsoil from disturbed areas is to be stored for future use.<br>▪ No visual evidence of erosion from topsoil stockpiles.<br>▪ No visual evidence of erosion from areas where topsoil has been reinstated. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Remove, stockpile and preserve topsoil for re-use during rehabilitation as the final soil layer. Determine the average depth of the topsoil prior to excavations, as relevant. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Prior to site clearing up to when topsoil is used for rehabilitation. | ▪ Inspection of project area (photographic records). | ▪ Monthly. |
| ▪ 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.<br>▪ Control drainage over the site to minimise erosion.<br>▪ Acceptable reinstatement and rehabilitation of disturbed areas to prevent erosion during operational phase. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Inspection of project area (photographic records). | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Excavated soil will be tested in line with the 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. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction and throughout the duration of the construction period. | ▪ Results of soil testing.<br>▪ Proof of safe disposal. | ▪ Monthly. |
| ▪ Adequate clean up and remediation of contaminated soil caused by spills and other construction activities. | ▪ Contractor to implement management actions. | ▪ Throughout the duration of the construction period. | ▪ Inspection of project area (photographic records). | ▪ As and when required for spills. |

### *12.2.17 Management of Excavations*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise environmental impacts associated with excavations. |
| **Targets** | ▪ No damage to sensitive environmental features outside construction area during excavations.<br>▪ No harm to people or animals as a result of excavations. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Construction activities shall remain within the designated construction area.<br>▪ Suitable barricading shall be erected around open excavations / trenches, as per the Construction Regulations (2014) or the prevailing legislation.<br>▪ Provide signage as a warning of open excavations.<br>▪ Divert runoff away from excavations, where necessary.<br>▪ Trench lengths shall be kept as short as practically possible.<br>▪ Trench walls shall be stabilised using battering, shoring and bracing or similar techniques depending on the stability of the trench sides. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Prior to excavations and up to reinstatement. | ▪ Excavation register.<br>▪ Inspection of excavations (photographic records). | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Inspect open trenches at least daily to ensure that animals have not become trapped. Such animals will be safely removed and released, where possible. Special equipment for handling of venomous snakes shall be available on site to ensure safe removal.<br>▪ Make adequate provision for subsidence. | | | | |

### 12.2.18 Management of Storage and Handling of Non-Hazardous Material

| | |
|---|---|
| **Management Objectives** | ▪ Effective and safe management of materials on site, in order to minimise the impact of non-hazardous materials on the environment. |
| **Targets** | ▪ No pollution due to handling, use and storage of non-hazardous material. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Materials shall be suitably stored to prevent environmental contamination and visual impacts.<br>▪ Storage requirements to be determined based on chemical qualities of material and Material Safety Data Sheets (MSDS).<br>▪ Where required, stored material shall be protected from rain and run-off to avoid environmental contamination.<br>▪ Materials shall be appropriately transported to avoid environmental contamination.<br>▪ Loose loads (e.g. sand, stone chip, refuse, paper and cement) shall be covered when vehicles travel on public roads.<br>▪ Suitable remedial measures, depending on the nature of the contaminant and the receiving environment, shall be instituted for spillages. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Period during which materials are stored and handled on site. | ▪ Evidence of spillages and appropriate remedial measures.<br>▪ MSDS register.<br>▪ Inspection of project area (photographic records). | ▪ Once-off – method statement approval.<br>▪ Monthly – compliance with management actions. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Materials shall be suitably used to prevent environmental contamination. | | | | |

### 12.2.19 *Management of Storage and Handling of Hazardous Material*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure the protection of the natural environment and the safety of personnel on site, by the correct management and handling of hazardous substances. |
| **Targets** | ▪ No pollution due to handling, use and storage of hazardous material.<br>▪ In the event of a spill, appropriate containment, clean up and disposal of contaminated material. Spills to be cleaned within 24 hours or sooner (depending on the nature of the spill). |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The Contractor shall develop a method statement for the storage and handling of hazardous substances.<br>▪ Hazardous substances shall be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), Occupational Health and Safety (OHS) Act (No. 85 of 1993), relevant associated Regulations and applicable SANS and international standards.<br>▪ Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination and will adhere to the requirements stipulated on the MSDS.<br>▪ Record the details and quantities of hazardous and flammable substances on the construction site.<br>▪ Appropriate signage shall be displayed at storage areas for hazardous substances.<br>▪ Where flammable liquids are being used, applied or stored the workplace will be effectively ventilated. | ▪ Contractor to implement management actions.<br>▪ Engineer to approve method statement.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Period during which hazardous materials are stored and handled on site. | ▪ Approved method statement.<br>▪ Evidence of spillages and appropriate reporting and remedial measures.<br>▪ MSDS register.<br>▪ Training register.<br>▪ Inspection of project area (photographic records). | ▪ Once-off – method statement approval.<br>▪ Monthly – compliance with management actions. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ No person shall smoke in any place in which flammable liquid is used or stored.<br>▪ Install an adequate number of fire-fighting equipment in suitable locations around the flammable liquids store.<br>▪ Where flammable liquids are decanted, the metal containers shall be bonded or earthed.<br>▪ No flammable material (e.g. paper, cleaning rags or similar material) shall be stored together with flammable liquids.<br>▪ Staff that will be handling hazardous materials will be trained to do so.<br>▪ Any hazardous materials (apart from fuel) shall be stored within a lockable store with a sealed floor. Suitable ventilation shall be provided.<br>▪ All storage tanks containing hazardous materials shall be placed in bunded containment areas with impermeable surfaces. These bunded areas must be able to contain 110% of the total volume of the stored hazardous material.<br>▪ MSDS, which contain the necessary information pertaining to a specific hazardous substance, shall be present for all hazardous materials stored on the site.<br>▪ Spill kits will be available for the clean-up of hazardous material spillages.<br>▪ Provide secondary containment where a risk of spillage exists.<br>▪ Drip trays shall be placed under parked heavy vehicles, equipment and other receptacles of hazardous material to prevent spillages.<br>▪ In the event of spillages of hazardous substances the appropriate clean up and disposal measures shall be implemented. | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Spill reporting procedures shall be displayed at all locations where hazardous substances are being stored.<br>▪ Hazardous materials will be disposed of at registered sites or handed to registered hazardous waste disposal facilities for disposal / recycling. Proof of adequate disposal shall be provided.<br>▪ Proper and timeous notification will be undertaken of any pollution incidents associated with hazardous materials. Any major incidents to be reported to DENC, as per the requirements of Section 30 of NEMA. | | | | |

### *12.2.20 Management of Waste*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise negative environmental impacts associated with waste.<br>▪ Apply waste management principles to prevent, minimise, recycle or re-use material, with disposal as a last option. |
| **Targets** | ▪ Maintain a clean and tidy construction site.<br>▪ A 100% record of all waste generated and disposed of at licenced waste disposal facilities.<br>▪ Valid disposal certificates for all waste disposed.<br>▪ Provision of adequate waste containers that are easily accessible and maintained.<br>▪ Waste bins to be removed and cleaned weekly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The Contractor shall develop a method statement for managing waste.<br>▪ Waste management activities shall comply with the NEMWA.<br>▪ The storage of general or hazardous waste in a waste storage facility shall comply with the norms and standards in GN No. R. 926 of 29 November 2013.<br>▪ Vermin / weatherproof bins shall be provided in sufficient numbers and capacity to store domestic | ▪ Contractor to implement management actions.<br>▪ Engineer to approve method statement.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Approved method statement.<br>▪ Waste register.<br>▪ Recycling targets.<br>▪ Disposal certificates. | ▪ Once-off – method statement approval.<br>▪ Monthly – compliance with management actions. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| waste. These bins shall be kept closed to reduce odour build-up and emptied regularly to avoid overfilling and other associated nuisances.<br>▪ Where possible, waste shall be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes).<br>▪ Establish and monitor recycling targets.<br>▪ Provide waste skips at the construction areas. These skips shall be sufficient in number, the skip storage area shall be kept clean, and skips shall be emptied and replaced before overflowing or spillage occurs.<br>▪ Ensure suitable housekeeping.<br>▪ The Contractor shall ensure that no burying, dumping or burning of waste materials, vegetation, litter or refuse occurs.<br>▪ All waste will be disposed of at suitable licensed disposal sites, based on the waste type (general versus hazardous).<br>▪ Ensure that waste is transported so as to avoid waste spills *en route*.<br>▪ Maintain records of all waste that is disposed of. | | | ▪ Inspection of project area (photographic records). | |

### *12.2.21 Management of Workshop and Equipment*

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|---|---|
| **Management Objectives** | ▪ Minimise environmental impacts associated with workshops and equipment use. |
| **Targets** | ▪ No environmental contamination associated with workshops and equipment use. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Maintenance of equipment and vehicles will be performed in such a manner so as to avoid any environmental contamination (e.g. use of drip trays).<br>▪ No washing of plant may occur on the construction site. Plant to be washed in dedicated areas.<br>▪ Drip trays will be provided for the stationary plant and for the "parked" plant.<br>▪ All vehicles and equipment shall be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site.<br>▪ Suitable storage and disposal of hydraulic fluids and other vehicle oils.<br>▪ All wastewater discharges from the workshop shall comply with the NWA. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Period from when the workshop is created up to de-establishment.<br>▪ Period during which equipment is utilised. | ▪ Inspection of workshop and equipment (photographic records) | ▪ Monthly |

### *12.2.22 Management of Pollution Generation Potential*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure that all possible causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment. |
| **Targets** | ▪ No verified complaints regarding pollution.<br>▪ No measurable signs of pollution.<br>▪ Dust fallout and noise levels to adhere to relevant standards.<br>▪ Water quality – construction activities may not cause an adverse impact that results in more than a 10% change in baseline values.<br>▪ All water discharges to comply with legal requirements associated with the NWA, including GN No. 399. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Noise –<br>○ The provisions of SANS 10103:2008 will apply to all areas within audible distance of residents.<br>○ Working hours to be agreed upon with the Engineer, so as to minimise noise disturbance.<br>○ Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed, where necessary.<br>○ No amplified music will be allowed on the site. The use of radios, tape recorders, compact disc players, television sets etc. will not be permitted unless at a level that does not serve as an intrusion to adjacent landowners.<br>▪ Dust –<br>○ 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.<br>○ Speed limits on site to be strictly adhered to.<br>▪ Lights –<br>○ Prior to construction the position and type of lighting will be planned to ensure that unnecessary light pollution will be eliminated.<br>○ All lighting installed on site must not lead to unacceptable light pollution to the surrounding community and natural environment (e.g. use of down-lighters).<br>▪ Cement –<br>○ Cement mixing shall take place on an impervious surface (e.g. cement mixing pit). | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Evidence of pollution.<br>▪ Review periodic results from environmental monitoring.<br>▪ Inspection of project area (photographic records). | ▪ Monthly. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ○ Waste concrete and cement sludge shall be removed on a regular basis (prevent overflowing) and shall be disposed of at a suitable facility.<br>○ Unused cement bags will be stored in an area not exposed to the weather and packed neatly to prevent leakage of cement.<br>○ Used cement bags will be stored so as to prevent windblown dust and potential water contamination. Used bags will be disposed of adequately at a licenced waste disposal facility.<br>○ Concrete transportation will not result in spillage.<br>○ Cleaning of equipment and flushing of mixers will not result in pollution, with all contaminated wash water entering the waste water collection system.<br>○ To prevent spillage onto roads, ready mix trucks will rinse off the delivery shoot into a suitable sump prior to leaving the site.<br>○ Suitable screening and containment will be in place to prevent windblown contamination from cement storage, mixing, loading and batching operations.<br>○ All visible remains of excess concrete will be physically removed on completion of the plastering or concrete pouring and disposed of in an acceptable manner. | | | | |

### 12.2.23 *Management of Flora and Fauna*

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|---|---|
| **Management Objectives** | ▪ Manage impacts to protected flora and fauna species that may be encountered within the construction domain.<br>▪ Control invasive alien plants and noxious weeds. |
| **Targets** | ▪ No unpermitted disturbance to protected flora and fauna species.<br>▪ No direct / indirect harm to fauna from construction activities.<br>▪ Ongoing eradication of alien plants and noxious weeds. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ 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.<br>▪ The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence.<br>▪ All watercourses and riparian areas are no-go areas. Signs must be put up to enforce this.<br>▪ Where possible, existing access routes and walking paths must be made use of.<br>▪ 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.<br>▪ 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.<br>▪ No plant species whether indigenous or exotic should be brought into / taken from the Project Area, to prevent | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction phase up to end of defects liability period (as relevant for specific management actions). | ▪ Encroachment of invasive alien plants and noxious weeds.<br>▪ Successful rehabilitation.<br>▪ Inspection of project area (photographic records). | ▪ Monthly |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| the spread of exotic or invasive species or the illegal collection of plants.<br>▪ A fire management plan needs to be complied and implemented to restrict the impact fire might have on the surrounding areas.<br>▪ 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 National Forests Act (Act No. 84 of 1998). 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.<br>▪ Noise must be kept to an absolute minimum during the evenings to minimize all possible disturbances to amphibian species and nocturnal mammals.<br>▪ No trapping, killing, or poisoning of any wildlife is to be allowed. Signs must be put up to enforce this.<br>▪ 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.<br>▪ 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). | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ 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.<br>▪ Use environmentally friendly cleaning and dust suppressant products.<br>▪ 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. | | | | |

### *12.2.24 Management of Watercourses*

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|---|---|
| **Management Objectives** | ▪ Ensure that the watercourses (including the Orange River to the south and unnamed non-perennial drainage system running adjacent to the north-western perimeter fence) are protected and incur minimal negative impact to their resource quality (flow, water quality, habitat and aquatic biota). |
| **Targets** | ▪ No impacts to water quality and aquatic health of watercourses as a result of construction activities.<br>▪ No visible evidence of erosion caused by the Project's activities.<br>▪ No dewatering of sediment-laden or cement laden water into watercourses. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Implement suitable stormwater measures on the construction site to trap silt-laden runoff.<br>▪ Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales).<br>▪ Ensure proper storage and careful handling of material that could cause water pollution. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction phase up to end of defects liability period (as relevant for specific management actions). | ▪ Visible evidence of pollution of watercourses.<br>▪ Destabilisation (erosion) of watercourses, directly attributable to | ▪ Monthly |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The upgrade and expansion works must take place within the confines of the K-WWTW''s existing perimeter fence.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.<br>▪ Routine monitoring of discharge points should be conducted to identify areas prone to erosion and bank collapse. Problem areas should be addressed immediately.<br>▪ Contamination of watercourses with unset cement or cement powder should be negated as it is detrimental to aquatic biota.<br>▪ 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 | | | Project activities.<br>▪ Successful rehabilitation.<br>▪ Inspection of project area (photographic records). | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| catered for with adequate concreted stormwater drainage depressions and channels with energy dissipaters that channel these flows into the river in a controlled manner.<br>▪ 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.<br>▪ 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".<br>▪ 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.<br>▪ Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.<br>▪ 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.<br>▪ Any materials excavated must not be deposited in the watercourse where it is prone to being washed downstream and smothering instream habitat.<br>▪ No dumping of construction material on-site may take place.<br>▪ All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported. | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ 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.<br>▪ 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.<br>▪ Install sandbags around soil stockpiles to prevent soils washing into water resources.<br>▪ Signs of erosion must be addressed immediately to prevent further erosion of the upgraded infrastructure.<br>▪ 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.<br>▪ Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.<br>▪ Landscape and re-vegetate all cleared areas as soon as possible to limit erosion potential.<br>▪ *See requirements for Management of Waste, Management of Water, Management of Ablution Facilities, Management of Storage and Handling of* | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| *Non-Hazardous and Hazardous Material, Management of Workshop and Equipment, and Management of Flora and Fauna.* | | | | |

### *12.2.25 Management of Heritage Features*

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|---|---|
| **Management Objectives** | ▪ Comply with legislative requirements with regards to archaeological, palaeontological, cultural resources and graves.<br>▪ Preserve and appropriately manage new discoveries made during construction, in accordance with the NHRA. |
| **Targets** | ▪ No archaeological, palaeontological, cultural resources or graves to be damaged during construction |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Chance find protocol:<br>○ If a chance find is made all work must cease in the immediate vicinity of the find.<br>○ The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the ECO or Engineer. The ECO must report the find to the relevant Heritage Agency (SAHRA and Ngwao-Boswa Jwa Kapa Bokone). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.<br>○ A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates. | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ From pre-construction and throughout the duration of the construction period. | ▪ Pre-construction survey report<br>▪ Records of chance finds.<br>▪ Permits on record.<br>▪ Inspection of barricading and visible signage (photographic records).<br>▪ Visual inspections (photographic records).<br>▪ Proof of training. | ▪ Monthly |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.<br>▪ Permits shall be obtained in terms of the NHRA if heritage resources are to be impacted on and for the removal of graves.<br>▪ Should any remains be found on site that are potentially human remains, apply the chance find procedure as described above. SAPS must also be contacted. | | | | |

### 12.2.26 *Management of Emergency Procedures*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise environmental impacts associated with emergency procedures. |
| **Targets** | ▪ Approved emergency response procedures, where relevant.<br>▪ No site fires to be caused by construction activities and workers. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The Contractor shall compile an Emergency Response Plan.<br>▪ Fire –<br>○ Comply with the National Veld and Forest Fire Act (No. 101 of 1998) and National Veld and Forest Fire Bill (B122B of 1998).<br>○ All contact details of the local fire brigade to list of emergency telephone numbers.<br>○ Proper emergency response procedure shall be in place for dealing with fires.<br>○ Burning of waste is not permitted.<br>○ Suitable precautions shall be taken (e.g. suitable fire extinguishers, water bowsers, welding | ▪ Contractor to implement management actions.<br>▪ Engineer to approve Emergency Response Plan.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Approved Emergency Response Plan.<br>▪ Signage displayed.<br>▪ Incident Register and Report.<br>▪ Inspection of project area (photographic records). | ▪ Once-off – Emergency Response Plan approval.<br>▪ Monthly – compliance with management actions. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| curtains) when working with welding or grinding equipment.<br>○ All fire control mechanisms (fire-fighting equipment) shall be routinely inspected by a qualified investigator for efficacy thereof and shall be approved by local fire services.<br>○ All staff on site shall be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the presence of a fire.<br>○ No fires are allowed on site.<br>○ Firebreaks shall be made for the construction area, as required.<br>○ Dedicated smoking areas to be provided.<br>▪ Accidental Leaks and Spillages –<br>○ Proper emergency response procedure shall be in place for dealing with spills and leaks.<br>○ Ensure that the necessary materials and equipment for dealing with spills and leaks are available on site, where practicable.<br>○ Remediation of the spill areas shall be undertaken to the satisfaction of the Engineer.<br>○ In the event of a hydrocarbon spill, the source of the spillage shall be isolated and contained. The area shall be cordoned off and secured. The Contractor shall ensure that there is always appropriate absorbent material readily available to absorb, breakdown and where possible, encapsulate minor hydrocarbon spillages.<br>○ All staff on site shall be made aware of actions to be taken in case of a spillage.<br>○ Provide contact details of person and emergency services to be notified in a case of spillages – | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| signage to be displayed at strategic points within the construction area (e.g. workshop, fuel storage area, hazardous material containers).<br>○ All major incidents (i.e. uncontrolled release of a hazardous substance, including from a major emission, fire or explosion, that causes, has caused or may cause significant harm to the environment, human life or property) to be reported to DENC and/or other relevant authorities. | | | | |

### 12.2.27 Management of Health and Safety

| | |
|---|---|
| **Management Objectives** | ▪ Provide a safe working environment to construction workers and the public. |
| **Targets** | ▪ Approved Health and Safety Plan.<br>▪ No incidents.<br>▪ Compliance with the OHS Act (Act No. 85 of 1993), Construction Regulations (2014) and other relevant regulations. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The Contractor shall compile a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for approval prior to the commencement of work. These requirements are aligned with the Construction Regulations (2014).<br>▪ Fencing and barriers will be in place in accordance with the OHS Act (Act No. 85 of 1993).<br>▪ Applicable notice boards and hazard warning notices will be put in place and secured.<br>▪ Night hazards will be suitably indicated (e.g. reflectors, lighting and traffic signage). | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance.<br>▪ Client / Safety Agent to audit Contractor in terms of OHS requirements | ▪ From pre-construction and throughout the duration of the construction period. | ▪ Approved Health and Safety Plan.<br>▪ Signage displayed.<br>▪ Incident Register and Report.<br>▪ Inspection of project area (photographic records). | ▪ Once-off – Health and Safety Plan approval.<br>▪ Monthly – compliance with management actions. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Emergency contact details will be prominently displayed.<br>▪ All construction personnel shall be clearly identifiable. All employees will also be issued with employee cards for identification purposes.<br>▪ All workers will be supplied with the required Personal Protective Equipment (PPE) as per the OHS Act (Act No. 85 of 1993).<br>▪ Maintain access control to prevent access of the public to the construction areas, as far as practicable.<br>▪ Use approved communication channels to inform the community of OHS measures to prevent incidents involving community members.<br>▪ The Contractor shall establish HIV/AIDs awareness programmes at the construction camp.<br>▪ Put in place a monitoring system to monitor health risks throughout the life of the project. | | | | |

### 12.2.28 *Management of Reinstatement and Rehabilitation*

| | |
|---|---|
| **Management Objectives** | ▪ Adequate reinstatement and rehabilitation of construction area.<br>▪ Conduct concurrent or progressive rehabilitation of areas affected by construction activities. |
| **Targets** | ▪ Complete site clean-up.<br>▪ Reinstate and rehabilitate areas disturbed by construction activities. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ The areas affected by construction activities, which will not form part of the development footprint shall be reinstated and rehabilitated.<br>▪ Cordon off areas that are under rehabilitation as no-go areas.<br>▪ Removal of structures and infrastructure - | ▪ Contractor to implement management actions.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period, as relevant to the concurrent or progressive | ▪ Approved Landscape Development Plan.<br>▪ Inspection of project area | ▪ Once-off – Landscape Development Plan approval.<br>▪ Monthly. |

<table>
<tr><th rowspan="2">Management Actions</th><th rowspan="2">Responsibilities</th><th rowspan="2">Implementation Timeframe</th><th colspan="2">Monitoring Requirements</th></tr>
<tr><th>Evidence</th><th>Frequency</th></tr>
<tr><td>
<ul><li><ul>
<li>Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services and fixtures.</li>
<li>Rehabilitate all temporary access roads utilised during construction which are not earmarked for use during the operational phase, and do not form part of the development footprint.</li>
</ul></li>
<li>Inert waste and rubble -<ul>
<li>Clear the site of all inert waste and rubble, including spoil material, surplus rock, foundations and batching plant aggregates. After the material has been removed, the site shall be re-instated and rehabilitated.</li>
<li>All remaining combustible biomass from bush clearing operations must be removed from the area, unless it is to be used in rehabilitation measures.</li>
</ul></li>
<li>Domestic waste -<ul>
<li>Remove from site all domestic waste and dispose of in the approved manner at a licenced waste disposal site.</li>
</ul></li>
<li>Hazardous waste and pollution control -<ul>
<li>Remove from site all pollution containment structures.</li>
<li>Remove from site all temporary sanitary infrastructure and waste water disposal systems. Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner.</li>
</ul></li>
<li>Final shaping -<ul>
<li>Make safe all dangerous excavations by backfilling and grading, as required.</li>
</ul></li>
</ul>
</td><td></td><td>reinstatement and rehabilitation of affected areas. Up to end of defects liability period.</td><td>(photographic records).</td><td></td></tr>
</table>

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ○ Monitor backfilled areas for subsidence (as the backfill settles) and fill depressions using available material.<br>○ Shape all disturbed areas to blend in with the surrounding landscape, where possible.<br>○ Ensure that no excavated material or stockpiles are left on site and that all material remaining after backfill is landscaped to blend in with the surrounding landscape.<br>▪ Topsoil replacement and soil amelioration -<br>○ Execute top soiling activity prior to the rainy season or any expected wet weather conditions.<br>○ Execute topsoil placement only after all construction work has ceased.<br>○ Contractor to test top 15 cm soil at predetermined distances for fertilizer requirements. All testing to occur at a SANS 17025 approved laboratory.<br>○ Replace and redistribute stockpiled topsoil together with herbaceous vegetation, overlying grass and other fine organic matter in all disturbed areas of the construction site, including temporary access routes. Replace topsoil to the original depth.<br>○ Place topsoil in the same area from where it was stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas of similar quality. The soil brought in must not come from areas infested by alien and invasive plant species.<br>○ The suitability of substitute material will be determined by means of a soil analysis addressing soil fraction, fertility, pH and drainage. | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| o Do not use topsoil suspected to be contaminated with the seed of alien vegetation. Alternatively, the soil is to be appropriately treated.<br>o Ensure that stormwater run-off is not channelled alongside the gentle mounding, but that it is taken diagonally across it.<br>o Shape remaining stockpiled topsoil not utilised elsewhere in an acceptable manner so as to blend in with the local surrounding area.<br>o After topsoil placement is complete, spread available stripped vegetation randomly by hand over the top-soiled area.<br>▪ Ripping and scarifying -<br>o Rip and/or scarify all areas following the application of topsoil to facilitate mixing of the upper most layers. Whether ripping and/or scarifying is necessary it will be based on the site conditions immediately before these works commence.<br>o Rip and/or scarify all disturbed (and other specified) areas of the construction site, including temporary access routes and roads, compacted during the execution of the works.<br>o Rip and/or scarify along the contour to prevent the creation of down-slope channels.<br>o Do not rip and/or scarify areas under wet conditions, as the soil will not break up.<br>▪ Planting -<br>o All plant species for use by the project must be reviewed and approved by qualified specialists prior to use on site. | | | | |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ○ Revegetation must match the vegetation type which previously existed, unless otherwise indicated by a suitable specialist.<br>○ Although the use of indigenous vegetation is promoted, where there is a risk of soil erosion (e.g. steep slopes) a suitable specialist must be consulted to determine the most appropriate stabilisation measures.<br>○ All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.<br>○ After planting, each plant must be well watered, adding more soil upon settlement if necessary.<br>▪ Grassing -<br>○ Suitably trained personnel must undertake grassing by making use of the appropriate equipment and indigenous grass species, as specified by the qualified specialists.<br>○ Sodding may be done at any time of the year, but seeding must be done by sowing appropriate seed mixtures at the most suitable time under the guidance of a qualified specialist. | | | | |

### 12.2.29 *Management of Decommissioning and Dismantling Activities*

Various existing structures and facilities at the K-WWTW, including the diesel-fired incinerator, sludge drying beds, obsolete old inlet works and the existing screw pump station, will be dismantled during the construction phase to make way for new structures associated with the upgrade and expansion Project. This section provides the management measures associated with the decommissioning activities.

| | |
|---|---|
| **Management Objectives** | ▪ Prevent pollution from decommissioning and dismantling activities.<br>▪ Ensure proper management of waste generated by decommissioning and dismantling activities.<br>▪ Apply waste management principles to prevent, minimise, recycle or re-use material, with disposal as a last option.<br>▪ Render the areas affected by decommissioning and dismantling activities safe, through rehabilitation and remediation (as necessary), for the proposed upgrade and expansion footprints. |
| **Targets** | ▪ A 100% record of all waste generated by decommissioning and dismantling activities that is disposed of at licenced waste disposal facilities (if not recycled or re-used).<br>▪ Valid disposal certificates for all waste disposed.<br>▪ Provision of adequate waste containers for waste generated by decommissioning and dismantling activities, that are easily accessible and maintained. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | **Evidence** | **Frequency** |
| ▪ The Contractor shall develop a method statement for decommissioning the earmarked infrastructure and facilities.<br>▪ Waste generated by decommissioning and dismantling of existing structures and facilities at the K-WWTW will be assessed in accordance with the NEM:WA Norms and Standards for Assessment of Waste for Landfill Disposal (GN No. R. 635 of 23 August 2013) and will be handled and disposed of accordingly.<br>▪ Excavated soil at the areas surrounding the existing structures and facilities at the K-WWTW to be decommissioned and dismantled will be tested in line with the NEM:WA National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (GN No. 331 of 2 May 2014) and will be handled and disposed of accordingly. | ▪ Contractor to implement management actions.<br>▪ Engineer to approve method statement.<br>▪ Engineer and ECO - to monitor compliance. | ▪ Throughout the duration of the construction period. | ▪ Approved method statement.<br>▪ Waste register.<br>▪ Recycling targets.<br>▪ Disposal certificates.<br>▪ Inspection of areas where decommission occurs (photographic records), and waste storage areas. | ▪ Once-off – method statement approval.<br>▪ Monthly – compliance with management actions. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Contain all liquid and solid hazardous wastes for temporary storage, transportation and safe disposal.<br>▪ Establish and maintain temporary waste storage areas for waste generated by decommissioning and dismantling activities. Separate hazardous from general waste. Prevent contamination from waste storage areas. Provide suitable signage are waste storage areas.<br>▪ Rehabilitate and remediate (as necessary) areas where existing structures and facilities at the K-WWTW have been dismantled and removed. Ensure areas are ready for the new structures that are to be constructed on the same footprints, as part of the upgrade and expansion works.<br>▪ Maintain records of all waste generated by decommissioning and dismantling activities that is disposed of.<br>▪ *See requirements for Management of Waste, Management of Water, Management of Emergency Procedures Management of Health and Safety, Management of Reinstatement and Rehabilitation (amongst others).* | | | ▪ Results of waste classification and soil testing.<br>▪ Proof of safe disposal. | |

## 12.3 Operational Phase

Where relevant, all management actions are to be carried forward from the construction phase to the operational phase. Specific management measures for the operational phase follow below.

### 12.3.1 *Management of Air Quality & Climate Change Impacts*

| | |
|---|---|
| **Management Objectives** | ▪ Minimise GHG emissions from operational activities and biological processes at K-WWTW. |
| **Targets** | ▪ Minimise the carbon footprint of the K-WWTW. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Designs to consider options for mitigating GHG emissions from the K-WWTW and to cater for increased inflows caused by changing climatic conditions.<br>▪ Improve energy efficiency at the K-WWTW.<br>▪ All vehicles used for operational purposes should be properly maintained and be in good working order.<br>▪ 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.<br>▪ The gas flare that will be used to burn off the methane gas produced as a result of the treatment of the wastewater will be operated in accordance with all relevant standards. | ▪ DKM to implement management actions. | ▪ Operational Phase. | ▪ Calculated carbon footprint.<br>▪ Energy efficiency audits.<br>▪ Odour monitoring records. | ▪ Monthly to Quarterly. |

### 12.3.2 *Management of Water Resources*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure that the watercourses (including the Orange River to the south and unnamed non-perennial drainage system running adjacent to the north-western perimeter fence) are protected and incur minimal negative impact to their resource quality (flow, water quality, habitat and aquatic biota). |
| **Targets** | ▪ No impacts to water quality and aquatic health of watercourses as a result of construction activities.<br>▪ No visible evidence of erosion caused by the Project’s activities.<br>▪ No dewatering of sediment-laden or cement laden water into watercourses. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Undertake hydrogeological investigations and implement recommendations. Determine vulnerability of groundwater to pollution incidents at the K-WWTW.<br>▪ Develop an emergency response plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.<br>▪ Implement adequate stormwater management at the K-WWTW.<br>▪ Implement monitoring programme that includes: effluent quality, groundwater and receiving aquatic environment (Orange River).<br>▪ Comply with conditions of the WUL.<br>▪ 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.<br>▪ Develop an emergency response plan for K-WWTW to deal with leakages or operational failures that may cause environmental pollution.<br>▪ Determine the 1:100 year floodline of the Orange River in relation to the K-WWTW.<br>▪ Safeguard the K-WWTW from major floods.<br>▪ Develop an emergency response plan for K-WWTW to deal with floods.<br>▪ Elevate electrical equipment and essential systems and equipment above the 1:100 year floodline of the Orange River.<br>▪ Provide flood barriers around essential systems and equipment.<br>▪ Secure or elevate chemical and other tanks.<br>▪ Adequate design of stormwater system at K-WWTW to cater minor and major flood events. | ▪ DKM to implement management actions. | ▪ Operational Phase. | ▪ Monitoring records for effluent discharges, groundwater, and aquatic health of the Orange River.<br>▪ Infrastructure monitoring records. | ▪ Monthly |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Flood damaged structures to be promptly repaired by the DKM.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ 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 100m of the river reach below the discharge point. | | | | |

### *12.3.3 Management of Storage and Handling of Hazardous Material*

| | |
|---|---|
| **Management Objectives** | ▪ Ensure the protection of the natural environment and the safety of personnel on site, by the correct management and handling of hazardous substances. |
| **Targets** | ▪ No pollution due to handling, use and storage of hazardous material.<br>▪ In the event of a spill, appropriate containment, clean up and disposal of contaminated material. Spills to be cleaned within 24 hours or sooner (depending on the nature of the spill). |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | **Evidence** | **Frequency** |
| ▪ 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), Occupational Health and Safety 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.<br>▪ Record the details and quantities of hazardous substances at the K-WWTW.<br>▪ Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination and will adhere to the requirements stipulated on the MSDS.<br>▪ 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.<br>▪ Prevent uncontrolled releases of hazardous materials to the environment.<br>▪ Implement engineering controls (such as containment, automatic alarms, and shut-off systems) for storage areas of hazardous substances.<br>▪ Develop an Emergency Preparedness and Response Plan, which includes the management of spills (amongst others). Such a plan must make provision for inter alia | ▪ DKM to implement management actions. | ▪ Operational Phase. | ▪ Emergency Preparedness and Response Plan.<br>▪ Evidence of spillages and appropriate reporting and remedial measures.<br>▪ MSDS register.<br>▪ Training register.<br>▪ Inspection of K-WWTW site. | ▪ Monthly |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| training, inspections, Standard Operating Procedures, mapping of locations of hazardous materials, specific PPE required, spill response equipment, response activities and responsibilities.<br>▪ All waste (general and hazardous) generated during the operational phase shall be disposed of at an appropriately licenced waste disposal facility.<br>▪ Ensure adequate disposal of wastewater. Contaminated water will not be discharged to the environment.<br>▪ Comply with the conditions of the WML regarding sludge management. | | | | |

### 12.3.4 Management of Access and Traffic

| | |
|---|---|
| **Management Objectives** | ▪ Ensure proper access control to the K-WWTW.<br>▪ Ensure the safety of all road users. |
| **Targets** | ▪ No direct harm to third parties due to inadequate access control.<br>▪ No speeding by operational vehicles.<br>▪ No accidents caused by operational activities. |

| Management Actions | Responsibilities | Implementation Timeframe | Monitoring Requirements | |
|---|---|---|---|---|
| | | | Evidence | Frequency |
| ▪ Ensure safe access to the K-WWTW, taking into consideration the high-speed environment along the N14.<br>▪ Adhere to SANRAL's requirements in terms of access to the K-WWTW from the N14 and traffic management measures.<br>▪ Maintain access control to site.<br>▪ Train operational staff of best practices regarding road safety. | ▪ DKM to implement management actions. | ▪ Operational Phase. | ▪ Visible signage.<br>▪ Proof of training. | ▪ Monthly. |

# APPENDIX H

## DETAILS OF EAP AND EXPERTISE

## Details of Environmental Assessment Practitioner

| | | | |
|---|---|---|---|
| **EAP:** | Donavan Henning | | |
| **Professional affiliation / registration:** | • Environmental Assessment Practitioners Association of South Africa (EAPASA) (Registration No.: 2020/1217)<br>• South African Council for Natural Scientific Professions (SACNASP) - Professional Natural Scientist (Registration No.: 400108/17) | | |
| **Company:** | Nemai Consulting (Pty) Ltd | | |
| **Physical address:** | No. 147 Bram Fischer Drive, Ferndale, 2194 | | |
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| **Telephone:** | 011 781 1730 | Fax: | 011 781 1731 |
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**Curriculum Vitae**

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## 1 PERSONAL PARTICULARS

| | |
|---|---|
| **Date of Birth:** | 1976-12-06 |
| **Name of Staff:** | Donavan Henning |
| **Years of Experience:** | 20 |
| **Nationality:** | RSA |

## 2 POSITION IN THE FIRM AND WITHIN THE ORGANIZATION OF THIS ASSIGNMENT

Registered Environmental Assessment Practitioner.

## 3 EDUCATION

| Institution (Date from – Date to) | Degree(s) or Diploma(s) obtained |
|---|---|
| RAU (1995 – 1997) | B.Sc. Zoology and Biochemistry |
| RAU (1998) | B. Sc. Hons. Zoology |
| RAU (1999 – 2000) | M. Sc. Freshwater Ecology |

## 4 MEMBERSHIP OF PROFESSIONAL BODIES

- Environmental Assessment Practitioners Association of South Africa (EAPASA) (2020/1217).
- South African Council for Natural Scientific Professions (SACNASP) (400108/17).

## 5 SUMMARY

Donavan Henning has been employed with Nemai Consulting since 2001, with 20 years' experience in the environmental field. During this time, he has applied, developed and implemented a host of environmental planning, assessment, management and monitoring tools.

## 6 RELEVANT EXPERIENCE

| | | |
|---|---|---|
| **1.** | **Project Name:** | **Upgrade and Expansion of the Kameelmond WWTW** |
| | **Client:** | Dawid Kruiper Municipality |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | Environmental Impact Assessment (EIA), Water Use Licence Application (WULA) and Waste Management Licence (WML). The scope included increasing the capacity of the Kameelmond WWTW from 16 Ml/d to 24 Ml/d. |
| | **Location:** | Upington, Northern Cape, RSA |
| | **Dates & duration:** | 2020 - current |
| **2.** | **Project Name:** | **Sunderland Ridge WWTW and Bulk Sewer Line** |
| | **Client:** | City of Tshwane |
| | **Position held:** | Assistant Environmental Assessment Practitioner |

| | | |
|---|---|---|
| | **Actual duties performed:** | Environmental Impact Assessment (EIA) for the proposed expansion of the Sunderland Ridge WWTW, in Centurion. The new WWTW occupies an area of approximately 60 hectares. This will allow for future expansion to a total capacity of 113Ml/d. The scope included a new 2.5km bulk sewer line between the existing Sunderland Ridge WWTW and the proposed extension. |
| | **Location:** | Centurion, Gauteng Province, RSA |
| | **Dates & duration:** | 2012 - 2014. |
| **3.** | **Project Name:** | **uMkhomazi Water Project Phase 1** |
| | **Client:** | Department of Water and Sanitation |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | Environmental Impact Assessment (EIA), Water Use Licence Application (WULA) and mining applications (quarries and borrow areas). The scope included a large storage dam (81 m high) on the uMkhomazi River, tunnel (32 km), gauging weir, balancing dam (46 m high) on Mbangweni River and raw water pipeline (5 km). |
| | **Location:** | Bulwer, KwaZulu-Natal Province, RSA |
| | **Dates & duration:** | Aug 2013 – Nov 2020, 7 years |
| **4.** | **Project Name:** | **Vaal Gamagara Regional Water Supply Scheme Phase 2** |
| | **Client:** | Sedibeng Water |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | EIA and WULA. The scope included a bulk water pipeline (190 km), pump stations and reservoirs. |
| | **Location:** | Delportshoop to Olifantshoek, Northern Cape Province, RSA |
| | **Dates & duration:** | Aug 2019 – Mar 2020, 7 months |
| **5.** | **Project Name:** | **Mokolo Crocodile River West Water Augmentation Project Phase 2** |
| | **Client:** | Department of Water and Sanitation |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | EIA and borrow pit applications. The scope included a weir on the Crocodile River, abstraction infrastructure (balancing dam, desilting woks, high-lift pumping station), transfer system (100 km), reservoirs, gravity pipeline (30 km) and gauging weirs. |
| | **Location:** | Thabazimbi to Lephalale, Limpopo Province, RSA |
| | **Dates & duration:** | Feb 2018 – Sept 2019, 19 months |
| **6.** | **Project Name:** | **Lower uMkhomazi Bulk Water Supply Scheme** |
| | **Client:** | Umgeni Water |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | EIA and WULA. The scope included abstraction works, low-lift pipeline, rising main to Reservoir, gravity main and water treatment plant. |
| | **Location:** | Craigie Burn, KwaZulu-Natal Province, RSA |
| | **Dates & duration:** | Aug 2017 – Sept 2018, 13 months |
| **7.** | **Project Name:** | **Augmentation of the Western Cape Water Supply System (Voëlvlei Dam)** |
| | **Client:** | Department of Water and Sanitation |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | EIA and WULA. The scope included a low level weir on the Berg River, abstraction works, pump station, rising main pipeline from the Berg River to Voëlvlei Dam, and a potential new summer release connection at the existing Swartland Water Treatment Works. |
| | **Location:** | Gouda, Western Cape, RSA |
| | **Dates & duration:** | Sept 2016 – Jul 2017, 10 months |

| | | |
|---|---|---|
| **8.** | **Project Name:** | **Ncwabeni Off-Channel Storage Dam and associated infrastructure** |
| | **Client:** | Department of Water and Sanitation |
| | **Position held:** | Environmental Assessment Practitioner |
| | **Actual duties performed:** | EIA and WULA. The scope included an Off-Channel Storage Dam and outlet infrastructure to make measured releases back to the Mzimkhulu River, abstraction / gauging weir, abstraction works, pump station and pipeline. |
| | **Location:** | Port Shepstone, KwaZulu-Natal Province, RSA |
| | **Dates & duration:** | Oct 2011 – Mar 2014, 2.5 years |

# APPENDIX I

## SPECIALISTS' DECLARATION OF INTEREST

the denc

Department:
Environment & Nature Conservation
NORTHERN CAPE PROVINCE
REPUBLIC OF SOUTH AFRICA

Private Bag X6102, Kimberley, 8300, Metlife Towers, T-Floor, Tel: 053 807 7300, Fax: 053 807 7328

# DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Application for authorization in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014 as amended.

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | |
| Date Received: | |

**1. Project title:**

K-WWTW EIA + WULA Ecological Assessment

**2. Details of the specialist:**

| | | | |
|---|---|---|---|
| **Project Specialist:** | ECOLOGY | | |
| **Trading name (if any):** | THE BIODIVERSITY COMPANY | | |
| **Business reg. no./ID. no.:** | 2012/190711/07 | | |
| **Contact person:** | ANDREW HUSTED | | |
| **Physical address:** | 777 PERIDOT STR, JUKSKEI PARK | | |
| **Postal address:** | ~~2153~~ AS ABOVE | | |
| **Postal code:** | 2158 | **Cell:** | 081 319 1225 |
| **Telephone:** | | **Fax:** | |
| **E-mail:** | info@thebiodiversitycompany.com | | |
| **Qualifications:** | MSc | | |
| **Professional affiliation (s) (if any)** | SACNASP Pr Sci Nat 400213/11 | | |

**3. Details of the consultant**

| | | | |
|---|---|---|---|
| **Project consultant/firm:** | | | |
| **Business reg. no./ID. no.:** | | | |
| **Contact person:** | | | |
| **Postal address:** | | | |
| **Postal code:** | | **Cell:** | |
| **Telephone:** | | **Fax:** | |
| **E-mail:** | | | |



Enquiries: G Letimela/ E-mail: gletimela@ncpg.gov.za
A.T. Makaudi
E-mail: eia@half.ncape.gov.za

Private Bag X6102, Kimberley, 8300
Tel. (053) 807 7430/Fax (053) 831 3530

4. **Declaration by the specialist appointed in terms of the Environmental Impact Assessment Regulations, 2014 as amended.**

I, Andrew Husted, declare that --

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

The Biodiversity Company

Name of company (if applicable):

10/06/2021

Date:

Signature of the Commissioner of Oaths:

Date:

Designation:

Official stamp (below):

**Certified as a true copy of original**

**Farai Shadreck Mbirimi BD52805**
**Minister of Religion / Commissioner of Oaths**
**391 11th Road, Erand, Midrand 1685**
**Date** 10 June 2021