Wetland Delineation & Assessment for the Proposed Tanganani Pipeline, City of Johannesburg, Gauteng Province

For:

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DOCUMENT SUMMARY DATA

PROJECT:	**Wetland Delineation & Assessment for the Proposed Tanganani Pipeline, City of Johannesburg, Gauteng Province**
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INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as 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 Wetland Consulting Services (Pty.) Ltd. and its staff 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.

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1. BACKGROUND INFORMATION

Wetland Consulting Services (Pty.) Ltd. (WCS) was appointed by Kongiwe Environmental (Pty) Ltd to conduct a wetland delineation and assessment study for a proposed pipeline near Diepsloot in the City of Johannesburg, Gauteng Province. A wetland assessment study was required to support the proposed environmental authorisation applications for the site.

The requirement to establish the existence and/or extent of wetlands within the proposed development site is based on the legal requirements contained in both the National Environmental Management Act (NEMA) and the National Water Act. Given the stringent legislation regarding developments within or near wetland areas, it is important that these areas are identified and developments planned sensitively in order to avoid and/or minimize any potential impacts to the wetland.

2. SCOPE OF WORK

The scope of work requested included the following tasks:

- Review and collation of existing wetland information and published data (e.g. NFEPA and its update);
- Site visit to identify and delineate wetlands in the field as per the DWAF 2005 wetland and riparian delineation guidelines;
- Undertake a wetland functional assessment of identified wetlands and/or wetland groupings;
- Undertake a present ecological status (PES) assessment of all wetlands identified within the study area using the WET-Health Level 1 assessment methodology;
- Undertake an ecological importance and sensitivity (EIS) assessment of all wetlands identified within the study area using the Rountree *et al*. 2013 methodology;
- Compilation of maps and shapefiles to accompany the wetland specialist report;
- Undertake a Water Use Risk Assessment as per the GN 509 methodology for the proposed pipeline; and
- Compilation of a detailed wetland delineation and assessment report.

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2.1 NEMA EIA Regulation 982 Requirements

No.	Requirement	Section in report
1	A specialist report prepared in terms NEMA EIA Regulation 982 must contain:	
a)	Details of -	
(i)	The specialist who prepared the report	Section 3
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Section 3
b)	A declaration that the specialist is independent	Section 4
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1 & 2
cA)	An indication of the quality and age of base data used for the specialist report	Section 8.1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 8
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 8.1
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
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	Sections 8 and 9
g)	An identification of any areas to be avoided, including buffers	Section 8.5
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 9
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 5
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Sections 8 and 9
k)	Any mitigation measures for inclusion in the EMPr	Section 9
l)	Any conditions for inclusion in the environmental authorisation	Section 11
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 11.1
n)	A reasoned opinion -	Section 11
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 11
(iA)	Regarding the acceptability of the proposed activity or activities	Section 11
(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 11.1
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	Not applicable
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q)	Any other information requested by the competent authority	Not applicable

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3. DETAILS OF SPECIALIST

3.1 DETAILS OF THE SPECIALIST WHO PREPARED THE REPORT

Table 1. Details of the Specialist

Project Consultancy	Wetland Consulting Services
Company Registration	1998/17216/07
Professional Affiliation	South African Council for Natural Scientific Professions (SACNASP) 400254/14
Contact Person	Mr Dieter Kassier
Physical Address	Room S153, Building 33, CSIR, Meiring Naude Road, Brummeria, 0184
Postal Address	P O Box 72295, Lynnwood Ridge, 0040
Telephone Number	+27 12 349 2699
Fax Number	+27 12 349 2993
E-mail	dieterk@wetcs.co.za

3.2 EXPERTISE OF THE Specialist

2.2.1 Qualifications of the Specialist

Dieter Kassier holds the following degrees:

- B.Sc. from UNISA (2007) Environmental Management (Zoology Stream).
- B.Sc. (Hons) from the NWU Potchefstroom Campus (2012) in Environmental Science: Aquatic Ecosystem Health.

Dieter Kassier holds a Professional Registration with SACNASP since 2014 – 400254/14. He is registered in two fields:

- Environmental Science
- Ecological Science

2.2.2 Past Experience of the Specialist

Dieter Kassier, Wetland Ecologist, Holds a B.Sc. degree in Environmental Management (with specialisation in Zoology) from the University of South Africa (UNISA) as well as a BSc Honours degree in Environmental Science (Aquatic Ecosystem Health) from the University of the North West (Potchefstroom Campus). After 5 years working within the field of nature conservation and tourism in the Limpopo Lowveld and a short stint as an environmental consultant, Dieter joined Wetland Consulting Services in 2007 and is based in Pretoria. Over the past ten years he has gained extensive experience in the delineation and assessment of wetlands and riparian zones and the development of mitigation and management measures for the purposes of Environmental Impact Assessments in a wide range of projects, with special emphasis on coal mining in the Mpumalanga Coalfields and infrastructure developments within the greater Gauteng region. In addition, his work has entailed the GIS mapping and classification of wetlands for various

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Environmental Management Frameworks (EMF's) and the City of Johannesburg wetland management plan. Dieter has also been involved in the compilation of several Biodiversity Action Plans and Biodiversity Assessments where in addition to the specialist wetland work, he has provided input for faunal studies and has undertaken avifauna surveys. Dieter is a Registered Natural Scientist (SACNASP) (Environmental & Ecological Science), and a member of the South African Wetland Society.

3.3 CV OF THE Specialist

A summarised CV of the Specialist is attached as APPENDIX 2 to this report.

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4. DECLARATION OF INDEPENDENCE

I, **Dieter Kassier,** as the appointed specialist hereby declare/affirm the correctness of the information provided as part of the application, and 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
- am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist

Wetland Consulting Services (Pty) Ltd

Name of company

26 June 2017

Date

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5. LIMITATIONS & ASSUMPTIONS

Wetland boundaries reflect the ecological boundary where the interaction between water and plants influences the soils, but more importantly the plant communities. The depth to the water table where this begins to influence plant communities is approximately 50 centimetres. This boundary, based on plant species composition, can vary depending on antecedent rainfall conditions, and can introduce a degree of variability in the wetland boundary between years and/or sampling period. A single day site visit was undertaken on the 19th January 2017 during which wetlands within the study area were identified and delineated.

Due to the scale of the remote imagery used (1:10 000 orthophotos and Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineate wetlands in the field, the delineated wetland boundaries cannot be guaranteed beyond an accuracy of about 15m on the ground. Should greater mapping accuracy be required, the wetlands would need to be pegged in the field and surveyed using conventional survey techniques.

The pipeline route runs along an area that is heavily utilised for illegal dumping of building rubble and refuse. Along the proposed wetland crossing, most of the soil surface is covered by such rubble and refuse, in some cases to more than 1m in depth. This disturbance makes it difficult to reliably observe wetland indicators within the top 500mm of the soil profile, as well as to observe wetland vegetation indicator species, which have been mostly replaced by weeds and invasive species. These disturbances therefore impose a level of uncertainty on the delineated wetland boundary, though the delineation and assessment as detailed in this report is still considered sufficient for the purpose of assessing the likely impact of the pipeline.

No access was granted to the land located northeast of the proposed pipeline route. The field assessment was therefore limited to observations of the wetland area to the southwest of the route, and field verification of the wetland delineation was also limited to this area.

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6. STUDY AREA

The study area for this report consists of a section of the proposed pipeline route located in close proximity to a large hillslope seepage wetland, as indicated in **Figure 1**. The proposed pipeline runs from the existing Diepsloot Reservoir located along Summit Road in a north-westerly direction, crossing Mnandi Road and extending another 550m beyond Mnandi Road. The full length of the proposed pipeline route is 1 000m.

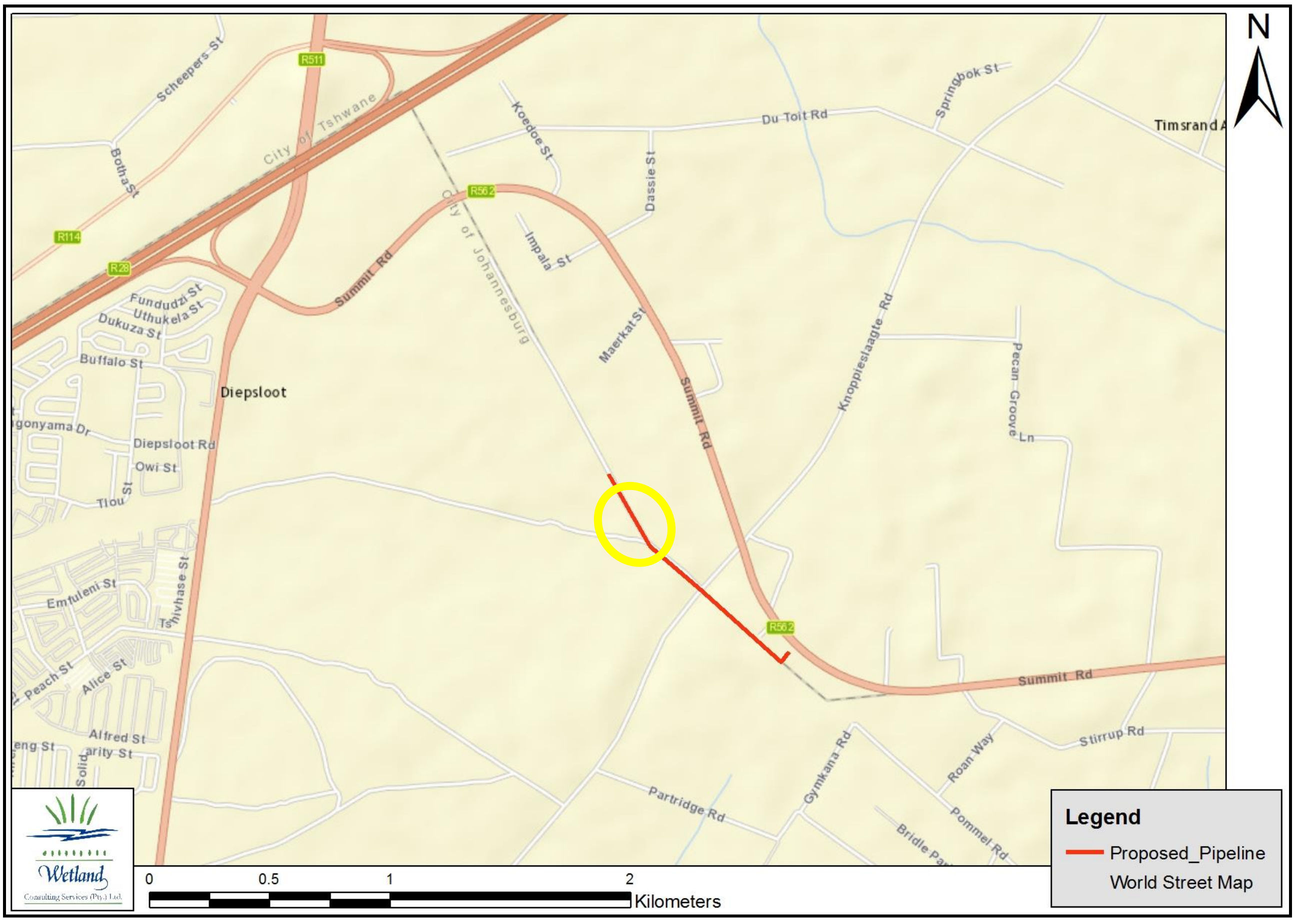

Figure 1. Map showing the location and extent of the study area. Only the section of route circled in yellow was surveyed in the field.

6.1 Catchment and Water Resources

The study area is located in the Limpopo River Catchment (Primary Catchment A), and more specifically quaternary catchment A21C (**Figure 2**). The pipeline route is located high in the catchment and runs in close proximity to the watershed between catchments A21C and A21B. Catchment A21C is drained by the Jukskei River and its tributaries. Information regarding catchment size, mean annual rainfall and runoff for the quaternary catchment is provided in **Table 2** below (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990).

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Table 2. Table showing the area, mean annual precipitation and mean annual run-off per quaternary catchment (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990)

Quaternary Catchment	Catchment Surface Area (ha)	Mean Annual Rainfall (MAP) in mm	Mean Annual Run-off (MAR) in mm	MAR as a % of MAP
A21C	68 639	682.17	49	7.18 %

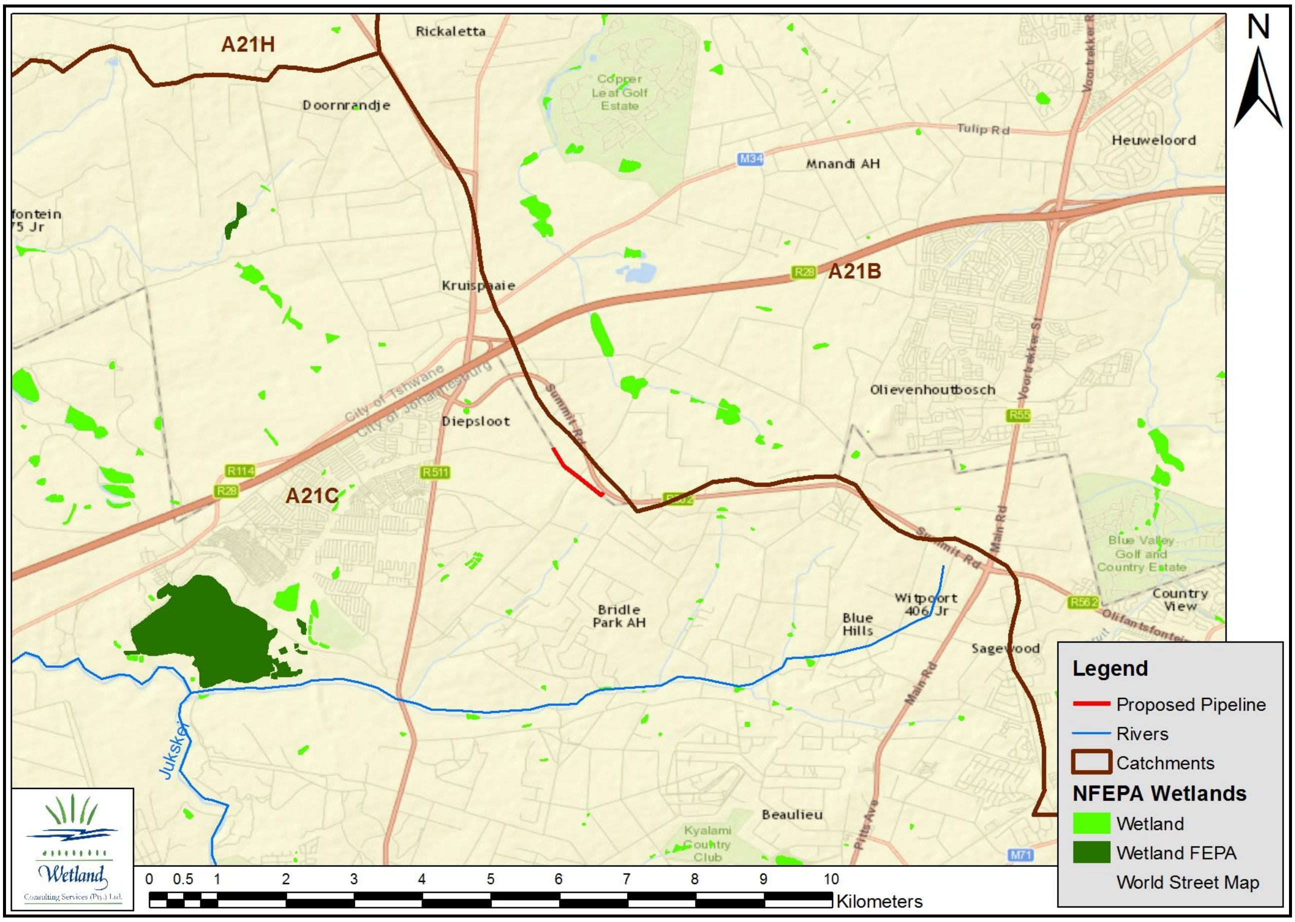

Figure 2. Map showing the approximate location of the study area in relation to the quaternary catchment boundaries, as well as major rivers and FEPA wetlands of the area.

Figure 2 furthermore illustrates the wetlands of the NFEPA database in relation to the study area. The Jukskei River, located about 6 km downstream of the site is considered to be in a largely modified condition (PES category D) according to DWA's 1999 data, and as largely modified (category D) in the NFEPA rivers database (Nel et al, 2011). The sub-catchment in which the study area is located has been classified as an "Upstream Management Area", indicating its importance as part of the catchment feeding the Hartbeespoort Dam.

No wetlands are indicated in the NFEPA database as occurring in the direct vicinity of the study area.

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6.2 Vegetation

A number of vegetation classification systems have been compiled for South Africa. According to the most recent vegetation classification of the country, "*The Vegetation of South Africa, Lesotho and Swaziland*" (Mucina and Rutherford, 2006), the study area falls within the Grassland Biome, Mesic Highveld Grassland Bioregion. At a finer level, the study area is classed as indicated in **Figure 3** as Egoli Granite Grassland (Gm10).

Figure 3. Map showing the vegetation types of the area

Egoli Granite Grassland Grassland is listed as *Endangered* in the National List of Ecosystems that are Threatened and in Need of Protection (GN1002 of 2011).

The Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel *et al*, 2011a) identified 791 wetland ecosystem types in South Africa based on classification of surrounding vegetation (taken from Mucina and Rutherford, 2006) and hydro-geomorphic (HGM) wetland type; seven HGM wetland types are recognised and 133 wetland vegetation groups. Based on this classification, the following wetland vegetation type could be expected as potentially occurring on site:

- Mesic Highveld Grassland Group 3_Seep

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The National Biodiversity Assessment 2011: Freshwater Component (Nel *et al*., 2011b) undertook an ecosystem threat status assessment for each of the 791 wetland ecosystem types where each wetland ecosystem type was assigned a threat status based on wetland type as well as on wetland vegetation group. This same assessment methodology was applied recently as part of a WRC funded project (WRC Project K5/2281) to determine threat statuses and protection levels for wetland vegetation groups, with the findings for the wetland vegetation group expected to occur on site provided in **Table 3** below.

Table 3. Summarised findings of the wetland vegetation group threat status assessment as undertaken as part of WRC Project K5/2281

Wetland Ecosystem Type	Ecosystem Threat Status	Protection level
Mesic Highveld Grassland Group 3	Least Threatened	Not protected

6.3 Provincial Conservation Plans

The Gauteng C-Plan indicates that virtually the entire pipeline route falls with Critical Biodiversity Areas (CBA) or Ecological Support Areas (ESA). These areas have been flagged as important biodiversity areas due to the presence of listed plant species and/or habitat for listed plant species, specifically *Gnaphalium nelsonii*, *Habenaria kraenzliniana* and *Trachyandra erythrorrhiza*. None of these species were observed within the direct vicinity of the proposed pipeline route and, given the high level of disturbance due to dumping, it is considered unlikely that these species occur within the direct proposed pipeline footprint.

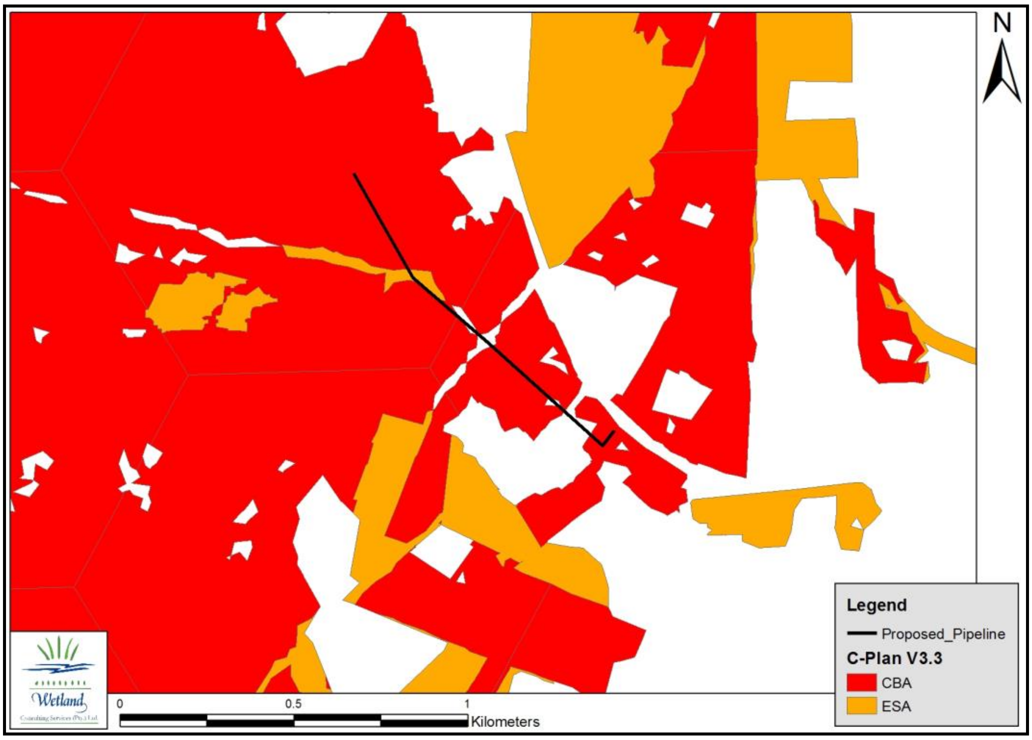

Figure 4. Extract from the provincial conservation plan (C Plan Version 3.3) for the study area and surrounds

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7. APPROACH

7.1 Wetland Delineation and Classification

The National Water Act, Act 36 of 1998, defines wetlands as follows:

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

The presence of wetlands in the landscape can be linked to the presence of both surface water and perched groundwater. Wetland types are differentiated based on their hydro-geomorphic (HGM) characteristics; i.e. on the position of the wetland in the landscape, as well as the way in which water moves into, through and out of the wetland systems. A schematic diagram of how these wetland systems are positioned in the landscape is given in **Figure 4** below.

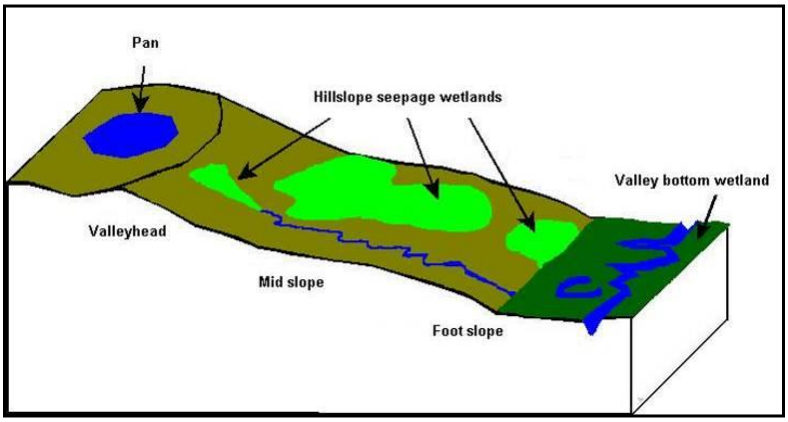

Figure 5. Diagram illustrating the position of the various wetland types within the landscape

Use was made of 1:50 000 topographical maps, 1:10 000 orthophotos and Google Earth Imagery to create digital base maps of the study area onto which the wetland boundaries could be delineated using ArcMap 10.1. A desktop delineation of suspected wetland areas was undertaken by identifying rivers and wetness signatures on the digital base maps. All identified areas suspected to be wetlands were then further investigated in the field.

Wetlands were identified and delineated according to the delineation procedure as set out by the "*A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas*" document, as described by DWAF (2005) and Kotze and Marneweck (1999). Using this procedure, wetlands were identified and delineated using the Terrain Unit Indicator, the Soil Form Indicator, the Soil Wetness Indicator and the Vegetation Indicator.

For the purposes of delineating the actual wetland boundaries use is made of indirect indicators of prolonged saturation, namely wetland plants (hydrophytes) and wetland soils (hydromorphic soils), with particular emphasis on hydromorphic soils. It is important to note that under normal conditions

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hydromorphic soils must display signs of wetness (mottling and gleying) within 50cm of the soil surface for an area to be classified as a wetland (*A practical field procedure for identification and delineation of wetlands and riparian areas*, DWAF). A hand-held soil auger (75mm bucket auger) was used to expose soil profiles on site.

The delineated wetlands were then classified using a hydro-geomorphic classification system based on the system proposed by Ollis *et al*. (2013).

7.2 Functional Assessment

A functional assessment of the wetlands on site was undertaken using the level 2 assessment as described in "Wet-EcoServices" (Kotze et al., 2007). WET-EcoServices is a tool developed to qualitatively assess the goods and services that individual wetlands provide so as to aid informed planning and decision making (Kotze *et al*., 2009). The tool is described as follows:

> "*WET-EcoServices* is used to assess the goods and services that individual wetlands provide, thereby aiding informed planning and decision making. It is designed for a class of wetlands known as palustrine wetlands (i.e. marshes, floodplains, vlei's or seeps). The tool provides guidelines for scoring the importance of a wetland in delivering each of 15 different ecosystem services (including flood attenuation, sediment trapping and provision of livestock grazing). The first step is to characterise wetlands according to their hydro-geomorphic setting (e.g. floodplain). Ecosystem service delivery is then assessed either at Level 1, based on existing knowledge or at Level 2, based on a field assessment of key descriptors (e.g. flow pattern through the wetland)." (Kotze et al., 2009)

7.3 Present Ecological State and Ecological Importance & Sensitivity

A present ecological state (PES) and ecological importance and sensitivity (EIS) assessment was conducted for every hydro-geomorphic wetland unit identified and delineated within the study area. This was done in order to establish a baseline of the current state of the wetlands and to provide an indication of the conservation value and sensitivity of the wetlands in the study area. For the purpose of this study, the tool WET-Health was used to assess the present ecological state of the wetlands. A WET-Health level 1 assessment was conducted to provide a relatively rapid assessment of the health and impacts affecting the wetlands (Macfarlane, et al., 2008).

The WET-Health assessment tool is however not applicable to pan wetlands. As such a modified version of the Resource Directed Measures for Wetland Ecosystems (DWAF, 1999) was utilised for determination of the PES for the pan. This modified version incorporates catchment considerations into the PES.

The ecological importance and sensitivity assessment was conducted according to the guidelines as discussed by DWAF (1999). In the method outlined by DWAF a series of determinants for EIS are assessed for the wetlands on a scale of 0 to 4 (Table 6), where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to determine the EIS.

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8. FINDINGS

8.1 Wetland Delineation and Typing

A single day site visit was undertaken on the 19th January 2017 to identify and delineate wetlands on site. This represents a mid-summer survey and is ideal for wetland surveys.

A single hydro-geomorphic wetland type was identified and delineated on site:

- Hillslope seepage wetland

In terms of the Ollis *et al*. (2013) wetland classification system, these wetlands are typed as detailed in **Table 4**.

Table 4. National Wetland Classification System applied to the wetlands of the study area.

Level 1: System	Level 2: Regional Setting	Level 3: Landscape Unit	Level 4A: Hydro-geomorphic Unit
Inland Systems	**DWAF Level 1 Ecoregion:** Highveld **NFEPA WetVeg:** Mesic Highveld Grassland Group 3	**Slope**	Seep/Hillslope Seepage

The identified wetland along the proposed pipeline route forms the extreme upper edge of a large hillslope seepage wetland draining in a westerly direction towards Diepsloot and forms the headwaters of the watercourse that drains through Diepsloot Township. The greater hillslope seepage wetland has been substantially impacted by historical sand mining and erosion, with large portions of the greater hillslope seepage wetland characterised by a shallow soil profile due to loss of soil to sand mining and subsequent erosion. A large erosion gully and areas of bare soil occur in the central reaches of the wetland (see the yellow arrow in **Figure 6**).

The upper section of hillslope seepage affected by the proposed pipeline alignment is less impacted by erosion and sand mining, though it has been heavily impacted by dumping of building rubble and refuse. The disturbances have further resulted in a number of alien and weedy species becoming established in the wetland. In addition a two-track crosses the upper reach of the wetland along the same route that the proposed pipeline will follow. An existing buried pipeline also crosses the wetland (**Figure 6**) with a single manhole observed within the wetland in close proximity to the proposed pipeline crossing.

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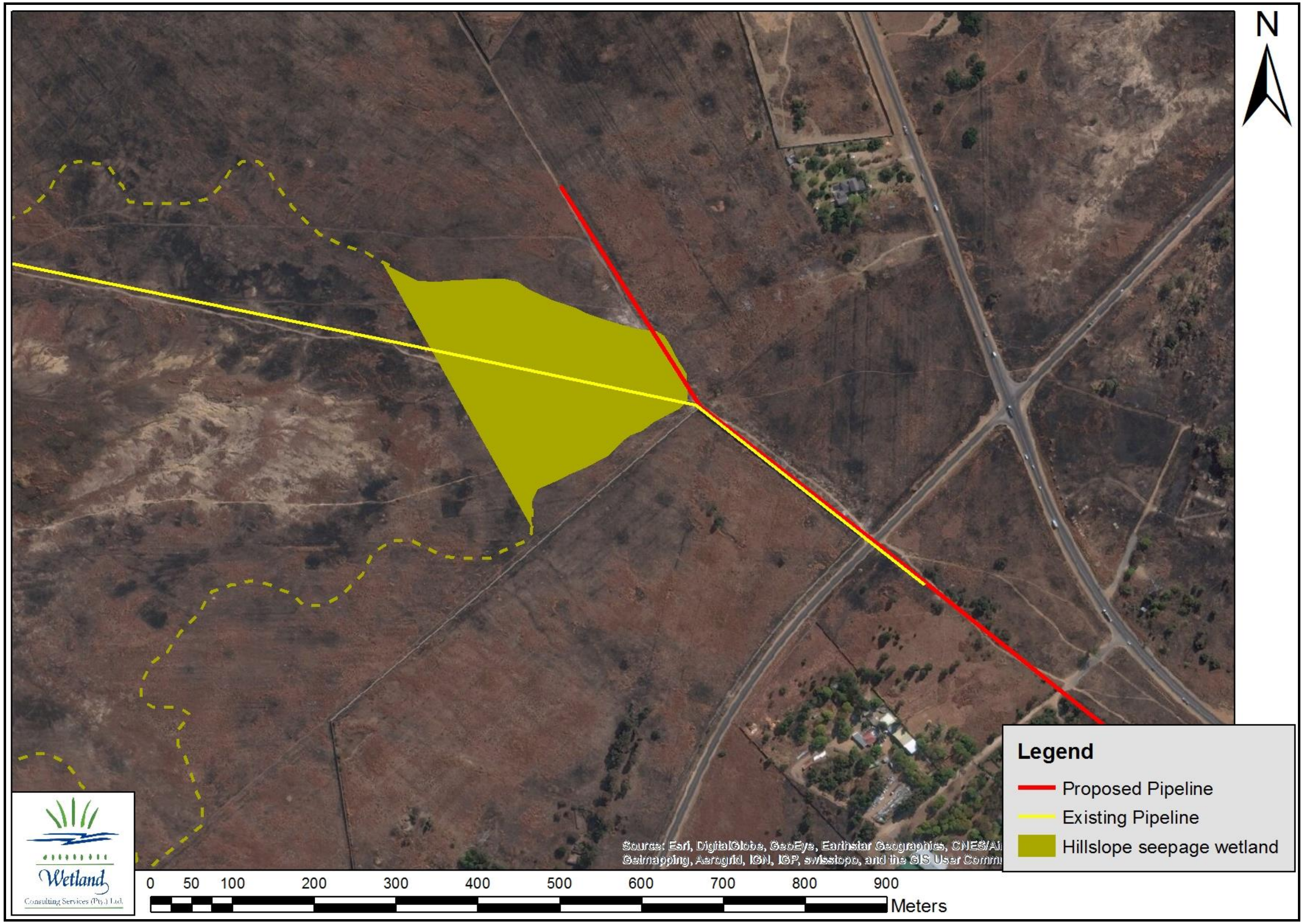

Figure 6. Map showing the extent of the delineated wetlands on site.

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Figure 7. Site photos. Photos 1 and 2 show dumping of rubble and refuse within the upper reach of the wetland along the proposed pipeline route; Photo 3 shows a view across the wetland area looking downslope towards Diepsloot in the distance; Photo 4 shows a view across the hillslope seepage wetland – the proposed pipeline will roughly follow the row of trees and shrubs visible in the right of the photo.

8.2 Functional Assessment

Numerous functions are typically attributed to wetlands, which include nutrient removal (and more specifically nitrate removal), sediment trapping (and associated with this is the trapping of phosphates bound to iron as a component of the sediment), stream flow augmentation, flood attenuation, trapping of pollutants and erosion control. Many of these functions attributed to wetlands are wetland type specific and can be linked to the position of wetlands in the landscape as well as to the way in which water enters and flows through the wetland. Thus not all wetlands can be expected to perform all functions, or to perform these functions with the same efficiency.

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WET-EcoServices is a tool developed to assess the goods and services that individual wetlands provide so as to aid informed planning and decision making (Kotze *et al*., 2009). In interpreting the results of the WET-EcoServices assessment, the following must be borne in mind:

- *The level of services delivered is based on current as well as future potential benefits* (i.e. a wetland might have high ability to perform a service such as trapping pollutants but is currently afforded little opportunity to perform the service due to a lack of pollutants within the wetland catchment, resulting in an intermediate score);
- *WET-EcoServices scores make no reference to the size of the wetland* (i.e. a 3ha wetland and a 300ha wetland might both score 3 for flood attenuation. Given the size of the wetlands in question, the overall importance of flood attenuation performed by the 300ha wetland is obviously greater than for the 3ha wetland);
- *Scores between different hydro-geomorphic wetland units (i.e. different wetland types) should not be compared directly*

Figure 8 below shows the results of the WET-EcoServices assessment. Most of the scores obtained are moderate to low, given the disturbed nature of the wetland on site. The highest scores were obtained for the water quality maintenance functions – phosphate trapping, nitrate removal and toxicant removal – which are associated with the slow, diffuse nature of water movement through the soil which allows for extended contact time between soil and water for these processes to occur. Flood attenuation also obtained a moderate score, mostly due to the regular flooding problems that are already experienced by the Diepsloot Township.

The wetland received a fairly low score for biodiversity maintenance as a direct consequence of the various disturbances that have impacted on the wetland, specifically the dumping of building rubble and refuse in the direct footprint of the proposed pipeline, as well as the erosion and historical sand mining in the central reaches of the wetland further downstream.

Direct human use benefits scored mostly very low, though provision of natural resources obtained a moderate to high score. This is based on the collection of thatching grass within the wetland and adjacent areas, as well as the subsistence hunting of wildlife on site. Given the prevailing poverty of the area, the importance of these resources is elevated.

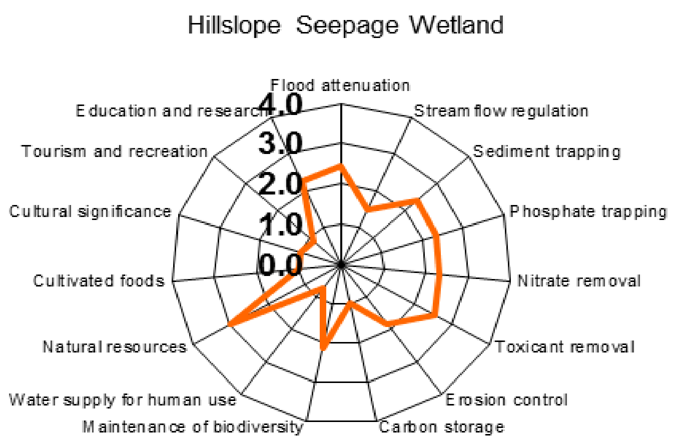

Figure 8. Results of the WET-EcoServices assessment

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8.3 Present Ecological Status (PES) Assessment

The hillslope seepage wetland is considered to be largely modified (PES category D – 4.7), with impacts relating mostly to changes to the wetland hydrology in terms of flow distribution and retention within the wetland and the direct transformation of habitat through degradation of the wetland vegetation. The hydrology of the hillslope seepage wetland is considered to have changed through a slight increase in flood peaks due to increased surface runoff from the catchment, though the most significant hydrological impacts relate to the flow retention and distribution within the wetlands brought about by the historical sand mining and resultant erosion. Loss of topsoil reduces the volumes of water stored within the wetland, while erosion gullies concentrate flows, lower the local water table and reduce retention time within the wetland.

Historical sand mining has altered the topography of the wetland, while infill/dumping along the proposed pipeline route has also impacted on the wetland geomorphology.

The wetland vegetation has responded to changes in the hydrological and geomorphological drivers and has also been degraded through direct disturbances, resulting in a vegetation composition along the section of wetland affected by the proposed pipeline route that is considered seriously modified. Alien species such as *Campuloclinium macrocephalum* (Pompom weed), *Datura ferox* (Thorn apple), *Melia azedarach* (Syringa), *Morus alba* (Mulberry) and *Tagetes minuta* (Khakibos) abound and cover large portions of the extreme upper reach of the wetland.

Table 5. Results of the PES assessment

HGM Unit	Threat descriptions			Combined score	PES Category
	Hydrology	Geomorphology	Vegetation		
Hillslope seepage wetlands	5.0	2.3	6.8	4.7	D

Table 6. Table showing the rating scale used for the PES assessment

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

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8.4 Ecological Importance and Sensitivity (EIS)

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

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

The scoring assessments for these three aspects of wetland importance and sensitivity were undertaken as per the methodology outlined in the document "Manual for the Rapid Ecological Reserve Determination of Wetlands (Version 2.0)" (Rountree *et al*, 2013). Based on this methodology, an EIS assessment was undertaken for all the delineated wetlands on site, with the results discussed below.

The hillslope seepage wetland was considered of Moderate importance and sensitivity, and rated highest in terms of hydrological/functional importance. The wetland plays a small role in moderating flooding and streamflow within the downstream watercourse flowing through Diepsloot Township, and provides water of generally good quality to the system. The importance in terms of ecological importance and sensitivity is limited by the degraded state of the wetland vegetation, though the wetland is located within Egoli Granite Grassland, which is considered Endangered.

Table 7. Results of the importance and sensitivity assessment.

Description	Score
Ecological importance and sensitivity	1.60
Hydrological/functional importance	1.75
Importance of direct human benefits	1.33
OVERALL IMPORTANCE	**1.75**

Table 8. Scoring system used for the EIS assessment

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

8.5 Buffer Zones & No-Go Areas

The GDARD requirements for Biodiversity Assessments require a 30m buffer zone around all wetlands in urban areas, with both the wetland and buffer zone regarded as sensitive. The 30m buffer zone is illustrated in **Figure 9** below. Given that the application is for a pipeline to cross a wetland, the application of a buffer zone is of limited value in this scenario. However, it is strongly recommended that the pipeline crossing be located within the existing disturbed habitat of the two-track and associated dumping. Areas of intact wetland habitat downslope of the disturbed area should be considered no-go areas, as illustrated in **Figure 9**.

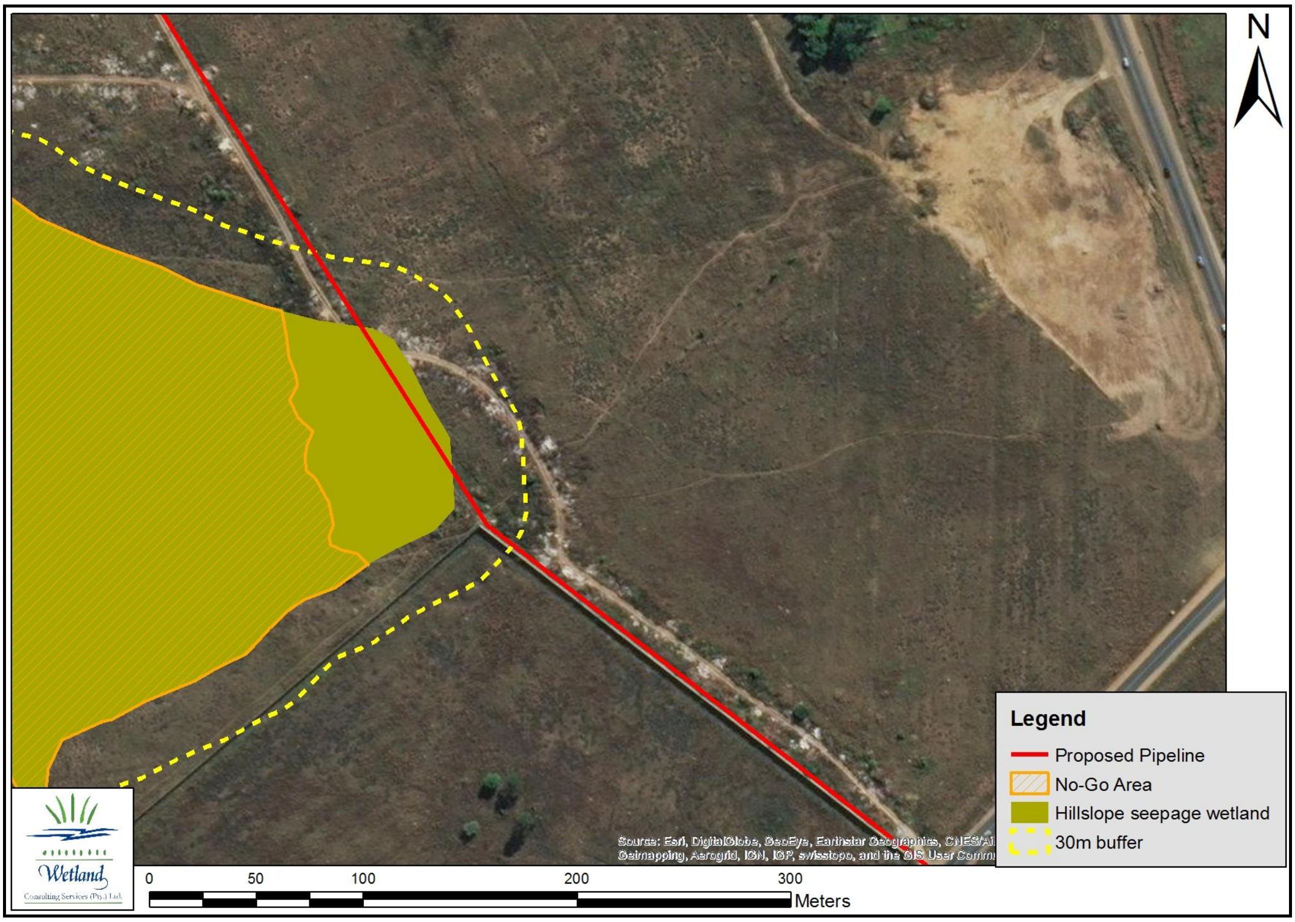

Figure 9. Map showing a 30m wetland buffer as well as the identified no-go zone for the pipeline.

9. IMPACT ASSESSMENT

The proposed project activities consist of the construction and operation of a potable water pipeline. It is understood that the pipeline will be installed below ground. A trench will be excavated across the affected wetland area wherein the pipe will be placed on a layer of bedding material (sand), where after the trench will be backfilled with the excavated material. Exact details on the pipeline dimension are not known.

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The following impacts are expected to occur:

Construction Phase:

- Disturbance of wetland habitat and fauna;
- Increased erosion within wetlands due to disturbance of wetland sediments;
- Increased sediment movement into the wetlands due to erosion on approach and departure slopes;
- Altered wetland hydrology due to interception/impoundment/diversion of flows;
- Increase in alien vegetation; and
- Deterioration in water quality due to spills and leaks of hazardous materials.

Operational Phase:

- Increased flows due to leaks or pipe failure; and
- Erosion due to subsidence along pipeline trench.

Each of the above impacts are briefly discussed below, with the environmental significance rating and recommended mitigation measures detailed in

9.1 Construction Phase – Disturbance of wetland habitat and fauna

A single hillslope seepage wetlands will be crossed by the proposed pipeline. As the pipeline will be buried along all of its length across the wetland area, a trench will need to be excavated across the full width of the wetland. This trench will be excavated within a servitude likely to be at least 5 m wide to allow access for excavation machinery, implying that a least a 5 m wide strip of wetland vegetation is likely to be significantly disturbed, and likely removed, during construction activities. Where construction related activities such as laydown areas, construction camps etc. extend into the wetland area further disturbance will results.

The affected area of wetland which will be crossed by the proposed pipeline is already highly disturbed, mostly due to dumping of rubble and refuse and the presence of a vehicle track. Numerous alien and weedy species occur in the area. This reduces the significance of the disturbance to wetland habitat.

This impact is expected to be Negative, Moderate, Short-term, restricted to the Site and Definite, resulting in an impact significance of **Moderate** (45).

Mitigation

- The construction servitude needs to be kept to a minimum width to limit vegetation destruction, and needs to be clearly demarcated in the field. Ideally the construction disturbance footprint should be kept to an area no wider than 5 m. No activities should be allowed outside the construction servitude.
- All materials stockpiles and construction camps should be located outside wetland areas.
- The areas where vegetation is destroyed and disturbed will however need to be monitored against invasion by alien vegetation and, if encountered, will need to be

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removed. If natural re-vegetation is unsuccessful, seeding and planting of the area will need to be implemented in consultation with an appropriate wetland vegetation specialist.
- Excavated soils will need to be replaced in the same order as excavated from the trench, i.e. sub-soil must be replaced first and topsoil must be replaced last. This will maximise opportunity for re-vegetation of disturbed areas.
- Excavation of the trench should only take place immediately before placement of the pipe. Ideally the trench should not remain open for longer than 7 days.

Impact rating after mitigation: Negative, Low, Short-term, restricted to the Site and High probability, resulting in an impact significance of **Low** (28).

9.2 Construction Phase – Increased erosion in wetlands

Disturbance of the wetland soils and clearing of the wetland vegetation along the servitude will expose the bare soils to erosion. Replaced wetland sediments if not landscaped to the surrounding profile could also result in the formation of preferential flow paths, with resultant flow concentration increasing the risk of erosion.

The affected area of wetland which will be crossed by the proposed pipeline is already highly disturbed, mostly due to dumping of rubble and refuse and the presence of a vehicle track. This results in extensive areas of bare soil as well as obstructions to flow that can cause localised impoundment and/or concentration of flow.

This impact is expected to be Negative, Low, Short-term, restricted to the Site and of High probability, resulting in an impact significance of **Low** (27).

Mitigation

- Undertake construction activities in the dry season.
- Limit the extent of the construction servitude to as small an area as possible.
- Excavated soils should be stockpiled on the upslope side of the excavated trench so that eroded sediments off the stockpile are washed back into the trench.
- Concentration and accumulation of flows along the servitude should be prevented by regularly providing for surface runoff to flow into the adjacent grassland rather than along the construction servitude and into the wetlands.
- Closure and rehabilitation of the pipeline servitude should commence as soon as the pipeline has been laid in the trench.
- Soils should be landscaped to the natural landscape profile with care taken to ensure that no preferential flow paths or berms remain.

Impact rating after mitigation: Negative, Low, Short-term, restricted to the Site and Low probability, resulting in an impact significance of **Low** (14).

9.3 Construction Phase – Increased sediment movement into wetlands

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Disturbance to the soils and vegetation on the approach and departure slopes to wetlands, is likely to provide a sediment source to the wetlands should storm events lead to surface run-off during the construction phase. The exposed pipeline servitude and trench could act as preferential flow paths concentrating surface run-off and leading to erosion on the side slopes and sediment deposition in the downslope wetland areas.

It must be noted that the existing vehicle track already forms a preferential flow path along the approach and departure slope to the wetland.

This impact is expected to be Negative, Low, Short-term, restricted to the Site and of High probability, resulting in an impact significance of **Low** (27).

Mitigation

- Limit the extent of exposed pipeline trench excavations at any one time by phasing the excavations and laying of the pipeline.
- Where possible, stockpile soils on upslope side of trench. If not possible, place a bidim wall or fibre roll sediment barrier adjacent to the wetland boundary to prevent sediments washing into the wetlands.
- Close trench and landscape back to natural profile as soon as possible after excavation.

Impact rating after mitigation: Negative, Low, Short-term, restricted to the Site and Low probability, resulting in an impact significance of **Low** (14).

9.4 Construction Phase – Altered wetland hydrology

Trench excavations could lead to breaches in subsurface control features such as ferricrete layers, altering the subsurface hydrology of wetlands and potentially leading to localised desiccation or flow concentration and subsequent erosion.

The placement of bedding material (typically sand) in the base of the trench could lead to the formation of a preferential flow path in the sub-surface, leading to partial desiccation of downslope areas and increasing erosion risk along the pipeline servitude.

No E-horizon was observed within the soil profile of the affected reach of wetland, suggesting that lateral flow through the soil profile is not an important process within the affected reach of the wetland.

This impact is expected to be Negative, Moderate, Short-term, Local and of Medium probability, resulting in an impact significance of **Moderate** (30).

Mitigation

- To prevent the formation of preferential flow paths in the subsurface, regular trench breakers (impermeable barriers) should be place within the trench along the approach

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and departure slopes to the wetland. This could be achieved for example with bentonite.

Impact rating after mitigation: Negative, Low, Short-term, restricted to the Site and Low probability, resulting in an impact significance of **Low** (14).

9.5 Construction Phase – Increase in alien vegetation and pioneer species

Disturbance brought about by the construction activities, specifically the clearing of vegetation will provide opportunity for alien and pioneer species to establish and replace indigenous grassland/wetland species. Numerous alien and weedy species already occur on site, associated with disturbances from dumping.

This impact is expected to be Negative, Moderate, Short-term, Local and of High probability, resulting in an impact significance of **Moderate** (40).

Mitigation

- It is recommended that all invasive alien vegetation be cleared from site following the completion of construction activities, with follow up clearing being undertaken after 6 months.

Impact rating after mitigation: Negative, Low, Short-term, restricted to the Site and Low probability, resulting in an impact significance of **Low** (14).

9.6 Construction Phase – Deterioration in water quality

During the construction phase, as activities are taking place within and adjacent to wetlands, there is a possibility that water quality can be impaired. Typically impairment will occur as a consequence of sediment disturbance resulting in an increase in turbidity. Water quality may also be impaired as a consequence of accidental spillages and the intentional washing and rinsing of equipment. It is possible that hydrocarbons will be stored and used on site, as well as cement and other potential pollutants.

This impact is expected to be Negative, Low, Short-term, Local and of Medium probability, resulting in an impact significance of **Low** (24).

Mitigation

- Institute environmental best practice guidelines as per the DWA Integrated Environmental Management Series for Construction Activities.
- Limit quantities of hazardous substances on site to the volumes used during 1 days' work.
- All soil contaminated due to leaks or spills should be remediated on site. If this is not possible, such contaminated soils must be disposed of in a suitable waste facility.

- Waste should be stored on site in clearly marked containers in a demarcated area. All waste material should be removed at the end of every working day to designated waste facilities at the main construction camp/suitable waste disposal facility. All waste must be disposed of offsite.

Impact rating after mitigation: Negative, Low, Short-term, restricted to the Site and Low probability, resulting in an impact significance of **Low** (14).

9.7 Operational Phase – Increased flows due to leaks or pipe failure

Pipe failure could result in significant increases in flow within the hillslope seepage wetland. Such increase in flow will likely lead to erosion.

Pipe leaks will have a more subtle impact, depending on the severity of the leak. Small leaks will result in increased soil wetness in temporary to seasonally saturated areas, leading to changes in vegetation structure and composition. Where leaks occur outside wetland areas, extended leaks could result in formation of artificial wetland habitat.

This impact is expected to be Negative, Low, Long-term, Local and of Low probability, resulting in an impact significance of **Low** (20).

Mitigation

- Regular inspections and maintenance of the pipeline must be undertaken during the operational phase, with any leaks repaired immediately.
- Any damage/erosion caused by pipe failure must be repaired immediately following the event.

Impact rating after mitigation: Negative, Low, Long-term, Local and Low probability, resulting in an impact significance of **Low** (20).

9.8 Operational Phase – Erosion due to subsidence along pipe trench

Before laying of the pipe within the excavated trench, a bedding layer will be placed in the trench. Bedding material is likely to have a higher permeability and porosity that the natural soil profile and could thus result in the formation of preferential flow paths within the trench. This is likely to be significant in all areas where the pipeline runs down slopes roughly perpendicular to the contours through hillslope seepage wetlands and on the approach and departure slopes to wetland crossings.

Where formation of such a preferential flow path results, piping is likely to occur, leading to subsurface erosion of material with resultant subsidence of the backfilled soils in the trench. Subsidence on the surface will result in preferential flow paths forming on the surface that could lead to erosion. Significant erosion could lead to pipe failure becoming a risk.

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This impact is expected to be Negative, Moderate, Long-term, restricted to the Site and of Medium probability, resulting in an impact significance of **Moderate** (33).

Mitigation

- Trench breakers must be installed along the pipeline trench. A material with low hydrological conductivity (a Bentonite mix is recommended), in the form of trench breakers should be packed around the pipe and should be installed at regular intervals to prevent the pipeline behaving as a conduit and to intercept any concentrated flow down the pipeline route. Spacing between trench breakers should vary depending on the slope of the landscape – the steeper the slope the smaller the distance between trench breakers. Spacing should be such that flows backing up behind one trench breaker extend back to the base of the previous trench breaker.
- A walk through survey should be undertaken long the entire pipeline route 6 months after completion of construction activities and then again at yearly intervals to survey for signs of subsidence along the pipeline route. Any subsidence should be immediately repaired.

Impact rating after mitigation: Negative, Low, Long-term, restricted to the Site and Low probability, resulting in an impact significance of **Low** (14).

10. WATER USE RISK ASSESSMENT

As part of the impact assessment, it was requested that the water use risk assessment methodology as included in GN509 of 2016 be applied to the following activities:

- Proposed pipeline crossing through hillslope seepage wetland.

The proposed potable water pipeline will cross the extreme upper edge of a large hillslope seepage wetland. As the pipeline will be buried, this requires the excavation of a trench across the upper reach of the wetland. The location of this activity within wetland habitat has a significant bearing on the outcome of the water use risk assessment, as the methodology of the risk assessment prescribes the highest severity rating for activities located within wetland habitat. Form the results it is clear that the proposed pipeline crossing is considered a **Moderate Risk**, and as such might require a water use licence application (WULA) to be submitted. However, the risk assessment methodology allows for the manual adjustment of the risk rating for activities that are considered borderline Low/Marginal risks, allowing for the manual adjustment of risk ratings by up to 25 points.

It is our considered opinion that the proposed potable water pipeline could be considered for authorisation under a General Authorisation (GA), given the following:

- The affected wetland will be impacted along its extreme upper edge within an area already heavily impacted by:
  - an existing vehicular track
  - numerous footpaths and regular human traffic

    - extensive dumping of both building rubble and an array of refuse
    - secondary vegetation with a prevalence of alien vegetation and weedy species
    - an existing buried water pipeline through the wetland, including the location of a manhole/inspection infrastructure within the wetland
- The affected wetland is considered to be largely modified (PES category D)
- It is considered highly unlikely that the proposed activity will increase the level of disturbance within the wetland. No change in PES category is expected.

The following additional measures must however be implemented in order for the pipeline to be considered for authorisation via a GA:

- All construction activity to take place within the dry season;
- All construction activity within the wetland to be completed within a 2 week period. The excavated trench should not remain open for more than 7 days.
- All invasive alien vegetation to be removed from the construction servitude and immediate adjacent areas.
- All building rubble and refuse to be removed from the construction servitude and immediate adjacent areas and disposed of in a suitable facility.
- A monitoring plan be implemented that includes the following:
    - Inspection to be undertaken of affected wetland area at completion of construction activities within the wetland, and after 6 months;
    - Inspections to be undertaken by wetland specialist or suitably qualified ecologist;
    - Inspection to focus on erosion, revegetation and alien vegetation; and
    - All recommendations from the monitoring report to be implemented.

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RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
NAME and REGISTRATION No of SACNASP Professional member: DIETER KASSIER (Pr. Sci. Nat.)
Reg no. 400254/14

No.	Phases	Activity	Aspect	Impact	Flow Regime		Chemical (Water		Habitat (Geomorph+ Vegetation)		Biota		Severity	Spatial scale	Duration		Consequence		Frequency of activity	Frequency of impact	Legal Issues	Detection		Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATERCOURSE
1	Construction Phase	Construction of potable water pipeline across hillslope seepage wetland	Access to site	Disturbance to wetland flora and fauna Increased erosion risk Increased sediment transport into wetland Increase in alien vegetation	5		5		5		5		5	1	1		7		1	1	5	1		8	56	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate
			Excavation of trench		5		5		5		5		5	1	1		7		1	4	5	1		11	77	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate
			Placement of bedding material		5		5		5		5		5	1	1		7		1	1	5	1		8	56	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate
			Placement of pipeline		5		5		5		5		5	1	1		7		1	1	5	1		8	56	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate
			Back-filling of trench		5		5		5		5		5	1	1		7		1	3	5	1		10	70	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate
			Landscaping backfilled soils		5		5		5		5		5	1	1		7		1	3	5	1		10	70	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate
2	Operational Phase	Operation of potable water pipeline	Leakage of pipeline	Increased flow in wetland Increased risk of erosion	5		5		5		5		5	1	1		7		5	1	5	1		12	84	M	High	Refer to Section 7 of the wetland specialist report (WCS, 2017)	Adjusted to LOW (Motivation provided in Section 8 of wetland specialist report (WCS, 2017)	PES - D EIS - Moderate

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11. CONCLUSION & REASONED OPINION

Wetland Consulting Services (Pty.) Ltd. (WCS) was appointed by Kongiwe Environmental (Pty) Ltd to conduct a wetland delineation and assessment study for a proposed pipeline near Diepsloot in the City of Johannesburg, Gauteng Province. A wetland assessment study was required to support the proposed environmental authorisation applications for the site.

The study area for this report consists of a section of the proposed pipeline route located in close proximity to a large hillslope seepage wetland (Figure 1). The proposed pipeline runs from the existing Diepsloot Reservoir located along Summit Road in a north-westerly direction, crossing Mnandi Road and extending another 550m beyond Mnandi Road. The full length of the proposed pipeline route is 1 000m. The pipeline will fall within quaternary catchment A21C (Figure 2).

The Gauteng C-Plan indicates that virtually the entire pipeline route falls with Critical Biodiversity Areas (CBA) or Ecological Support Areas (ESA). However, the pipeline route assessed was found to be significantly disturbed. The route follows an existing two-track with extensive dumping of refuse and building rubble on either side of the road.

A single wetlands was identified along the proposed pipeline route, with the wetland habitat in question forming the extreme upper edge of a large hillslope seepage wetland draining in a westerly direction towards Diepsloot. The greater hillslope seepage wetland has been substantially impacted by historical sand mining and erosion. The upper section of hillslope seepage affected by the proposed pipeline alignment is less impacted by erosion and sand mining, though it has been heavily impacted by dumping of building rubble and refuse. As a consequence, the hillslope seepage wetland is considered to be largely modified (PES category D – 4.7), and of Moderate importance and sensitivity.

The proposed construction and operation of the pipeline will result in a number of potential impacts to the wetland. However, given the highly disturbed nature of the wetland habitat in question, the fact that the pipeline follows an existing disturbance in the form of a two-track, and the various mitigation measures proposed, ***all the expected impacts can be reduced to Low environmental significance after mitigation***.

11.1 Reasoned Opinion

Based on the outcomes of our study, specifically also considering the existing disturbances impacting on the affected wetland and resulting in the largely modified condition of the affected wetland, together with the fact that expected impacts can be mitigated to Low significance through the application of a number of easily implementable mitigation measures, it is our considered opinion that the proposed pipeline detailed in this report could be authorised from a wetland perspective.

The following conditions of authorisation are however proposed:

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- All construction activity to take place within the dry season (June to September);
- All construction activity within the wetland to be completed within a 2 week period. The excavated trench should not remain open for more than 7 days.
- All invasive alien vegetation to be removed from the construction servitude and immediate adjacent areas.
- All building rubble and refuse to be removed from the construction servitude and immediate adjacent areas and disposed of in a suitable facility.
- A monitoring plan be implemented that includes the following:
  - Inspection to be undertaken of affected wetland area at completion of construction activities within the wetland, and after 6 months;
  - Inspections to be undertaken by wetland specialist or suitably qualified ecologist;
  - Inspection to focus on erosion, revegetation and alien vegetation; and
  - All recommendations from the monitoring report to be implemented.

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APPENDIX 1 – IMPACT ASSESSMENT METHODOLOGY

The impact assessment methodology used in this report is based on the requirements of DWA's 'Operational Guideline (Department of Water Affairs, 2010). The impact assessment will be based on the following key elements:

Probability of occurrence: this describes the likelihood of the impact actually occurring and is indicated as:

- Improbable, where the likelihood of the impact is very low;
- Probable, where there is a distinct possibility of the impact to occur;
- Highly probable, where it very likely that the impact will occur;
- Definite, where the impact will occur regardless any management measure.

Consequence of occurrence in terms of:

- Nature of the impact;
- Extent of the impact, either local, regional, national or across international borders;
- Duration of the impact, either short term (0-5 years), medium term (6-15 years) or long-term (the impact will cease after the operational life of the activity) or permanent, where mitigation measures by natural processes or human intervention will not occur;
- Intensity of the impact, either being low, medium or high effect on the natural, cultural and social functions and processes.

Significance level of the risk posed by the water use is determined through a synthesis of the **probability** of occurrence and **consequence** of occurrence.

The ranking of the risks was based on the quantitative assessment as described above and categorized into high, medium, or low risks. Management measures were then identified to mitigate, prevent and/or reduce the risk. These measures primarily focused on the risks identified as high in the ranking matrix, but will also include measures for medium and low risks.

In order to assess each of the factors for each impact, the ranking scales as contained in **Table 8** below were used.

Once the factors had been ranked for each impact, the environmental significance of each impact could be assessed by applying the SP formula. The SP formula can be described as:

SP = (magnitude + duration + extent) x probability

The maximum value of significance points (SP) is 100. Environmental effects could therefore be rated as either high (H), moderate (M), or low (L) significance on the following basis:

- More than 60 points indicates high (H) environmental significance
- Between 30 – 60 points indicate moderate (M) environmental significance
- Less than 30 points indicates low (L) environmental significance

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Table 9. Ranking Scales for impact assessment

PROBABILITY = P 5 – Definite / don't know 4 – High probable 3 – Medium probability 2 – Low probability 1 – Improbable 0 – None	**DURATION = D** 5 – Permanent 4 – Long-term (ceases after operational life) 3 – Medium-term (5 – 15 years) 2 – Short-term (0-5 years) 1 - Immediate
EXTENT = E 5 – International 4 – National 3 – Regional 2 – Local 1 – Site 0 – None	**MAGNITUDE = M** 10 – Very high / Don't know 8 – High 6 – Moderate 4 – Low 2 – Minor

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APPENDIX 2 – CV OF SPECIALIST

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