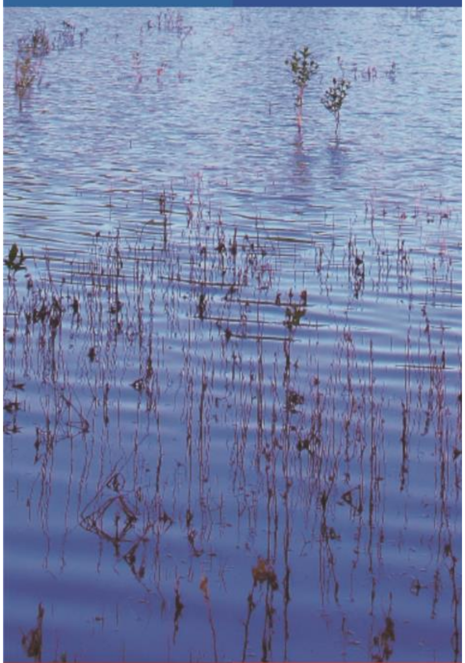
KPSX Weltevreden

Wetlands Assessment

BHP2690



March 2015

Environmental Authorisation for the Klipspruit Extension: Weltevreden

Wetlands Assessment

Project Number:

BHP2690

Prepared for:

BHP Billiton Energy Coal South Africa (Pty) Limited (BECSA)

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Executive Summary

Digby Wells Environmental (Digby Wells) has been requested by BHP Billiton Energy Coal South Africa (Pty) Limited (BECSA) to complete a wetland assessment for the proposed Klipspruit Extension (KPSX): Weltevreden opencast coal mine. The objectives of this study were to delineate and assess the associated wetland areas within the study area, as well as conduct an impact assessment.

A site visit was undertaken from the 4th to the 8th of August 2014 to determine the boundaries of wetlands and to assess their ecological integrity and functionality. Wetland areas were delineated and then identified according to their respective hydro-geomorphic (HGM) units. An ecological health assessment was conducted for the wetland areas to describe the current state and ecological relevance of each wetland unit using Wet-Health of the Wetland Management Series. The health of a wetland can be determined as a measure of the deviation of wetland structure and function from that wetland's natural reference condition. An ecological functional assessment of the associated wetland areas was undertaken using the WET-Eco-services tool to determine services provided by each wetland unit. Furthermore, an impact assessment was conducted to assess the impacts that the proposed mining activity will have on wetlands in the area.

Four wetland HGM units were recorded, namely: channelled valley bottom wetlands, valley bottom wetlands without a channel, hillslope seeps and pan / depressions. A total of 1317ha of wetland was delineated, 54% of which belonged to the valley bottom type.

The majority of wetlands were allocated a Present Ecological Status (PES) of D, indicating that they were largely modified. Certain valley bottom wetlands were allocated a PES of E, due to the presence of dense alien bushclumps, excavations and crops. The pan was allocated a PES between C and D, as impacts were restricted mainly to the catchment of the pan and the actual HGM unit was intact. The seep received a PES score of C, as this HGM unit was in a relatively functional state. Wetlands were regarded as largely functional, particularly with regard to their ability to process nutrients, filter toxins and as important habitat for flora and fauna. Although the pan / depression wetland was allocated a PES of C/D, it is regarded as important for maintenance of biodiversity and scored very high for this. The pan on Grootpan farm was found to support red data avifauna, namely: the Lesser Flamingo (*Phoenicopterus ruber*), a Near Threatened (NT) species according to the national list and Grass Owl (*Tyto capensis*), listed as Vulnerable (VU). The Ecological Importance and Sensitivity (EIS) for wetlands on site was C and D (moderate to low EIS)

Despite the fact that wetlands on site were no longer in a pristine condition, they were regarded as highly sensitive due to their link to the greater Olifants River catchment. Due to cumulative impacts on this catchment, primarily from mining but also from agricultural activity, the Olifants River Catchment has undergone considerable alteration to its natural state. Further deterioration of water quality in this catchment should be avoided at all costs. The catchment has been highlighted by the Department of Water and Sanitation (DWS) as sensitive and a 200m buffer has been allocated around all wetlands within it.

The proposed opencast mine is anticipated to cause degradation of wetland functionality and integrity. An estimated 342ha of wetland area is expected to be lost due to the opencast mining development.

It is recommended that a 100m buffer, at least, be placed around all wetlands in the project area. Further to this, decant points should be kept outside of the 100m buffer. The groundwater study for this project, not yet complete at the time that this report was compiled, will give an indication of where decant is expected to take place after mining. Should this not be possible, an offset strategy should be formulated to compensate for the loss of wetlands on site. The South African National Biodiversity Institute (SANBI) has recently released the offset guidelines for wetlands in South Africa and this is regarded as the best-practice guideline to be used, with the wetland calculator, to determine wetland offset areas. Offsets are regarded strictly by the DWS as a last resort and all efforts should be made to adhere to the mitigation hierarchy. The intention of the wetland offsets is to compensate for the loss of wetlands to development.

List of Acronyms and Abbreviations

BECSA	BHP Billiton Energy Coal South Africa (Pty) Limited
CR	Critical Endangered
DD	Data Deficient
DEA	Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
DWS	Department of Water and Sanitation
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EN	Endangered
HGM	Hydro-geomorphic Unit
KNP	Kruger National Park
LC	Least Concern
NE	Not Evaluated
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological Status
VU	Vulnerable

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1 Introduction

Wetlands are sensitive ecosystems that perform many complex functions including the maintenance of water quality, carbon storage, stream-flow regulation, flood attenuation, various social benefits as well as the maintenance of biodiversity (Kotze *et a*l.,2007). The Ramsar Convention on Wetlands refers to wetlands as one of the most important life support systems on earth owing to the services provided. Wetlands are defined according to the National Water Act, 1998 (Act 36 of 1998) (NWA) as: *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

1.1 Threat to Wetlands in South Africa

Wetlands in South Africa however, are poorly conserved owing primarily to a general underestimation of the ecological and economic importance of these systems (Swanepoel and Barnard, 2007). It is approximated that between 35-50% of all the wetland areas within South Africa have been destroyed as a result of anthropogenic stressors (Swanepoel and Barnard, 2007) and a cumulative loss of these important systems is on-going. Some of the major contributing factors to the decline of wetlands in South Africa include mining, industrial and agricultural activities as well as poor treatment of waste water from industry and mining (Oberholster *et al.*, 2011).

Wetlands are highly susceptible to the degradation of quality and a reduction in quantity as a result of anthropogenic resource use activities, land surface development (Gibbs, 2000) and landscape-management (Kotze and Breen, 1994; Whitlow, 1992), all practices that alter the hydrological regime impacting these wetland systems (Winter and Llamas, 1993). Historically, wetlands have been perceived to be wastelands (Maltby, 1986) and this has resulted in the exploitation, alteration and in many cases the complete destruction of these valuable ecosystems, with an accompanying loss of associated ecosystem goods and services (Begg, 1986). It is now acknowledged that these ecosystems perform functions making them invaluable to the management of both water quantity and quality, and as a result wetlands are regarded as integral components of catchment systems (Jewitt and Kotze, 2000; Dickens *et al*., 2003).

1.2 Status of the Olifants River Catchment

The Olifants River originates near Bethal in the Highveld of Mpumalanga and flows through the Kruger National Park (KNP) into Mozambique (DWA 2013). The main tributaries are the Wilge, Elands and Ga-Selati Rivers on the left bank and the Klein Olifants, Steelpoort, Blyde, Klaserie and Timbavati Rivers on the right bank.

There is a large demand for water-use in this catchment to source activities such as: power generation, mining, urban development, improved service delivery to rural communities and irrigation. Ineffective functioning of wastewater works, as well as point-source pollution from informal settlements, has resulted in increased concentrations of microbial pathogens such as *Vibrio cholera* and *Shigella sp* in the upper Olifants River system (Water Wheel May/June 2013).

Coal mining is the dominant sector in this catchment, where most of South Africa's coal is found in the Witbank Coalfield. Many mines in the region have been abandoned; some are on fire, some have undergone subsidence and most are decanting acid mine drainage (AMD) into wetland systems (McCarthy 2011). High sulphate concentrations, as well as high salinities are characteristic of features of the water in the Olifants River. Witbank Dam for instance, regularly exceeds the maximum sulphate concentrations acceptable for domestic use (200mg / L). Mass fish and crocodile deaths (including cases in the KNP) have been linked to water deterioration in the catchment (de Villiers and Mkwelo 2009).

Water treatment plants (based on reverse osmosis) have been established to remedy the problem of polluted water but have insufficient capacity to achieve this. Due to current and proposed mining activities in the Olifants River Catchment, further deterioration of water quality is expected.

It is imperative that wetlands in South Africa are managed in a sustainable way and that they are not damaged during the process of meeting the needs of the growing South African economy. This report serves as a wetland assessment, identifying and delineating wetlands associated with the proposed opencast coal mine, as well as assessing their ecological integrity and ecological services provided. Standardised South African methodology was employed for the purposes of this study and the following literature and guidelines were used:

- The practical field procedure for identification and delineation of wetlands and riparian areas described by the DWAF (2005);
- Wet-EcoServices: A technique for rapidly assessing ecosystem services provided by wetlands (Macfarlane *et al.,* 2009);
- Wet-Health: A technique used for assessing the ecological health of wetland systems.

In addition, the report concludes with an Impact Assessments that identifies the potential impacts that the development and operation of the proposed coal mine will have on the wetland systems on site. Mitigation measures are also recommended here.

2 Terms of Reference

Digby Wells was commissioned by BECSA to complete a wetland assessment for the proposed Weltevreden opencast coal mine. This wetland assessment is designed to define wetland boundaries within the area of interest and to identify the ecological relevance of each assessed wetland area. This survey supports the following regulations and regulatory procedures:

- Section 19 of the National Water Act, 1998 (Act 36 of 1998) ;
- Section 21 of the Environment Conservation Act, 1989 (Act 73 of 1989);

- Section 24 of the Constitution of the Republic of South Africa , 1996 (Act 108 of 1996) (applicable to Environmental Rights); and
- Section 5 of the National Environmental Management Act, 1998 (Act 108 of 1998) (NEMA).

3 Methodology

3.1 Wetland Identification

Maps were generated from 1:50 000 topographic maps and satellite imagery, onto which the wetland boundaries were delineated. The identified wetlands were classified according to the hydro-geomorphic (HGM) determinants based on modification of the system proposed by Brinson (1993), and modified for use by Marneweck and Batchelor (2002) and subsequently revised by Kotze *et al.* (2004).

A field investigation took place from the 4th to the 8th of August 2014. The wetland delineation procedure was started from the downstream part of the area to be delineated, utilising cues such as the presence of water or obligate hydrophilic vegetation. A total of 124 soil sampling points were taken (Figure 3-1), using a soil auger to examine the first 0.5m of the soil profile for the presence of soil wetness and/or soil form indicators (DWAF, 2005).

3.2 Wetland Delineation

In accordance with the DWAF guidelines (2005) the wetland delineation procedure considers four attributes to determine the limitations of the wetland. These attributes are discussed in further detail later on in this section. The four attributes are:

- Terrain Unit Indicator – helps to identify those parts of the landscape where wetlands are more likely to occur;
- Soil Form Indicator – identifies the soil forms, which are associated with prolonged and frequent saturation;
- Soil Wetness Indicator – identifies the morphological “signatures” developed in the soil profile as a result of prolonged and frequent saturation; and
- Vegetation Indicator – identifies hydrophilic vegetation associated with frequently saturated soils.

In accordance with the definition of a wetland in the NWA, vegetation is the primary indicator of a wetland, which must be present under normal circumstances. However, the soil wetness indicator tends to be the most important in practice and the remaining three indicators are then used in a confirmatory role. The reason for this is that the response of vegetation to changes in the soil moisture regime or management is relatively quick and may be transformed whereas the morphological indicators in the soil are significantly more long-lasting and will hold the indications of frequent and prolonged saturation long after a wetland has been drained (perhaps several centuries) (DWAF, 2005).

Figure 3-1 represents the sampling points taken for the site. Green points signify the location of hydrophilic vegetation indicators, blue points represent soils that showed wetland features such as mottling and gleying, and brown points indicate terrestrial soil points.

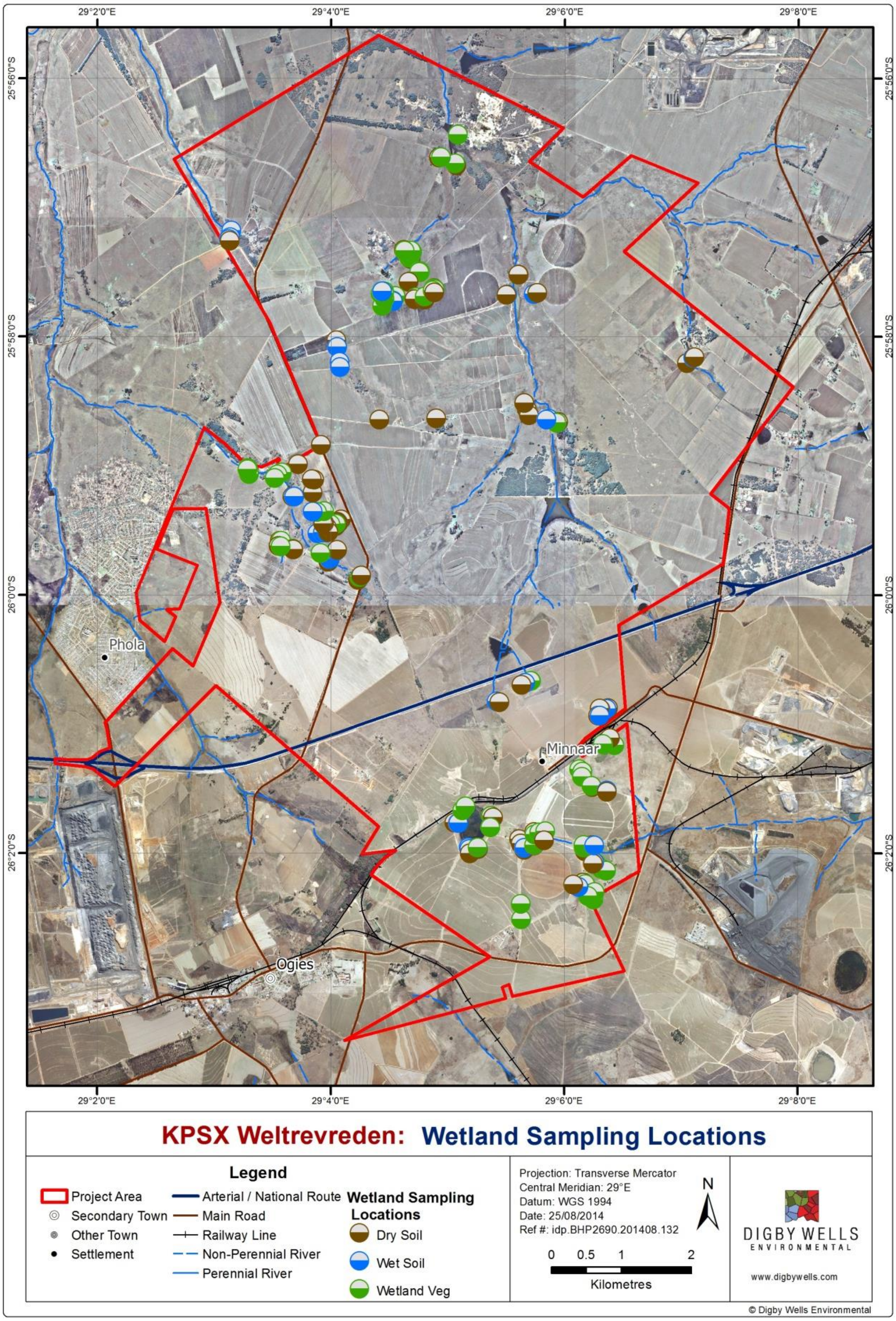


Figure 3-1: Sampling points

3.3 Wetland Ecological Health Assessment

The WET-Health tool (as prescribed by Kotze *et al.* 2007) was used to determine the PES of wetlands associated with the study site. The health of a wetland can be determined from a measure of the deviation of wetland structure and function from the wetland's natural reference condition (Macfarlane *et al.* (2007)). The health assessment attempts to evaluate the hydrological, geomorphological and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions. The PES is determined according to Table 3-1.

Table 3-1: Impact scores and Present Ecological State categories used by Wet-Health

Description	Combined Impact Score	PES Category
Unmodified, natural.	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has 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 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 recognisable.	6-7.9	E
Modifications have reached a critical level and ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

3.4 Wetland Functional Assessment

An ecological functional assessment of the wetland associated with the study area was undertaken in accordance with the method described by Kotze *et al.* (2007 This methodology provides for a scoring system to establish the services of the wetland ecosystem. Wetlands were grouped according to homogeneity and assessed utilising the functional assessment technique, Wet-Eco-services, developed by Kotze *et al.*, (2007) to provide an indication of the benefits and services. As a result of this, scores are not wetland area specific but do, however, provide an indication of the ecological services offered by the different HGM units as a whole for this study. In addition, the Ecological Importance and Sensitivity (EIS) for each HGM unit was assessed.

3.5 Impact Assessment

The impacts of the development and operation of the opencast mining project on the receiving wetlands areas within the project area were assessed at different stages of the development of the mine according to the methodology indicated in Table 3-2.

A clearly defined rating scale is used to assess each impact in terms of severity, spatial extent and duration (which determines the consequence) and in terms of the frequency of the activity and the frequency of the related impact (which determines the likelihood of occurrence). The overall impact significance is then determined using a significance rating matrix (

Table 3-3) based on the scores obtained for consequence and likelihood of occurrence, to assign a final impact rating.

Table 3-2: Impact Assessment methodology

Rating	Severity	Spatial scale	Duration	Probability
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	International The effect will occur across international borders	Permanent: No Mitigation No mitigation measures of natural process will reduce the impact after implementation.	Certain/ Definite. The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	National Will affect the entire country	Permanent: Mitigation Mitigation measures of natural process will reduce the impact.	Almost certain/Highly probable It is most likely that the impact will occur.

Rating	Severity	Spatial scale	Duration	Probability
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate	Province/ Region Will affect the entire province or region	Project Life The impact will cease after the operational life span of the project.	Likely The impact may occur.
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year	Municipal Area Will affect the whole municipal area	Long term 6-15 years	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	Local Local extending only as far as the development site area	Medium term 1-5 years	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.	Limited Limited to the site and its immediate surroundings	Short term Less than 1 year	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures

Rating	Severity	Spatial scale	Duration	Probability
1	Limited damage to minimal area of low significance, (e.g. ad hoc spills within plant area). Will have no impact on the environment.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month	Highly unlikely/None Expected never to happen.

Table 3-3 Significance categories

Significance										
		Consequence (severity + scale + duration)								
		1	3	5	7	9	11	15	18	21
Probability / Likelihood	1	1	3	5	7	9	11	15	18	21
	2	2	6	10	14	18	22	30	36	42
	3	3	9	15	21	27	33	45	54	63
	4	4	12	20	28	36	44	60	72	84
	5	5	15	25	35	45	55	75	90	105
	6	6	18	30	42	54	66	90	108	126
	7	7	21	35	49	63	77	105	126	147

Significance		
High (Major)	108- 147	
Medium-High (Moderate)	73 - 107	
Medium-Low (Minor)	36 - 72	
Low (Negligible)	0 - 35	

3.6 Study Limitations

The following limitations were encountered during this study:

- Owing to the time of sampling, during the winter season, it is likely that certain vegetation indicator species and sensitive plants were not recorded, as the sampling duration did not coincide with the flowering time of these species; and
- Access to Portion 33 of the farm Grootpan 7 IS and Portions 1, 6 and 11 of the farm Tweefontein 328 JS was restricted during the time that the field investigations took place. As a consequence of this, the wetlands in this area were delineated on desktop level and based on extrapolation of areas in the vicinity that were ground-truthed.

4 Study Area

The KPSX: Weltevreden study area is located north of Ogies on either side of the N12 highway in the Mpumalanga Province (Figure 4-1). The site falls within the farms Grootpan 7 IS, Hartebeestlaagte 325 JS, Tweefontein 328 JS, Weltevreden 324 JS and Wildebeestfonein 327 JS. The dominant land use in the greater study region is coal mining and agriculture.

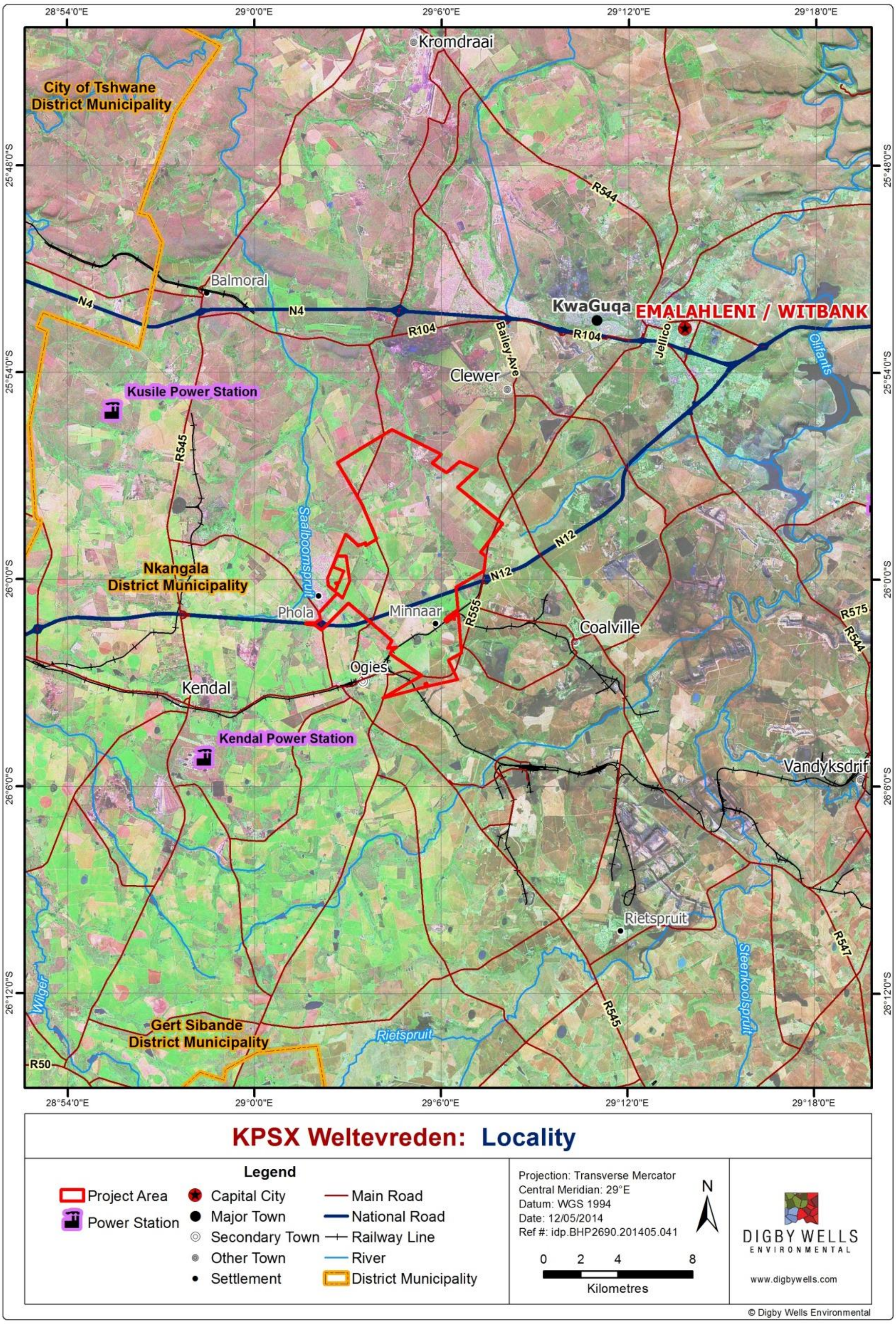


Figure 4-1: Local setting

4.1.1 Quaternary Catchments

The water resources of South Africa have been divided into Quaternary Catchments, which are regarded as the principal water management units in the country (DWAF 2011). A Quaternary Catchment is a fourth order catchment in a hierarchical classification system in which the primary catchment is the major unit. The majority of the study area falls within the quaternary catchment B20G, with wetlands associated with the Saalboomspruit, a tributary of the Wilge River. The south-western portion of the site falls within the B11F catchment, which is bisected by the Olifants River, and a small portion at the north-east of the site occurs within the catchment B11G. The quaternary catchments are regarded as Largely Modified, according to the Department of Water and Sanitation (DWS).

The water systems associated with the study area are all linked to the Olifants River and fall within the greater Olifants River catchment. The Quaternary catchments are represented in Figure 4-2. Owing to the cumulative impacts on the Olifants River, as well as its link to important habitats in the Kruger National Park (KNP), the DWS has recently placed significant emphasis on the importance of conservation of watercourses associated with this catchment.

The pan / depression wetlands on site fall within the Eastern Temperate Freshwater Wetlands vegetation type, according to Mucina and Rutherford, 2006. This vegetation type is regarded as one of the most important habitats in Mpumalanga (Fourie *et al.* 2014).

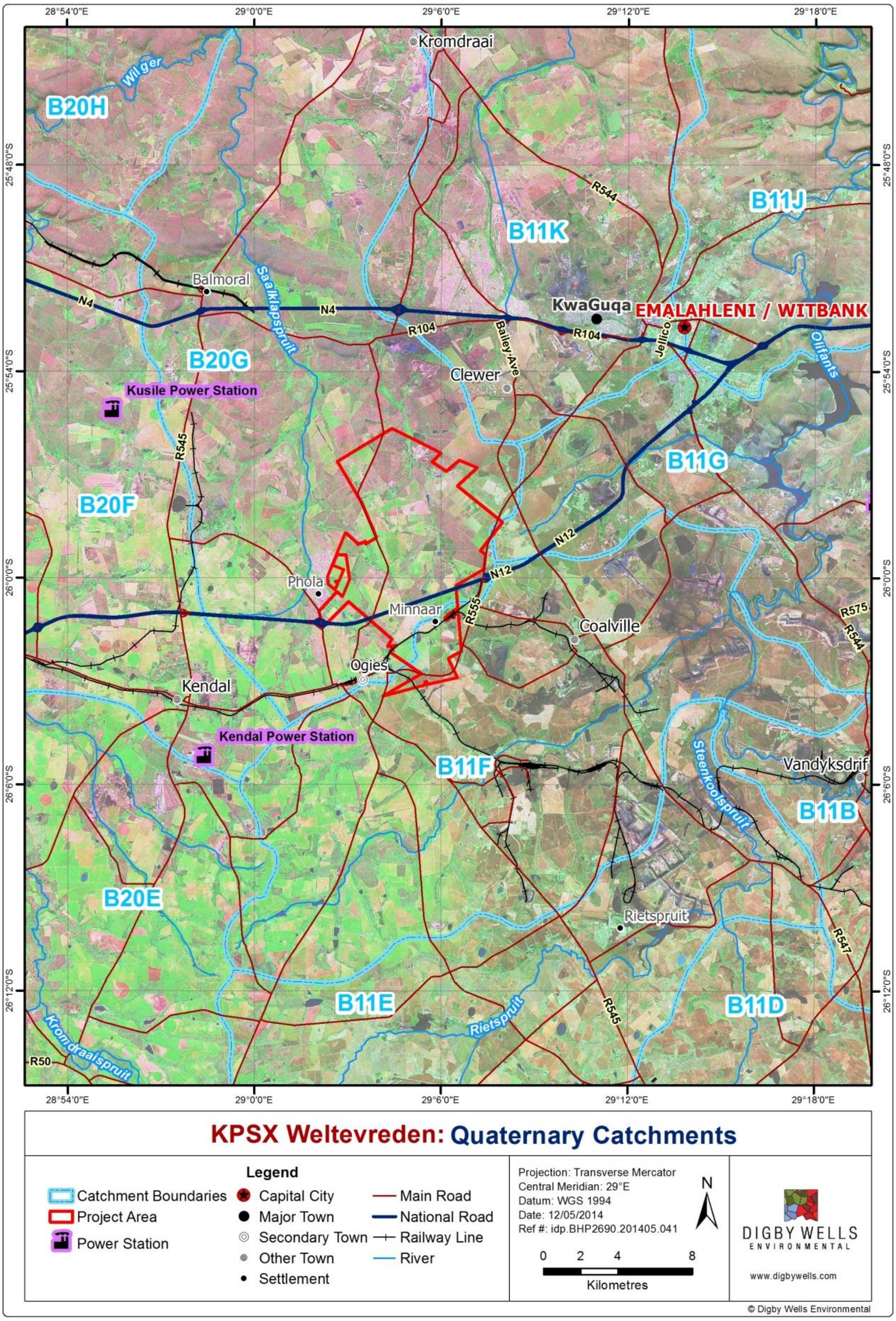


Figure 4-2: Quaternary Catchments

4.1.2 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources were considered to evaluate the importance of the wetland areas located within the project area (Nel *et al.* 2011).

Spatial layers used include the wetland classification and ranking. The NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity. Table 4-1 below indicates the criteria which were considered for the ranking of wetland areas. Figure 4-3 represents the NFEPA wetlands identified on site. Not all of the wetlands present on site have been identified by NFEPA and this may be attributed to the large-scale desktop nature of the NFEPA assessment. Two valley bottom systems and a pan / depression, have been identified and have been allocated a ranking of two. This indicates that these wetlands are of particular importance for the maintenance of the biodiversity and protection of natural habitat.

Table 4-1: NFEPA wetland classification ranking criteria

Criteria	Rank
Wetlands that intersect with a RAMSAR site.	1
Wetlands within 500 m of an IUCN threatened frog point locality; Wetlands within 500 m of a threatened waterbird point locality; Wetlands (excluding dams) with the majority of their area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes; Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented; and Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands that are good, intact examples from which to choose.	2
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of biodiversity importance, but with no valid reasons documented.	3
Wetlands (excluding dams) in A or B condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and Wetlands in C condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion).	4
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing Impacted Working for Wetland sites.	5
Any other wetland (excluding dams).	6

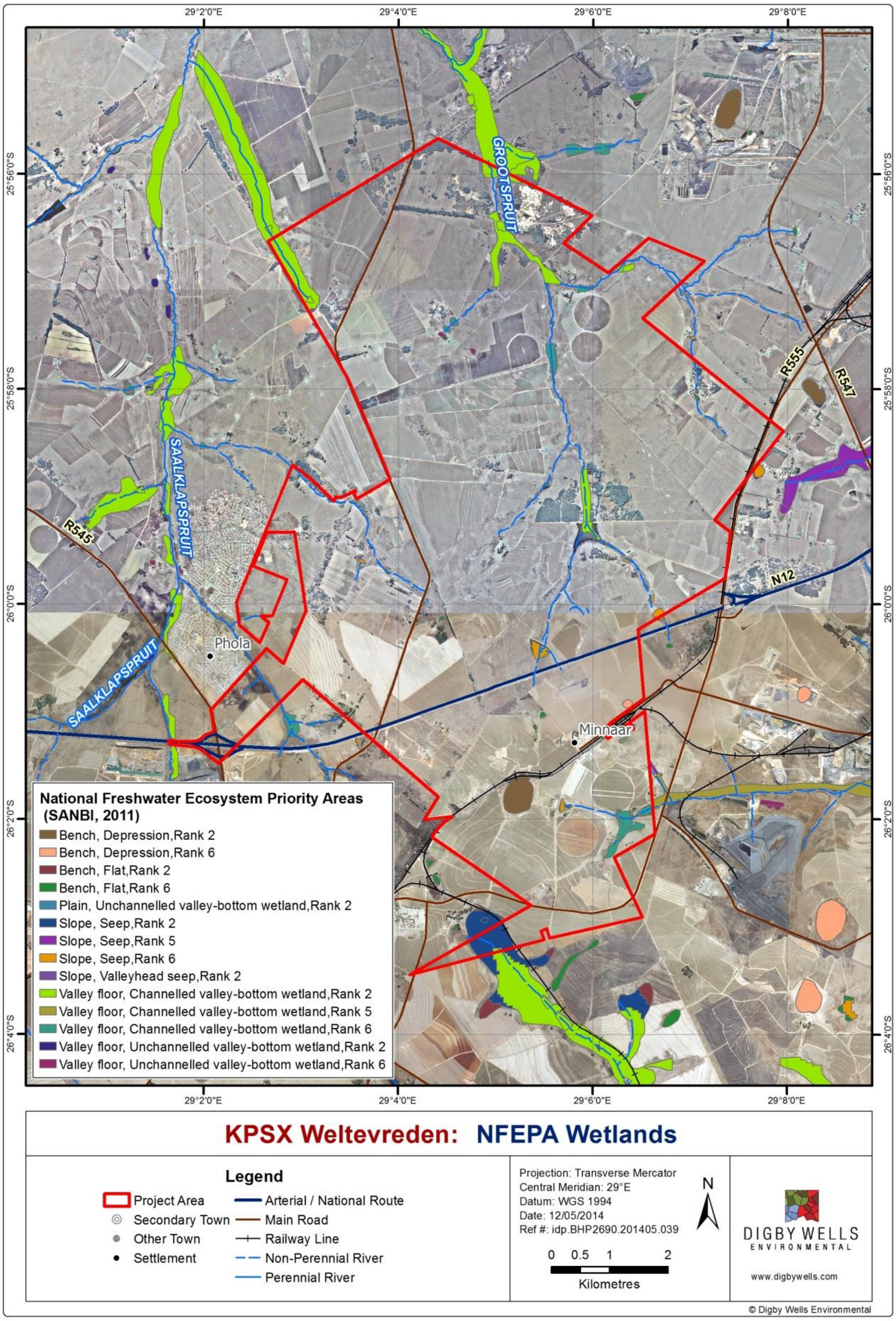


Figure 4-3: NFEPA wetlands

4.2 Mpumalanga Conservation Plan

The Mpumalanga Biodiversity Conservation Plan (MBCP) is a plan developed conjointly by the Mpumalanga Tourism and Parks Agency (MTPA) and Department of Agriculture and land Administration (DALA) to guide conservation and land-use decisions in the province in order to support sustainable development. The MTPA recognises that wetlands are specialised systems that perform ecological functions that are crucial for human and environmental welfare. Figure 4-4 indicates that the Mpumalanga C-plan classifies the majority of the site as modified, with some ‘irreplaceable’, ‘necessary’ and ‘natural’ areas. Irreplaceable areas are necessary to meet the requirements of the Mpumalanga C-plan.

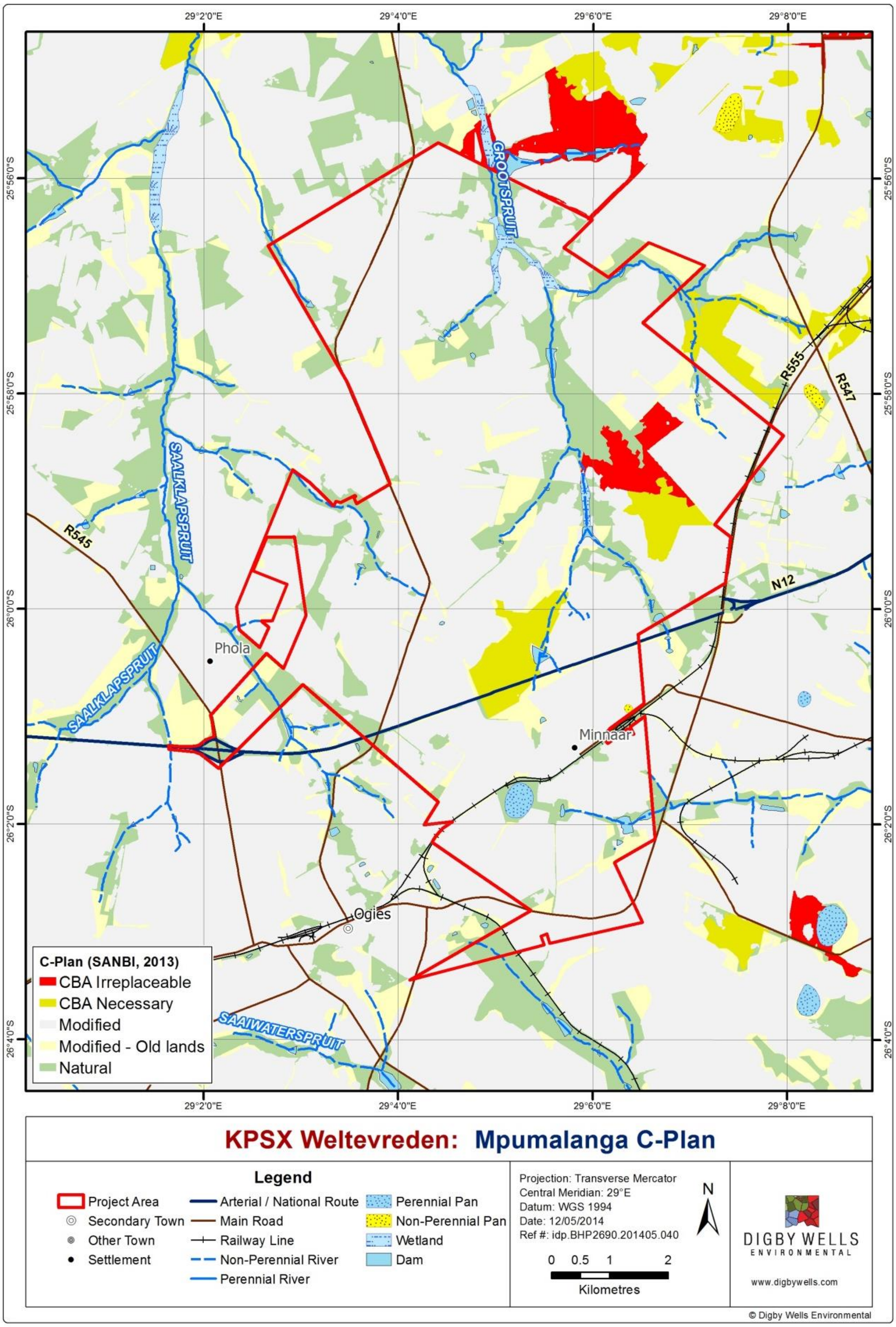


Figure 4-4: Mpumalanga C-plan

5 Wetland Delineation

The wetland delineation was completed with the aid of aerial imagery, as well as verification in the field. The total area of wetlands on site is 1317ha, comprised primarily of valley bottom systems (54%), as listed in Table 5-1.

Table 5-1: Area of wetlands on site

HGM Unit	Area (ha)	Proportion of wetlands on site (%)
Channelled valley bottom	519	39
Valley Bottom without a channel	192	15
Hillslope seeps	568	43
Pan / depressions.	31.56	2.4
Total	**1317**	

Figure 5-1 represents the wetland delineation and also shows the recommended buffers for protection around the wetlands on site. The buffer zones are a requirement to facilitate the protection of the delineated wetland areas within the project area. The purpose of the establishment of buffer zones is to minimise the anthropogenic impacts associated with the proposed development on the receiving water resources. A buffer zone is defined as:

"*the strips of undeveloped, typically vegetated land (composed in many cases of riparian habitat or terrestrial plant communities) which separate development or adjacent land uses from aquatic ecosystems (rivers and wetlands).*"

A number of justifications have been provided for the establishment of buffer zones, some of which are listed below:

- Reducing the impacts of adjacent land uses on water resource quality and the associated biodiversity; and
- Sustaining or improving the ability of the water resources to provide goods and services to the current and future water end users within the catchment area.

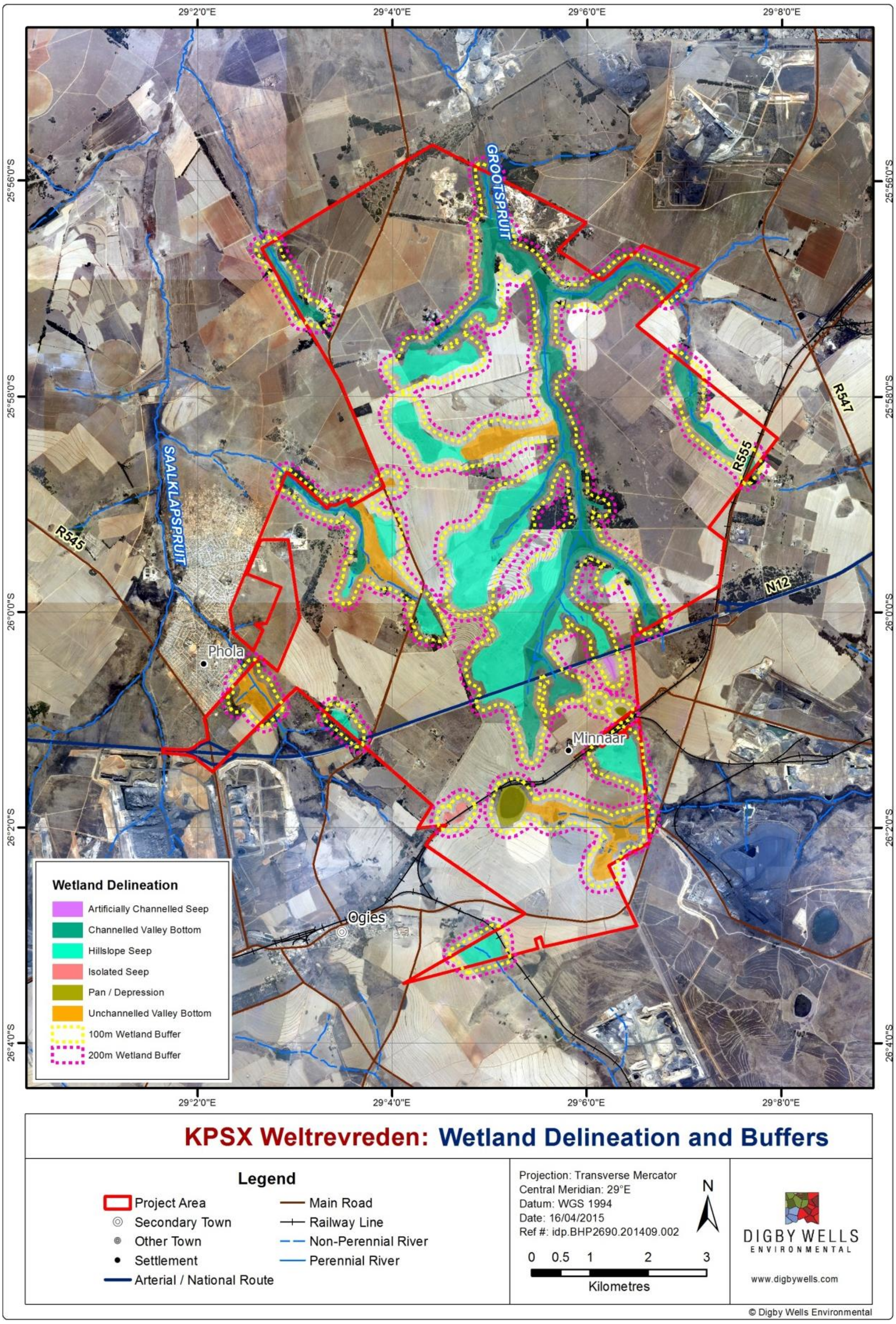


Figure 5-1: Wetland delineation and associated buffer zones

5.1 Terrain Indicator

As mentioned in section 3.1, the hydro-geomorphic approach is used to classify wetlands into primary units. This is in contrast to the former system of classification that made use of broad-level features such as vegetation cover, size and depth of the wetlands (Cowardin *et al.* 1979). There is a shift towards using this system of classification internationally, according to Brinson 2003, Semeniuk and Semeniuk 1995, Finlayson *et al.* 2002, Tiner 2003 (in SANBI 2009). Figure 5-2 represents examples of HGM units found on site.

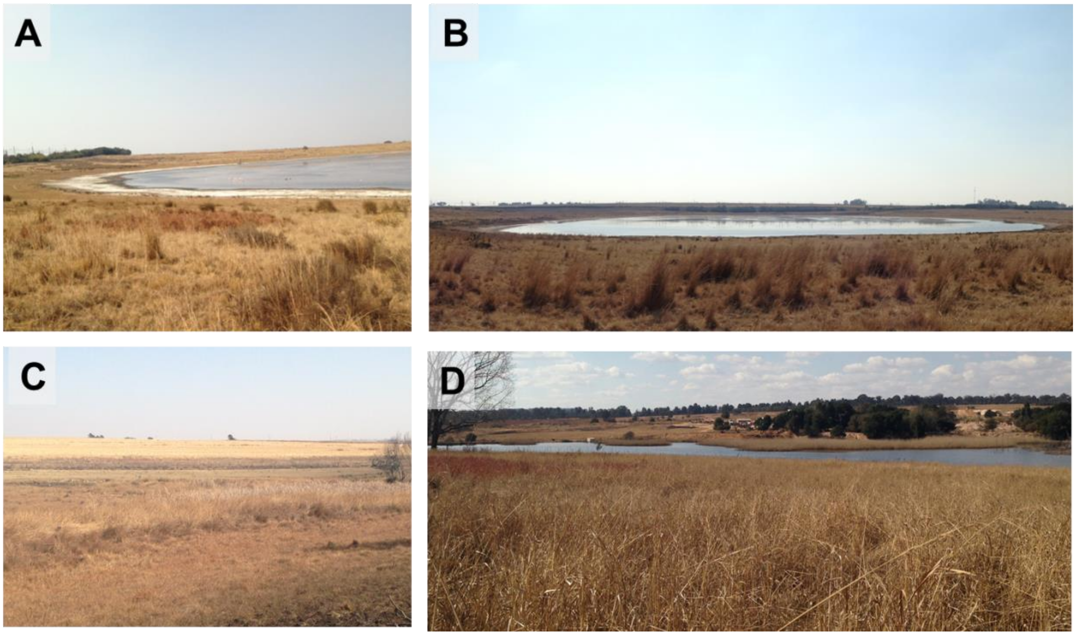


Figure 5-2: Examples of HGM units identified on site (A & B: Grootpan depression; C: valley bottom without a channel and D: channelled valley bottom)

5.2 Soil Indicator

Two aspects are considered when using soils as wetland indicators, namely, soil form and characteristic hydric soil features. Soil samples were taken (where possible) as transects across wetlands to determine boundaries. Figure 5-3 shows typical hydric soil indicators such as mottling, gleying and shrink/swell features. In addition to this, E-horizon soils were used to confirm wetland boundaries.

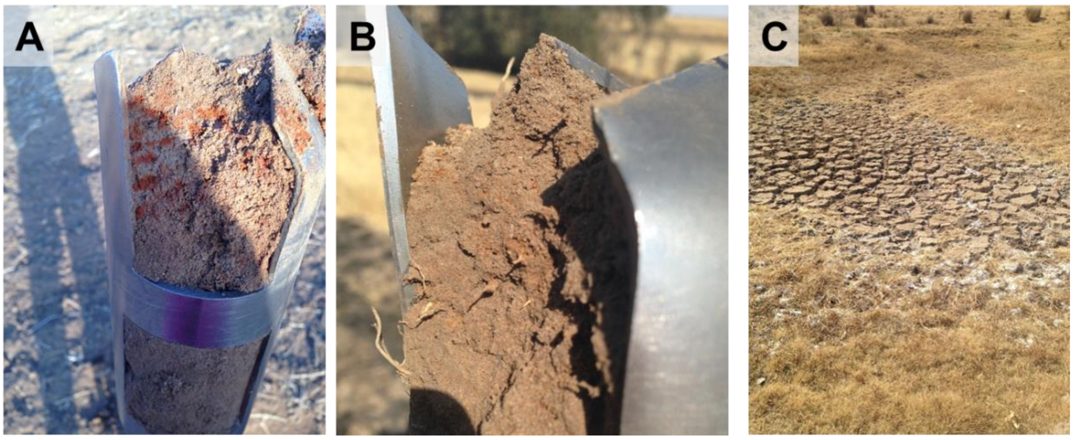


Figure 5-3: Examples of soil indicators (A: mottling and gleying of hydric soils associated with the permanent wetland: B: temporary wetland mottling and C: characteristic shrink-swell features of a channel)

5.3 Vegetation Indicator

Species identified on site that make up the hydrophytic wetland vegetation community include: *Andropogon eucomis* (Snowflake Grass), *Imperata cylindrica* (Cottonwool Grass), *Juncus effusus* (Soft Rush) and *Limosella major* (Northern Mudwort) in the seasonal wetland zones; and *Phragmites australis* (Giant Reed) and *Typha capensis* (Common Reed) in the permanent wetland zone of channels (Figure 5-4). Due to the sampling period, before the rainy season, it was not possible to identify any additional indicator plant species that may occur on site, as the time of sampling did not coincide with flowering times.

A hydrophytic plant community is a vegetation community that is dominated by species that have colonised and have been distributed as a result of hydrological factors such as flow rates, water depth, timing and duration of flooding, sediment accumulation, and underground water exchange. These species have adapted to an inundated environment and are used as indicators of the presence of wetlands according to the DWAF specifications.

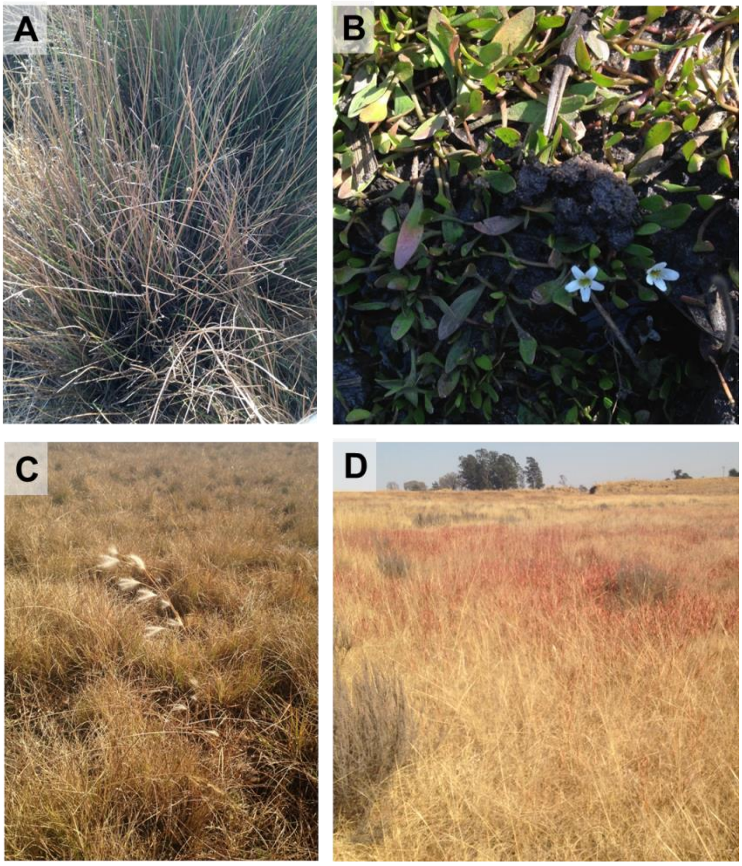


Figure 5-4: Vegetation indicators (A: *Juncus effusus* (Soft Rush); B: *Limosella major* (Northern Mudwort) in a channel; C: *Andropogon eucomus* (Snowflake Grass) and D: *Imperata cylindrica* (Cottonwool Grass) in a seepage wetland)

6 Wetland Integrity and Functionality

6.1 Wetland PES

The health of wetland is determined, using the Wet-Health tool, by assessing the current impacts on three modules, namely: vegetation, hydrology and geomorphology. Each of these components has undergone considerable alteration from their natural state, due primarily to agricultural activities.

Vegetation

The natural vegetation expected for wetlands in the area includes species such as: *Agrostis lachnantha*, *Cynodon dactylon, Cyperus congestus, Eragrostis gummiflua, Harpochloa falx, Leersia hexandra, Scleria dieterlenii, Schoenoplectus decipiens, Setaria sphacelata* and *Ranunculus multifius* (dominant plant species found in Eastern Temperate Wetlands, Mucina and Rutherford 2006). These have been replaced by maize crops and secondary grassland plant species such as *Seriphium plumosum*, hardy *Eragrostis* species and *Juncus effusus*.

Hydrology

Owing to the presence of small dams and centre pivots, it can be deduced that water from the wetlands is being used for seasonal irrigation. It is expected that some water will be lost to evaporation from dams, as well as from agricultural abstractions.

The extent of invasion by alien trees that take up high volumes of water is considerable. Bushclumps occur within catchments of the pan and valley bottom systems.

Geomorphology

Damming has resulted in reduced sediment transport through the wetland systems. Although dams in the wetlands are small, they contribute collectively to a significant impact. Further to this, sand mining is taking place directly in valley bottom systems.

Examples of current impacts to wetlands on site are represented in Figure 6-1. Watercourses that were allocated a PES of E were impacted by farming practices, damming, sand mining, the presence of roads and headcut erosion. The remaining wetlands received a PES of D, with exception to the pan on Grootpan farm and the hillslope seep leading to the main system on site (Figure 6-2). The pan was allocated a PES between C and D, as impacts were restricted mainly to the catchment of the pan and the actual HGM unit was intact. The seep received the highest PES score, as this HGM unit was in a relatively functional state.

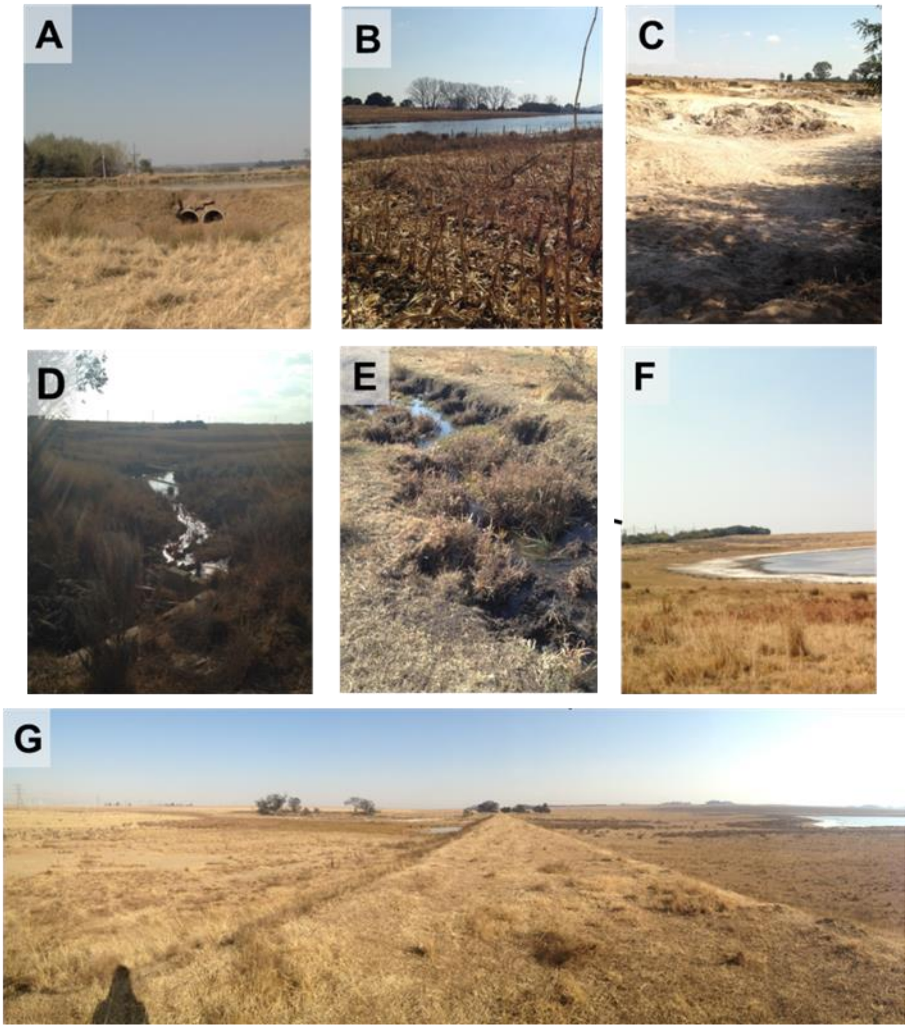


Figure 6-1: Examples of current impacts on wetlands on site (A: culverts underneath a dam; B: maize crops in the catchment and wetland of the channelled valley bottom; C: sand-mining in the wetland area; D & E: cannalisation due to erosion; F: alien bushclumps along a railway in the catchment of Grootpan and G: dam wall on Grootpan farm)

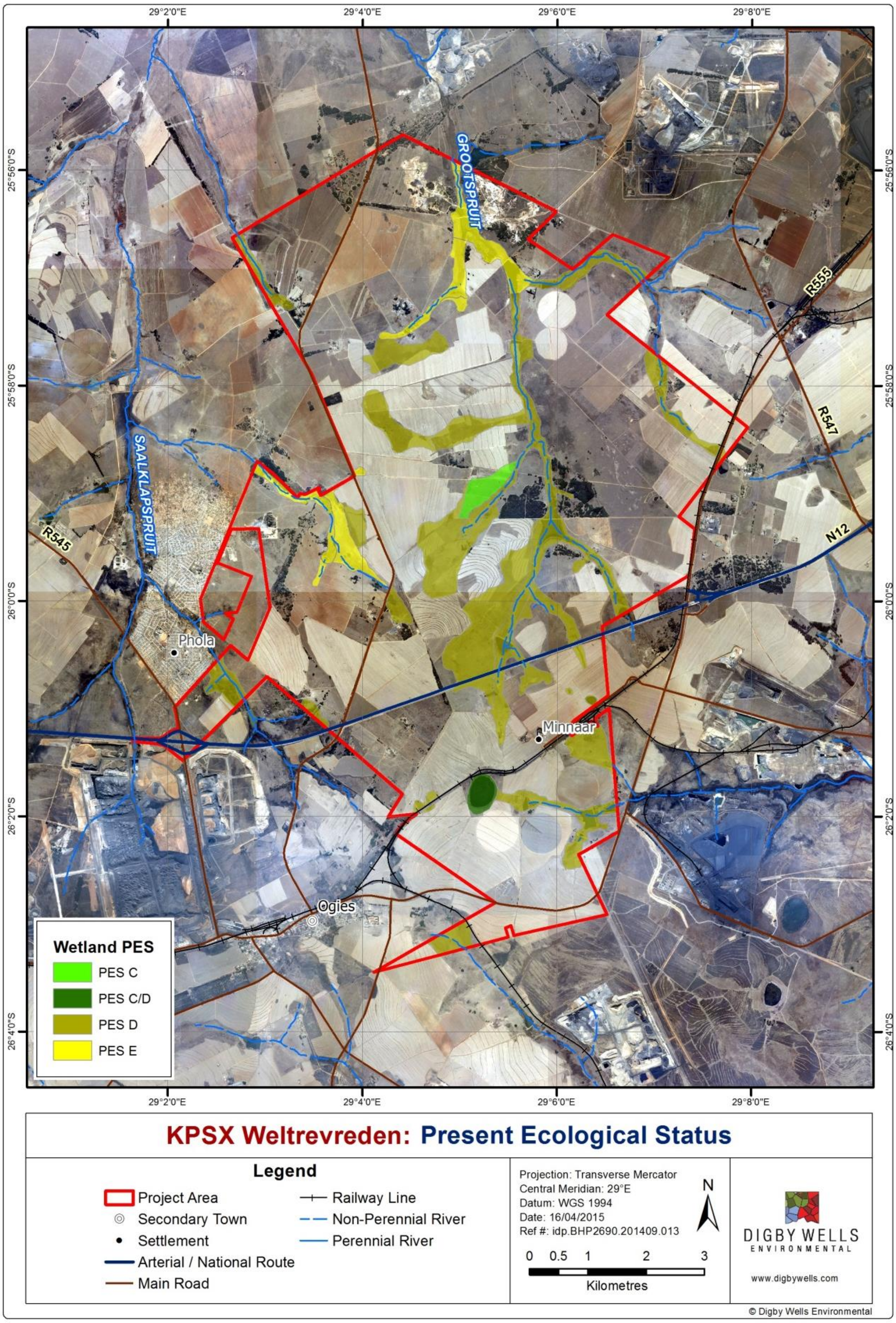


Figure 6-2: PES of wetlands associated with the site

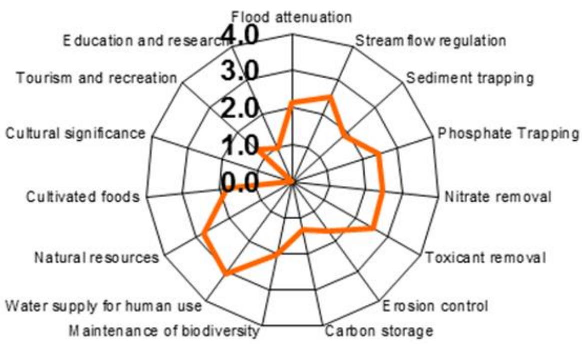
6.2 Wetland Eco-services and Ecological Importance and Sensitivity (EIS)

Wetlands represent a diversity of ecological attributes, including ecological services such as water storage, biogeochemical cycling, maintenance of biodiversity and biotic productivity (Stevenson *et al.* 2002). The general features of each wetland unit were assessed in terms of functioning and the overall importance of the wetland systems on site were then determined at a landscape level. Eco-services were classified according to these categories:

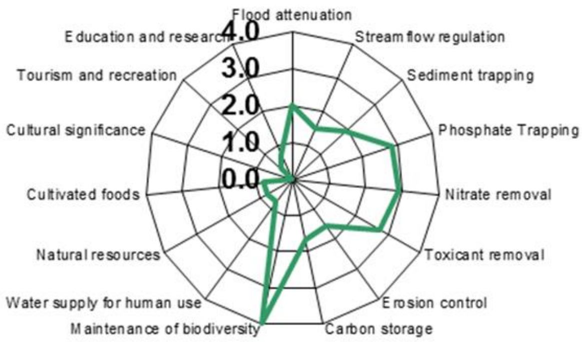
- <0.5 Low
- 0.5-1.2 Moderately Low
- 1.3-2.0 Intermediate
- 2.1-2.8 High
- >2.8 Very High

The valley bottom wetlands scored high for nutrient processing (2.5), toxicant removal (2.5) and stream-flow regulation (2.5). The hillslope seep wetlands scored very high for nutrient processing (2.9).

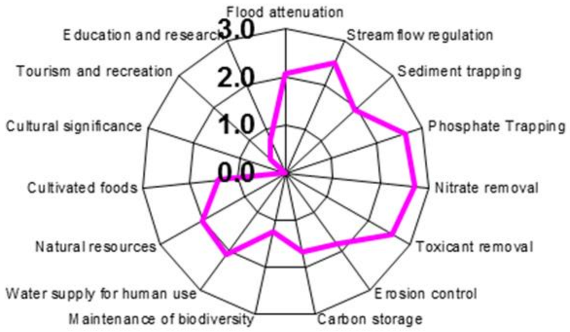
Although the pan / depression wetland was allocated a PES of C/D, it is regarded as important for maintenance of biodiversity and scored Very High (4) for this. The pan on Grootpan farm was found to support red data avifauna, namely, the Lesser Flamingo (*Phoenicopterus ruber*), a Near Threatened (NT) species according to the national list, and Grass Owl (*Tyto capensis*), listed as Vulnerable (VU). Figure 6-3 shows the radial plots of eco-services provided by wetlands on site.



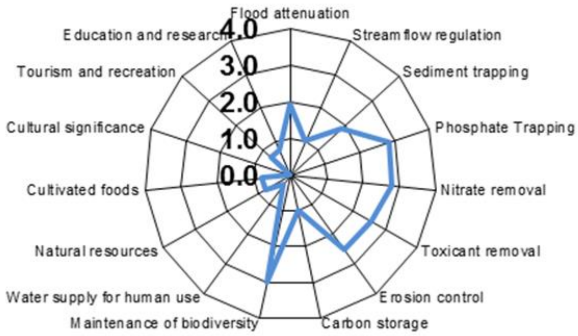
Channelled valley bottom



Valley bottom without a channel



Hillslope Seeps



Pan / Depressions

Figure 6-3: Radial plots of Eco-services supplied by wetlands on site

The EIS for the wetlands is represented in Figure 6-4. Wetlands were allocated scores of C and D, indicating that they had moderate and low EIS respectively.

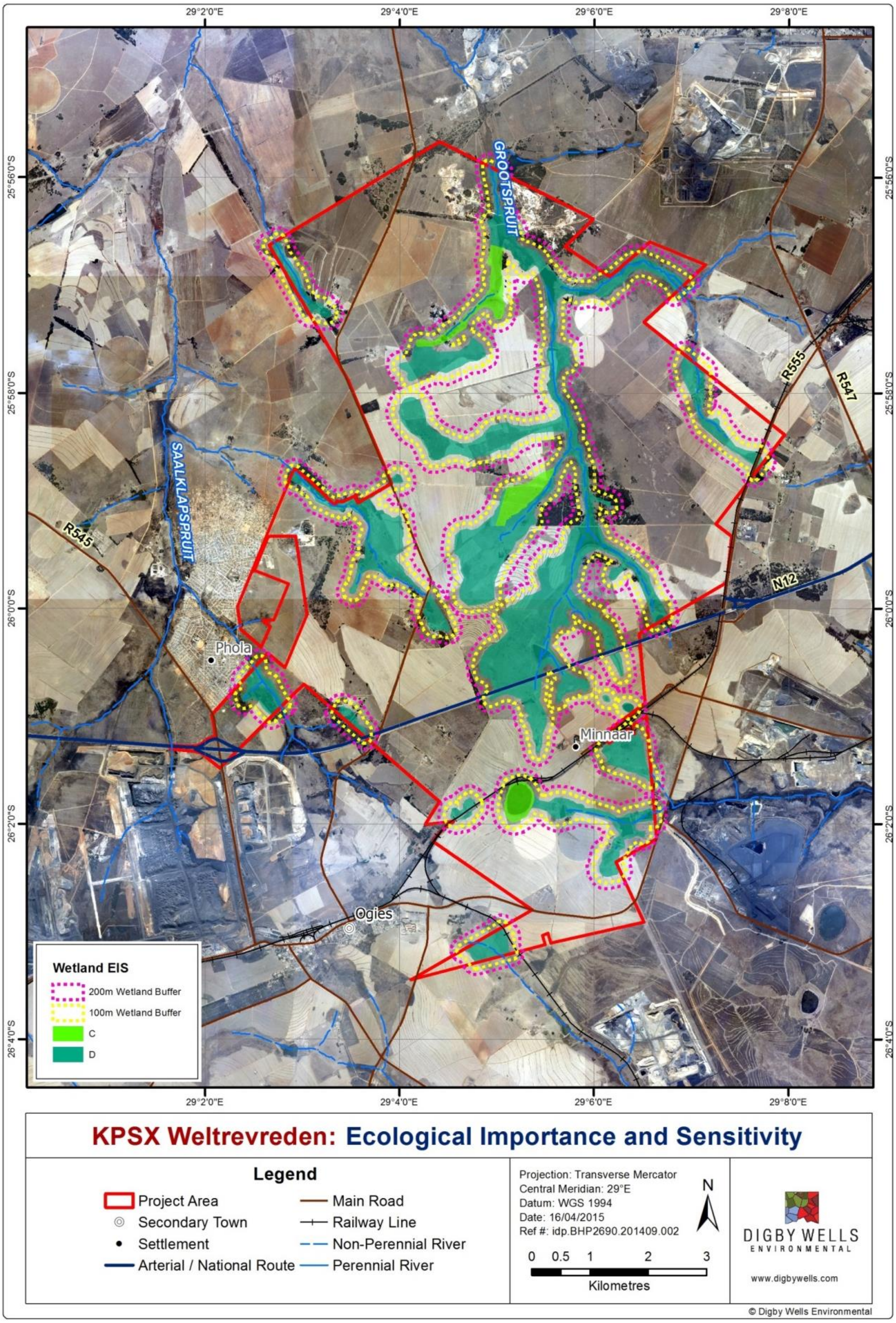


Figure 6-4: Ecological Importance and Sensitivity

7 Impact Assessment

The aim of the Impact Assessment is to strive to avoid damage or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts (DEA, 2013). Offsets to compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is described in Table 7-1.

Table 7-1: Mitigation Hierarchy

Avoid or Prevent	Refers to considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option, but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, mining should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the other steps in the mitigation.
Minimise	Refers to considering alternatives in the project location, sitting, scale, layout, technology and phasing that would minimise impacts on biodiversity, associated ecosystem services. In cases where there are environmental constraints, every effort should be made to minimise impacts.
Rehabilitate	Refers to rehabilitation of areas where impacts are unavoidable and measures are provided to return impacted areas to near natural state or an agreed land use after mine closure. Rehabilitation may, however, fall short of replicating the diversity and complexity of natural systems.
Offset	Refers to measures over and above rehabilitation to compensate for the residual negative impacts on biodiversity after every effort has been made to minimise and then rehabilitate the impacts. Biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity.

7.1 Impacts of the proposed opencast mining operation

The proposed opencast pits and infrastructure for the mine are represented in Figure 7-1 with the wetland delineation. Two opencast pits are proposed to be mined on site, resulting in a loss of 342ha of wetland habitat. Impacts on this system are regarded as highly significant, as this will affect wetlands of the Olifants River Catchment, which has already undergone a considerable decline in water quality due to mining activities.

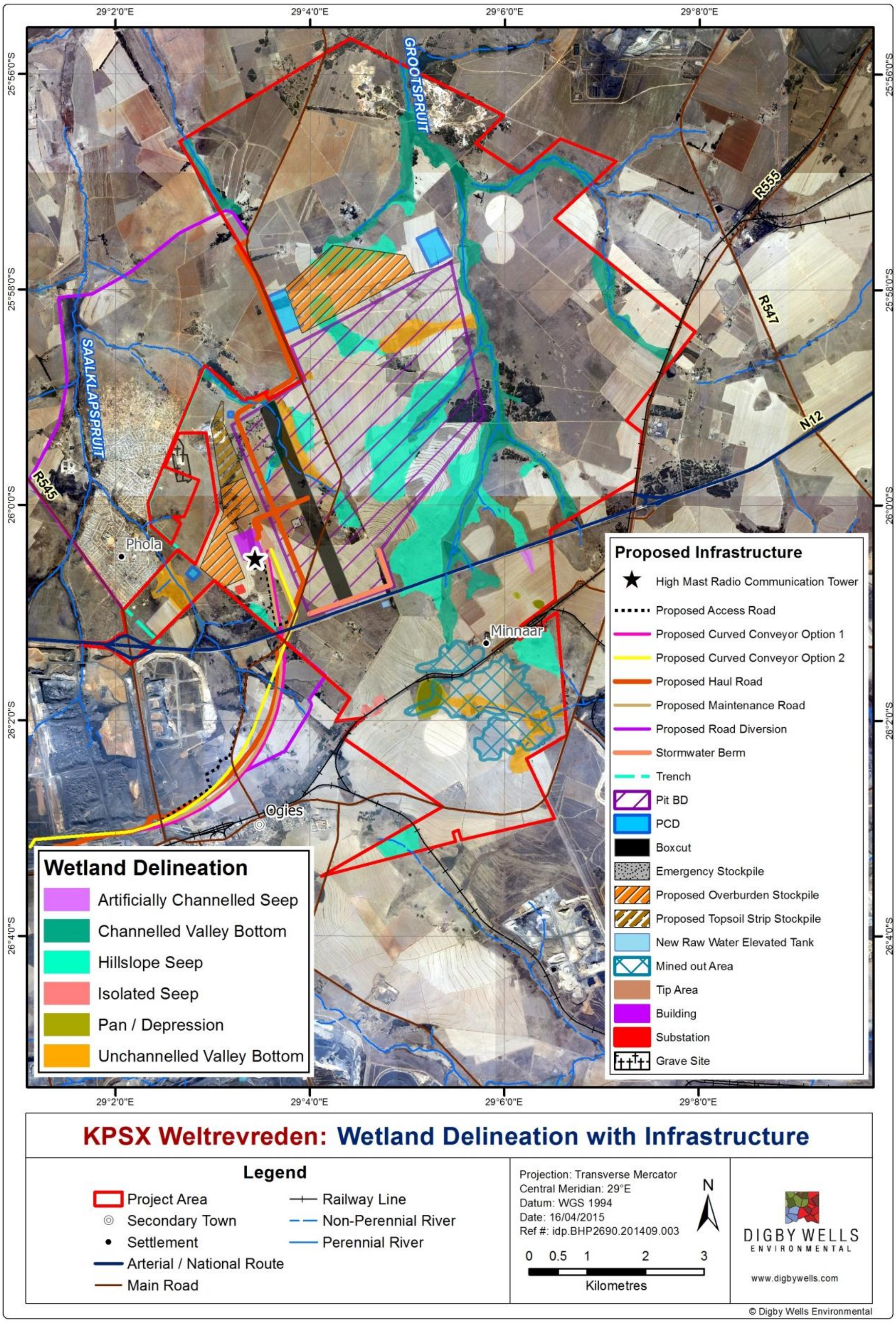


Figure 7-1: Impacts Assessment

7.1.1 Issue 1: Direct loss of wetlands

The direct loss of valley bottom systems linked to the Olifants River catchment will occur due to opencast mining. Although rehabilitation efforts can be aimed at reinstating the natural hydrology of the former wetlands after mining, there is no mitigation for the removal of wetland habitat. This impact is only assessed for the construction phase, as loss of wetlands will be a once-off and permanent impact. Two major issues are identified due to the direct loss of wetlands on site, namely:

- Loss of valley bottom systems linked to the greater stream network and
- Loss of hillslope seeps from aquifers that are linked to the major watercourses on site.

Issue 1	**Direct loss of wetland areas**				
Parameters	***Severity***	***Spatial scale***	***Duration***	***Probability***	***Significance***
Impact 1	***Loss of valley bottom systems***				
Construction Phase					
Pre-mitigation	Significant (6)	Local (3)	Permanent (6)	Likely (7)	Medium-High (77)
Post-mitigation	None				
Impact 2	***Loss of seepage wetlands***				
Construction Phase					
Pre-mitigation	Very Serious (5)	Local (3)	Permanent (6)	Certain (6)	Medium-High (84)
Post-mitigation	None				

In the case where the mine plan cannot be amended, an offset strategy should be implemented to conserve wetlands of similar ecological integrity and functionality in proximity to the study area. The wetland offset guidelines for South Africa were in draft form at the time of this study but can be consulted to advise offset design and implementation. It is imperative that a 'like-for-like' approach be undertaken for wetland offsets so that the wetlands that are permanently lost are compensated for through formal protection of similar wetlands in the area. Wetlands in the greater area (outside of the project area) should be assessed for potential wetland offsets. An offset strategy, however, should be regarded as a last resort.

7.1.2 Issue 2: Loss of wetland integrity

During the construction phase, an influx of vehicles and machinery onto the site will increase the risk of spillage of hydrocarbons. Further to this, failure to contain contaminated water originating from the mine workings, pollution control dams, storm water drains and containment, workshops and return water from opencast workings would result in the contamination of water resources within the project area. Furthermore, spills and overtopping of the pollution control dams would impact on the water quality of wetlands within the project area. The contamination of wetland areas within the project area is regarded as very significant and may result in a loss of sensitive species. Owing to the existing pressure on the Olifants River catchment, it is strongly recommended that contamination of water resources in this area be prevented.

The primary impacts on the Olifants River catchment occur in the upper parts of the catchment, where mining activities and agricultural activities have been the cause of pollution of water resources. Release of water from storage dams in particular, has caused considerable environmental degradation. Two major impacts have been identified to occur due to contamination of water in wetland areas on site:

- Loss of wetland functionality; and
- Transport of contaminants into the greater stream network of the Olifants River catchment.

Issue 2	**Loss of wetland integrity**				
Parameters	***Severity***	***Spatial scale***	***Duration***	***Probability***	***Significance***
Impact 3	***Loss of ecosystem functionality***				
Construction Phase					
Pre-mitigation	Very serious (5)	Local (3)	Permanent (6)	Certain (5)	Medium-Low (70)
Post-mitigation	Serious (4)	Local (3)	Long-term (4)	Probable (4)	Medium-Low (44)
Operational Phase					
Pre-mitigation	Serious (4)	Local (3)	Permanent (6)	Certain (5)	(Medium-Low (65)
Post-mitigation	N/A				
Impact 3	***Transport of contaminants into the greater stream network of the Olifants River catchment***				
Construction Phase					
Pre-	Very Serious	Local (3)	Permanent	Probable	Medium-Low

Issue 2	Loss of wetland integrity				
mitigation	(5)		(6)	(4)	(56)
Post-mitigation	Serious (4)	Local (3)	Medium-term (3)	Unlikely (3)	Low (30)
Operation Phase					
Pre-mitigation	Very Serious (5)	Local (3)	Permanent (6)	Likely (4)	Medium-Low (56)
Post-mitigation	N/A				

Although impacts due to contamination are regarded as considerable, loss of wetland habitat is the major concern for this project. The mitigation hierarchy process has been considered for this project and the details pertaining to the relevant sections and the associated recommendations are presented in Table 7-2.

Table 7-2: The details pertaining to the mitigation hierarchy for the project

Stage	Description
Avoid	Although the mine plan has been designed to avoid wetlands as far as possible, wetland areas cannot be avoided from the layout.
Minimise	Realistically there is no mitigation for the mining (opencast) of wetlands, these impacts would have to be offset. Where impacts could be minimised, mitigation measures have been prescribed.
Rehabilitate	No formal rehabilitation plan has been included for this specialist study. Details pertaining to site rehabilitation will be included in the Rehabilitation Plan for the mine.
Offset	No formal offset strategy has been formulated for the project. It is recommended that the impacts to the wetland areas be offset by managing and enhancing the ecological state and services being offered by the remaining wetland areas within the project area.

It is strongly recommended that an offset strategy be formulated before mining takes place.

8 Discussion

The proposed Weltevreden opencast coal mine is situated within the quaternary catchments B20G, B11F and B11G. These catchments are regarded as Largely Modified, due to the cumulative impacts of coal mining in the region. Despite their poor condition, further impacts to these water resources are regarded as highly significant, due to the connectivity of the watercourses associated with these catchments to the Olifants River.

Not all of the wetlands present in the project boundary have been identified by the NFEPA. Those that were recorded were allocated a ranking of two. This indicates that these wetlands are of particular importance for the maintenance of the biodiversity and protection of natural habitat and, as a result of this, these wetlands should be protected. Further to this, areas on site are listed as irreplaceable, necessary and natural according to the Mpumalanga C-plan. If these areas are not conserved, the objectives of the Mpumalanga C-plan will not be met.

Four HGM units were recorded on site: valley bottom without a channel, channelled valley bottom, hillslope seeps and pan/depressions. Of the 1317ha of wetlands that are associated with the study site, 54% of these are valley bottom systems. The significance of this is that a large proportion of wetlands in the study area are not isolated but are linked to the greater stream network. Any impacts to wetlands on site, as a result of the proposed mining activities (especially deterioration of water quality) are likely ultimately to reach the Olifants River.

The wetland integrity and functionality assessment highlighted that the most significant causes of reduced ecosystem health was the cumulative effect of small dams, throughout the site, as well as the presence of crops either in the catchment or directly in wetland areas. The majority of wetlands received a PES of D (Largely Modified), indicating that a large change in ecosystem processes and loss of natural habitat and biota has occurred. Wetlands that received a PES of E were affected by a number of impacts including the presence of alien bushclumps in the wetland, excavation for sand mining, the presence of dams and erosion gulleys. Although the pan on Grootpan farm is regarded as Moderately Modified, it provides important habitat for avifauna. This pan is valuable because the majority of the study area has been transformed and little habitat remains for fauna present in the region.

Toxicant removal is an important eco-service provided by wetlands in the area, due to the regular input of pesticides and fertilisers from crops into the natural environment. Vegetation acts as a natural filter and processes these toxic substances. Stream-flow regulation, nutrient processing, maintenance of biodiversity and water supply for human use were the primary eco-services provided by wetlands. There is potential for these services to be improved and for additional services to be provided by wetlands if the existing impacts of damming, crops and alien bushclumps were to be removed.

The proposed opencast coal mine is anticipated to cause not only a loss of wetland habitat (342ha) but also a deterioration of health and eco-services of wetlands on site. The impacts can reach a national scale, impacting one of the most important watercourses in the country, the Olifants River. The Olifants River is one of the most polluted rivers in South Africa and further degradation of this system should be avoided.

The following recommendations flow from this study:

- A buffer around wetlands of 100m at least, should be adhered to so that impacts on wetlands can be avoided. Further to this, decant points should be kept outside of the 100m buffer. The groundwater study for this project, not yet complete at the time that this report was compiled, will give an indication of where decant is expected to take place after mining:

- It is strongly recommended that an offset strategy should be implemented to compensate for the loss of wetlands before mining is allowed to take place. SANBI has recently released the Draft Guidelines for Wetland Offsets and this is regarded as the standard best-practice approach in South Africa. It is imperative that a 'like-for-like' approach be undertaken when selecting offset areas.

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Water Wheel May/ June 2013. Lani van Vuuren. Olifants – Time to stand up for a river under siege.

Appendix A: CV of the specialist

Ms Crystal Rowe

Flora and Fauna Ecologist and Wetland Specialist

Biophysical Department

Digby Wells Environmental

EDUCATION

2011: BSc Honours (Botany) – Nelson Mandela Metropolitan University

2008-2011: Undergraduate BSc – Nelson Mandela Metropolitan University

EMPLOYMENT

June 2013 – Present: Digby Wells Environmental

December 2011 – June 2013: Natural Scientific Services CC

EXPERIENCE

June 2013 – Present: Digby Wells Environmental

Crystal was appointed by Digby Wells Environmental chiefly as a Flora and Fauna Ecologist but also to assist in conducting wetland assessment studies. Crystal's flora background aids in her understanding on wetlands from a floral perspective. The wetland assessment studies include in particular the delineation of wetland boundaries, classification of wetland units according to the HGM Classification System, integrity description of the identified wetland units, functional assessment of the identified wetland units and subsequent compilation of management recommendations mitigation against the impacts. In addition, Crystal has also completed a course in Tools for Wetland Assessments at Rhodes University (2011).

December 2011 – June 2013: Natural Scientific Services CC

Field work and report compilation for Biodiversity Baseline Assessments, Wetland Assessments (WA) and Impact Assessments (IA).

PROJECT EXPERIENCE

Wetland Assessments

- Numerous wetland assessments in Mpumalanga Province;
- Wetland assessment for Dube Tradeport, Kwa-Zulu Natal;
- Wetland assessment for Yzermyn in the Wakkerstroom area, Kwa-Zulu Natal;
- Wetland studies in Northern Mozambique, and;
- Wetland studies in Sierra Leone.

Appendix B: Wetland Delineation Methodology

WETLAND DELINEATION

In accordance with the definition of a wetland in the National Water Act (NWA), vegetation is the primary indicator of a wetland, which must be present under normal circumstances. However, the soil wetness indicator tends to be the most important in practices. The remaining three indicators are then used in a confirmatory role. The reason for this is that the response of vegetation to changes in the soil moisture regime or management are relatively quick and may be transformed, whereas the morphological indicators in the soil are significantly more permanent and will hold the indications of frequent and prolonged saturation long after a wetland has been drained (perhaps several centuries) (DWAF, 2005). In accordance with DWAF guidelines (2005) the wetland delineation procedure considers four attributes to determine the limitations of the wetland. The four attributes are:

Terrain Unit Indicator

Terrain Unit Indicator (TUI) areas include depressions and channels where water would be most likely to accumulate. These areas are determined with the aid of topographical maps, aerial photographs and engineering and town planning diagrams (these are most often used as they offer the highest degree of detail needed to accurately delineate the various zones of the wetland) (DWAF, 2005).

Soil Form Indicator

Hydomorphic soils are taken into account for the Soil Form Indicator (SFI) which will display unique characteristics resulting from prolonged and repeated water saturation (DWAF, 2005). The continued saturation of the soils results in the soils becoming anaerobic and thus resulting in a change of the chemical characteristics of the soil. Iron and manganese are two soil components which are insoluble under aerobic conditions and become soluble when the soil becomes anaerobic and thus begin to leach out into the soil profile. Iron is one of the most abundant elements in soils and is responsible for the red and brown colours of many soils. Resulting from the prolonged anaerobic conditions, iron is dissolved out of the soil, and the soil matrix is left a greying, greenish or bluish colour, and is said to be "gleyed". Common in wetlands which are seasonally or temporarily saturated is a fluctuating water table, these results in alternation between aerobic and anaerobic conditions in the soil (DWAF, 2005). Iron will return to an insoluble state in aerobic conditions which will result in deposits in the form of patches or mottles within the soil. Recurrence of this cycle of wetting and drying over many decades concentrates these insoluble iron compounds. Thus, soil that is gleyed and has many mottles may be interpreted as indicating a zone that is seasonally of temporarily saturated (DWAF, 2005).

Soil Wetness Indicator

In practice, the Soil Wetness Indictor (SWI) is used as the primary indicator (DWAF, 2005). Hydromorphic soils are often identified by the colours of various soil components. The frequency and duration of the soil saturation periods strongly influences the colours of these components. Grey colours become more prominent in the soil matrix the higher the duration and frequency of saturation in a soil profile (DWAF, 2005). A feature of hydromorphic soils are coloured mottles which are usually absent in permanently saturated soils and are most prominent in seasonally saturated soils, and are less abundant in temporarily saturated soils (DWAF, 2005). For a soil horizon to qualify as having signs of wetness in the temporary, seasonal or permanent zones, a grey soil matrix and/or mottles must be present.

Vegetation Indicator

If vegetation was to be used as a primary indicator, undisturbed conditions and expert knowledge are required (DWAF, 2005). Due to this uncertainty, greater emphasis is often placed on the SWI to delineated wetland areas. In this assessment the SWI has been relied upon to delineated wetland areas in addition, the identification of indicator vegetation species and the use of plant community structures has been used to validate these boundaries. As one moves along the wetness gradient from the centre of the wetland to the edge, and into adjacent terrestrial areas plant communities undergo distinct changes in species composition. Valuable information for determining the wetland boundary and wetness zone is derived from the change in species composition. When using vegetation indicators for delineation, emphasis is placed on the group of species that dominate the plant community, rather than on individual indicator species (DWAF, 2005).

The Health Of Wetlands

Table 9-1: Health categories used by WET-Health for describing the integrity of wetlands

Description	Score	Category
Unmodified, natural	0 – 1	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 – 2	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2.1 – 4	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4.1 - 6	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6.1 – 8	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.	8.1 – 10	F