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ENVIRONMENTAL



Exxaro Matla Coal Mine's No.3 Mine River Diversion Annual Biomonitoring Report

Annual Flora and Fauna Ecological Monitoring Report 2016/2017

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EXECUTIVE SUMMARY

Digby Wells Environmental have been appointed by Exxaro Coal Mpumalanga (Pty) Ltd to complete the monitoring of the river diversion area at the No.3 Mine of Exxaro Matla Coal Mine, Mpumalanga Province. The Rietspruit River was diverted as a result of high extraction mining activities at the No. 3 Mine of Exxaro Matla Coal Mine. This report details the results of the flora and fauna monitoring for the period 2016/2017 and includes data captured from three transect surveys.

The three transects were located across the Rietspruit River (Transects 1 and 2) and the river diversion area (Transect 3). Two site visits were conducted for this monitoring report; which took place on the 30th of June 2017 and the 26th of July 2017 to account for seasonal variation.

Transect 1 yielded 11 plant species and was dominated by *Sporobolus africana*, *Eragrostis plana*, *Setaria sphacelata* and *Paspalum dilatatum*. Transect 2 yielded 33 plant species and was dominated by *Cosmos bipinnatus*, *Eragrostis plana*, *Leersia hexandra* and *Themeda triandra*. Transect 3 yielded 25 species and was dominated by *Agrostis lachnantha*, *Eragrostis plana*, *Sporobolus africana* and *Cyperus esculentus*. Vegetation cover was largely terrestrial, with wetland plants restricted to a narrow channel. Ten alien and invasive plant species were recorded and were found throughout the vegetation transects. Of the 10 exotic plant species recorded four are listed by the National Environmental Management: Biodiversity Act (Act No. 10 of 2004): Regulations on Alien Invader Plants. Exotic plants were confined to the edges of roads and disturbed areas but pose a risk to species diversity.

Relatively few mammal species were identified during this survey, however, the mammal species identified during desktop survey are mostly nocturnal and secretive, this can be attributed to pressure from persecution and habitat destruction. Three NEMBA protected mammal species were identified during this survey. With the previous survey being used as baseline information it is possible to draw a conclusion on the trends present in the mammal species richness and diversity. Previous information available indicated that 26 birds were recorded, with the 2016 survey recording 38 and 2017 surveys recording 37. From a protected species point of view the African Grass Owl (*Tyto capensis*) the Secretarybird (*Sagittarius serpentarius*) and Greater Flamingo (*Phoenicopterus roseus*) were not recorded this time.

The following recommendations were made from this report:

- As aforementioned in the former biomonitoring report, metal stakes should be placed in the ground to mark the vegetation transects to allow for accuracy. Alternatively, white painted wooden posts would suffice.
- The following features should be monitored for vegetation:
 - Relative increase/decrease of increaser grass species;
 - Extent of alien plant invasion (number of individuals encountered as well as a list of species and a distribution map);

- Relative abundance of terrestrial and hydromorphic plant species.
- Fixed-point photographs should be taken along each vegetation transect to monitor any obvious changes;
- All Declared Alien Invader Plants (as per NEMBA Regulations on Declared Alien Invader Species) should be removed. Where alien plant species, such as *Cosmos bipinnatus*, provide a stabilising function, suitable alternative species should be planted (such as *Cynodon dactylon*);
- The GPS points of all dense Declared Alien Invader plant species (as listed by NEMBA: Regulations on Alien Invader Species, 2014) stands should be recorded and photographed and added to the appendix of the next monitoring report.
- The area should be protected from regular veldfires. Burning or cutting firebreaks are recommended. A firebreak should be maintained around the perimeter of the floodplain, as well as between the floodplain and the Grass-Owl roost sites, especially during breeding season. This would allow a portion of the territory to remain unburned in the event of a fire.
- African Grass-Owl habitat (both roosting and hunting habitat) should be burned in 3-year cycles in order to maintain an adequate grass thickness. It is important not to exclude fire completely as this would render the grass moribund and unsuitable. It is, however, important that some habitat remains for the African Grass-Owls when burning. The floodplain and the roost habitat at points B and C should therefore be burned in alternating years.

Cattle and other livestock should be kept out of the habitat. Livestock cause excessive trampling of African Grass-Owl habitat, rendering it unsuitable for creating roosts and nests.

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1 Introduction

The Exxaro Matla Coal Mine is situated 20km west of the Kriel Power Station in the Mpumalanga Province. The area falls within the Nkangala District Municipality. The vegetation in the area is typical of the Highveld and falls within the grassland biome with specific reference to the Eastern Highveld Grassland (Mapping Unit Gm12, Mucina and Rutherford, 2006) and the Eastern Temperate Freshwater Wetland (Mapping Units AzF3, Mucina and Rutherford, 2006). Matla Coal Mine has diverted the Rietspruit River as a result of the expansion of high extraction mining activities west of the current no. 2 and no. 3 mine workings.

This report details the findings of the flora, fauna and wetland monitoring studies associated with the Exxaro Matla Coal Mine's No. 3 Mine river diversion project for the period of 2016/2017. The results of previous reports (Golder, 2009 and 2013) were compared to the findings in this study to identify ecological trends and to monitor the success of the river diversion project with respect to the establishment of riparian features. Three transects were monitored; two of which cross the Rietspruit River and one crossing the river diversion area, as well as the Rietspruit River. In addition, the river diversion route, as well as the Rietspruit River was traversed to record important ecological features.

The habitat associated with the Exxaro Matla Coal Mine's No. 3 Mine river diversion project should be typical of the riparian zone, supporting hydromorphic vegetation and wetland features. Wetlands are defined according to the National Water Act, 1998 (Act 36 of 1998) (NWA) as: "Riparian habitat that includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."

2 Terms of Reference

Digby Wells Environmental (Digby Wells) has been appointed by Exxaro Coal Mpumalanga (Pty) Ltd to conduct a flora, fauna and wetland assessments of areas associated with the Matla Coal Mine's No. 3 Mine river diversion as per the conditions of various Environmental authorization applications and licence conditions at the Exxaro Matla Coal Mine No 3 Mine, Mpumalanga Province, South Africa.

3 Methodology

Two site visits were conducted for this fauna, flora and wetlands monitoring report; which took place on the 30th of June 2017 and the 26th of July 2017 to account for seasonal variation.

3.1 Flora

3.1.1 Desktop Assessment

The regional vegetation for the greater study area was accessed (Mucina and Rutherford, 2006) and broad preliminary habitats were identified using aerial imagery, to be ground-truthed when field studies commenced. The following literature and databases were consulted in order to achieve this:

- PRECIS (Pretoria Computerised Information System). This plant taxonomy database provides information for species that occur in southern Africa and follows the format of Germishuizen and Meyer, 2003. The database is accessed on the Plants Of Southern Africa (POSA) website and is updated every two months (posa.sanbi.org);
- Mpumalanga Nature Conservation Act, 1999. (Act no. 10 of 1998) – Schedule eleven and twelve: protected plant species; and
- Vegetation Map of Southern Africa (Mucina and Rutherford, 2012).

3.1.2 Field Visit

Vegetation was assessed at fixed points along the transects presented in Figure 3-1, with focus on the following measureable aspects:

- Dominant species present;
- Species diversity – a complete species list was recorded along each transect;
- Veld condition – The ecological status of grasses is often used to determine veld condition (van Wyk and van Oudtshoorn 1999). The point-transect method was used by walking transects through the vegetation and to point the stick down at every second step. The plant species nearest to the stick were recorded. The percentage of each species is calculated after 100 points have been counted for each homogenous vegetation unit. Grasses are categorised according to their sensitivity to habitat conditions according to the following status:
 - Decreaser: Grasses that are abundant in good veld;
 - Increaser I: Grasses that are abundant in overutilised veld;
 - Increaser II: Grasses that are abundant in overgrazed veld;
 - Increaser III: Grasses that are commonly found (but not necessarily abundant) in overgrazed veld); and
 - Invaders: All grasses that are invaders.

In addition to the ecological status of grasses on site, the extent of ground-cover and susceptibility to erosion was monitored.

Presence of any species of special concern (SSC) was recorded. SSC include provincially protected species (listed in Schedule 12 of the Mpumalanga Nature Conservation Act no. 10

of 1998) and Red Data listed plant species listed by the South African National Biodiversity Institute (SANBI), species listed by the National Environmental Management Biodiversity Act (Act No 10 of 2004): Threatened or Protected Species (NEMBA: TOPS List) and the International Union of Conservation of Nature (IUCN). The co-ordinates of all SSC was recorded.

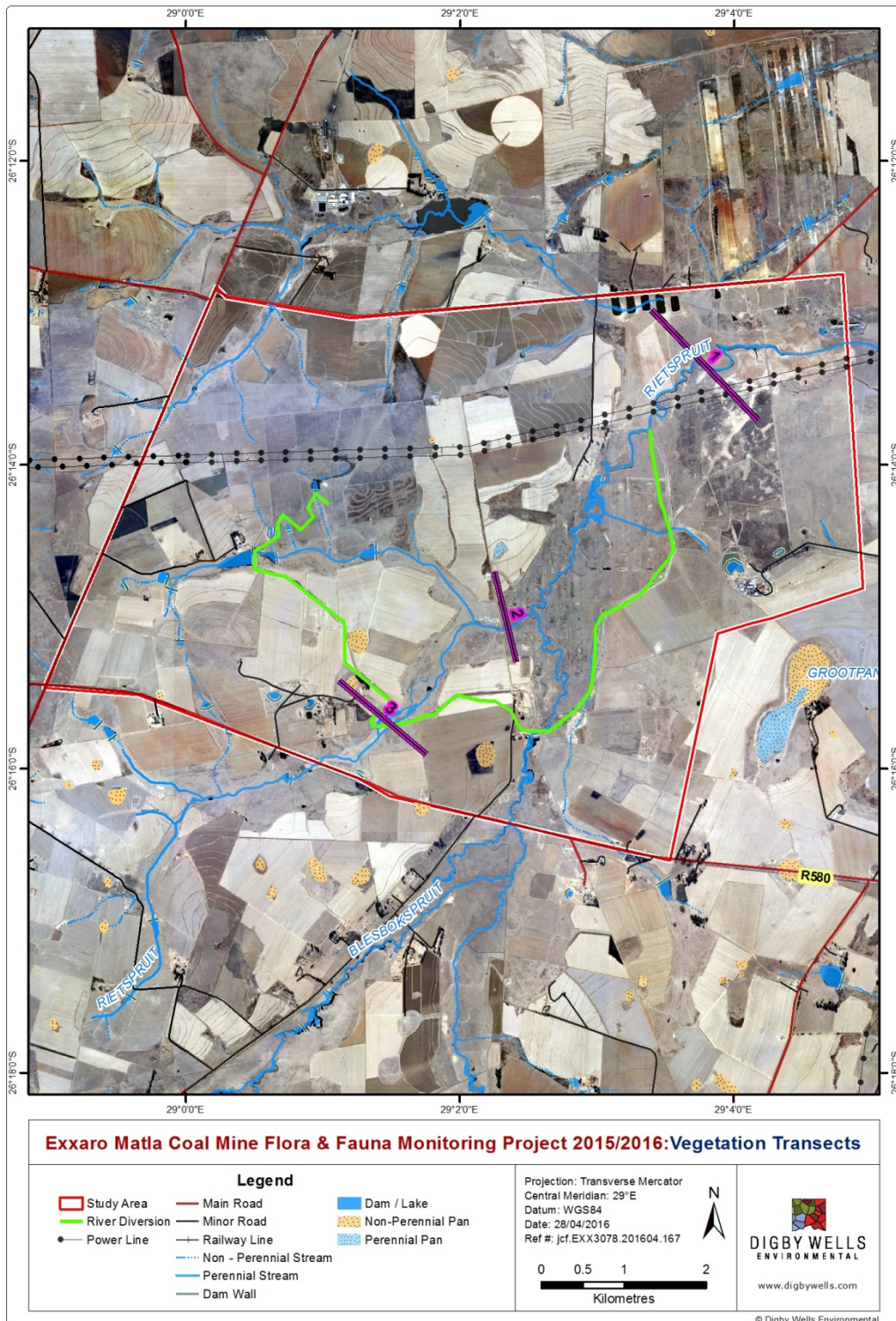


Figure 3-1: Transects

3.2 Fauna

Field surveys were conducted concurrently with vegetation surveys and all animals (mammals, birds, reptiles and amphibians) observed in the area were recorded. Any ecological indicators, such as calls, tracks and dung were also noted. An invertebrate assessment consisting of opportunistic observations and refuge examinations, excluding sweep-netting for insects, was completed. Detailed fauna lists of all species recorded were generated and discussed and related back to the floristic component of the area.

The current status of the faunal environment was determined and an evaluation of the extent of site-related effects in terms of certain ecological indicators, as well as identification of specific important ecological attributes such as rare and endangered species, protected species, sensitive species and endemic species was made. The faunal environment and habitat were characterised in relation to biota and the extent of site-related effects. The presence of Red Data and protected species were mapped. The deliverables include:

3.2.1 Birds

A desktop study on bird species that may potentially be present, as well as species recorded in the previous studies was conducted. Any protected species recorded within study area and their protected status according to IUCN Red Data list and NEMBA: TOPS List was completed. The potential of these protected species to be present was also evaluated.

Visual sightings were conducted with binoculars and identification was obtained from recognised field guide text books. Spot counts were conducted randomly and birds encountered outside the transects, but within the vicinity was also recorded. A complete list of bird species encountered within the boundaries of the study area was compiled. Transects were completed for the bird assessment. Bird sample sites were randomly spread across the study area. Supporting material such as bird sounds and text books was used to identify birds on site. The following was recorded during the bird survey:

- All birds encountered or noted during the surveys;
- A list of the most prominent birds encountered and possible species that can be expected to be present;
- A list of rare and endangered species encountered during the survey;
- Possible migration species that were not on site during the survey was assessed from literature surveys; and
- A species list of all the birds that can possibly be present within the study area was obtained from desktop information.

3.2.1.1 *African Grass-Owls (Tyto capensis)*

Based on previous experience and records *Tyto capensis* (African Grass-Owl) prefers the grass *Imperata cylindrica* (Cottonwool Grass). Site investigations was also be based on information collected in conjunction with previous monitoring data from the Endangered

Wildlife Trust and in conjunction with the Middleburg Bird Club and available information from Matla Coal Mine. Previously recorded nesting sites can then be reassessed and new nests searched for.

3.2.2 Mammals

A list of all potential mammals was compiled by means of desktop study and all potential Red Data species highlighted. The presence of mammals was recorded using tracks, dung, ecological indicators, camera traps, non-fatal traps (Sherman traps) and visual sightings of the animals themselves, sample sites covered all habitat available for mammals species within the study area, and was not limited to the vegetation study transects. The following was recorded during the mammal survey:

- All mammals encountered or noted during the transect surveys;
- Tracks and dung of mammals encountered during the transect survey was, where possible, identified and recorded;
- A list of the most prominent mammal species recorded along the transects was compiled;
- A list of rare and endangered species encountered along the transects surveys, as well as species listed according to the results of a desktop study but which were not recorded during the survey, was compiled;
- A list of protected species that occur on the potential list but not recorded along the transects during the surveys; and
- A list of exotic or introduced vertebrate species recorded along these transects.

3.2.3 Arthropods

Invertebrates and butterflies were sampled utilising the following techniques:

- A butterfly net was used to sample day-flying Lepidoptera;
- Unknown species of butterflies were preserved in plastic bags for identification purposes;
- Species was identified to family level and where possible to genus and species level;
- Evaluation of invertebrate biodiversity is included.

3.2.4 Amphibians and Reptiles

Reptiles and amphibians were sampled using both active sampling techniques. Active searching was done and as many as possible were caught, identified and photographed using the rubber band technique (knocking reptiles from their perch's with rubber bands). Sample sites were concentrated in areas where habitat that could support reptile and amphibian species was found. The following was recorded:

- All frogs, snakes, lizards and tortoises encountered or noted along the transect surveys was recorded;
- A list of the most prominent amphibian and reptile species was compiled;
- A list of rare and endangered species encountered along the transect surveys, as well as species listed according to the results of a desktop study but which were not recorded during the survey; and
- A list of protected species that occur on the potential list but not recorded during the transect surveys.

3.3 Study Limitations

The following limitations were encountered during this assessment:

- Whilst every effort is made to identify all plant species encountered; the sampling time does not coincide with the time of fruiting/flowering of all plants and not every species could be identified (especially during the 2017 assessment);
- The GPS' used in this assessment have a 5m inaccuracy and as a consequence, the transect line may not have been walked to the exact co-ordinates provided;
- The time-span available for fauna monitoring is insufficient to collect a realistic idea of faunal diversity on site. The suitability of habitat, however, was regarded as a significant indicator of the potential for faunal diversity.

4 Regional Vegetation Setting

The river diversion falls entirely within the Eastern Highveld Grassland vegetation type (Mapping Unit Gm12, Mucina and Rutherford, 2006). This vegetation type occurs in the Mpumalanga and Gauteng Provinces in the plains between Belfast in the east and the eastern side of Johannesburg in the west extending southwards to Bethal, Ermelo and west of Piet Retief. Altitude of the vegetation type distribution ranges from 1 520m to 1 780m, but also declines as low as 1 300m (Mucina & Rutherford, 2006). The conservation status of this vegetation type is poor, with large parts that are either currently cultivated or have been previously ploughed, and the remaining untransformed vegetation that occurs is patchy remnants which is often heavily grazed.

Only a very small fraction of the vegetation type is conserved in statutory reserves (Nooitgedacht and Jericho Dam Nature Reserves) and in private reserves (Holkrans, Kransbank, Morgenstond) (Mucina & Rutherford, 2006). Some 44% is transformed primarily by cultivation, plantations, mines, urbanisation and through the building of dams (Mucina & Rutherford, 2006). Cultivation may have had a more extensive impact, indicated by land-cover data. Important taxa for this vegetation type are listed in Table 4-1 and Figure 4-1 shows its distribution.



Table 4-1: Common and characteristic plant species of the Eastern Highveld Grassland

Plant life form	Species
Grasses and sedges:	<i>Abildgaardia ovata</i> , <i>Andropogon appendiculatus</i> , <i>A. schirensis</i> , <i>Aristida aequiglumis</i> , <i>A. bipartita</i> , <i>A. congesta</i> , <i>A. junciformis</i> , <i>A. stipitata</i> , <i>Brachiaria serrata</i> , <i>Bulbostylis contexta</i> , <i>Chloris virgata</i> , <i>Cymbopogon caesius</i> , <i>C. pospischilii</i> , <i>Cynodon dactylon</i> , <i>Digitaria diagonalis</i> , <i>D. monodactyla</i> , <i>D. ternata</i> , <i>D. tricholaenoides</i> , <i>Diheteropogon amplexens</i> , <i>Elionurus muticus</i> , <i>Eragrostis capensis</i> , <i>E. chloromelas</i> , <i>E. curvula</i> , <i>E. plana</i> , <i>E. racemosa</i> , <i>Harpochloa falx</i> , <i>Heteropogon contortus</i> , <i>Hyparrhenia hirta</i> , <i>Koeleria capensis</i> , <i>Microchloa caffra</i> , <i>Panicum coloratum</i> , <i>P. natalense</i> , <i>Setaria incrassate</i> , <i>S. nigrirostris</i> , <i>S. sphacelata</i> , <i>Themeda triandra</i> , <i>Tristachya biseriata</i> and <i>T. rehmannii</i> .
Forbs:	<i>Acalypha penduncularis</i> , <i>A. wilmsii</i> , <i>Berkheya insignis</i> , <i>B. pinnatifida</i> , <i>B. setifera</i> , <i>Crabbea acaulis</i> , <i>Cynoglossum hispidum</i> , <i>Dicoma anomala</i> , <i>Haplocarpha scaposa</i> , <i>Helichrysum caespititium</i> , <i>H. nudifolium</i> , <i>H. rugulosum</i> , <i>Hermannia coccocarpa</i> , <i>H. depressa</i> , <i>H. transvaalensis</i> , <i>Ipomoea crassipes</i> , <i>I. oblongata</i> , <i>Jamesbrittenia silenoides</i> , <i>Pelargonium luridum</i> , <i>Pentanisia prunelloides</i> , <i>Peucedanum magalismontanum</i> , <i>Pseudognaphalium luteoalbum</i> , <i>Rhynchosia effusus</i> , <i>Rhynchosia totta</i> , <i>Salvia repens</i> , <i>Schistostephium crataegifolium</i> , <i>Sonchus nanus</i> , <i>Vernonia natalensis</i> , <i>V. oligocephala</i> and <i>Wahlenbergia undulata</i> .
Succulents:	<i>Aloe greatheadii</i> var <i>davyana</i>
Shrubs:	<i>Anthospermum rigidium</i> , <i>Chaetacanthus costatus</i> , <i>Diospyros austro-africana</i> , <i>D. lycoides</i> , <i>Euphorbia striata</i> , <i>Helichrysum melanacme</i> , <i>Gnidia burchellii</i> , <i>G. capitata</i> , <i>Polygala uncinata</i> and <i>Searsia bicolor</i> .
Geophytes (bulbs):	<i>Boophane disticha</i> , <i>Eucomis autumnalis</i> , <i>Hypoxis villosa</i> , <i>Zantedeschia albomaculata</i>

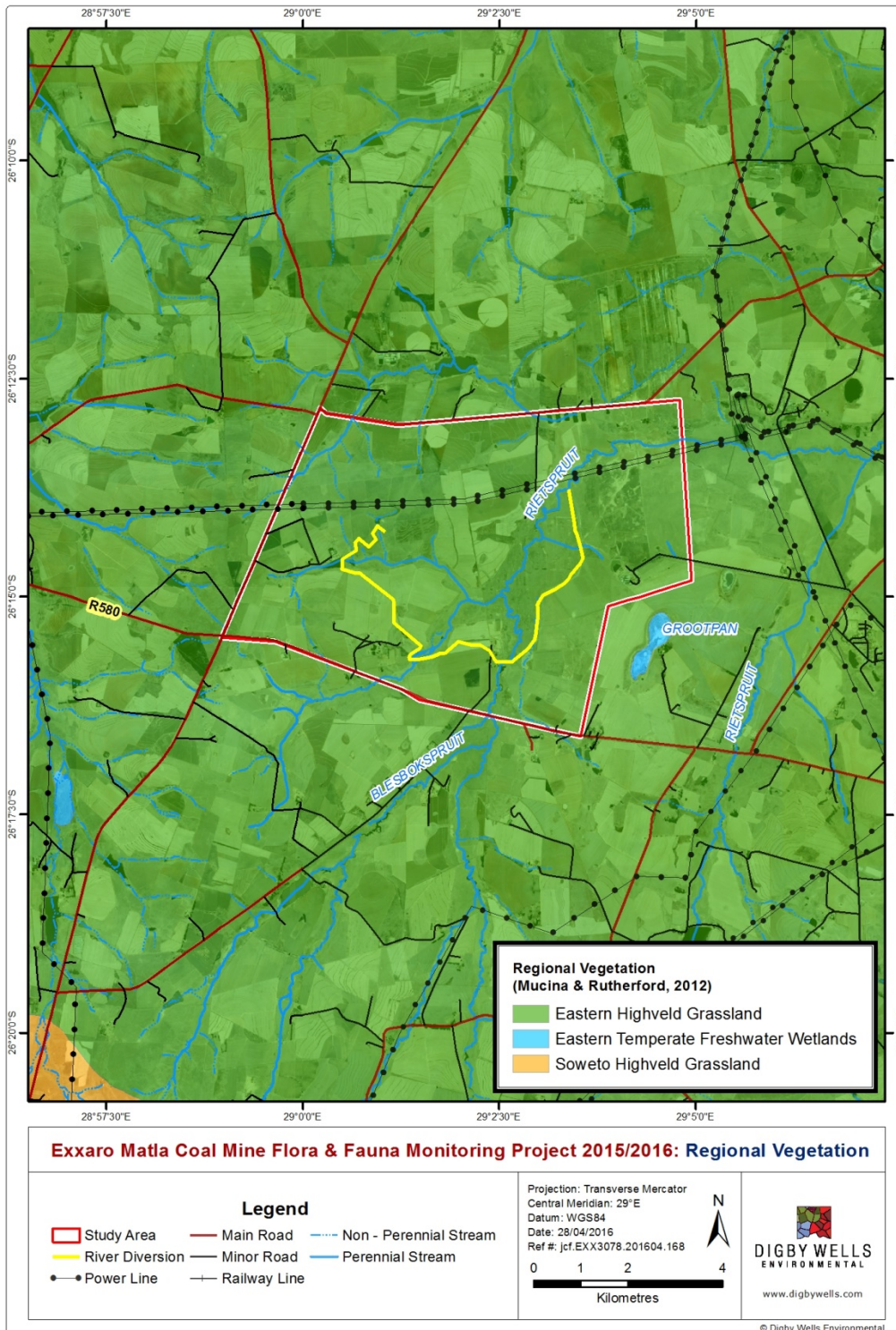


Figure 4-1: Regional Vegetation

5 Results and Discussion

5.1 Vegetation Analysis

The three transects were assessed on the 30th of June 2017. Due to the lack of identifiable characteristics (such as flowers/fruits) during the winter season, identified species richness is expected to be lower compared to the previous assessment.

Overgrazing is evident in all transects, predominantly Transect 1, where the majority of the area has been trampled and basal cover has been reduced significantly. Increased grass species are dominant in all transects, further indicating overgrazed veld. It is important that this is rectified as the Wetland Monitoring and Management Plan (Golder, 2008) states that cattle should be excluded from all wetland areas as a condition of the approved Water Use Licence. Table 5-1 lists the pertinent details of the vegetation transects which are further described in this section. Plant species recorded along the transects are listed in Appendix A. No protected species were identified in any of the transects.

Table 5-1: Species richness and dominant species recorded along the different transects

Transect	Species Richness		Dominant Species
	2016 (#)	2017 (X)	
1	39	11	<ul style="list-style-type: none"> ■ <i>Setaria sphacelata</i> #, X ■ <i>Eragrostis plana</i> #, X ■ <i>Sporobolus Africana</i> # ■ <i>Typha capensis</i> # ■ <i>Berkheya erysithales</i> # ■ <i>Paspalum dilatatum</i> #
2	60	33	<ul style="list-style-type: none"> ■ <i>Themeda triandra</i> #, X ■ <i>Cynodon dactylon</i> X ■ <i>Eragrostis gummiflua</i> X ■ <i>Imperata cylindrical</i> X ■ <i>Cosmos bipinnatus</i> # ■ <i>Eragrostis plana</i> # ■ <i>Leersia hexandra</i> (host plant for Marsh Sylph butterfly)#
3	33	25	<ul style="list-style-type: none"> ■ <i>Agrostis lacnantha</i> #, X ■ <i>Cynodon dactylon</i>, # ■ <i>Eragrostis plana</i> #, X ■ <i>Sporobolus Africana</i> #, X ■ <i>Cyperus esculentus</i> #

5.1.1 Transect 1

Transect 1 represents wetland features interspersed between terrestrial habitats that have formed due to subsidence in the vicinity. At the time of the survey, a large proportion of the site was inundated with water. The Rietspruit River was vegetated with riparian species and well utilised by bird species. Examples of habitat found along transect 1 are represented in Figure 5-1. *Setaria sphacelata* (African Bristlegrass), *Eragrostis plana* (Tough Love Grass), *Sporobolus africana* (Rat's-tail Dropseed) and patches of *Typha capensis* (Bulrush) were the dominant species, with a total of 11 plant species recorded. Plant species were almost impossible to identify due to the extent of overgrazing; plants has been grazed almost to ground level, with the exception of a few unpalatable species. As a result, only 11 species were identified. Alien invasive species identified on site include *Cirsium vulgare* (Spear Thistle) (NEMBA: Category 1b), *Verbena bonariensis* (Tall Verbena) (NEMBA: Category 1b). The indigenous weed, *Berkheya erysithales* was also prevalent on site.



Figure 5-1: Examples of the Vegetation Associated With Transect 1 (A: Landscape Indicating Overgrazing; B: Trampling Over the Majority of the Transect; C: Water Inundation)

5.1.2 Transect 2

Transect 2 exhibited a higher species richness (33 species) than the other transects as well as a good basal cover. The most dominant species identified were *Themeda triandra* (Red Grass), *Cynodon dactylon* (Couch Grass), and *Eragrostis gummiflua* (Gum Grass). Wetland species were also evident, with *Imperata cylindrica* (Cottonwool Grass) and *Juncus effusus* (Soft Rush) being dominant. Various alien species were present, including: *Bidens pilosa* (Black Jacks), which formed dense stands along the road edge, *C. vulgare* (NEMBA:

Category 1b), and *Verbena bonariensis* (NEMBA: Category 1b). Native weeds include *B. erysithales*, *Seriphium plumosum* (Bankrupt Bush) and *Gomphocarpus fruticosus* (Milkweed). Examples of the vegetation associated with Transect 2 are presented in Figure 5-2.



Figure 5-2: Examples of the Vegetation Associated with Transect 2 (A: Landscape; B: *Imperata cylindrica*, a Wetland Species; C: Infestation of *Bidens pilosa* Along the Roads' Edge)

5.1.3 Transect 3

Transect 3 represents the area associated with the river diversion. *Agrostis lachnantha* (Bent Grass), *C. dactylon*, *E. plana* and *S. africana* were the dominant species in this transect. Contrary to the previous year's survey of Transect 3, hydromorphic species are now abundant (*I. cylindrica*, *A. lachnantha*, *Cyperus* sp., *Juncus* sp.), with a fair amount of water present (see Figure 3-4). Various forbs were also present, such as *Plantago* and *Hypoxis* species. Examples of the vegetation associated with Transect 3 are presented in Figure 5-3. Twenty-five species were encountered along the transect. Six invasive species were identified. *V. bonariensis* (NEMBA: Category 1b), *V. brasiliensis* (NEMBA: Category 1b), and *Pennisetum clandestinum* (Kikuyu Grass) which is a highly invasive grass in wetland areas (NEMBA: Category 1b).



Figure 5-3: Examples of the Vegetation Associated with Transect 3 (A: Wet Area within the Transect; B: Landscape; C: *Agrostis lachnantha*, an Obligate Wet Species)

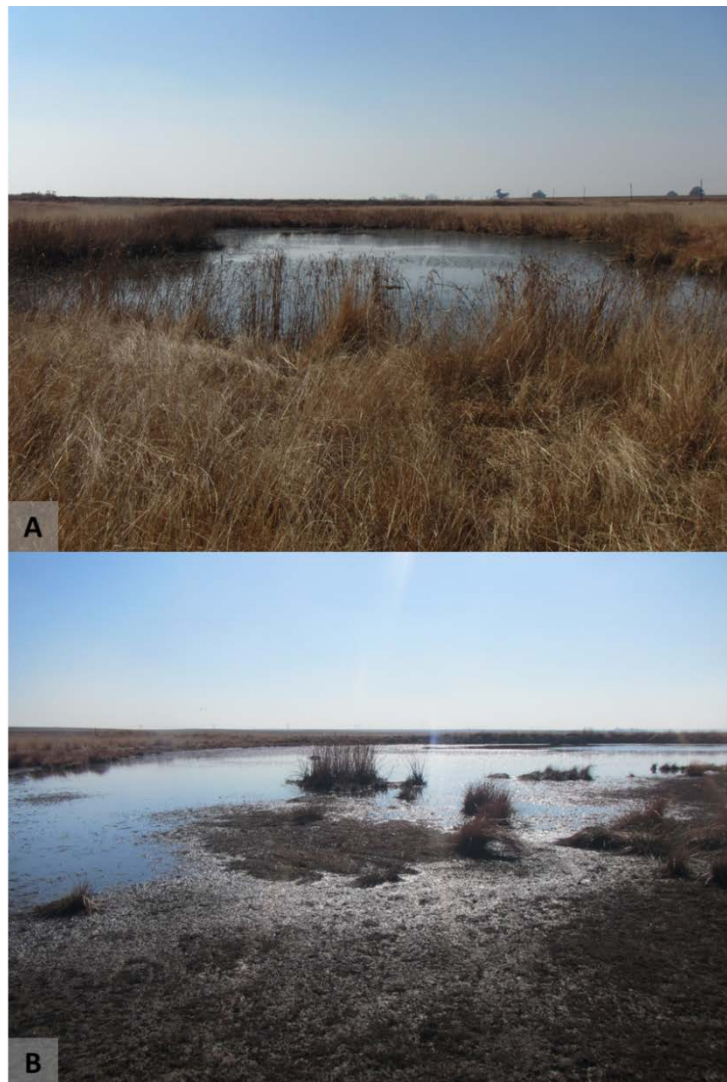


Figure 5-4: Wetland Areas

5.2 Alien Plant Species Inspection

Ten alien plant species were recorded during the transect walks as listed in Table 5-2; with examples illustrated in Figure 3-5. Some native species showed invasive habit in response to overgrazing, such as *B. erysithales* and *S. plumosum*. Alien Invasive plant species in South Africa have been classified according to NEMBA (No. 10 of 2004), as published in NEMBA: Regulation on Alien Invader Species (GN R599 in GG 37886 of 1 August 2014) into the following categories:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area; and

- Category 3: Invasive species controlled by activity.

Table 5-2: Plant species recorded on site (July 2017(x) and February 2016(#))

Family	Species	CARA/NEMBA	Transect		
			1	2	3
Agavaceae	<i>Agave sisalana</i>	2; 2		#	
Amaranthaceae	<i>Amaranthus hybridus</i>	Not Listed		#	x
	<i>Gomphrena celesioides</i>	Not Listed		#	
Asteraceae	<i>Bidens pilosa</i>	Not Listed	#,x	#,x	#,x
	<i>Campuloclinium macrocephalum</i>	1;1b		#	x
	<i>Cirsium vulgare</i>	1; 1b	#,x	#,x	#
	<i>Conyza albida</i>	Not Listed	#,x	#,x	#
	<i>Cosmos bipinnata</i>	Not Listed		#	
	<i>Taraxacum officinale</i>	Not Listed	#	#	
	<i>Senecio sp.</i>	Not Listed			#
	<i>Tagetes minuta</i>	Not Listed	#	x	
Fabaceae	<i>Trifolium repens</i>	Not Listed			x
Poaceae	<i>Pennisetum clandestinum</i>	Category 1b in wetlands			x
	<i>Paspalum dilatatum</i>	Not Listed	#		#
Polygonaceae	<i>Rumex crispus</i>	Not Listed			x
Solanaceae	<i>Datura stramonium</i>	1;1b	#	#	
	<i>Physalis peruviana</i>	Not Listed		#	
	<i>Solanum panduriforme</i>	Not Listed			#
Verbenaceae	<i>Verbena bonariensis</i>	1b	#,x	#,x	#,x
	<i>Verbena brasiliensis</i>	1b	#	#	#, x

#=2016

X=2017



Figure 5-5: Examples of Alien Species (A: *Berkheya rigida*; B: *Berkheya erysithales*; C: *Verbena bonariensis*; D: *Cirsium vulgare*)

5.3 Protected Plant Species

Boophone disticha (Declining), *Crinum bulbispermum* (Declining), *Kniphofia typhoides* (Near threatened) are expected species in the quarter degree squares (QDS) 2629AC, whilst *Frithia humilis* (Endangered) is expected in QDS 2629AA. None of these species were recorded in any of the three transects in this survey.

No provincially protected species listed in Schedule 11 or specially protected species as listed in Schedule 12 of the Mpumalanga Nature Conservation Act (No. 10 of 1998), were identified on site.

5.4 Fauna

5.4.1 Mammals

A database search for mammal species that have been recorded in the QDS 2629 AA in which the study area occurs was completed on the virtual museum of the Animal Demography Unit (ADU)(<http://www.adu.org.za>). In the database, no recent records of mammals have been formally uploaded in the study area. Mammal species that have been recorded near the project area in the Mpumalanga Province, and that possibly occur in the area of interest are discussed below.

Mammal species expected to occur in the study area include 3 protected species, Table 6-1, one being confirmed, as per ADU database. The species identified visually during the surveys are, Steenbuck (*Raphicerus campestris*), Bushpig (*Potamochoerus larvatus*) and Black Backed Jackal (*Canis mesomelas*). The animals of which signs were recorded included Cape Clawless Otter (*Aonyx capensis*) droppings and foraging marks of the Cape Porcupine (*Hystrix africaeaustralis*) and Shrub Hare (*Lepus saxatilis*). Serval (*Leptailurus serval*) was recorded on camera traps during the 2016 survey period. The variety of vegetation types occurring in the study area allows for an ecologically diverse assemblage of plant species which may support a variety of mammal species. Considering this, the expected species list for this study may potentially be more extensive than is currently recorded.

The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. A number of burrows seen in the general project area indicates that there is a dense population of rodents, likely multimammate mice. As in 2016, despite high abundances of small mammals in the project area, low diversity of species was recorded thus leading to a relatively low overall biodiversity of small mammals. However, high abundances of small mammals are important to avian, amphibian and reptilian diversity as they contribute toward a valuable food source for these animals.


Table 6-3: List of mammal species expected and observed in the project area

Scientific name	Common name	Red list category	2015/2016	2017
<i>Aonyx capensis</i>	Cape Clawless Otter	Protected (NEMBA) MPB: Protected	Yes	Yes
<i>Atilax paludinosus</i>	Marsh Mongoose	LC		
<i>Canis mesomelas</i>	Black-backed Jackal	LC	Yes	Yes
<i>Cryptomys hottentotus</i>	Common Mole-rat	LC		
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	Yes	Yes
<i>Galerella sanguinea</i>	Slender Mongoose	LC		
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	Yes	Yes
<i>Ichneumia albicauda</i>	White-tailed mongoose	LC		Yes
<i>Lepus saxatilis</i>	Shrub Hare	LC		Yes
<i>Lutra maculicollis</i>	Spotted-necked Otter	EN (IUCN) MPB: Protected		
<i>Mastomys coucha</i>	Multimammate Mouse	LC	Yes	
<i>Otomys irroratus</i>	Vlei Rat	LC	Historically recorded in surrounding area	
<i>Sylvicapra grimmia</i>	Common Duiker	LC		
<i>Potamochoerus</i>	Bushpig	LC	Yes	Yes



Scientific name	Common name	Red list category	2015/2016	2017
<i>larvatus</i>				
<i>Raphicerus campestris</i>	Steenbuck	LC, MPB: Protected	Yes	Yes
<i>Leptailurus serval</i>	Serval	NT	Yes	
<i>Tatera brantsii</i>	Highveld Gerbil	LC		

5.4.2 Avifauna

In the aquatic biomonitoring report of August 2013 it is mentioned that 26 bird species were recorded during that specific project (Golder, 2013). The 2016 study recorded 38 species and 2017 study recorded 37 species during the two seasonal site visits that covered all available habitats in the project area. According to the South African Bird Atlas Project (SABAP2), approximately 300 species of birds have been identified in the general area; the majority of these birds are comprised of grassland species. All birds that could be present within study area (QDS 2629 AA) were considered during this project. Of these species, 23 have been assigned a red data status one critically endangered, 13 near threatened, one endangered and eight vulnerable with four endemic to South Africa. The species recorded are listed in the Table 5-4 below.

The dominant habitat of the river diversion and surrounding area generally includes mesic Highveld grassland dominated by agriculture (maize production and grazing).

During the site visit a number of bird species were observed in the farming areas which were predominated by agricultural fields and farm roads.

Throughout the natural grassland vegetation type of the study area a African Grass-Owl (*Tyto capensis*) was previously observed in the form of two roosting sites located in close proximity to the water treatment dams north of river diversion. This species is considered vulnerable in South Africa according to The Red Data Book of Birds of South Africa, Lesotho and Swaziland, with between 1 000 and 5 000 birds remaining in this country (Barnes, 2000).

Although not observed during the 2016 or 2017 survey, a number of birds of prey should be present periodically throughout the year and would in all likelihood include Red Data summer migrants species such as Pallid Harrier (*Circus macrourus*), African Marsh Harrier (*Circus ranivorus*) and Montagu's Harrier (*Circus pygargus*). These species do however prefer the less impacted grassland areas to sustain their preferred prey species.



The grasslands and agricultural fields of the study area harbour a number of typical Highveld endemics. These included White Storks along with widow, weaver and bishop species (within the wetter areas). A number of Marsh Owls (*Asio capensis*) and African Quailfinch's (*Ortygospiza fuscocrissa*) were also observed within the grasslands – the latter species generally feed on the seeds of the wetter grass species and are renowned wetland indicators. African Pipit (*Anthus cinnamomeus*) and Orange throated Longclaw (*Macronyx capensis*) were observed throughout the study area. The study area is also ideal habitat for quail and button-quail species, although these species are highly nomadic and were not identified during the site investigation.

A number of water birds were identified within the open water of the farm dams within the project area and include species such as Common Sandpiper (*Actitis hypoleucos*), Cattle Egret (*Bubulcus ibis*), Egyptian Goose (*Alopochen aegyptiaca*), Spurwinged Goose (*Plectropterus gambensis*), Sacred Ibis (*Threskiornis aethiopicus*), Red-knobbed Coot (*Fulica cristata*), African Snipe (*Gallinago nigripennis*), Goliath Heron (*Ardea goliath*), Yellowbilled Duck (*Anas undulata*), White-faced Duck (*Dendrocygna viduata*), Cattle Egret (*Bubulcus ibis*), and Three-banded Plover (*Charadrius tricollaris*).

Table 5-4: Bird species recorded in the 2015/2016 study period

Species	Common Name	Conservation Status	2016	2017
<i>Recurvirostra avosetta</i>	Avocet, Pied	MPB: Protected	#	
<i>Euplectes orix</i>	Bishop, Southern Red	MPB: Protected	#	x
<i>Pycnonotus tricolor</i>	Bulbul, Dark-capped	MPB: Protected	#	x
<i>Fulica cristata</i>	Coot, Red-knobbed	MPB: Protected	#	x
<i>Phalacrocorax lucidus</i>	Cormorant, White Breasted			x
<i>Microcarbo africanus</i>	Cormorant, Reed			x
<i>Corvus albus</i>	Crow, Pied	MPB: Protected	#	x
<i>Anhinga rufa</i>	Darter, African			x
<i>Streptopelia senegalensis</i>	Dove, Laughing	-	#	x
<i>Oena capensis</i>	Dove, Namaqua	MPB: Protected	#	
<i>Streptopelia turtur</i>	Dove, Turtle			x
<i>Anas undulata</i>	Duck, Yellow-billed	MPB: Protected	#	x



Species	Common Name	Conservation Status	2016	2017
<i>Bubulcus ibis</i>	Egret, Cattle	MPB: Protected	#	x
<i>Egretta garzetta</i>	Egret, Little	MPB: Protected	#	x
<i>Ceryle rudis</i>	Kingfisher, Pied	MPB: Protected		x
<i>Elanus caeruleus</i>	Kite, Black-shouldered	MPB: Protected		x
<i>Falco amurensis</i>	Falcon, Amur	MPB: Protected	#	
<i>Lanius collaris</i>	Fiscal, Common (Southern)	MPB: Protected	#	
<i>Phoenicopterus ruber</i>	Flamingo, Greater	SA Red Data: NT IUCN: NT NEMBA, TOPS: MPB: Protected	#	
<i>Scleroptila lewaillantii</i>	Francolin, Red Winged	MPB: Protected		x
<i>Pternistis swainsonii</i>	Francolin, Swainson	-		x
<i>Chroicocephalus cirrocephalus</i>	Gull, Grey headed	MPB: Protected		x
<i>Corythaixoides concolor</i>	Go-away-bird, Grey	MPB: Protected	#	
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	-	#	x
<i>Plectropterus gambensis</i>	Goose, Spur Winged	MPB: Protected		x
<i>Tringa nebularia</i>	Greenshank, Common	MPB: Protected	#	
<i>Tachybaptus ruficollis</i>	Grebe, Little	MPB: Protected		x
<i>Numida meleagris</i>	Guineafowl, Helmeted	MPB: Protected	#	x
<i>Scopus umbretta</i>	Hamerkop, Hamerkop	MPB: Protected	#	x
<i>Ardea melanocephala</i>	Heron, Black-headed	MPB: Protected	#	



Species	Common Name	Conservation Status	2016	2017
<i>Ardea goliath</i>	Heron, Goliath	MPB: Protected		x
<i>Threskiornis aethiopicus</i>	Ibis, African Sacred	MPB: Protected	#	
<i>Plegadis falcinellus</i>	Ibis, Glossy	MPB: Protected	#	x
<i>Bostrychia hagedash</i>	Ibis, Hadedea	MPB: Protected	#	x
<i>Elanus caeruleus</i>	Kite, Black-shouldered	MPB: Protected	#	x
<i>Vanellus armatus</i>	Lapwing, Blacksmith	MPB: Protected	#	
<i>Vanellus coronatus</i>	Lapwing, Crowned	MPB: Protected	#	x
<i>Macronyx capensis</i>	Longclaw, Cape	MPB: Protected	#	x
<i>Cisticola fulvicapilla</i>	Neddicky	MPB: Protected	#	
<i>Asio capensis</i>	Owl, Marsh	MPB: Protected		x
<i>Anthus cinnamomeus</i>	Pipit, African	MPB: Protected	#	
<i>Charadrius tricollaris</i>	Plover, Three-banded	MPB: Protected	#	x
<i>Prinia subflava</i>	Prinia, Tawny-flanked	MPB: Protected		x
<i>Ortygospiza atricollis</i>	Quailfinch, African	MPB: Protected	#	
<i>Sagittarius serpentarius</i>	Secretarybird	SA Red Data: VU IUCN: VU NEMBA, TOPS: MPB: Protected	#	x
<i>Lanius collurio</i>	Shrike, Red-backed	MPB: Protected	#	
<i>Gallinago nigripennis</i>	Snipe, African	MPB: Protected	#	
<i>Pternistis swainsonii</i>	Spurfowl, Swainson's	MPB: Protected	#	
<i>Ciconia ciconia</i>	Stork, White	MPB: Protected	#	

Species	Common Name	Conservation Status	2016	2017
<i>Himantopus himantopus</i>	Stilt, Black-Winged	MPB: Protected		x
<i>Anas capensis</i>	Teal, Cape	MPB: Protected		x
<i>Anas erythrorhyncha</i>	Teal, Red billed	MPB: Protected		x
<i>Motacilla capensis</i>	Wagtail, Cape	MPB: Protected		x
<i>Ploceus capensis</i>	Weaver, Cape	MPB: Protected	#	
<i>Euplectes progne</i>	Widowbird, Long-tailed	MPB: Protected	#	
<i>Vidua macroura</i>	Whydah, Pin tailed	MPB: Protected		x
<i>Accipiter melanoleucus</i>	Sparrowhawk, Black	MPB: Protected	#	
<i>Ploceus velatus</i>	Weaver, Masked	MPB: Protected	#	x

5.4.3 Reptiles

No baseline information was available for the species richness or diversity for reptiles in the project area. Further to this, no reptiles were recorded during the surveys for this project. However according to the animal demography unit's virtual museum a total of 40 species have been recorded in this QDS in the past (<http://sarca.adu.org.za/>). Of these species, one has been assigned a Red Data status, the Giant Girdled Lizard (*Smaug Giganteus*) (NT) and these species are listed in Table 5-5. Twelve species in this list are designated as endemic to the Highveld.


Table 5-5: Expected reptile species for the project area

Genus	Species	Common name	Red list	Endemic
<i>Agama</i>	<i>Aculeate, distanti</i>	Distant's Ground Agama	NE	Yes
<i>Agama</i>	<i>atra</i>	Southern Rock Agama	NE	-
<i>Aparallactus</i>	<i>capensis</i>	Black-headed Centipede-eater	NE	-
<i>Homoroselaps</i>	<i>lacteus</i>	Spotted Harlequin Snake	NE	Yes
<i>Amplorhinus</i>	<i>multimaculatus</i>	Many-spotted Snake	NE	-
<i>Boaedon</i>	<i>capensis</i>	Brown House Snake	NE	-
<i>Crotaphopeltis</i>	<i>hotamboeia</i>	Red-lipped Snake	NE	-
<i>Dasypeltis</i>	<i>scabra</i>	Rhombic Egg-eater	NE	-
<i>Duberria</i>	<i>Lutrix, lutrix</i>	South African Slug-eater	NE	Yes
<i>Lamprophis</i>	<i>aurora</i>	Aurora House Snake	NE	Yes
<i>Lamprophis</i>	<i>guttatus</i>	Spotted House Snake	NE	-
<i>Lycodonomorphus</i>	<i>inornatus</i>	Olive House Snake	NE	Yes
<i>Lycodonomorphus</i>	<i>rufulus</i>	Brown Water Snake	NE	-
<i>Lycophidion</i>	<i>Capense, capense</i>	Cape Wolf Snake	NE	-
<i>Psammophis</i>	<i>brevirostris</i>	Short-snouted Grass Snake	NE	-
<i>Psammophis</i>	<i>crucifer</i>	Cross-marked Grass Snake	NE	-



Genus	Species	Common name	Red list	Endemic
<i>Psammophylax</i>	<i>Rhombeatus rhombeatus</i>	Spotted Grass Snake	NE	-
<i>Pseudaspis</i>	<i>cana</i>	Mole Snake	NE	-
<i>Chamaesaura</i>	<i>aenea</i>	Coppery Grass Lizard	NE	Yes
<i>Cordylus</i>	<i>vittifer</i>	Common Girdled Lizard	NE	-
<i>Pseudocordylus</i>	<i>Melanotus, melanotus</i>	Common Crag Lizard	NE	Yes
<i>Smaug</i>	<i>Giganteus</i>	Giant Girdled Lizard	VU	Yes
<i>Hemachatus</i>	<i>haemachatus</i>	Rinkhals	NE	-
<i>Naja</i>	<i>mossambica</i>	Mozambique Spitting Cobra	NE	-
<i>Lygodactylus</i>	<i>Ocellatus, ocellatus</i>	Spotted Dwarf Gecko	NE	Yes
<i>Pachydactylus</i>	<i>affinis</i>	Transvaal Gecko	NE	Yes
<i>Pachydactylus</i>	<i>capensis</i>	Cape Gecko	NE	-
<i>Pachydactylus</i>	<i>vansoni</i>	Van Son's Gecko	NE	-
<i>Gerrhosaurus</i>	<i>flavigularis</i>	Yellow-throated Plated Lizard	NE	-
<i>Leptotyphlops</i>	<i>Scutifrons, conjunctus</i>	Eastern Thread Snake	NE	-
<i>Leptotyphlops</i>	<i>Scutifrons, scutifrons</i>	Peters' Thread Snake	NE	-
<i>Acontias</i>	<i>breviceps</i>	Short-headed Legless Skink	NE	Yes
<i>Acontias</i>	<i>gracilicauda</i>	Thin-tailed Legless Skink	NE	Yes



Genus	Species	Common name	Red list	Endemic
<i>Trachylepis</i>	<i>capensis</i>	Cape Skink	NE	-
<i>Trachylepis</i>	<i>punctatissima</i>	Speckled Rock Skink	NE	-
<i>Trachylepis</i>	<i>varia</i>	Variable Skink	NE	-
<i>Afrotyphlops</i>	<i>bibronii</i>	Bibron's Blind Snake	NE	-
<i>Varanus</i>	<i>niloticus</i>	Water Monitor	NE	-
<i>Bitis</i>	<i>Arietans, arietans</i>	Puff Adder	NE	-
<i>Causus</i>	<i>rhombeatus</i>	Rhombic Night Adder	NE	-

5.4.4 Amphibians

According to Carruthers (2001), a number of factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the study area should provide a number of different species of amphibians. During the surveys a total of three amphibian species were identified.

Limited baseline data was available from previous reports with regards to amphibians, however the Giant Bullfrog (protected) was identified previously. Amphibians expected to occur on site are listed in the Table 5-6 below (<http://sarca.adu.org.za/>).

Within the study area, further niche differentiation was encountered by means of geographic location, this differentiation includes, banks of dams, open water, inundated grasses, reed beds, trees, rivers and open ground. Three frog species were previously identified on site during the 2016 survey, namely: the Clicking Stream Frog (*Strongylopus grayii*), Giant Bullfrog (*Pyxicephalus adspersus*) and Common River Frog (*Amietia angolensis*). Only the Clicking Stream Frog (*Strongylopus grayii*) was recorded in 2017. This result is attributed to the timing of the survey.

Table 5-6: Amphibian species that could possibly be found in the project area

Family	Genus	Species	Common name	Red list category (IUCN)
Bufonidae	<i>Amietophrynus</i>	<i>gutturalis</i>	Guttural Toad	LC



Bufonidae	<i>Amietophrynus</i>	<i>maculatus</i>	Flatbacked Toad	LC
Bufonidae	<i>Amietophrynus</i>	<i>rangeri</i>	Raucous Toad	LC
Bufonidae	<i>Schismaderma</i>	<i>carens</i>	Red Toad	LC
Hyperoliidae	<i>Hyperolius</i>	<i>marmoratus</i>	Painted Reed Frog	LC
Hyperoliidae	<i>Kassina</i>	<i>senegalensis</i>	Bubbling Kassina	LC
Hyperoliidae	<i>Semnodactylus</i>	<i>wealii</i>	Rattling Frog	LC
Phrynobatrachidae	<i>Phrynobatrachus</i>	<i>natalensis</i>	Snoring Puddle Frog	LC
Pipidae	<i>Xenopus</i>	<i>laevis</i>	Common Platanna	LC
Ptychadenidae	<i>Ptychadena</i>	<i>porosissima</i>	Striped Grass Frog	LC
Pyxicephalidae	<i>Amietia</i>	<i>angolensis</i>	Common or Angola River Frog	LC
Pyxicephalidae	<i>Amietia</i>	<i>fuscigula</i>	Cape River Frog	LC
Pyxicephalidae	<i>Cacosternum</i>	<i>boettgeri</i>	Common Caco	LC
Pyxicephalidae	<i>Cacosternum</i>	<i>nanum</i>	Bronze Caco	LC
Pyxicephalidae	<i>Strongylopus</i>	<i>fasciatus</i>	Striped Stream Frog	LC
Pyxicephalidae	<i>Strongylopus</i>	<i>grayii</i>	Clicking Stream Frog	LC
Pyxicephalidae	<i>Tomopterna</i>	<i>cryptotis</i>	Tremelo Sand Frog	LC
Pyxicephalidae	<i>Tomopterna</i>	<i>natalensis</i>	Natal Sand Frog	LC
Pyxicephalidae	<i>Tomopterna</i>	<i>tandyi</i>	Tandy's Sand Frog	LC

5.4.5 Invertebrates

Butterflies provide an indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytopes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope species (species with specific habitat requirements with populations concentrated in a small area) which may be very specialised (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch and identify. It is for this reason that Lepidoptera will be used as the primary focus for the invertebrate survey. The Red Data species possibly found on site is the Marsh

sylph (*Metisella meninx*). The larval host plant of *Metisella meninx* is rice grass, *Leersia hexandra* (G.A. Henning & Roos 2001). Unlike many other threatened butterfly species in South Africa, no specific association with ant species is present in the early stages of the life cycle of the *Metisella meninx*. The ideal habitat of *Metisella meninx* is treeless marshy areas where *Leersia hexandra* (rice grass) is abundant. Some treeless marshy habitats are present along the major streambeds in the area. There may be suitable habitat for *Metisella meninx* on the site along the water courses and also the small marshes and seasonal water course in open grassland.

5.5 Species of Special Concern

5.5.1 Mammal Species of Special Concern

1. Serval (*Leptailurus serval*) – “Near-threatened”, NEMBA: TOPS Protected

Servals show a wide distribution range, although they are limited by their obligate preference for surface water. Therefore, they are always found near water and in areas with sufficient shelter such as tall grass (Skinner & Smithers, 1990) with an abundance of suitable prey – mainly Murid rodents (e.g. genera *Mastomys*, *Mus* and *Otomys*).

Serval is expected to occur on the moist grassland areas alongside pans and the wetland features. It was also recently observed from a number of sites (both natural and rehabilitated) corresponding to the upper Olifants River catchment, thereby highlighting the possibility that it could occur on site.

2. Brown Hyena (*Parahyaena brunnea*) – “Near-threatened” NEMBA: TOPS Protected

Brown Hyenas have a wide distribution range (an indication of a wide habitat tolerance) throughout South Africa, but is nowadays found mainly in rural areas not typified by intensive cultivation or urbanisation.

3. Honey Badger (*Mellivora capensis*) – “Near-threatened”

Honey Badgers are widespread and generally very catholic in their habitat requirements. They are predominately nocturnal, solitary and very unobtrusive in behavior (Skinner & Chimimba, 2005).

4. Shrew Taxa – “Data Deficient”

All shrew taxa (genera *Crocidura* & *Myosorex*) are classified as “Data Deficient” and many of these could occur on the study area. The moist grassland that borders the pans and drainage lines provide optimal habitat for *Myosorex varius* (Forest Shrew) and *Crocidura* spp. Both genera are by no means rare or uncommon, although seldom encountered due to their shy and retiring habits.

5. Cape Clawless Otter (*Aonyx capensis*) - “Near-threatened”

The Cape Clawless Otter is a robust animal and is both nocturnal and diurnal, often found away from water. They feed on crabs, molluscs, fish, birds and a range of rodents and amphibians. They have an acute sense of smell and well-developed canines.

6. Spotted-necked Otter (*Lutra maculicollis*) - "Near-threatened"

African spotted-necked otters have slim bodies and long, tapering tails. Their feet-fully covered with webbing-have long, strong claws. Their fur is a uniform chocolate to reddish brown with blotches of white or creamy white markings on their throat, chest and sometimes groin areas

They live in continuous waterways such as, rivers and wetlands that have large areas of open water surrounded by canopies of dense vegetation. When on land, they seldom venture more than 10m from the water's edge.

5.5.2 Bird Species of Special Concern

In Table 5-7 a list of 14 red listed bird species that could utilize the study site based on their respective breeding, roosting and foraging requirements. However, the African Grass-Owl (*Tyto capensis*) (VU), Greater Flamingo (*Phoenicopterus. Ruber*) (VU), Secretary Bird (*Sagittarius serpentarius*) (VU) and African Marsh Harrier (*Circus ranivorus*) were recorded in the project area from previous field observations. In addition, the dams in the area could sustain small numbers of foraging Lesser flamingos (*Phoenicopterus minor*).



Table 5-7: Bird SSC

Species	Red Data Status	Preferred Habitat	Potential Likelihood of Occurrence
<i>Anthropoides paradiseus</i> (Blue Crane)	SA Red Data: VU IUCN: VU NEMBA, TOPS: Protected MPB: Protected	Prefers open pristine grasslands, as well as wetland habitats.	An irregular visitor to the various wetland and grassland.
<i>Circus macrourus</i> (Pallid Harrier)	SA Red Data: NT IUCN: NT NEMBA, TOPS: Protected MPB: Protected	Considered a vagrant to South Africa.	An erratic summer visitor to the area.
<i>Circus ranivorus</i> (African Marsh Harrier)	SA Red Data: EN IUCN: LC NEMBA, TOPS: Protected MPB: Protected	Restricted to permanent wetlands with extensive reedbeds.	Could occur on site
<i>Circus maurus</i> (Black Harrier)	SA Red Data: EN IUCN: VU NEMBA, TOPS: Protected MPB: Protected	Generally confined to the clay grassland of the southern part of Mpumalanga	Irregular winter visitor.
<i>Eupodotis caerulescens</i> (Blue Korhaan)	SA Red Data: LC IUCN: NT NEMBA, TOPS: Protected MPB: Protected	Prefers extensive open short grassland and cultivated land.	An uncommon resident on the study area.

5.5.3 Reptile Species of Special Concern

1. *Thin-tailed Legless Skink (Acontias g. gracilicauda)* (MPB: Protected)

This rare and localised fossorial species could be present on the grasslands on site. It is known from only a few localities within Mpumalanga (information obtained from the SARCA initiative) although it probably occurs more widely than previously thought due to its fossorial habits. However, its patchy distribution range results in it having a subsequent fragmented metapopulation.

A metapopulation consists of spatially separated populations of the same species that interact at some level with each other – it is broadly applied to species with fragmented distributions.

2. *Aurora House Snake (Lamprophis aurora)* & *Olive House Snake (L. inornatus)* (MPB: Protected)

These rare species are limited to mesic grasslands and have a temperate and fragmented distribution pattern. They are thus vulnerable to habitat modification. Both species could occur along the moist grassland that borders various wetland features.

6 Ecological Trends

6.1 Flora

As with the 2016 survey period transect 2 showed the highest species diversity, as well as species richness, and the composition was following the regional vegetation type (described in section 4). Even though the survey was completed in the dry season wetland plant species were still found within the channel. This may be attributable to a lack of grazing pressure. The 2016 and 2017 prevalence of the decreaser species, *Themeda triandra* (Red grass) in transects 2 and 3, further substantiates a lack of grazing pressure and the general veld condition can be regarded as a good reference for the river diversion area. Alien invasion on the edges of transect 1, however, poses a risk to edge effects and further spread.

Transect 3, associated with the river diversion area, showed relatively low diversity in relation to transects 1 and 2 and showed a prevalence of terrestrial plant species encroaching into the wetland. Alien plant invasion was considerable and of concern was the establishment of *Pennisetum clandestinum* (Kikuyu); a category 1b species (NEMBA) in transect 2. This species is particularly invasive and can cause further deterioration to species diversity and should be addressed through a dedicated eradication programme. Transect 2 and 3 both showed a dominance of increaser grass species due to overgrazing, a change from 2016 with transect 1 not having as much increaser species as before. There does not seem to be any marked change in vegetation composition for the three transects in terms of species dominance with many of the 2016 species being recorded again in 2017. To this end, more species were recorded for each of the transects in 2016 than compared to 2013, with 2017 being less than 2016. This slight decrease in species richness from last year is attributed to the timing of the survey, however the continued presence of existing stressors (primarily overgrazing), is still a concern as, the area is still being grazed.

The river diversion route itself showed poor plant species recruitment and evidence of sheet and gully erosion on the banks of the diversion was prominent. The target ecological state for the vegetation associated with the river diversion is climax grassland dominated by decrease species; no alien plant species and species diversity representative of transect 2.

6.2 Fauna

6.2.1 Mammals

Relatively few mammal species were identified during this study, this could be attributed to the length of the field work component, however the mammal species identified during desktop survey are mostly nocturnal and secretive, mostly due to pressure from persecution and habitat destruction. In addition, the species that dominated the specific study area are riparian/wetland species such as Otters and Mongooses. This trend is continuing from 2016 when much of the same species were encountered. The protected species recorded in 2016 are thought to be present in the area, but not recorded during this survey.

6.2.2 Avifauna

The bird species encountered during this project are an indication of the type of habitat present in the project area as well as the ecological state that it is in. The majority of the study area was in proximity to water resources, (river diversion, rivers and dams), separated by natural grassland used for grazing and agricultural areas. With this setting in mind the majority of the birds that frequented the area were riparian and water birds, grassland natives and birds that frequent agricultural areas. Previous information available indicated that 26 birds were recorded in 2013, with 2016 recording 38, and the current survey recording 37. From a protected species point of view the African Grass-Owl (*Tyto capensis*) the Secretarybird (*Sagittarius serpentarius*) and Greater Flamingo (*Phoenicopterus ruber*) was not recorded during this survey however, but their presence was confirmed previously.

6.2.3 Herpetofauna

The habitat available to amphibians on the project site varies between open water, wetlands, marshes, pans and farm dams. One amphibian was recorded during this survey, this decrease in numbers is primarily due to the timing of the field survey.

Previously 3 amphibian species were recorded, and with no impacts to suggest otherwise it is thought that these species still persist.

6.2.4 Invertebrates

Insects are the most abundant macroscopic organisms in terrestrial and aquatic habitats (Picker *et. al.* 2004). Human threats pose significant threats to insect populations. Threats to butterflies in South Africa include: the establishment of alien invasive vegetation, changing fire regimes (either increased or reduced frequency), agricultural activities, urbanisation, plantation forestry, increased grazing and road construction (Ball 2006).

During the field survey no species were identified within the study area.

7 Conclusion and Recommendations

The following recommendations have been made for this monitoring report:

- As aforementioned in the former biomonitoring report (Golder, 2013), metal stakes should be placed in the ground to mark the vegetation transects to allow for accuracy. Alternatively, white painted wooden posts would suffice.
- The following features should be monitored for vegetation:
 - Relative increase/decrease of increaser grass species;
 - Extent of alien plant invasion (number of individuals encountered as well as a list of species);
 - Relative abundance of terrestrial and hydromorphic plant species.
- Fixed-point photographs should be taken along each vegetation transect to monitor any obvious changes;
- All alien and invasive plant species should be removed. Where alien plant species, such as *Cosmos bipinnatus*, provide a stabilising function, suitable alternative species should be planted (such as *Cynodon dactylon*); and
- The GPS points of all dense alien plant stands should be recorded and photographed and added to the appendix of the next monitoring report.

7.1 Grass Owl Recommendations

During the Environmental Wildlife trust (EWT) African Grass-Owl survey at Exxaro Matla Coal Mine (2013), a total of four African Grass-Owls were flushed from more suitably sized patches of *Imperata sp.* Pellets and feathers were collected at one of the roosts.

Management recommendations that EWT provided are:

7.1.1 Habitat Management

The African Grass-Owl roost site on Vierfontein 61 IS should be protected and managed so as to ensure their persistence on the site. African Grass-Owls are traditionally thought to be nomadic, constantly moving around to areas with adequate prey abundance and habitat structure. While this may hold true in drier areas with unpredictable rainfall, such as the seasonally available habitat in parts of the Limpopo province, African Grass-Owls on the Highveld tend to be sedentary, occupying small patches of adequate habitat year-round. Breeding pairs are territorial and a single pair can occupy a territory for many years, provided the habitat is maintained. Patches of habitat supporting breeding pairs act as source sites for the greater African Grass-Owl population. It is therefore of vital importance that sites such as this should be conserved as they act as important links in a chain connecting dispersing owls and ensuring a genetic diversity within the population.

There are two facets to managing African Grass-Owl habitat: 1) the management of roost/nest habitat and 2) the management of hunting grounds. African Grass-Owls primarily hunt over the same moist grass fringing a wetland in which they make their roosts and nests. If this habitat patch is small, however, they may range much further to hunt. Preliminary radiotelemetry results indicate that the average territory size for a pair of African Grass-Owls is around 350 ha. It is likely that the owls on Vierfontein 61 IS roost at the western edge of their territory (African Grass-Owls do not regularly hunt over maize fields). It is probable that the territory of the owls at site B and C extend across the Rietspruit floodplain to the river diversion. It is therefore important that the entire floodplain is maintained as a conservation area. A couple of recommendations are provided below:

- The area should be protected from regular unplanned veld fires. Burning or cutting firebreaks are recommended. A firebreak should be maintained around the perimeter of the floodplain, as well as between the floodplain and the African Grass-Owl roost sites. This would allow a portion of the territory to remain unburned in the event of a fire.
- African Grass-Owl habitat (both roosting and hunting habitat) should be burned in 3-year cycles in order to maintain an adequate grass thickness. It is important not to exclude fire completely as this would render the grass moribund and unsuitable. It is, however, important that some habitat remains for the owls when burning. The floodplain and the roost habitat at points B and C should therefore be burned in alternating years. Block/Mosaiek burning regime must be implemented.
- Cattle and other livestock should be kept out of the habitat. Livestock cause excessive trampling of African Grass-Owl habitat, rendering it unsuitable for creating roosts and nests – fencing with a safe barrier to protect them from flying into the fence.

7.1.2 Habitat Improvement

The Rietspruit floodplain provides an opportunity to create additional breeding habitat for African Grass-Owls. Water trapped within the trenches caused by the collapse of underground tunnels following strip mining has allowed for the creation of a series of small wetlands. The grassland surrounding these wetlands could be transformed into patches of ideal African Grass-Owl habitat by planting the correct species in the right areas. *Imperata cylindrica* is the grass species most often used by African Grass-Owls as breeding habitat. *Imperata cylindrica* grows using an extensive rhizome system which makes it ideal for transplanting small blocks of grass in a similar manner to planting lawn grass. Alternatively they can be planted as plugs in between the existing grass. Planting plugs is most successful in areas with poor soil as they often out-compete other species under such conditions.

8 References

- Ball J.B. 2006. Approaches towards a critical evaluation and update of the red list of South African butterflies. Unpublished MSc thesis, Stellenbosch University.
- Barnes K. N. (ed) 2000. The Eskom Red data Book of Birds of South Africa, Lesotho & Swaziland. Birdlife South Africa, Johannesburg.
- Carruthers, Vincent. 2009. *Frog and Frogging in Southern Africa*. Struik Publishers (Pty) Ltd, Cape Town.
- Germishuizen, G. & Meyer, N.L. (eds) 2003. Plants of southern Africa: an annotated checklist. *Strelitzia* 14.
- Golder Associates, 2008. Matla Coal Wetland Monitoring and Management Plan Report no. 01. Report No : 11642-6061-2
- Golder Associates 2013. Aquatic biomonitoring report for the Matla river diversion. Report no.: 11613447-12099-1.
- Mucina, L. & Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. SANBI, Pretoria.
- Mucina, L. & Rutherford, M.C. (eds) 2012. The Vegetation of South Africa, Lesotho and Swaziland. SANBI, Pretoria – Mapping layer.
- Picker M., Griffiths C. and Weaving A. 2004. Field guide to insects of South Africa. Struik Publishing: 444 pp
- van Wyk E. and van Oudtshoorn F. 1999. Guide to grasses of Southern Africa. Briza publications: 279 p.
- Woodhall S. 2005. Field Guide to Butterflies of South Africa. Struik Publishers: Cape Town, South Africa.
- Skinner J.D. and Chimimba C.T. 2005. The Mammals of the Southern African Subregion (3rd Ed.). Cambridge University Press, Cape Town



Appendix A: Plant Species list

Family	Species Name	Threat Status	Transect 1	Transect 2	Transect 3
Asclepiadaceae	<i>Gomphocarpus fruticosus</i>	LC		x	
Asteraceae	<i>Berkheya erysithales</i>	LC	x	x	x
Asteraceae	<i>Berkheya rigida</i>	LC		x	x
Asteraceae	<i>Bidens pilosa</i>	Alien	x	x	x
Asteraceae	<i>Cirsium vulgare</i>	Alien	x	x	
Asteraceae	<i>Conyza albida</i>	Alien	x	x	
Asteraceae	<i>Helichrysum aureonitens</i>	LC		x	
Asteraceae	<i>Senecio sp.</i>	Alien			x
Asteraceae	<i>Seriphium plumosum</i>	LC		x	
Asteraceae	<i>Tagetes minuta</i>	Alien		x	
Cyperaceae	<i>Cyperus esculentus</i>	LC		x	x
Cyperaceae	<i>Cyperus sp.</i>	-		x	x
Fabaceae	<i>Trifolium repens</i>	Alien			x
Hypoxidaceae	<i>Hypoxis sp.</i>	-		x	x
Juncaceae	<i>Juncus effusus</i>	LC		x	x
Plantaginaceae	<i>Plantago lanceolata</i>	LC			x
Poaceae	<i>Agrostis lachnantha</i> ²	LC			x
Poaceae	<i>Andropogon appendiculatus</i> *	LC		x	
Poaceae	<i>Aristida sp.</i>	-		x	
Poaceae	<i>Chloris sp.</i>	-		x	x
Poaceae	<i>Cymbopogon sp.</i>	-		x	



Poaceae	<i>Cynodon dactylon</i> ²	LC		x	x
Poaceae	<i>Eragrostis curvula</i> ²	LC		x	x
Poaceae	<i>Eragrostis gummiflua</i> ²	LC		x	x
Poaceae	<i>Eragrostis plana</i> ²	LC	x	x	x
Poaceae	<i>Heteropogon contortus</i> ²	LC		x	x
Poaceae	<i>Hyparrhenia hirta</i> ¹	LC	x	x	x
Poaceae	<i>Imperata cylindrica</i> ¹	LC	x	x	x
Poaceae	<i>Pennisetum clandestinum</i>	Alien		x	
Poaceae	<i>Setaria sp</i> *	-		x	
Poaceae	<i>Setaria sphacelata</i> *	LC	x	x	x
Poaceae	<i>Sporobolus africanus</i> ³	LC	x	x	x
Poaceae	<i>Themeda triandra</i> *	LC		x	x
Polygonaceae	<i>Rumex crispus</i>	Alien			x
Typhaceae	<i>Typha capensis</i>	LC	x		
Verbenaceae	<i>Verbena bonariensis</i>	Alien	x	x	x
Verbenaceae	<i>Verbena brasiliensis</i>	Alien			x
	<i>Unidentified sp. 1</i>			x	
	<i>Unidentified sp. 2</i>			x	
	<i>Unidentified sp. 2</i>			x	



Family	Species Name	Threat Status	Transect 1	Transect 2	Transect 3
Asclepiadaceae	<i>Gomphocarpus fruticosus</i>	LC		x	
Asteraceae	<i>Berkheya erysithales</i>	LC	x	x	x
Asteraceae	<i>Berkheya rigida</i>	LC		x	x
Asteraceae	<i>Bidens pilosa</i>	Alien	x	x	x
Asteraceae	<i>Cirsium vulgare</i>	Alien	x	x	
Asteraceae	<i>Conyza albida</i>	Alien	x	x	
Asteraceae	<i>Helichrysum aureonitens</i>	LC		x	
Asteraceae	<i>Senecio sp.</i>	Alien			x
Asteraceae	<i>Seriphium plumosum</i>	LC		x	
Asteraceae	<i>Tagetes minuta</i>	Alien		x	
Cyperaceae	<i>Cyperus esculentus</i>	LC		x	x
Cyperaceae	<i>Cyperus sp.</i>	-		x	x
Fabaceae	<i>Trifolium repens</i>	Alien			x
Hypoxidaceae	<i>Hypoxis sp.</i>	-		x	x
Juncaceae	<i>Juncus effusus</i>	LC		x	x
Plantaginaceae	<i>Plantago lanceolata</i>	LC			x
Poaceae	<i>Agrostis lachnantha</i> ²	LC			x
Poaceae	<i>Andropogon appendiculatus</i> *	LC		x	
Poaceae	<i>Aristida sp.</i>	-		x	
Poaceae	<i>Chloris sp.</i>	-		x	x
Poaceae	<i>Cymbopogon sp.</i>	-		x	
Poaceae	<i>Cynodon dactylon</i> ²	LC		x	x
Poaceae	<i>Eragrostis curvula</i> ²	LC		x	x



Poaceae	<i>Eragrostis gummiflua</i> ²	LC		x	x
Poaceae	<i>Eragrostis plana</i> ²	LC	x	x	x
Poaceae	<i>Heteropogon contortus</i> ²	LC		x	x
Poaceae	<i>Hyparrhenia hirta</i> ¹	LC	x	x	x
Poaceae	<i>Imperata cylindrica</i> ¹	LC	x	x	x
Poaceae	<i>Pennisetum clandestinum</i>	Alien		x	
Poaceae	<i>Setaria sp*</i>	-		x	
Poaceae	<i>Setaria sphacelata*</i>	LC	x	x	x
Poaceae	<i>Sporobolus africanus</i> ³	LC	x	x	x
Poaceae	<i>Themeda triandra*</i>	LC		x	x
Polygonaceae	<i>Rumex crispus</i>	Alien			x
Typhaceae	<i>Typha capensis</i>	LC	x		
Verbenaceae	<i>Verbena bonariensis</i>	Alien	x	x	x
Verbenaceae	<i>Verbena brasiliensis</i>	Alien			x
	<i>Unidentified sp. 1</i>			x	
	<i>Unidentified sp. 2</i>			x	
	<i>Unidentified sp. 2</i>			x	