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A wetland assessment of the site proposed for development of the Emdeni Public transport Facility in Soweto.

A wetland assessment of the site proposed for development of the Emdeni Public transport Facility in Soweto

by

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Commissioned by

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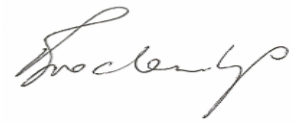
DECLARATION OF INDEPENDENCE:

We, George Johannes Bredenkamp, Id 4602105019086, and Catharina Elizabeth Venter Id 7912290014082

- Declare that GJ Bredenkamp holds a DSc and CE Venter a MSc in biological sciences, are registered with SACNASP as a professional scientists which sanctions us to function independently as a specialist consultants
- As per prerequisites of the Natural Scientific Professions Act No. 27 of 2003, this project was our work from its inception, reflects exclusively our observations and unbiased scientific interpretations, and was executed to the best of our ability
- abide by the Code of Ethics of the SACNASP
- Act as independent specialist consultants in the field of ecology, vegetation science, and wetlands
- Are committed to nature conservation but concomitantly recognize the need for economic development
- Are assigned as specialist consultants by Pierre Joubert Landscape Architect And Environmental Planner for the proposed project “A vegetation and wetland assessment of the site proposed for development of the Emdeni Public transport Facility in Soweto” described in this report
- Do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work performed
- Have or will not have any vested interest in the proposed activity proceeding
- Have no and will not engage in conflicting interests in the undertaking of the activity
- Undertake to disclose to the client and the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations 2014
- Will provide the client and competent authority with access to all information at my disposal, regarding this project, whether favourable or not.
- Reserve the right to only transfer our intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent from the client(s) will be required for us to release any part of this report to third parties.



GJ Bredenkamp CE Venter

SUMMARY

It is proposed to upgrade and formalise the current Emdeni informal public transport facility in Soweto. EcoAgent CC was appointed by Pierre Joubert Landscape Architect and Landscape Planner to make an assessment of the vegetation of the site, with special reference to the wetland systems that may be present on or close to the site.

The wetland surveys were done on 4 December 2017 and 4 November 2019 by Prof George Bredenkamp and Ms Ina Venter. The site is located in developed area in Soweto. Standard methods of wetland assessment were used, in accordance to the relevant legislation and minimum requirements of GDARD.

A wetland unit is located on the eastern boundary of the site. The wetland area is in PES class C, which is Moderately Modified. The portion adjacent to the site is however severely modified, with significant impacts from infill, sedimentation and stormwater. A wetland is present to the east of the site and receives stormwater from the surrounding development. The site is covered by deep infill and the historical extent of the wetland is therefore unknown.

The preferred alternative takes place outside the wetland unit and its buffer zone. If the mitigations measures included in this report is adhered to and the stormwater plan is implemented no negative impacts are anticipated and the PES class of the wetland will remain the same. This development is supported.

For Alternative 2, the proposed taxi rank is located outside the wetland unit, but the proposed storm water attenuation system and a very small portion of the parking is located in the buffer zone for the wetland. The wetland risk is low during the operational phase of the project and the attenuation system may even result in a positive impact, but the risk during the construction phase is moderate, which has been decreased to low in the opinion of the specialist. The construction activities will take place up to the edge of the wetland without a buffer area to mitigate the impact. The construction impact will however be a short-term impact, which will be mitigated by the rehabilitation and stormwater attenuation plan. It is however of great importance that the construction activities take place in the winter season when rainfall is unlikely. This is unlikely to affect the PES class of the wetland.

1. ASSIGNMENT

The site is described as occurring on the 291.2 ha of RE of the Farm Soweto 387 IQ. The area is already developed as residential and business areas. To formalise and develop the Emdeni Public Transport Facility sub-division and rezoning is required for the approximately 0.8 ha site. Site is located near intersection of Maholwane & Jabavu/ Mtshunyana Streets. For this development an EIA is needed. Eco-Agent CC Ecological Consultants were appointed by Pierre Joubert Landscape Architect and Environmental Planner to complete a wetland assessment on the site, as part of the EIA process.

This investigation is in accordance with the EIA Regulations No. R982-985, Department of Environmental Affairs and Tourism, 4 December 2014 emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as well as the National Water Act 1998 (Act 36 of 1998) and other relevant legislation.

Scope

The assignment is interpreted as follows:

1. Initial preparations:

- Obtain all relevant maps and information on the natural environment of the concerned area.
- This includes information on red data plant and fauna species that may occur in the area.

2. Wetland assessment

- Conclusively identify the presence or absence of wetland conditions as prescribed by the DWAF (2005) delineation guideline;
- Identify the outer edge of the wetland temporary zone;
- Indicate the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the wetland;
- Indicate wetland buffer zones;
- A risk matrix for the wetland adjacent to the site.

3. Do an impact assessment.

Assumptions and Limitations

The mapping was completed using a Garmin Dakota GPS and Google Earth images. It is therefore likely that a mapping error of up to 10m may be present.

The site is covered by more than 2m of infill. The historical boundary of the wetland could therefore not be determined. The current boundary of the wetland was determined using the existing signs of wetness on site.

It is assumed that all attempts will be made to limit the impact of the proposed project to the environment and that the mitigation measures included in this report will be adhered to. Should this not be the case, the risk assessment and buffer requirements will be influenced.

2. RATIONALE

It is widely recognised that it is of utmost importance to conserve natural resources in order to maintain ecological processes and life support systems for plants, animals and humans. To ensure that sustainable development takes place, it is therefore important that the environment is considered before relevant authorities approve any development. This led to legislation protecting the natural environment. The Environmental Conservation Act (Act 73 of 1989), the National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998), the National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004) and the National Water Act 1998 (Act 36 of 1998) ensure the protection of ecological processes, natural systems and natural beauty as well as the preservation of water resources and biotic diversity in the natural environment. It also ensures the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes or products or human activities. A draft list of Threatened Ecosystems was published (Government Gazette 2009) as part of the National Environmental Management Biodiversity Act, 2004. (Act 10 0f 2004). Details of these Threatened Ecosystems have been described by SANBI & DEAT (2009) and a list of Threatened or Protected Species (TOPS) regulations is also available (NEMBA Notice 388 of 2013). International and national Red Data lists have also been produced for various threatened plant and animal taxa.

All components of the ecosystems (physical environment, including water resources, vegetation, animals) of a site are interrelated and interdependent. A holistic approach is therefore imperative to effectively include the development, utilisation and where necessary

conservation of the given natural resources in an integrated development plan, which will address all the needs of the modern human population (Bredenkamp & Brown 2001).

In order to evaluate the vegetation and wetland habitats, it is necessary to make a thorough inventory of these ecosystems on the site. This inventory should then serve as a scientific and ecological basis for the planning exercises.

Definitions and Legal Framework

In a South African legal context, the term watercourse is often used rather than the terms wetland or river. The National Water Act (NWA) (1998) includes wetlands and rivers into the definition of the term watercourse.

Watercourse means:

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

The National Water Act, 1998 (Act 36 of 1998) defines a wetland 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.”

Authoritative legislation that lists impacts and activities on biodiversity and wetlands and riparian areas that requires authorisation includes (Armstrong, 2009):

- National Environmental Management Act, 1998 (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- The older Environment Conservation Act, 1989 (Act 73 of 1989);
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983);
- National Water Act, 1998 (Act 36 of 1998);

- National Forests Act, 1998 (Act 84 of 1998);
- National Environmental Management: Protected Areas Act 2003 (Act 57 Of 2003) (as Amendment Act 31 of 2004 and Amendment Act 15 of 2009)
- Government Notice Regulation 1182 and 1183 of 5 September 1997, as amended (ECA);
- Government Notice Regulation 385, 386 and 387 of 21 April 2006 (NEMA);
- Government Notice Regulation 392, 393, 394 and 396 of 4 May 2007 (NEMA);
- Government Notice Regulation 398 of 24 March 2004 (NEMA); and
- Government Notice Regulation 544, 545 and 546 of 18 June 2010 (NEMA)
- Government Notice Regulation 982, 983, 984 and 985 of 4 December 2014 (NEMA).

In summary:

- Vegetation, Flora and ecosystems are protected by National Environmental Management Act, 1998 (Act No. 107 of 1998) and the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- Wetlands and other watercourses are protected water resources in the National Water Act (NWA), Act 36 of 1998.
- Development or transformation of a watercourse is regarded as a water use, which can only be allowed through an approved Water Use License, irrespective of the condition of the affected watercourse.
- The NWA defines water use in a watercourse specifically related to wetlands and riparian areas as broad impacts that include the following:
    - impeding or diverting the flow of water in a watercourse (Section 21 c); and
    - altering the bed, banks, course or characteristics of a watercourse (Section 21 i);
- A recent DWA stipulation published in Government Gazette No 32805 on 18 December 2009 also require that a Water Use License should be applied for when any wetlands are present within a 500 m radius of water use activities as defined by section 21 (c) and section 21 (i) of the NWA. A Risk Matrix should by compiled for any development within 500 m of a wetland
- Risk assessment for developments that are located within 500 m of the edge of a wetland, in accordance with DWA Notice 509 of 2016 - general authorisation in terms of section 39 of the National Water Act, 1998 (act no. 36 of 1998) for water uses as defined in section 21(c) or section 21(i)]

- Wetlands are also protected in other environmental legislation, such as the National Environmental Management Act (NEMA), Act 107 of 1998. The act lists several activities that require authorisation before they can be implemented.
- NEMA lists various activities that require authorisation, when the activity is located within 32 m or less from the edge of a wetland or other watercourse.

3. STUDY AREA

3.1 Location and the receiving environment

The site is described as occurring on the 291.2 ha of RE of the Farm Soweto 387 IQ. The site is located in Region D of Soweto, Johannesburg. The general area of Region D is already developed as residential and business areas (Figure 1 & Figure 2). The site of approximately 0.8 ha is located near the intersection of Maholwane & Jabavu / Mtshunyana Streets.

The following applies:

- The site falls within a developed town area.
- The site does not fall within a protected area or a conservancy.
- A wetland system is present at the eastern boundary of the site, but within and close to the site area the wetland was covered by rubble filling (to level an adjacent soccer field).
- The site is currently totally transformed and covered by weeds with a small part used as an informal vegetable garden.

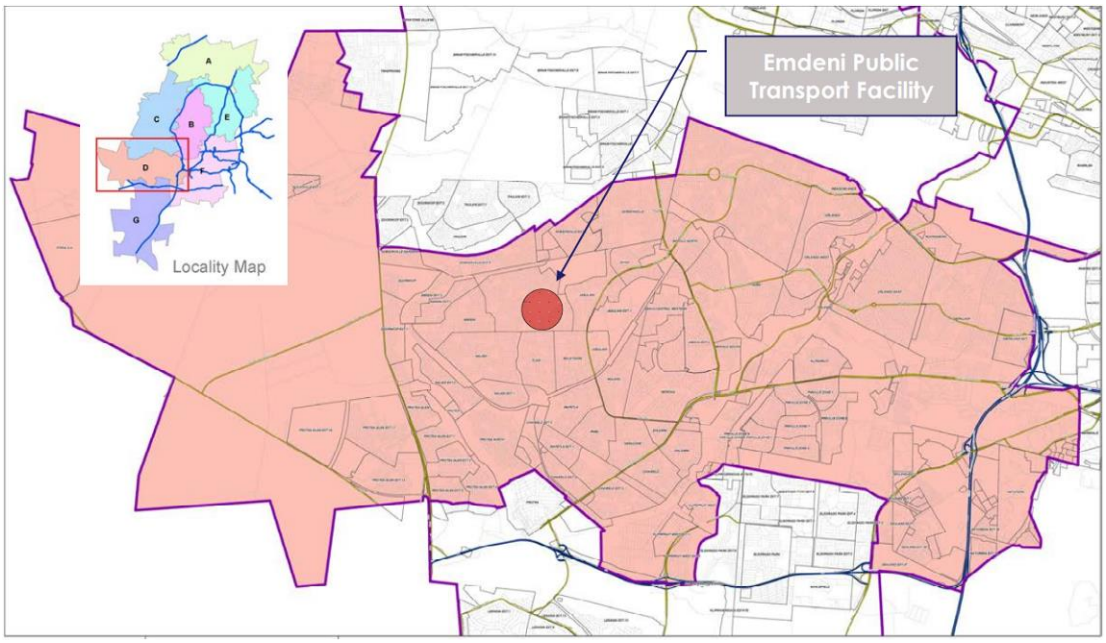


Figure 1: The locality the Emdeni Public Transport Facility (map provided by Pierre Joubert Landscape Architect and Environmental Planner)

Figure 2: The study site indicated on the 1:50 000 topographical map.

3.2 Physical Environment

Regional Climate

Summer rainfall has a mean annual precipitation of 600-700 mm and dry winters with frequent frost. The climate is cool temperate, with extreme differences between summer maximum and winter minimum temperatures.

Geology and soil

Most of the area is underlain by shale sandstone or mudstone of the madzaringe formation of the Karoo Supergroup.

Topography and drainage

The site is located on a slightly east-facing slope within a broad slightly undulating plain. Wetland is present at the eastern boundary of the site. Soils on the specific site are partly covered by rubble filling that was done for the levelling of an adjacent soccer field.

Land-use

The general broader area is residential and small business.

Vegetation Types

The site is in located within the Soweto Highveld Grassland (Gm 8) (Mucina & Rutherford 2006) that is an endangered ecosystem, though the site is totally transformed within the Soweto town, and no original natural vegetation occur here.

4. METHODS

4.1 Initial preparations:

For background information, the relevant maps, aerial photographs and other information on the natural environment of the concerned area were obtained.

4.2 Wetland assessment

Wetland Delineation

Aerial photographs of the site were investigated prior to the site visit. All the wetland areas on site and within 500m of the site were delineated based on the aerial photographs.

The wetlands on site are delineated according to the Department of Water Affairs (DWA) wetland delineation guideline (DWAF 2005). Several wetland indicators are used to delineate the wetland area. The wetland indicators used are the:

- Vegetation indicator;
- Terrain unit indicator;
- Soil wetness indicator.

Present Ecological State

The Present Ecological State (PES) of the wetland were calculated using the WET-Health assessment (Macfarlane *et al* 2009). This assessment evaluates the change from natural to the hydrology, geomorphology and vegetation of the wetland and gives a score for each of these assessments. From this, a PES class is assigned. A summary of the PES classes is attached in Table 1. A combined score of the three can be calculated for the wetland, although this is not recommended. For the purposes of this study, the level 1 assessment were used.

Table 1: PES categories (from Macfarlane et al 2009).

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

Ecological Importance and Sensitivity

A draft Ecological Importance and Sensitivity (EIS) tool has been developed for wetlands by Rountree *et al.* The EIS assessment tool gives a score between 0 and 4, with 0 a very low score and 4 very high. In general, most wetlands have a score between 1 and 2.5. Very disturbed wetlands have a low score. Wetlands with a score higher than 2.5 has some very special and distinctive features and are normally unique wetlands.

Table 2: Classification of the EIS categories based on score.

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

Impact Assessment

The methods and format of the impact tables used in this chapter are in accordance to the requirements of the 2014 Regulations.

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

- The **probability (P)** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

- The **duration (D)**, wherein it will be indicated whether:

  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;

  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;

  - medium-term (5–15 years) – assigned a score of 3;

  - long term (> 15 years) - assigned a score of 4; or

  - permanent - assigned a score of 5;

» The **extent (E)**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):

» The **magnitude (M)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

» the **significance (S)**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, moderate or high;

- the significance rating is calculated by the following formula:

  S (significance) = (D + E + M) x (P)

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed.

» the degree to which the impact may cause irreplaceable loss of resources.

» the *degree* to which the impact can be *mitigated.*

Impacts should be identified for the construction and operational phases of the proposed development. Proposed mitigation measures should be practical and feasible such that they can be realistically implemented by the applicant.

Risk Assessment

A Risk Assessment was conducted for the wetland units on site only. The Risk Assessment took the consequence and likelihood of the impact into consideration to determine the risk. The risk assessment took place according to the DWS protocol (2014b). The risk assessment is completed as per Notice of 509 of 2016 under the Department of Water and Sanitation with regards to General Authorisations for Section 21 (c) and (i) water uses. Scores were allocated as follows:

Consequence:

Consequence = Severity + Spatial scale + duration

Severity:

- Insignificant / non-harmful: 1
- Small / potentially harmful: 2
- Significant / slightly harmful: 3
- Great / harmful: 4
- Disastrous / extremely harmful and/or wetland involved: 5

Spatial scale:

- Area specific: 1
- Whole site: 2
- Regional / neighbouring areas: 3
- National: 4
- Global: 5

Duration:

- One day a month, PES, EIS and REC not impacted: 1
- One month to a year, PES, EIS and REC impacted but no change in status: 2
- One to 10 years, PES, EIS and REC impacted to a lower status but can be improved over this period through mitigation: 3
- Life of the activity, PES, EIS and REC permanently lowered: 4
- More than life of the organisation / facility, PES and EIS scores a E or F: 5

Likelihood:

Likelihood = Frequency of the activity + Frequency of impact + Legal issues + Detection

Frequency of the incident / impact:

- Almost never / almost impossible / >20%: 1
- Very seldom / highly unlikely / >40%: 2
- Infrequent / unlikely / seldom / >60%: 3
- Often / regularly / likely / possible / >80%: 4
- Daily / highly likely / definitely / >100%: 5

Legal issues:

- No legislation: 1
- Fully covered by legislation: 2

Detection:

- Immediately: 1
- Without much effort: 2
- Need some effort: 3
- Remote and difficult to observe: 4
- Covered: 5

Frequency of the activity:

- Annually or less: 1
- 6 Monthly: 2
- Monthly: 3
- Weekly: 4
- Daily: 5

RISK:

The significance of each potential impact was calculated as follows: Risk = Consequence x Likelihood. The significance rating classes should influence the development project as described below (Table 3).

Table 3: Significance rating categories showing values for Low, Medium and High significance

Significance	Rating
Low Environmental Significance	0 - 55
Medium Environmental Significance	56 – 169
High Environmental Significance	170 -300

5. RESULTS: WETLAND ASSESSMENT

5.1 General description of the wetland on the site

The wetland adjacent to the site is a seep wetland, which becomes a channelled valley bottom wetland downstream (Figure 4). The site is located very close to the origin of the wetland and is surrounded by development. It appears that most of the stormwater in the wetland unit catchment enter this wetland unit, which may have resulted in an increase in the wetness of the wetland unit.

Large amounts of soil (approximately 2m) were deposited on site and to the south of the site, thereby altering the soil profile, topography and vegetation cover in this area. Due to the depth of the deposited soil, a normal handheld soil auger could not be used to delineate the historical wetland boundary. Due to all the catchment changes, and the age of the infill, the delineation and assessment of the current extent of the wetland is considered to be sufficient for this assessment. In addition to

the deep infill, shallow infill / sedimentation is present in the wetland adjacent to the site.

5.2 Wetland delineation

During the delineation of the wetland the vegetation, topography and soils in the area were taken into account, as well as disturbances. The delineation indicates the current boundary of the wetland, with existing development and soil infill in place.

Vegetation

Most of the wetland unit is dominated by a monostand of *Typha capensis*, a common wetland plant in the area (Figure 3A). The drier portions of the wetland are dominated by grass and weedy species, including large patches of the alien grasses *Pennisetum clandestinum* (Kikuyu) and *Paspalum dilatatum.* It is expected that the wetland was dominated by grass and sedge species prior to development in the catchment, and that the current species composition is a result of the changes in hydrology, topography and water quality. The vegetation is however a very good indication of wetland conditions in the area and the current boundary of the wetland could be delineated based on the vegetation cover. The historical extent of the wetland could not be determined based on the current vegetation cover.

Table 4: Plant species observed in the wetland unit to the east of the site.

Species	Type of species?	Artificial canal	Existing wetland
Agrostis lachnantha	Obligate wetland		x
Bromus catharticus	Obligate wetland	x	
Cirsium vulgare	Facultative		x
Conyza bonariense	Disturbance	x	
Juncus effusus	Obligate wetland		x
Paspalum dilatatum	Facultative wetland	x	
Pennisetum clandestinum	Disturbance	x	
Phragmites australis	Obligate wetland		x
Plantago lanceolata	Facultative wetland	x	
Rorippa nasturtium-aquaticum	Obligate wetland	x	
Rorippa nudiuscula	Obligate wetland		x
Rumex crispus	Obligate wetland	x	
Trifolium repens	Facultative wetland		x
Typha capensis	Obligate wetland	x	
Vachellia karroo	Facultative terrestrial		x

Verbena rigida	Disturbance		x
Veronica anagallis-aquatica	Obligate wetland	x	

Topography

The topography of the site was significantly altered by deep infill over the entire site (Figure 3B) and extending to the north and south of the site and shallow infill / sedimentation to the east of the site, inside the wetland area. A sports field is present directly to the south of the site and the infill extends to the area south of the sports field as well. The deep infill seems to peter out to the north of the site, but drops abruptly on the eastern border of the site, where a steep incline of approximately 2m is located and the existing wetland area starts at the bottom of the incline. The shallow infill / sedimentation is present in this portion of the wetland. An artificial canal originates at small dam that appears to be a stormwater dam and passes adjacent to this steep drop, to the east of the site. Several other artificial stormwater canals are also present in the rest of the wetland unit, located further away from the site.

Soils

The soil were highly modified by the activities on site and adjacent to site. Deep infill (approximately 2m) is present over the entire site, as well as extensive areas to the south of the site. Although wetland soils are present to the east of the site, outside the deep infill area, this soil has also been disturbed. A clear layer of imported soil is present in the top 20cm of the soil profile and plastic bags and other refuse were encountered up to 40cm depth of the soil profile. The top layer of soil in the soil profile is a red-brown loam sand, similar to the infill, with red and yellow high chroma mottles starting at 10cm depth (Figure 3E). The soil becomes a grey sand with red mottles at 40cm depth (Figure 3F). The grey sand is likely the original wetland soil, but the infill has been in place for a sufficient time to develop mottling as well.

Historical aerial photographs

Historical aerial photographs from 1968 were investigated to determine the possible previous extent of the wetland on site. The aerial photographs are however not of very good quality and the boundaries of the wetland is very unclear. It appears that the wetland may have extended into the site in the past (Figure 6), but this cannot be confirmed.

Figure 3: Photographs illustrating (A) the vegetation in the wetland; (B) the deep infill on site and to the south of the site; (C) the artificial stormwater canal and (D) stormwater dam; (E) the mottling in the shallow imported soil in the wetland and the (F) grey soil with mottling in the wetland unit.

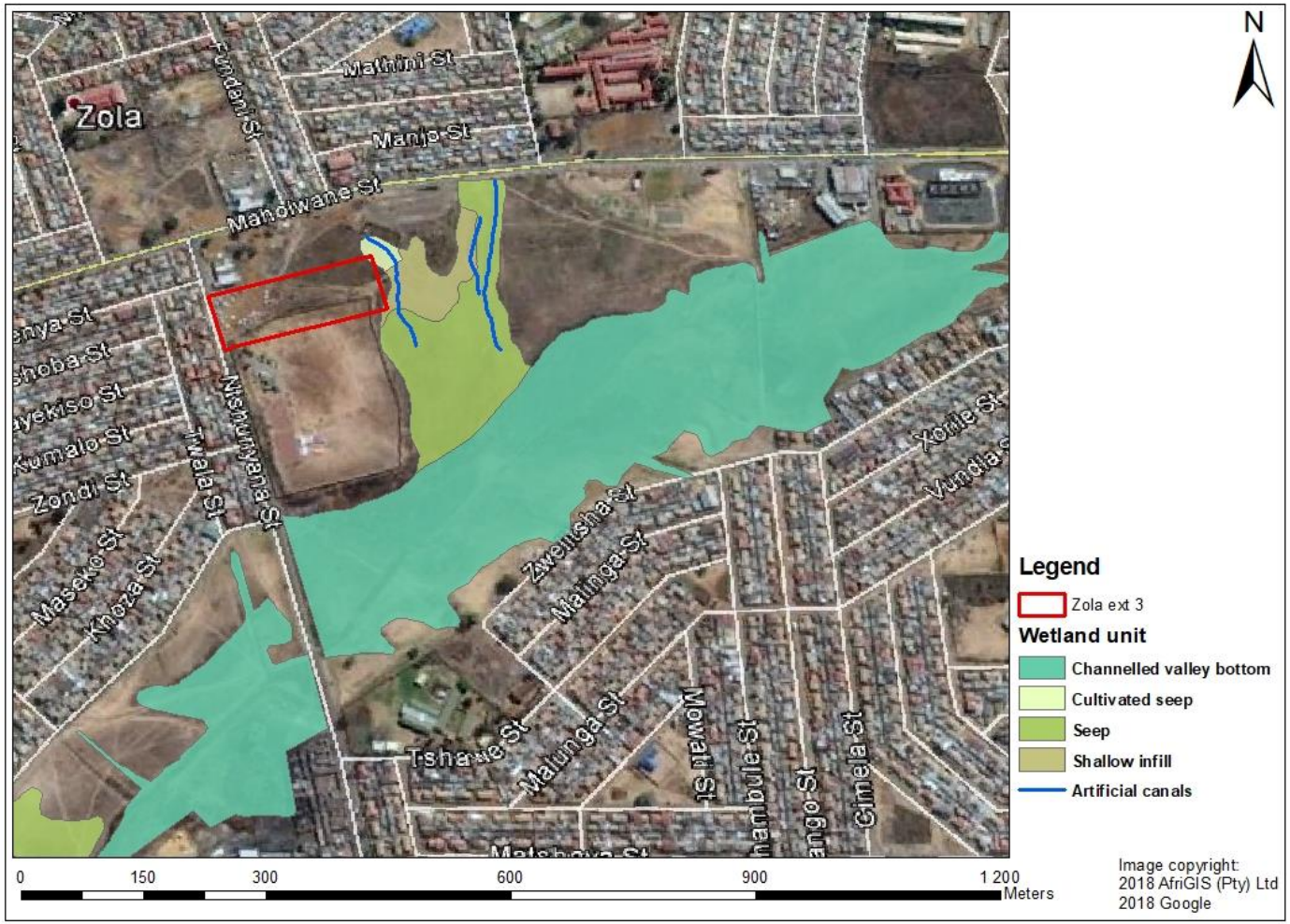


Figure 4: The wetland areas in proximity to the site.

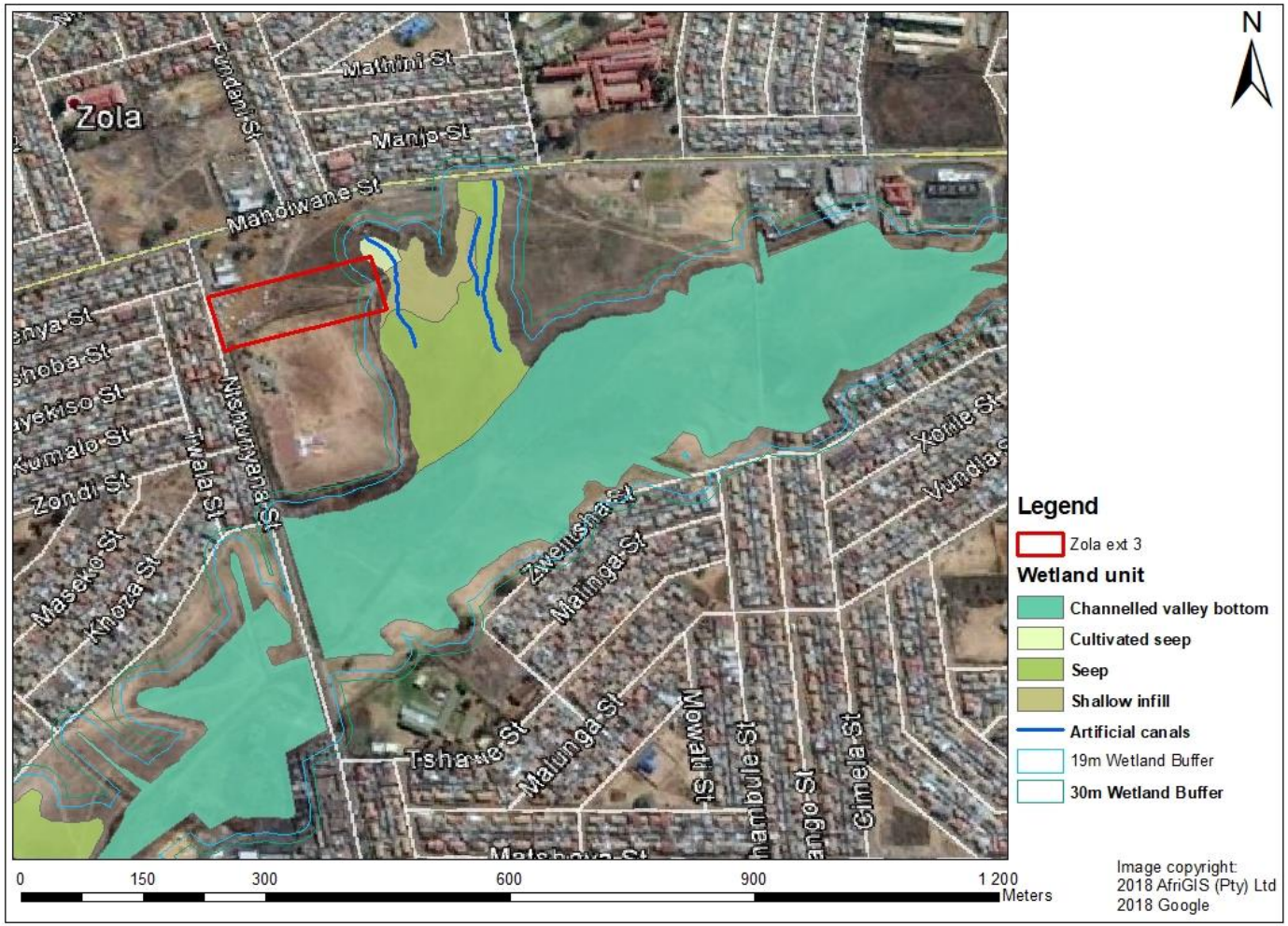


Figure 5: 19m and 30m buffer zones around the wetland areas adjacent to the site.

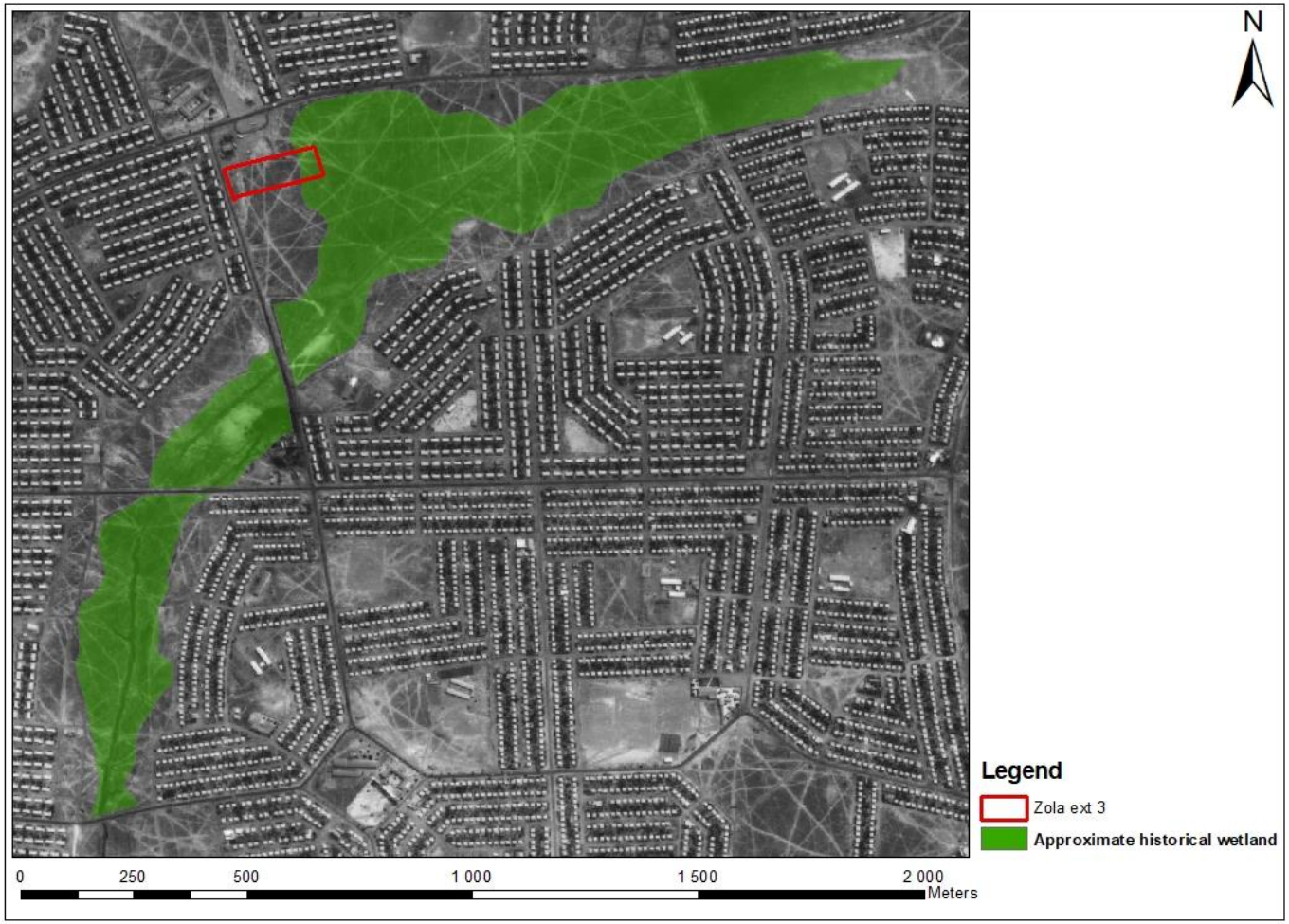


Figure 6: Approximate historical extent of the wetland on an aerial photographs from 1968.

5.5 Present Ecological Status (PES)

This wetland has an overall PES in class C, which is Moderately Modified. The PES score for the hydrology of the wetland is in class D, which is Largely Modified, while the geomorphology is Largely Natural (PES class B) and the vegetation is Moderately Modified. The PES is determined across the historical extent of the wetland, but since this is not know exactly, the PES scores may have some inaccuracies. The scores do however reflect the current status of the wetland fairly accurately.

Hydrology – The hydrology of the wetland is mostly modified by the development surrounding the wetland. The development is fairly dense and the extent of impermeable surfaces in the catchment were increased significantly. The stormwater drains from the development enters the wetland, where it resulted in artificial canals in the wetland (Figure 3C).

Geomorphology – This is likely the least accurate of the PES scores since the method does not adequately reflect the impact extent of the infill on the wetland. It is however clear that the significant increase in runoff and the erosion features in the wetland has an impact on geomorphology of the wetland.

Vegetation – Portions of the wetland vegetation has been lost due to the infill, while other portions has been infested by alien and invasive plant species. It is possible that the vegetation in the majority of the wetland has been altered from grass/sedge dominated to dominated by *Typha capensis*, since this is the type of vegetation expected in this type of wetland, when not surrounded by development.

5.6 Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity of the wetland is Low (Table 5), indicating that the wetland is not considered to be of ecological importance and is unlikely to be affected by changes in the hydrology and flow of the wetland. This is due to the existing alteration and impacts to the wetland unit on site.

Table 5: EIS scores of the wetland unit.

Aspect	Score	Significance
Ecological Importance and Sensitivity	0.8	Low
Hydro-functional Importance	1.0	Low
Direct Human Benefits	0.5	Low

5.7 Buffer Zones

A buffer zone is intended as an area to mitigate the impact of the development on sensitive features on site. Several buffer sizes are recommended for wetland units is the various provinces, with a 30m buffer specified for wetlands within the urban edge in Gauteng. In addition, the buffer zone tool was used to determine the buffer zone for the site (Macfarlane *et al* 2014). According to the buffer tool, a combined buffer 19m if required for the wetland unit on site. The 30m buffer required by GDARD is therefore considered to be sufficient on site. No buffer requirements are indicated in the hydropedological assessment for the site. A 19m buffer zone is therefore considered to be sufficient on site (Figure 5).

Due to constraints in space and available property, the proposed development extends into the wetland buffer and the corner of the attenuation pond encroach into the edge of the wetland. The portions of the development encroaching into the buffer area is a very small portion of the parking lot and the attenuation pond. These impacts must be mitigated.

6. IMPACT ASSESSMENT

The development will take place on the existing infill on site, a portion of which is already used as an informal taxi rank. Two alternatives are assessed. For the preferred alternative the entire development and attenuation ponds are located outside the 30m wetland buffer. For the second alternative, majority of the development is located outside the wetland buffer, but the stormwater attenuation ponds are located inside the wetland buffer and construction will take place up to the edge of the wetland. Please refer to Section 7 below for more information.

6.1 Impacts on the wetland habitat, species composition and functions (Preferred alternative)

Nature: The loss of wetland habitat and functions due to the development of a taxi rank on site. The wetland adjacent to the site is the most altered of all the habitat units and largely dominated by alien species, mainly Kikuyu (*Pennisetum clandestinum*).				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Improbable	2	Improbable	2
Duration	Short term	1	Short term	1
Extent	Local	1	Local	1
Magnitude	Slight	4	Slight	4
Significance	**Low significance**	**12**	**Low significance**	**12**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Permanent	5	Permanent	5
Extent	Local	1	Local	1
Magnitude	No impact	0	No impact	0
Significance	**Low significance**	**12**	**Low significance**	**6**
Status (positive or negative)	Negative		Negative	
Reversibility	N/A		N/A	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			
Mitigation: *Refer to the mitigation measures in Section 8 below.*				
Cumulative impacts: Expected that little accumulative effects will occur at the				

wetland.
Residual Risks: None is anticipated provided that the mitigation measures are implemented correctly.

6.2 Impacts due to sedimentation and erosion (Preferred alternative)

Nature: The loss of wetland habitat due to sedimentation and erosion. Sedimentation and erosion are a risk on site in the absence of a sufficient stormwater plan, but can be mitigated with an appropriate management plan (as provided).				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Improbable	2
Duration	Short term	1	Short term	1
Extent	Local	1	Local	1
Magnitude	Slight	4	Slight	4
Significance	**Moderate significance**	**18**	**Low significance**	**12**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Permanent	5	Long term	4
Extent	Local	1	Local	1
Magnitude	No impact	0	No impact	0
Significance	**Low significance**	**12**	**Low significance**	**5**
Status (positive or negative)	Negative		Positive	
Reversibility	N/A		N/A	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			
Mitigation: *Refer to the mitigation measures in Section 8 below.*				
Cumulative impacts: Expected that little accumulative effects will occur at the wetland, as the impacts are not expected to be significantly different to the current impacts on site.				
Residual Risks: None is anticipated provided that the mitigation measures are implemented correctly.				

6.1 Impacts on the wetland habitat, species composition and functions (alternative 2)

Nature: The loss of wetland habitat and functions due to the development of a taxi rank on site. The wetland adjacent to the site is the most altered of all the habitat units and largely dominated by alien species, mainly Kikuyu (*Pennisetum clandestinum*).				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Improbable	2	Improbable	2
Duration	Short term	1	Short term	1
Extent	Local	1	Local	1
Magnitude	Slight	4	Slight	4
Significance	**Low significance**	**12**	**Low significance**	**12**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Permanent	5	Permanent	5
Extent	Local	1	Local	1
Magnitude	No impact	0	No impact	0
Significance	**Low significance**	**12**	**Low significance**	**6**
Status (positive or negative)	Negative		Negative	
Reversibility	N/A		N/A	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			
Mitigation: *Refer to the mitigation measures in Section 8 below.*				
Cumulative impacts: Expected that little accumulative effects will occur at the wetland.				
Residual Risks: None is anticipated provided that the mitigation measures are implemented correctly.				

6.2 Impacts due to sedimentation and erosion (alternative 2)

Nature: The loss of wetland habitat due to sedimentation and erosion. Sedimentation and erosion is a risk on site in the absence of a sufficient stormwater plan, but can be mitigated with an appropriate management plan.				
	Without mitigation		**With mitigation**	
CONSTRUCTION PHASE				
Probability	Probable	3	Improbable	2

Duration	Short term	1	Short term	1
Extent	Local	1	Local	1
Magnitude	Slight	4	Slight	4
Significance	**Moderate significance**	**18**	**Low significance**	**12**
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	Improbable	2	Very improbable	1
Duration	Permanent	5	Long term	4
Extent	Local	1	Local	1
Magnitude	No impact	0	No impact	0
Significance	**Low significance**	**12**	**Low significance**	**5**
Status (positive or negative)	Negative		Positive	
Reversibility	N/A		N/A	
Irreplaceable loss of resources?	No		No	
Can impacts be mitigated?	Yes			
Mitigation: *Refer to the mitigation measures in Section 8 below.*				
Cumulative impacts: Expected that little accumulative effects will occur at the wetland, as the impacts are not expected to be significantly different to the current impacts on site.				
Residual Risks: None is anticipated provided that the mitigation measures are implemented correctly.				

7. RISK MATRIX

This development is mainly proposed to be located on the existing infill adjacent to the existing wetland area. For the proposed preferred alternative the entire development is located outside the wetland buffer. For Alternative 2 the stormwater system and proposed attenuation ponds are located in the wetland buffer and will encroach into the edge of the wetland area (Figure 7 and Figure 8).

Table 6: Wetland risk assessment table for the preferred alternative.

Phase	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
				Flow Regime	Physico & Chemical	Habitat	Biota													
Construction	Site clearing	Vegetation clearing	Loss of wetland habitat and functions	1	1	2	2	1.5	1	1	3.5	2	1	5	1	9	32	L	70	Refer to the mitigation measures included in this report
		Erosion		1	2	2	2	1.8	1	1	3.8	2	2	5	2	11	41	L	75	
		Sedimentation		2	3	2	2	2.3	1	1	4.3	2	2	5	2	11	47	L	75	
		Soil compaction		2	2	2	1	1.8	1	1	3.8	3	3	5	2	13	49	L	70	
		Encroachment of invasive species		1	1	2	2	1.5	2	1	4.5	2	2	5	2	11	50	L	80	
Construction	Construction camp	Littering	Pollution of the wetland units	1	2	2	2	1.8	2	1	4.8	2	2	5	1	**10**	**48**	L	85	Refer to the mitigation measures included in this report
		Biological waste		1	2	1	2	1.5	2	1	4.5	2	2	5	2	**11**	**50**	L	70	
		Spillage of hydrocarbons		1	2	1	2	1.5	2	2	5.5	2	2	5	1	**10**	**55**	L	75	

Phase	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
				Flow Regime	Physico & Chemical	Habitat	Biota													
Construction	Stormwater management	Erosion	Loss of wetland habitat and functions	2	3	2	2	1	2	2	5	2	1	5	1	**9**	**45**	**L**	75	Refer to the mitigation measures included in this report
		Sedimentation		2	3	2	2	2.3	2	1	5.3	2	2	5	1	**10**	**53**	**L**	75	
		Change in hydrology of the wetland		3	3	2	2	2	2	2	6	2	1	5	1	**9**	**54**	**L**	70	
		Geomorphology alteration		2	1	2	2	1.8	2	2	5.8	1	1	5	1	**8**	**46**	**L**	70	
		Vegetation change		1	1	2	2	1.5	2	2	5.5	1	1	5	1	**8**	**44**	**L**	80	
Operational	Stormwater management	Erosion	Loss of wetland habitat and functions	2	1	2	1	1.5	2	2	5.5	2	2	5	1	**10**	**55**	**L**	80	Refer to the mitigation measures included in this report
		Sedimentation		1	2	2	1	1.5	2	2	5.5	2	1	5	1	**9**	**50**	**L**	80	
		Change in hydrology of the wetland		2	1	2	1	1.5	2	2	5.5	2	2	5	1	**10**	**55**	**L**	75	
		Geomorphology alteration		2	1	2	2	1.8	2	2	5.8	2	1	5	1	**9**	**52**	**L**	75	
		Vegetation change		2	1	2	2	1.8	2	2	5.8	2	1	5	1	**9**	**52**	**L**	75	
Operational	Management of open spaces	Infestation by alien and invasive species	Loss of wetland habitat and functions	1	1	2	2	1.5	2	2	5.5	2	2	5	1	**10**	**55**	**L**	70	Refer to the mitigation measures included in this report
		Alteration in species composition		1	1	2	2	1.5	2	1	4.5	1	1	5	1	**8**	**36**	**L**	75	
		Trampling and unauthorised vehicle access		1	1	2	2	1.5	1	1	3.5	1	1	5	1	**8**	**28**	**L**	80	

Table 7: Wetland risk assessment table for Alternative 2.

Phase	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes
				Flow Regime	Physico & Chemical	Habitat	Biota														
Construction	Site clearing	Vegetation clearing	Loss of wetland habitat and functions	5	5	5	5	5	1	1	7	2	1	5	1	9	63	M	70	Refer to the mitigation measures included in this report	L
		Erosion		5	5	5	5	5	1	1	7	2	2	5	2	11	77	M	75		L
		Sedimentation		3	5	5	5	4.5	1	1	6.5	2	2	5	2	11	72	M	75		L
		Soil compaction		2	2	2	1	1.8	1	1	3.8	3	3	5	2	13	49	L	70		
		Encroachment of invasive species		1	1	2	2	1.5	2	1	4.5	2	2	5	2	11	50	L	80		
Construction	Construction camp	Littering	Pollution of the wetland units	1	2	2	2	1.8	2	1	4.8	2	2	5	1	**10**	**48**	L	85	Refer to the mitigation measures included in this report	
		Biological waste		1	2	1	2	1.5	2	1	4.5	2	2	5	2	**11**	**50**	L	70		
		Spillage of hydrocarbons		1	2	1	2	1.5	2	2	5.5	2	2	5	1	**10**	**55**	L	75		
Construction	Stormwater management	Erosion	Loss of wetland habitat and functions	4	4	4	4	4	2	2	8	2	2	5	1	**10**	**80**	M	75	Refer to the mitigation measures included in this report	L
		Sedimentation		4	4	2	2	3	2	2	7	2	2	5	1	**10**	**70**	M	75		L
		Change in hydrology of the wetland		5	5	2	2	3.5	2	2	7.5	2	2	5	1	**10**	**75**	M	70		L
		Geomorphology alteration		5	5	5	5	5	2	2	9	1	1	5	1	**8**	**72**	M	70		L
		Vegetation change		5	5	5	1	4	2	2	8	1	1	5	1	**8**	**64**	M	80		L

Phase	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes
				Flow Regime	Physico & Chemical	Habitat	Biota														
Operational	Stormwater management	Erosion	Loss of wetland habitat and functions	2	1	2	1	1.5	2	2	5.5	2	2	5	1	**10**	**55**	**L**	80	Refer to the mitigation measures included in this report	
		Sedimentation		1	2	2	1	1.5	2	2	5.5	2	1	5	1	**9**	**50**	**L**	80		
		Change in hydrology of the wetland		2	1	2	1	1.5	2	2	5.5	2	2	5	1	**10**	**55**	**L**	75		
		Geomorphology alteration		2	1	2	2	1.8	2	2	5.8	2	1	5	1	**9**	**52**	**L**	75		
		Vegetation change		2	1	2	2	1.8	2	2	5.8	2	1	5	1	**9**	**52**	**L**	75		
Operational	Management of open spaces	Infestation by alien and invasive species	Loss of wetland habitat and functions	1	1	2	2	1.5	2	2	5.5	2	2	5	1	**10**	**55**	**L**	70	Refer to the mitigation measures included in this report	
		Alteration in species composition		1	1	2	2	1.5	2	1	4.5	1	1	5	1	**8**	**36**	**L**	75		
		Trampling and unauthorised vehicle access		1	1	2	2	1.5	1	1	3.5	1	1	5	1	**8**	**28**	**L**	80		

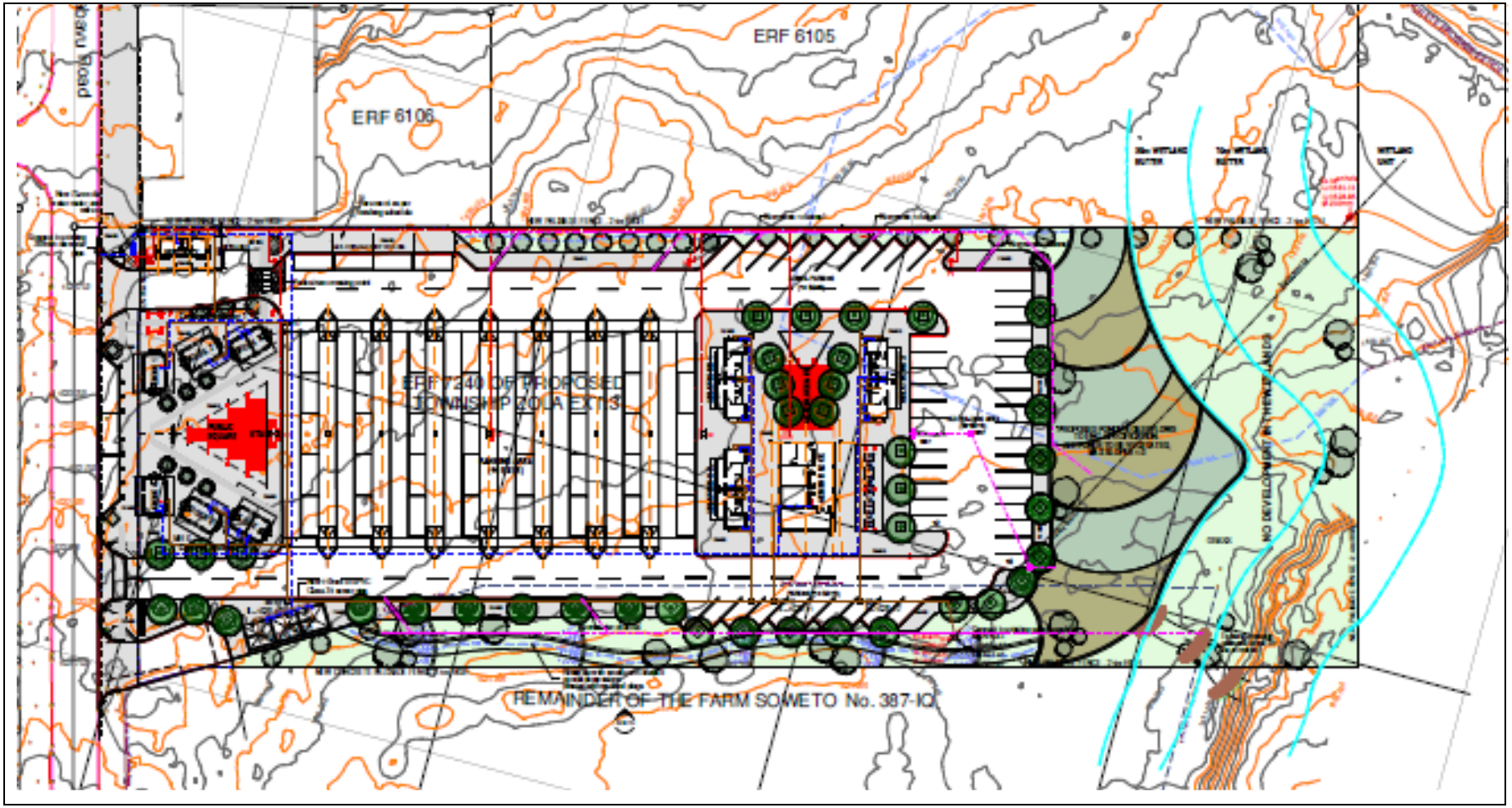


Figure 7: Preferred layout with the wetland area and buffers indicated.

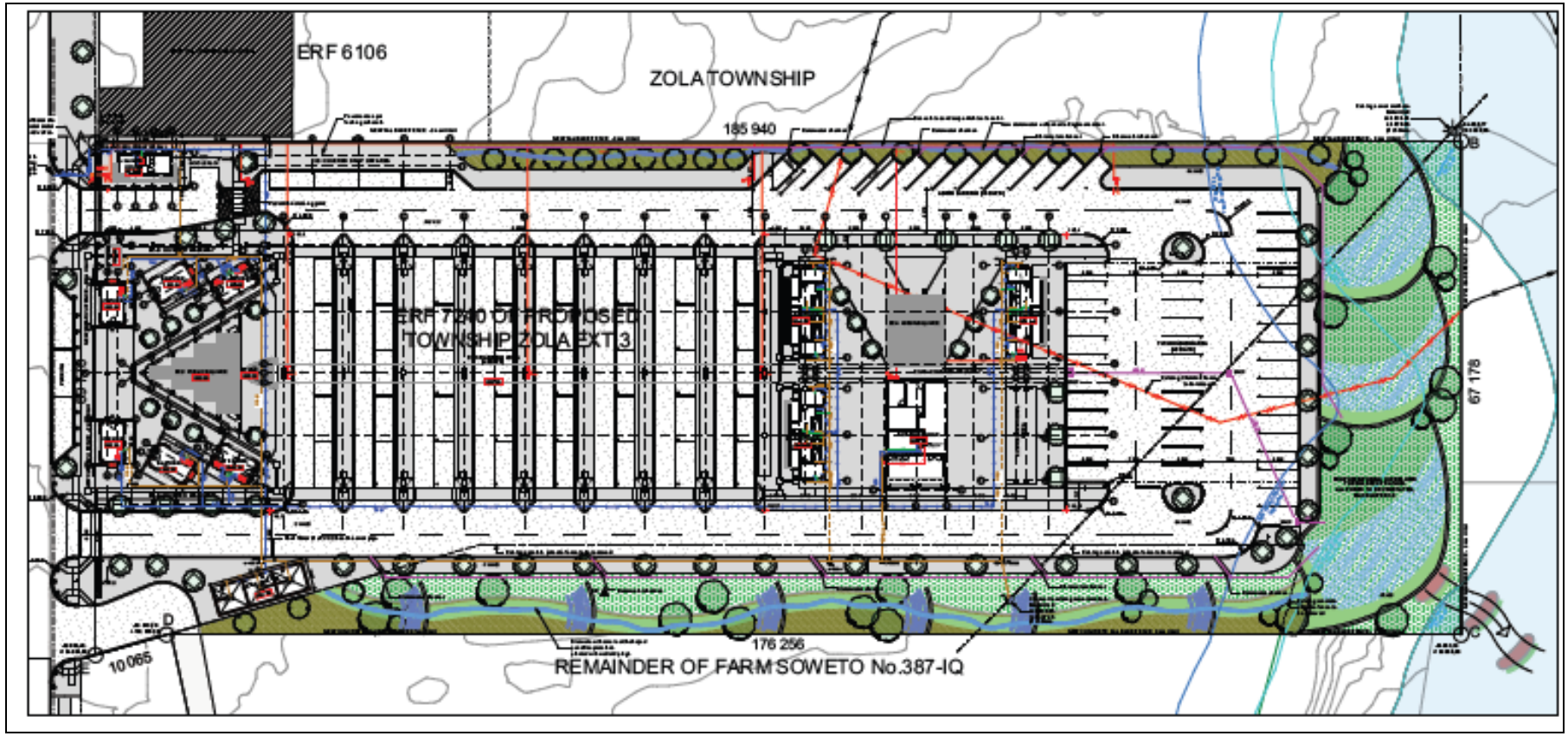


Figure 8: Alternative 2 layout with landscaped stormwater systems and wetland buffer zones.

7.1 Damage to the wetland habitat on site and downstream of the site

7.1.1 Loss of indigenous plant species, wetland habitat and habitat for species of conservation importance

Proposed alternative

This alternative is located on deep infill adjacent to the wetland unit. The area is very disturbed and the vegetation is altered. The alien species *Pennisetum clandestinum* (Kikuyu) is the dominant species in the wetland unit. The proposed development is therefore unlikely to result in a loss or alteration of the wetland unit.

Alternative 2

Several actions related to construction activities may result in a loss of wetland habitat and functioning, including construction activities within wetlands, vehicle movement and roads through wetland areas, dumping and temporary storage of materials in wetlands, clearing of vegetation and removal of soil.

Alterations to the hydrology and geomorphology of the wetland and wetland catchment may result in changes to the wetland habitat and species composition as well. This includes increased areas bare of vegetation and sealed surfaces, resulting in increased runoff from the catchment area. The runoff from the development must be controlled in a sufficient stormwater management plan for the site, or it may result in a slight increase in the erosion and sedimentation in the wetland. This is of particular importance during the construction phase.

The proposed stormwater attenuation ponds are located inside the 19m wetland buffer and is present almost up to the edge of the wetland. Due to the location of the proposed stormwater attenuation ponds the construction impacts have a medium risk. The portion of the wetland located adjacent to the site is however the most degraded portion of the wetland and approximately 40cm of imported sediment is present across most of this wetland unit. In addition, the construction impacts will be a short-term impact, whereas the installation of the proposed stormwater attenuation system will result in an overall improvement to the site. The assessed risk during the construction phase has therefore been lowered to a low risk, as per professional

opinion. This has been lowered in consultation with a second wetland specialist and the aquatic specialist.

Mitigation:

- The wetland and open space area must be clearly demarcated on site, preferably with a fence. No construction activities may take place in these areas, including the temporary storage of materials, location of the construction camp and location of temporary ablution facilities.
- No vehicle movement or clearing of vegetation may take place in these areas.
- Construction must take place in the winter season, when rainfall on site is unlikely.
- All mitigation measures included in this report must be adhered to, including the recommendations with regard to stormwater management and to control erosion and sedimentation.
- Adhere to all requirements and recommendations included in the ecological stormwater and rehabilitation plan compiled for the site by Habitat Landscape Architects.
- Include soft structures in the design of the stormwater system.
- Use permeable surfaces wherever possible.
- Securely fence the site to prevent trampling of the wetland area by persons trying to take short-cuts to the site. The only access point must be from the road.
- For alternative 2: The long-term weather prediction for the site must be consulted for the site prior to the commencement of construction of the stormwater system in the wetland buffer. Do not proceed if there is a likelihood of rain.

7.1.2 Infestation by invasive plant species

Invasive plant species tend to establish in and around disturbed areas. A few alien and invasive species were observed on site during the site visit. These species may become established in disturbed areas on site and several other species may also be present. Several invasive species may become established on site during the construction or operational phases of the project. These species are most likely to become established in areas disturbed areas.

Mitigation:

- Compile an alien and invasive species control and monitoring plan.
- Populations of invasive species on site must be controlled, during the construction and operational phases.
- The spread of invasive and weedy species from the site must be prevented.

- Several alien and invasive species resemble indigenous species, especially as seedlings. Care must be taken not to control indigenous species during the control of invasive species.

7.1.3 Erosion & sedimentation

Clearing of vegetation from the site and increased runoff on site may result in a slight increase in the erosion on site and in the downstream wetland areas. This may potentially cause damage to the wetland systems on site and downstream of the site. An increased sediment load in the water on site may result in excess sedimentation in downstream areas or in depression wetlands.

Preferred alternative

This alternative is unlikely to have an adverse impact on the wetland unit. The mitigation measures included in this report must however be adhered to, to ensure the potential erosion and sedimentation impact is minimised.

Alternative 2

The portions of the project located outside the wetland buffer is unlikely to have an adverse impact. The attenuation pond for the site is however located on the edge of the wetland, and completely inside the wetland buffer. The attenuation pond will attenuate flow entering the wetland, but the construction of the attenuation pond may result in damages to the wetland, including some erosion and sedimentation in the wetland. Since no buffer is present between the attenuation pond and the wetland, the impacts will affect the wetland directly.

Mitigation:

- Stabilise and revegetate all areas bare of vegetation as soon as possible.
- Monitor the entire site for signs of erosion throughout the construction and operational phases of the project.
- Monitoring during the operation phases may take place as part of the inspection and maintenance of stormwater system.
- All erosion features must be rehabilitated as soon as possible.
- Implement erosion control measures where necessary.
- Implement an erosion control fence / berm along the edge of the wetland unit to prevent sedimentation entering the wetland area.
- No construction vehicles may pass the erosion fence.
- Implement sediment fences around all other erosion prone areas.

- Adhere to all requirements and recommendations included in the ecological stormwater and rehabilitation plan compiled for the site by Habitat Landscape Architects.

7.2 Stormwater management

7.2.1 Construction Phase

The increase of impermeable surfaces on site, with the associated increase in runoff from the site may result in a slight alteration to the hydrology and geomorphology of the site. Increased flow may result in erosion in the wetland or wetland catchment, with associated sedimentation in the downstream wetland areas. The areas cleared of vegetation is also more likely to be eroded until the stormwater system is in place and stabilised.

Preferred alternative

The potential of erosion and sedimentation affecting the wetland unit is smaller for this alternative than for Alternative 2, due to the buffer area around the wetland.

Alternative 2

The potential for erosion and sedimentation is especially true of the attenuation pond located on the edge of the wetland. There is no buffer between the wetland and the attenuation pond. The construction activities are highly likely to cause damage to the wetland unit. Sedimentation is highly likely to take place in the wetland.

Mitigation:

- Construction must take place during the winter season to limit the risk of erosion on site and sedimentation in the wetland.
- Ensure that no sediment-laden stormwater enter the wetlands directly.
- Stabilise and revegetate all areas bare of vegetation as soon as possible.
- Monitor the entire site for signs of erosion throughout the construction and operational phases of the project. This may take place as part of the regular inspections for maintenance on site.
- All erosion features must be rehabilitated as soon as possible.
- Implement erosion control measures where necessary.
- Implement sediment fences around erosion prone areas.

7.2.2 Operation Phase

Development on site results in a significant increase in sealed surfaces in the wetland catchment. This will in turn result in increased runoff, which increase the risk of erosion and sedimentation on site and in the wetland units.

Mitigation:

- Adhere to all requirements and recommendations included in the ecological stormwater and rehabilitation plan compiled for the site by Habitat Landscape Architects.
- Storm water may not enter the watercourses directly, it must be attenuated before exiting the storm water system.

7.3 Construction camp and prevention of pollution of the water resources

The most likely source of contaminants associated with the project is the possibility of sewage entering the wetland system. Ablution facilities at the taxi rank is strongly advised for the operational phase of the project. Additional potential sources of pollution include littering and the spillage of petrochemicals.

General mitigation:

- The construction camp and all associated facilities must be located outside the wetland and wetland buffer and outside all designated open space areas.
- Adhere to all other mitigation measures in this report.

Mitigation for littering:

- Sufficient rubbish bins must be provided on site and cleared on a regular basis.
- Rubbish must be disposed of at a registered landfill.
- Rubbish may not be dumped on site or allowed to spread from the rubbish bins on site.

Mitigation for pollution by petrochemicals:

- Refuelling and maintenance must preferably take place off-site.
- Refuelling may only take place at a registered fuel depot.
- The vehicles must be inspected for oil leaks etc. regularly and any observed leaks must be repaired as soon as possible.
- Any spillages of hydrocarbon fuels must be cleaned up immediately.
- All regulations etc. included in the waste act must be adhered to.

Mitigation for temporary ablution facilities:

- The wetland and wetland buffer zone must be clearly demarcated on site and no construction activities may take place in these areas, including the temporary storage of materials and location of temporary ablution facilities.
- Sufficient temporary ablution facilities must be provided for the workers during the construction phase.
- Any portable toilets must be cleaned regularly to prevent overflow and spillages.

8. CONCLUSION

It is important to note that all rivers and wetlands in South Africa are considered to be ecological sensitive systems and enjoy legal protection (National Water Act 1998, National Environmental Management Act, 1998).

A wetland is present to the east of the site and receives stormwater from the surrounding development. The site is covered by deep infill and the historical extent of the wetland is therefore unknown.

The preferred alternative takes place outside the wetland unit and its buffer zone. If the mitigations measures included in this report is adhered to and the stormwater plan is implemented no negative impacts are anticipated and the PES class of the wetland will remain the same. This development is supported.

For Alternative 2, the proposed taxi rank is located outside the wetland unit, but the proposed storm water attenuation system and a very small portion of the parking is located in the buffer zone for the wetland. The wetland risk is low during the operational phase of the project and the attenuation system may even result in a positive impact, but the risk during the construction phase is moderate, which has been decreased to low in the opinion of the specialist. The construction activities will take place up to the edge of the wetland without a buffer area to mitigate the impact. The construction impact will however be a short-term impact, which will be mitigated by the rehabilitation and stormwater attenuation plan. It is however of great importance that the construction activities take place in the winter season when rainfall is unlikely. This is unlikely to affect the PES class of the wetland.

The proposed taxi rank will not affect the PES class of the wetland. The development on site is supported.

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and

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The National Environment Management Act, 1998 (Act No. 107 of 1998) and Regulations 982-985, Government Gazette 38282, December 2014, (EIA Regulations)

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ABRIDGED CURRICULUM VITAE: GEORGE JOHANNES BREDENKAMP

Born: 10 February 1946 in Johannesburg, South Africa.

Citizenship: South African

Marital status: Married, 1 son, 2 daughters

Present work address

Department of Botany, University of Pretoria, Pretoria, 0002, South Africa

Tel:(27)(12)420-3121 Fax: (27)(12)362 5099

E-Mail: gbredenk@postino.up.ac.za

or

EcoAgent CC

PO Box 25533, Monument Park, 0105, South Africa

Tel and Fax: (27)(12) 346 3180

Cell 082 5767046

E-Mail: george@ecoagent.co.za

Qualifications:

1963 Matriculation Certificate, Kemptonpark High School

1967 B.Sc. University of Pretoria, Botany and Zoology as majors,

1968 B.Sc. Hons. (cum laude) University of Pretoria, Botany.

1969 T.H.E.D. (cum laude) Pretoria Teachers Training College.

1975 M.Sc. University of Pretoria, Plant Ecology .

1982 D.Sc. (Ph.D.) University of Pretoria, Plant Ecology.

Theses: (M.Sc. and D.Sc.) on plant community ecology and wildlife management in nature reserves in South African grassland and savanna.

Professional titles:

- MSAIE South African Institute of Ecologists and Environmental Scientists
  - 1989-1990 Council member
- MGSSA Grassland Society of Southern Africa
  - 1986 Elected as Sub-editor for the Journal

- 1986-1989 Serve on the Editorial Board of the Journal
- - 1990 Organising Committee: International Conference: Meeting Rangeland challenges in Southern Africa
- 1993 Elected as professional member

• PrSciNat. South African Council for Natural Scientific Professions **Registration Number 400086/83**

- 1993-1997 **Chairman** of the Professional Advisory Committee: Botanical Sciences
- 1993-1997: **Council** Member
- 1992-1994: Publicity Committee
- 1994-1997: Professional Registration Committee

Professional career:

- Teacher in Biology 1970-1973 in Transvaal Schools
- Lecturer and senior lecturer in Botany 1974-1983 at University of the North
- Associate professor in Plant Ecology 1984-1988 at Potchefstroom University for CHE
- Professor in Plant Ecology 1988-2008 at University of Pretoria.
- 2009 – current Professor Extra-ordinary in the Dept of Plant Science, University of Pretoria
- • Founder and owner of the Professional Ecological Consultancy firms Ecotrust Environmental Services CC and Eco-Agent CC, 1988-present.

Academic career:

• Students:

- Completed post graduate students: M.Sc. 53; Ph.D. 14.
- Presently enrolled post-graduate students: M.Sc. 4; Ph.D. 2.

• Author of:

- 175 scientific papers in refereed journals
- >150 papers at national and international congresses
- >250 scientific (unpublished) reports on environment and natural resources
- 17 popular scientific papers.
- 39 contributions in books

• Editorial Committee of

- South African Journal of Botany,

- Journal Grassland Society of Southern Africa,
- Bulletin of the South African Institute of Ecologists.
- Journal of Applied Vegetation Science.(Sweden)
- Phytocoenologia (Germany)
-

• FRD evaluation category: C2 (=leader in South Africa in the field of Vegetation Science/Plant Ecology)

Membership:

• International Association of Vegetation Science.
• British Ecological Society
• International Society for Ecology (Intecol)
• Association for the Taxonomic study of the Flora of Tropical Africa (AETFAT).
• South African Association of Botanists (SAAB)

1988-1993 Elected to the **Council** of SAAB.
1989-1990 Elected as **Chairman** of the Northern Transvaal Branch
1990 Elected to the Executive Council as **Vice-President**
1990- Sub-editor Editorial Board of the Journal
1991-1992 Elected as **President** (2-year period)
1993 **Vice-President** and Outgoing President

• Wildlife Management Society of Southern Africa
• Suid-Afrikaanse Akademie vir Wetenskap en Kuns
(=South African Academy for Science and Art).
• Wildlife Society of Southern Africa

1975 - 1988: Member
1975 - 1983: Committee member, Pietersburg Centre
1981 - 1982: **Chairman**, Pietersburg Centre

• Dendrological Society of Southern Africa

1984 - present: Member
1984 - 1988: Committee member, Western Transvaal Branch
1986 - 1988: **Chairman**, Western Transvaal Branch
1987 - 1989: Member, Central Committee (National level)
1990 - 2000: Examination Committee

• Succulent Society of South Africa

1987 - 2000

• Botanical Society of South Africa

2000 – present: Member

2001- 2008: Chairman, Pretoria Branch

2002 – 2006: Chairman, Northern Region Conservation Committee

2002- 2007: Member of Council

Special committees:

• Member of 10 special committees re ecology, botany, rangeland science in South Africa.

• Member of the International Code for Syntaxonomical Nomenclature 1993-present.

Merit awards and research grants:

1968 Post graduate merit bursary, CSIR, Pretoria.

1977-1979 Research Grant, Committee re Research Development, Dept. of Co-operation and Development, Pretoria.

1984-1989 Research Grant, Foundation for Research Development, CSIR, Pretoria.

1986-1987 Research Grant, Dept. of Agriculture and Water Supply, Potchefstroom.

1990-1997 Research Grant, Dept. of Environmental Affairs & Tourism, Pretoria.

1991-present Research Grant, National Research Foundation , Pretoria.

1991-1993 Research Grant, Water Research Commission.

1999-2003 Research Grant, Water Research Commission.

2006 South African Association of Botanists Silver Medal for outstanding contributions to South African Botany

Abroad:

1986 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom

Visits to Israel, Italy, Germany, United Kingdom, Portugal.

1987 Travel Grant, Potchefstroom University for Christian Higher Education, Potchefstroom.

Visits to Germany, Switzerland, Austria, The Netherlands, United Kingdom.

1990 Travel Grant, FRD.

Visit to Japan, Taiwan, Hong-Kong.

1991 Travel Grant, FRD.

Visits to Italy, Germany. Switzerland, Austria, France, The Netherlands, United Kingdom.

1993 Travel Grant, University of Pretoria.

Visits to the USA, Costa Rica, Czech Republic, Austria.

1994 Travel Grant FRD.

Visits to Switzerland, The Netherlands, Germany, Czech Republic.

1995 Travel Grant FRD, University of Pretoria
Visits to the USA

1996 Travel Grant, University of Pretoria
Visit to the UK.

1997 Travel Grant University of Pretoria, Visit Czech Republic, Bulgaria

1998 Travel Grant, University of Pretoria, Visit Czech Republic, Italy, Sweden

1999 Travel Grant, University of Pretoria, Visit Hungary, Spain, USA

2000 Travel Grant, University of Pretoria, Visit Poland, Italy, Greece.

2001 Travel Grant, NRF, Visit Brazil

2006 German Grant Invited lecture in Rinteln, Germany

Consultant

Founder and owner of Ecotrust Environmental Services CC and Eco-Agent CC

Since 1988 **>250** reports as consultant on environmental matters, including:

- Game Farm and Nature Reserve planning,
- Environmental Impact Assessments,
- Environmental Management Programme Reports,
- Vegetation Surveys,
- Wildlife Management,
- Veld Condition and Grazing Capacity Assessments,
- Red data analysis (plants and animals).

ABRIDGED CURRICULUM VITAE: CATHARINA E VENTER

Name:	**Catharina Elizabeth Venter** trading as Kyllinga Consulting
Position:	Senior Ecologist and Wetland Scientist
Date of Birth:	29 December 1979
Nationality:	South African
Languages:	Afrikaans, English

EDUCATIONAL QUALIFICATIONS

- M.Sc (Botany), University of Pretoria (2003)
- B.Sc Hons (Botany), University of Pretoria (2001)
- B.Sc (Environmental Sciences), University of Pretoria (2000). Majored in Geography and Botany
- Matriculated, Sasolburg High School (1997)

Additional

- Introduction to ArcGIS 1 (2006)
- Bringing your data into ArcGIS (2006)
- Introduction to ArcView 3.x (2003).

FIELDS OF EXPERTISE

- **Ecological Assessment:**
  Ecological Assessments as part of the Environmental Impact Assessment Process
- **Wetland Assessment:**
  Wetland Assessments as part of the Environmental Impact Assessment Process and Water Use Applications, as well as rehabilitation plans for wetlands, including planning or the Working for Wetlands programme. Large scale wetland assessments (catchment scale).
- **GIS:**
  Compilation of maps for submission as part of Environmental Impact Assessment Process. Creating spatial databases and large scale wetland maps (catchment scale). Projection conversions and matching/overlaying different format GIS maps.
- **Environmental Impact Assessment**
  Undertaken numerous Environmental Scoping Reports, as required by the Environment Conservation Act, 1989 (Act 73 of 1989), the National Environmental Management Act, 1998 (Act 107 of 1998), as amended and the Development Facilitation Act, 1995 (Act 67 of 1995). Project experience includes the establishment of various housing typologies, golf courses, commercial and industrial projects, infrastructure development (roads), resorts and/or game lodges as well as filling stations.
- **Public Participation:**
  Undertaken numerous public participation processes, ranging from basic to extensive, as required by relevant environmental legislation.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

- Professional Natural Scientist (Pr.Sci.Nat) in the field of Botanical Science (Reg no. 400048/08)
- Member of the Botanical Society of South Africa

EMPLOYMENT HISTORY EXPERIENCE

Kyllinga Consulting (July 2015 - present)
Senior Ecologist responsible for wetland and ecological specialist assessments.
Spatial Ecological Consulting (February 2010 – June 2015)
Senior Ecologist responsible for wetland and ecological specialist assessments.

- Wetland Related Assessments

More than 40 wetland assessments conducted between 2010 and 2015.

- Vegetation Assessments

Approximately 16 vegetation assessments between 2010 and 2015.

- Management Plans

Completed two ecological management plans.

MSA Group Services (previously Exigent Environmental CC) (August 2004 – January 2010)

Environmental Scientist responsible for ecological and wetland assessments and the compilation of maps. Also conducted various scoping and EIA applications and EMPRs.

- Ecological Assessments

In excess of 50 ecological assessments conducted between 2004 and 2010, including managing the inclusion of the fauna specialist assessments.

- Wetland Assessments

More than 60 wetland verification projects, wetland delineations and wetland assessments, completed between 2004 and 2010.

- As well as:

Rehabilitation Projects; Fatal Flaw / Screening Assessments; National Department of Agriculture Authorisations; Mining Related Assessments; Private, Public Partnership Projects; Resource Management Plans (RMP); Environmental Management Plans; Environmental Management Programme; Environmental Exemption Processes; Basic Assessments; Environmental Impact Assessments

Part-time employment (2002-2004)

Tutor for botany practicals; Assisting Wildlife management students with Braun-Blanquette analysis; Researcher for a project on the vegetation communities and ecology of the Kruger National Park; Research assistant for the analysis of street trees in Tshwane urban forest; Various part time projects related to vegetation and wetlands

COUNTRIES OF WORK EXPERIENCE

- South Africa
- Lesotho
- Botswana
- Mozambique

PAPERS AND PUBLICATIONS

Co-author and data contributor to: SIEBEN, E. *et al*. The vegetation of inland wetlands with salt-tolerant vegetation in South Africa: description, classification and explanatory environmental factors, submitted to the South African Journal of Botany for review in Feb 2015.

Co-author and data contributor to: SIEBEN, E. *et al*. The herbaceous vegetation of subtropical freshwater wetlands in South Africa: description, classification and explanatory environmental factors, submitted to the South African Journal of Botany for review in Feb 2015.

Co-author and data contributor to: SIEBEN, E. *et al*. The vegetation of grass lawn wetlands of floodplains and pans in semi-arid regions of South Africa: description, classification and explanatory environmental factors, submitted to the South African Journal of Botany for review in Jan 2015.

Co-author of several vegetation descriptions in: MUCINA, L. & RUTHERFORD, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

VENTER, C.E. & BREDENKAMP, G.J. In prep. Major plant communities on the Mfabeni swamp, St Lucia. *Bothalia.*

VENTER, C.E.; BREDENKAMP, G.J. & GRUNDLING, P-L. 2003. Plant community types, and their association with habitat factors as ecosystem driving forces, of Mfabeni swamp. Proceedings of the congress: *Environment of the St Lucia Wetland: Processes of Change*, Cape Vidal, September 4th- 7th, 2003.

VENTER, C.E.; BREDENKAMP, G.J.; GRUNDLING P-L. 2002. Vegetation change on rehabilitated peatland on Rietvlei Nature Reserve. *Kudu* 46(1):53-63.

PRESENTATIONS

Venter, C.E.; Bredenkamp, G.J. & Grundling, P-L. 2003. Plant community types, and their association with habitat factors as ecosystem driving forces, of Mfabeni Swamp. *Environment of the St Lucia Wetland: Processes of Change*, Cape Vidal, September 4th- 7th, 2003.

Poster Presentations

Venter, C.E.; Bredenkamp, G.J.; Grundling P-L. 2002. Baseline vegetation surveys of rehabilitated peatland on Rietvlei Nature Reserve. SAAB Converence. Grahamstown.

Venter, C.E.; Bredenkamp, G.J.; Grundling P-L. 2003. Vegetation change on rehabilitated peatland on Rietvlei Nature Reserve. SAAB Converence. Pretoria.

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