# Wetland Assessment for the proposed Olifantsvlei Dual Filling Station

# Gauteng

December 2017

**REFERENCE**

Olifantsvlei

**CLIENT**


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| **Report Name** | **Wetland Assessment for the proposed Olifantsvlei Dual Filling Station** | |
| **Reference** | **Olifantsvlei** | |
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## EXECUTIVE SUMMARY

The Biodiversity Company was commissioned to conduct a wetland assessment as part of the Basic Assessment (BA) environmental authorisation process and Water Use Licence Application (WULA) for the proposed service station in Olifantsvlei, Gauteng. Two site visits were conducted for this project, the first visit was completed in April 2017 and the second was completed in late November 2017.Both of these site visits would constitute a wet season survey.

The studies were completed to meet the requirements (and comments) the City of Johannesburg and the Gauteng Department of Agriculture and Rural Development.

There were no wetland NFEPA's identified within the project area. The City of Johannesburg wetland dataset does indicate the presence of channelled valley bottom wetland within 500m of the project area.

Two (2) HGM types of wetland were identified and delineated for the study. The wetland types include a channelled valley bottom wetland (HGM 1) and a hillslope seepage wetland (HGM 2).

The PES of HGM 1 and HGM 2 were determined to be largely modified and moderately modified respectively. The Channelled Valley Bottom (HGM 1) and the Seep (HGM 2) had an overall intermediate and moderately low level of service respectively. The only moderately high (the highest benefit recorded) level of services was to be the attenuation of floods associated with HGM 1. The remaining services for the HGM units were scored as intermediate or lower. HGM 1 and HGM 2 showed a Moderate (Class C) level of importance for the Ecological Importance & Sensitivity. A buffer zone of 30m has been recommended for this project.

The proposed service station and associated infrastructure (roads) does pose a risk on the identified wetland system, with the level of risk determined to vary from low to moderate, without mitigation. The highest risks identified for the construction phase, were those associated with the clearing of areas, the construction of infrastructure, and possible crossings and stabilisation of wetlands. These moderate risks can be reduced to low risks if the mitigation measures are implemented.

The operational phase shows moderate risk for all aspects however these are on the border of being low risks and with mitigation can be successfully reduced to low. These risks are mainly associated with increased flow volumes and peaks into the receiving environment as well as possible contamination of the system.

Recommendations have been made for areas regarded as either permissible or non-permissible for the site development plan. The areas recommended (permissible) for development are largely unnatural areas which have been developed for the management of stormwater. These structures can be upgraded to continue with the management of stormwater, and also incorporated into the design of the dual filling stations.

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# Declaration

I, Wayne Jackson declare that:

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

Wayne Jackson

Wetland Ecologist

The Biodiversity Company

4 December 2017

# 1 Introduction

The Biodiversity Company was commissioned to conduct a wetland assessment as part of the Basic Assessment (BA) environmental authorisation process and Water Use Licence Application (WULA) for the proposed service station in Olifantsvlei, Gauteng. Two site visits were conducted for this project, the first visit was completed in April 2017 and the second was completed in late November 2017.Both of these site visits would constitute a wet season survey.

The studies will be completed to meet the requirements (and comments) the City of Johannesburg (CoJ) (Ref: NB/EIM/10/03) and the Gauteng Department of Agriculture and Rural Development (GDARD) (Ref: Gaut 002/17-18/E0068).

## 1.1 Objectives

The aim of the assessment is to provide information to guide the development of the proposed service station with respect to the current state of the wetland systems in the area of study. This was achieved through the following:

- The delineation and assessment of wetlands within 500m of the project area;
- A risk assessment for the proposed development; and
- The prescription of mitigation measures and recommendations for identified risks.

# 2 Key Legislative Requirements

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

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

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

A watercourse means:

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

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

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

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

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

### 2.2 National Environmental Management Act (Act 107 of 1998)

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

## 3 Project Area

The project area is situated just south of Johannesburg (Figure 1) of the M1 highway. The project is for a dual filling station along the east and west carriageways of the R82 (Vereeniging Road) which is located on the Remainder of Portion 36 of the Farm Olifantsvlei 327 IQ.

The project area is located in quaternary catchment C22D, within the Vaal Water Management Area (WMA 5).

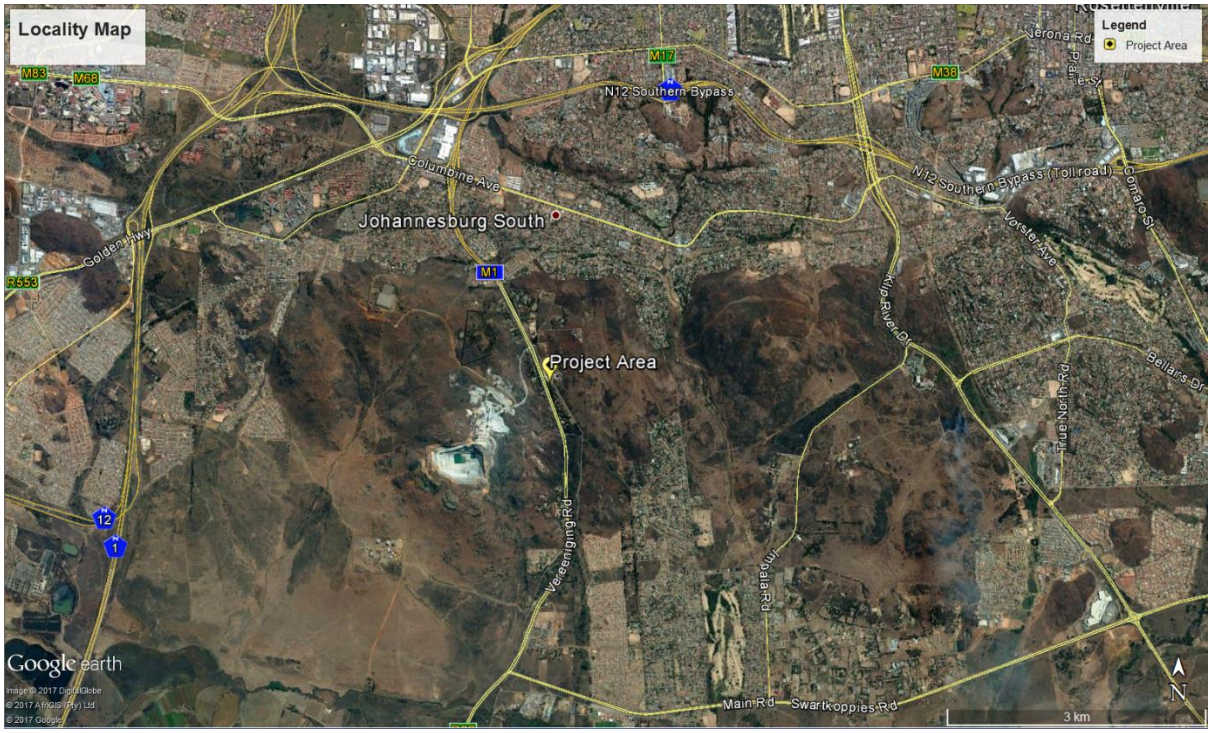


**Figure 1: Locality map showing the general setting in relation to the proposed project area**

# 4 Limitations

The following aspects were considered as limitations for the water resource assessment;

- The GPS used for wetland delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.
- Wetland systems identified at desktop level within 500m of the project area were considered for the identification and desktop delineation, with wetland areas within the project area being the focus for ground truthing.
- The information regarding the activities to be completed on the site, allowed us to do a general assessment on the impacts and the buffer requirement.
- The delineated wetlands and prescribed buffer areas must be used to inform and guide the site development plan for the dual filling stations.

# 5 Methodology

## 5.1 Desktop Assessment

The following information sources were considered for the desktop assessment;

- Information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org);
- Aerial imagery (Google Earth Pro);
- City of Johannesburg wetland dataset (2009);
- The National Freshwater Ecosystem Priority Areas (Nel, et al., 2011); and
- Contour data (5m).

## 5.2 Wetland Assessment

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels. In addition, the method also includes the assessment of structural features at the lower levels of classification (Ollis et al., 2013).

### 5.2.1 Wetland Delineation

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

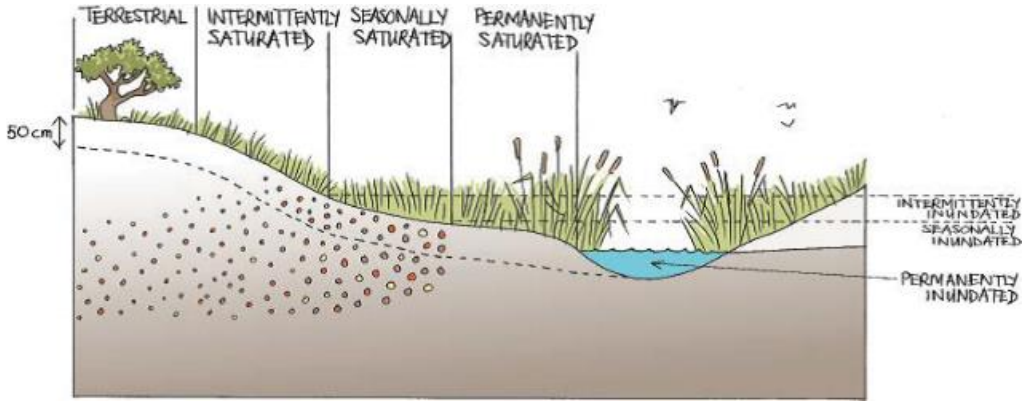


**Figure 2: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al., 2013)**

### 5.2.2 Wetland Present Ecological Status (PES)

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 1.

**Table 1: The PES categories (Macfarlane, et al., 2009)**

| Impact Category | Description | Impact Score Range | Present State Category |
|---|---|---|---|
| None | **Unmodified, natural** | **0 to 0.9** | **A** |
| Small | **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. | **1.0 to 1.9** | **B** |
| Moderate | **Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact. | **2.0 to 3.9** | **C** |
| Large | **Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred. | **4.0 to 5.9** | **D** |
| Serious | **Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable. | **6.0 to 7.9** | **E** |
| Critical | **Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota. | **8.0 to 10** | **F** |

### 5.2.3 Wetland Ecosystem Services

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze et al., 2009). An assessment was

undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 2).

**Table 2: Classes for determining the likely extent to which a benefit is being supplied**

| Score | Rating of likely extent to which a benefit is being supplied |
|---|---|
| **< 0.5** | Low |
| **0.6 - 1.2** | Moderately Low |
| **1.3 - 2.0** | Intermediate |
| **2.1 - 3.0** | Moderately High |
| **> 3.0** | High |

### 5.2.4 Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3.

**Table 3: Description of EIS categories.**

| EIS Category | Range of Mean | Recommended Ecological Management Class |
|---|---|---|
| **Very High** | 3.1 to 4.0 | **A** |
| **High** | 2.1 to 3.0 | **B** |
| **Moderate** | 1.1 to 2.0 | **C** |
| **Low Marginal** | < 1.0 | **D** |

## 5.3 Risk Assessment

The risk assessment was conducted in accordance with the DWS risk-based water use authorisation approach and delegation guidelines. The significance of the impact is calculated according to Table 4.

**Table 4: Significance ratings matrix**

| Rating | Class | Management Description |
|---|---|---|
| 1 – 55 | (L) Low Risk | Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded. |
| 56 – 169 | M) Moderate Risk | Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded. |
| 170 – 300 | (H) High Risk | Always involves wetlands. Watercourse(s)impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. |

# 6 Results & Discussions

## 6.1 Desktop Assessment

### 6.1.1 Geology & Soils

The geology of the area is mainly Ventersdorp lava, breccia and tuff. According to the land type database (Land Type Survey Staff, 1972 - 2006) the development falls within the Ib43 land type. It is expected that, the dominant soils in the crest and midslope positions will be soils of the shallow Glenrosa and Mispah forms. The soils that dominated the footslopes and the valley bottoms are Rensburg and Bonheim soil forms.

### 6.1.2 Wetland NFEPAs

There were no wetland NFEPA's identified within the project area.

### 6.1.3 City of Johannesburg wetlands

A wetland audit was completed for the City of Johannesburg (2009) with the intention of locating wetland areas that may then be considered for spatial planning. The available dataset was considered in order to identify any possible wetland areas in close proximity to the project area. The dataset does indicate the presence of channelled valley bottom wetland within 500m of the project area (Figure 3).


**Figure 3: The CoJ (2009) wetland within project area**

## 6.2 Wetland Assessment

The survey included assessing all the wetland indicators as well as assessing the Present Ecological Score (PES) or health of the wetland, the wetland's ability to provide goods and services (Eco-Services) and the Ecological Importance and Sensitivity (EIS) of the wetlands.

The wetland delineation and HGM unit is shown in Figure 4. The wetland classification as per SANBI guidelines (Ollis et al., 2013) in Table 5. Two (2) HGM types of wetland were identified and delineated for the study. The wetland types include a channelled valley bottom wetland (HGM 1) and a hillslope seepage wetland (HGM 2).

**Table 5: Wetland classification as per SANBI guideline**

| UNIT | LEVEL 1 | LEVEL 2 | | LEVEL 3 | LEVEL 4 | | |
|---|---|---|---|---|---|---|---|
| | System | DWS Ecoregion/s | NFEPA Wet Veg Group/s | Landscape Unit | 4A (HGM) | 4B | 4C |
| HGM 1 | Inland | Highveld | Central Bushveld Group 1 | Valley Floor | Channelled Valley Bottom | N/A | N/A |
| HGM 2 | Inland | Highveld | Central Bushveld Group 1 | Slope | Seep | N/A | N/A |


**Figure 4: Project overall wetland delineation**

### 6.2.1 Channelled Valley Bottom (HGM 1)

The channelled valley bottom wetland drains from the north to the south on the eastern portion of Vereeniging Road. There is a small wetland portion on the western side of the road which drains under the road to the main wetland. The area has been significantly altered by the main road and erosion is evident on the channel banks. The catchment is steep and any runoff generated will result in a sharp hydrograph. The dominant soils are shallow rocky soils on the slopes with Rensburg soils in the valley bottom. Vegetation (including trees) which were identified within the channel and considered for the delineation include *Salix spp, Populus spp*, and *Phragmites australis*. Photographs of the system are presented in Figure 5.

### 6.2.2 Hillslope Seep (HGM 2)

A seepage wetland was identified and delineated adjacent to the channelled valley bottom system. The seepage system is connected to the watercourse, and was identified by a large stand of *Imperata cylindrica*. The dominant soil forms identified for the hillslope seepage area include the Bonheim and Shortlands forms. Alien vegetation is well established on the periphery of the wetland area, with evidence of alien vegetation becoming established within the delineated wetland area. Photographs of the system are presented in Figure 6.

**Figure 5: The channelled valley bottom within the project area**

**Figure 6: The seepage wetland within the project area**

## 6.3 Present Ecological State (PES)

The PES results are described in the sections below with the results presented in Table 6. Photographs of aspects impacting on the integrity of the wetlands are presented in Figure 7.

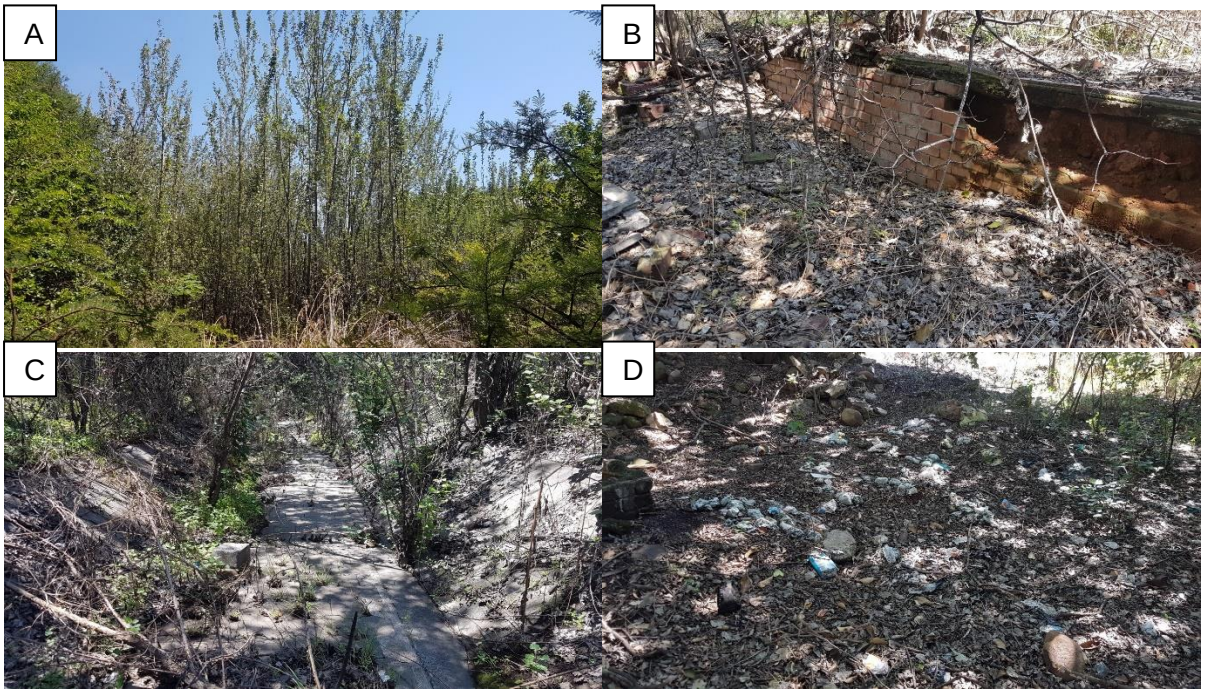


**Figure 7: Photographs of aspects impacting on the wetlands. A) Alien vegetation, *Populus spp.* B) Development and altered hydrology. C) Channelised stormwater measures. D) Solid waste disposal**

**HYDROLOGY**

The catchment area is very steep with shallow rocky outcrops, with large areas characterised by rocks and the Mispah soil form. The area has been developed with large roads and the natural hydrology has been seriously modified (Class E) by the drainage lines that have been installed as well as all the impervious areas that are present. The upper reaches of the channelled system have been channelised to accommodate stormwater. The hydrology of the seepage area is in a moderately modified state (Class C).

**GEOMORPHOLOGY**

The geomorphology of the systems has been altered by the drainage channels that have been installed as well as the increased runoff from impervious areas. The main road has been developed on a possible wetland areas which has reduced the wetland size in the area. The development of the area, and the altered hydrology have caused a narrowing of the channelled system. These disturbances have also encroached into the wetland areas. The geomorphology of the channelled system and the seep was determined to be largely modified (Class D) and moderately modified respectively.

**VEGETATION**

Alien vegetation is established across the wetland system with the existing infrastructure also altering the vegetation component. The disturbances to the larger project area have allowed for the establishment and encroachment of alien vegetation into the wetland systems. A total of 63 tree, shrub and herbaceous plant species were recorded in the proposed project area during the field assessment, with a total of 22 alien plants being recorded. Ten (10) category 1b species were recorded at the site and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act as stated above. The identified category 1b species were *Datura ferox, Melia azedarach* and *Solanum mauritianum*.

**Table 6: The PES results for the project area**

| Wetland | Area (ha) | Hydrology | | Geomorphology | | Vegetation | |
|---|---|---|---|---|---|---|---|
| | | Rating | Score | Rating | Score | Rating | Score |
| HGM 1 | 0.64 | E: Seriously Modified | 6.0 | D: Largely Modified | 4.2 | D: Largely Modified | 4.8 |
| Overall PES Score | | 5.2 | | Overall PES Class | | D: Largely Modified | |
| HGM 2 | 0.18 | C: Moderately Modified | 2.9 | C: Moderately Modified | 2.5 | C: Moderately Modified | 3.5 |
| Overall PES Score | | 2.9 | | Overall PES Class | | C: Moderately Modified | |

## 6.4 Ecosystem Services Assessment

The Ecosystem services provided by the HGM unit present at the site were assessed and rated using the WET-EcoServices method (Kotze et al., 2009). The summarised results for

the HGM units are shown in Table 9. The HGM units were classified according to the HGM type in order to perform the WET-EcoServices assessment.

The Channelled Valley Bottom (HGM 1) and the Seep (HGM 2) had an overall intermediate and moderately low level of service respectively. The only moderately high (the highest benefit recorded) level of services was to be the attenuation of floods associated with HGM 1. The remaining services for the HGM units were scored as intermediate or lower.

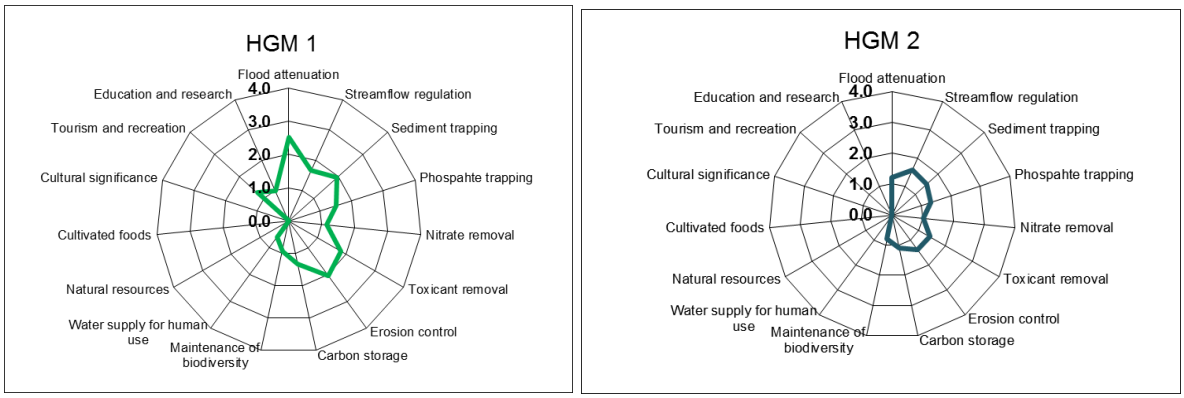


**Figure 8: The spider diagram for Eco-Services rendered by the HGM units**

**Table 7: The Eco-Services being provided by the wetlands**

| Wetland Unit | | | | | HGM 1 | HGM 2 |
|---|---|---|---|---|---|---|
| Ecosystem Services Supplied by Wetlands | Indirect Benefits | Regulating and supporting benefits | Flood attenuation | | 2.5 | 1.2 |
| | | | Streamflow regulation | | 1.7 | 1.6 |
| | | | Water Quality enhancement benefits | Sediment trapping | 2.0 | 1.5 |
| | | | | Phosphate assimilation | 1.5 | 1.3 |
| | | | | Nitrate assimilation | 1.2 | 1.0 |
| | | | | Toxicant assimilation | 1.8 | 1.4 |
| | | | | Erosion control | 2.0 | 1.4 |
| | | | Carbon storage | | 1.3 | 1.1 |
| | Direct Benefits | Biodiversity maintenance | | | 0.9 | 0.8 |
| | | Provision of benefits | Provisioning of water for human use | | 0.6 | 0.0 |
| | | | Provisioning of harvestable resources | | 0.0 | 0.0 |
| | | | Provisioning of cultivated foods | | 0.0 | 0.0 |
| | | Cultural benefits | Cultural heritage | | 0.0 | 0.0 |
| | | | Tourism and recreation | | 1.3 | 0.0 |
| | | | Education and research | | 1.0 | 0.0 |
| Overall | | | | | 17.8 | 11.3 |
| Average | | | | | 1.2 | 0.8 |

## 6.5 Ecological Importance & Sensitivity (EIS)

The EIS assessment was applied to the HGM units described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 8. The following aspects were considered for this component of the assessment:

- Most of the project area is classified as an 'Irreplaceable' Critical Biodiversity Area (CBAs) and Ecological Support Area (ESAs).
- vegetation community was listed by Mucina & Rutherford (2006) as Least Threatened (LT).
- According to the National Biodiversity Assessment (NBA) the project area is situated in an environment which is rated as not protected and Least Threatened (LT) but poorly protected.
- The proposed development is expected to have a minimal impact on any formally or informally protected areas.
- No Red Data plants were recorded but several individual *Hypoxis hemerocallidea* which are protected in Gauteng, were observed.
- No bird, mammal, amphibian or reptile species of conservation concern were recorded during the survey but the likelihood of occurrence of some species was rated as low-moderate to high based on habitat availability;

HGM 1 and HGM 2 showed a Moderate (Class C) level of importance for the Ecological Importance & Sensitivity as well as for the Hydrological Importance respectively. The Direct Human benefits were rated to be Low with a (Class D) rating for both wetland systems.

**Table 8: The EIS results for the project**

| WETLAND IMPORTANCE AND SENSITIVITY | |
|---|---|
| ***HGM 1*** | |
| | **Importance** |
| **ECOLOGICAL IMPORTANCE & SENSITIVITY** | **2.0** |
| **HYDROLOGICAL/FUNCTIONAL IMPORTANCE** | **1.8** |
| **DIRECT HUMAN BENEFITS** | **0.5** |
| ***HGM 2*** | |
| | **Importance** |
| **ECOLOGICAL IMPORTANCE & SENSITIVITY** | **1.3** |
| **HYDROLOGICAL/FUNCTIONAL IMPORTANCE** | **1.3** |
| **DIRECT HUMAN BENEFITS** | **0.0** |

## 6.6 Buffer Zones

Buffer zones have been used in land-use planning to protect natural resources and limit the impact of one land-use on another. A buffer zone has been prescribed for this project to server as a "barrier" between the proposed development and the wetland system.

In the Province of Gauteng, the GDARD requires a buffer zone of 30m and 50m (GDARD, 2014) must be allocated to wetland areas within and beyond urban areas respectively. It has been assumed that taking into account the nature of the project, a 30m buffer zone will be applicable to this project as a minimum (Figure 9).


**Figure 9: The 30m buffer area recommended for the project**

# 7 Risk Assessment

The proposed project is for the development of a dual service filling station. The risk assessment considered aspects that may impact directly, or indirectly as a result of the project, which is located on the periphery of wetland systems.

Findings from the DWS aspect and impact register / risk assessment are provided in Table 9, Table 10, and Table 11.

**Table 9: Impacts assessed for the proposed project**

| | A Husted (Pr Sci Nat 400213/11) | |
|---|---|---|
| **Activity** | **Aspect** | **Impact** |
| Construction and operation of a service station including additional infrastructure | Construction of new infrastructure | Impeding the flow of water<br>Loss of aquatic habitat<br>Siltation of watercourse.<br>Erosion of watercourse.<br>Sedimentation of the watercourse.<br>Flow sediment equilibrium change<br>Water quality impairment |
| | Clearing areas | |
| | Watercourse crossings | |
| | Road Construction & Maintenance | |
| | Stream Channel Stabilisation | |
| | Land Management | |
| | Site Drainage | |
| | Settling Ponds | |

| | | |
|---|---|---|
| | Stormwater Management | |
| | Erosion and sedimentation control | |
| | Pollution Control | |
| | Installation of new tanks & oil traps | |
| | Operation of machinery & equipment | |
| | Temporary infrastructure | |
| | Staff ablutions | |
| | Operation of service station | |

**Table 10: DWS Risk Impact Matrix for the proposed project**

| Severity | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Aspect** | **Flow Regime** | **Water Quality** | **Habitat** | **Biota** | **Severity** | **Spatial scale** | **Duration** | **Consequence** |
| **Construction Phase** | | | | | | | | |
| Construction of new infrastructure | **3** | **3** | **3** | **3** | 3 | **2** | **4** | 9 |
| Clearing areas | 4 | 4 | 3 | 3 | 3.5 | 2 | 3 | 8.5 |
| Watercourse crossings | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 8 |
| Road Construction & Maintenance | **3** | **3** | **3** | **3** | 3 | **2** | **3** | 8 |
| Stream Channel Stabilisation | 3 | 2 | 2 | 2 | 2.25 | 1 | 3 | 6.25 |
| Land Management | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 |
| Site Drainage | 3 | 3 | 3 | 2 | 2.75 | 1 | 3 | 6.75 |
| Settling Ponds | 3 | 4 | 3 | 2 | 3 | 1 | 3 | 7 |
| Stormwater Management | 3 | 3 | 3 | 2 | 2.75 | 2 | 3 | 7.75 |
| Erosion and sedimentation control | 2 | 3 | 3 | 3 | 2.75 | 2 | 2 | 6.75 |
| Pollution Control | 0 | 5 | 0 | 4 | 2.25 | 1 | 2 | 5.25 |
| Installation of new tanks & oil traps | **3** | **3** | **3** | **3** | 3 | **2** | **4** | 9 |
| Operation of machinery & equipment | 0 | 5 | 0 | 4 | 2.25 | 1 | 2 | 5.25 |
| Temporary infrastructure | 2 | 3 | 3 | 3 | 2.75 | 2 | 2 | 6.75 |
| Staff ablutions | 0 | 5 | 0 | 4 | 2.25 | 1 | 2 | 5.25 |
| **Operational Phase** | | | | | | | | |
| Drainage patterns change due to road extent and levels | 2 | 1 | 2 | 1 | 1.5 | 3 | 4 | 8.5 |
| Site Management | 2 | 1 | 1 | 1 | 1.25 | 3 | 4 | 8.25 |
| Storm water management | 2 | 2 | 1 | 2 | 1.75 | 2 | 4 | 7.75 |
| Traffic / vehicle activity | 1 | 2 | 1 | 2 | 1.5 | 2 | 4 | 7.5 |
| Operation of service station | 3 | 2 | 2 | 2 | 2.25 | 2 | 4 | 8.25 |

**Table 11: DWS Risk Impact Matrix for the proposed project continued**

| Aspect | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Sig. | Without Mitigation | With Mitigation |
|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | |
| Construction of new infrastructure | 1 | 4 | **1** | 2 | 8 | 72 | **Moderate*** | **Low** |
| Clearing areas | 1 | 4 | 1 | 2 | 8 | 68 | **Moderate*** | **Low** |
| Watercourse crossings | 1 | 3 | 5 | 1 | 10 | 80 | **Moderate*** | **Low** |
| Road Construction & Maintenance | 1 | 4 | 1 | 2 | 8 | 64 | **Moderate*** | **Low** |
| Stream Channel Stabilisation | 1 | 2 | 5 | 2 | 10 | 62.5 | **Moderate*** | **Low** |
| Land Management | 1 | 1 | 1 | 1 | 4 | 24 | **Low** | **Low** |
| Site Drainage | 1 | 3 | 1 | 2 | 7 | 47.25 | **Low** | **Low** |
| Settling Ponds | 1 | 2 | 1 | 2 | 6 | 42 | **Low** | **Low** |
| Stormwater Management | 1 | 2 | 1 | 2 | 6 | 46.5 | **Low** | **Low** |
| Erosion and sedimentation control | 1 | 2 | 1 | 2 | 6 | 40.5 | **Low** | **Low** |
| Pollution Control | 1 | 2 | 1 | 2 | 6 | 31.5 | **Low** | **Low** |
| Installation of new tanks & oil traps | 1 | 2 | 1 | 1 | 5 | 45 | **Low** | **Low** |
| Operation of machinery & equipment | 1 | 3 | 1 | 2 | 7 | 36.75 | **Low** | **Low** |
| Temporary infrastructure | 1 | 2 | 1 | 1 | 5 | 33.75 | **Low** | **Low** |
| Staff ablutions | 1 | 2 | 1 | 2 | 6 | 31.5 | **Low** | **Low** |
| **Operational Phase** | | | | | | | | |
| Drainage patterns change due to road extent and levels | 3 | 2 | 1 | 1 | 7 | 59.5 | **Moderate*** | **Low** |
| Site management | 3 | 1 | 1 | 1 | 6 | 49.5 | **Low** | **Low** |
| Stormwater management | 3 | 1 | 1 | 1 | 6 | 46.5 | **Low** | **Low** |
| Traffic / vehicle activity | 4 | 2 | 1 | 1 | 8 | 60 | **Moderate*** | **Low** |
| Operation of service station | 4 | 1 | 1 | 1 | 7 | 57.75 | **Moderate*** | **Low** |

( * ) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

The proposed service station and associated infrastructure (roads) does pose a risk to the identified wetland system, with the level of risk determined to vary from low to moderate, without mitigation. The highest risks identified for the construction phase, were those associated with the clearing of areas, the construction of infrastructure, and possible crossings and stabilisation of wetlands. These moderate risks can be reduced to low risks if the mitigation measures are implemented.

The operational phase shows moderate risk for all aspects however these are on the border of being low risks and with mitigation can be successfully reduced to low. These risks are mainly associated with increased flow volumes and peaks into the receiving environment as well as possible contamination of the system.

## 7.1 Recommendations

Recommendations have been made for areas regarded as either permissible or non-permissible for the site development plan (SDP) (Figure 10). The areas recommended (permissible) for development are largely unnatural areas which have been developed for the management of stormwater (Figure 11). These structures can be upgraded to continue with the management of stormwater, and also incorporated into the design of the dual filling stations.


**Figure 10: The permissible and non-permissible areas for the SDP**

**Figure 11: The current stormwater measures within the area regarded as permissible for development**

The following recommendations are provided:

- Recommendations have been made towards a buffer zone as required by the provincial authority. A minimum buffer zone of 30 m is recommended for the non-permissible areas identified for the SDP.
- The status and functioning of the recommended buffer area can be improved through a dedicated vegetation strategy and a landscape management plan, which should include soft engineering approaches.
- An integrated alien plant control program (as per the AIS Regulations) should be developed for the buffer and other open spaces within the property, including delineated water resources.
- Make use of preventative construction techniques (source controls), such as to limit the amount of impervious material near watercourses as far as possible, and to demarcate setbacks from the watercourse in the form of a buffer zone with a natural vegetation cover.
- Consider green engineering measures such as water polishing or naturally vegetated attenuation ponds to improve water quality. Other structural control measures include grass swales, infiltration trenches and basins, wet ponds, and constructed wetlands.
- Discharged stormwater must be released in a controlled manner with a diffuse flow pattern and be accompanied by energy dissipating interventions to prevent erosion

## 7.2 Project mitigation measures

The following specific mitigation measures are provided:

- The new tanks should be double walled steel tanks which consist of a primary steel inner tank shell and a secondary containment steel outer shell which are separated by a continuous interstitial space between the two shells.

- All steel tanks and coatings must comply with the requirements of the South African National Standard (SANS 1535).
- The drainage lines feeding the wetlands are to be protected and no contaminants are allowed to enter these drains. These drainage lines must be vegetated to act as some form of constructed / biological system to reduce flow and polish water.
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly.
- A suitable stormwater plan must be compiled for the property. This plan must attempt to displace and divert storm water from the Shell service station, and discharge the water into adjacent areas without eroding the receiving areas. It is preferable that run-off velocities be reduced and flows discharged into the local watercourses.

## 7.3 General mitigation measures

The following general mitigation measures are provided:

- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access.
- Laydown yards, camps and storage areas must be beyond the water resources. Where possible, the construction of the road and crossings must take place from the existing dirt road and not from within the aquatic systems.
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly.
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces.
- Temporary storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion.
- Prevent uncontrolled access of vehicles through the river system that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas.
- All chemicals and toxicants to be used for the road upgrade must be stored outside the channel system and in a bunded area.
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”.
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the watercourse. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.

- Erosion and sedimentation into the channel must be minimised through the effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed banks.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- Large trees and other debris often collect upstream against the culverts, damming up the channel with risk of flooding and damaging the river crossing and its banks. This debris should be cleared routinely with appropriate disposal of the debris. Timber can be sold or donated to local communities.
- No dumping of construction material on-site may take place.
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.
- Due to the potential increase of pedestrians using the new road, it is suggested that waste bins are installed and maintained at the end of the new road to reduce solid waste disposal into the stream. Signage discouraging littering of the system can also be erected.
- Quarterly vegetation rehabilitation surveys need to be conducted of the vegetation within the project footprint for a period of at least a year after construction has been completed to assess vegetation regrowth and recovery.
- An alien invasive plant management plan needs to be compiled and implemented post construction to control current invaded areas and prevent the growth of invasives on cleared areas.

# 8 Conclusions

There were no wetland NFEPA's identified within the project area. The City of Johannesburg wetland dataset does indicate the presence of channelled valley bottom wetland within 500m of the project area.

Two (2) HGM types of wetland were identified and delineated for the study. The wetland types include a channelled valley bottom wetland (HGM 1) and a hillslope seepage wetland (HGM 2).

The PES of HGM 1 and HGM 2 were determined to be largely modified and moderately modified respectively. The Channelled Valley Bottom (HGM 1) and the Seep (HGM 2) had an overall intermediate and moderately low level of service respectively. The only moderately high (the highest benefit recorded) level of services was to be the attenuation of floods associated with HGM 1. The remaining services for the HGM units were scored as intermediate or lower. HGM 1 and HGM 2 showed a Moderate (Class C) level of importance for the Ecological Importance & Sensitivity. A buffer zone of 30m has been recommended for this project.

The proposed service station and associated infrastructure (roads) does pose a risk on the identified wetland system, with the level of risk determined to vary from low to moderate, without mitigation. The highest risks identified for the construction phase, were those

associated with the clearing of areas, the construction of infrastructure, and possible crossings and stabilisation of wetlands. These moderate risks can be reduced to low risks if the mitigation measures are implemented.

The operational phase shows moderate risk for all aspects however these are on the border of being low risks and with mitigation can be successfully reduced to low. These risks are mainly associated with increased flow volumes and peaks into the receiving environment as well as possible contamination of the system.

Recommendations have been made for areas regarded as either permissible or non-permissible for the site development plan. The areas recommended (permissible) for development are largely unnatural areas which have been developed for the management of stormwater. These structures can be upgraded to continue with the management of stormwater, and also incorporated into the design of the dual filling stations.

# 9 References

City of Johannesburg. 2009. Audit of Wetlands within the City of Johannesburg, Final Report.

Department of Water Affairs and Forestry (DWS). (2005). A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria: Department of Water Affairs and Forestry.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2009. A Technique for rapidly assessing ecosystem services supplied by wetlands. Mondi Wetland Project.

Land Type Survey Staff. (1972 - 2006). Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Macfarlane, D. M., Bredin, I. P., Adams, J. B., Zungu, M. M., Bate, G. C., & Dickens, C. W. (2014). Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands, and Estuaries. Water Research Commission.

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. 2007. A technique for rapidly assessing wetland health: WET-Health. WRC Report TT 340/08.

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

South African National Biodiversity Institute (SANBI). 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).