WETLAND DELINEATION REPORT
FOR
PORTIONS 1-187 (OF REM) OF THE FARM ALICAVILLE NO. 2147

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INTRODUCTION

Background

NMH Consulting compiled a wetland delineation report in 2005 as part of an Environmental Authorisation process to develop the property known as Portions 1-187 (of Rem) of The Farm Aliceville No. 2147. The wetland map from this report was taken into account in the proposed development layout, which reflected a 20m wetland buffer around all wetlands. Based on this layout, and an Environmental Impact Assessment (EIA) process, a positive Record of Decision (ROD) was issued by the competent authority, duly approving the proposed development. The development proposal was also approved by the DFA (Development Facilitation Act) Tribunal and construction commenced in term of the ROD.

More recently, in 2014, the developer applied to the competent authority to amend the ROD to allow for the development of a retirement village. The competent authority requested that the wetland delineation report be updated with specific reference to the impacts of the proposed amended layout. This report therefore sets out to:

- Delineate the boundary of the wetland across the property, using the methods outlined in the Department of Water Affairs and Forestry guideline document on wetland delineation (DWAF, 2005) to confirm the extent of wetland area
- To provide an assessment of the impacts of the amended layout on the delineated wetlands.

Wetlands defined

Wetlands are defined as areas of land where the top 50 cm of soil shows signs of prolonged soil wetness. "Prolonged", means long enough for anaerobic (lacking oxygen) conditions to develop. When these conditions develop in the soil only certain types of plants can survive. These are known as hydrophytes (water plants) and their ability to survive soil saturation ranges from temporary inundation to permanently submerged, depending on the species. These soil conditions develop when the amount of water entering an area exceeds the amount of water draining from it. Thus wetlands are generally found in low lying areas with shallow surface or ground water, which causes anaerobic conditions to develop for at least part of the year. These areas are often characterised, and are easily identifiable, by the presence of reeds or other hydrophytes. However wetlands are also highly variable in character and many of the wetlands in KZN, and indeed around the world, do not fit the stereotypical concept of a wetland held by most people. Wetlands can range from shallow reed-fringed lakes with large amounts of surface water, to narrow temporarily inundated valley bottom areas, and thus can be difficult to identify.

Legislation

Wetlands are protected by South African national legislation. They are broadly protected by the Constitution of the country which states that everyone is entitled to an environment that is safe and healthy. Since wetlands contribute to providing society with a safer healthier environment, they deserve to be protected. Other legislation regarding the protection of wetlands is included in Table 1.

Table 1: Legislation related to wetlands

Legislation	Requirements	Activities	Notes
The National Water Act (No. 36 of 1998)	For certain activities a water use licence is required	These activities include extracting water for any form of use, and diverting or obstructing the flow of a water course.	

The National Environmental Management Act 107 of 1998 (NEMA) Environmental Impact Assessment regulations	Certain activities that require government authorisation before commencing	No disturbance of more than $50m^2$ can occur within 32m of a watercourse (which includes wetlands) without environmental approval from the DAEA&RD.	The developer has approvals from the competent authority for a layout which allows a 20m buffer to the wetlands delineated in 2005 by NMH Consulting.

A Water Use License is required before a wetland may be disturbed or destroyed, and often this will require additional approval from the Department of Economic Development, Tourism and Environmental Affairs (EDTEA) following an Environmental Impact, or Basic Assessment process. Obtaining these approvals for development within wetlands is relatively time consuming given the value assigned to wetlands by government and other conservation bodies

In summary no disturbance is allowed within wetlands without an environmental authorisation from the Department of EDTEA and a Water Use License from the Department of Water Affairs. In this case a positive ROD was granted by the competent authority at the time, approving a development layout that allowed for a 20m buffer around wetlands (as delineated by NHM Consulting in 2005).

AIMS

The aim of this study is to determine the extent and nature of the wetland area on the site using currently accepted scientific methods for wetland delineation, namely those described in "A practical field procedure for identification and delineation of wetlands and riparian areas" (DWAF, 2005).

SITE DESCRIPTION

The long rectangular property lies in a roughly east west orientation and is located between the southernmost edge of Pennington residential and Umdoni Country Club. The site is bounded in the east by the coastal railway line and in the west by a small residential development. Minerva Road crosses the site in the east and provides access to the Umdoni Country Club. The topography of the site is undulating but generally slopes toward the east, with higher lying areas situated in the western parts of the site. The geology of the site appears to be dominated by sandstone. The site is well vegetated with a mosaic of forest woodland and grassland of varying condition.

Plate 1: A photograph of the site looking westwards across Minerva Road.

METHODS

The site was visited on 2nd and 3rd of August 2014, in order to collect relevant data. The national Department of Water Affairs (DWA) guideline on wetland delineation in South Africa lists four indicators that should be interrogated in order to establish if an area is a wetland or not. These are as follows:

Topography
Wetlands generally form in areas of poor drainage, so the topography (shape) of the land, was examined first. Valleys or basins are areas where water naturally accumulates and wetlands are most likely to be found in these low lying areas. However, it must be noted that there are numerous wetland areas that are not in low lying areas. These are known as hillslope seepage wetlands.

Soil wetness indicators
The most telling sign is soil colour and structure. In soils that have been saturated for long periods of time (a few weeks at a time over a number of years is usually sufficient), metal oxides (rust - which give soil its colour) are dissolved and washed out resulting in a greyer (gleyed) colour tone. Where the water table fluctuates small spots of oxidation occur within the gleyed soil matrix forming the characteristic mottling associated with seasonally and temporarily inundated soil. A soil augur was used to examine soil samples from 0-10cm and 40-50cm below the surface at each sample site. The colour (Chroma and Value) of the soil matrix was noted for each sample, as well as the degree and colour of mottling. One hundred and thirty seven (137) soil samples sites were chosen across the site.

Plate 2: Soil sample taken within the wetland area at the site. Note the dark grey matrix and distinct orange mottles.

Vegetation

The type of vegetation growing on a site is a good indicator of how well soil drains. Reeds (e.g. *Phragmites* sp.) or bulrushes (e.g. *Typha* sp.) are a sure sign of wetland. Dominant vegetation growing within a 2m radius of each soil auger site was noted.

Soil form indicators

Although not often used in KZN, soil form indicators can be used in a confirmatory role in delineating wetlands. The DWA guideline provides information on interpreting soil form, as defined by the Soil Classification Working Group (1991). In this case topography, soil wetness, vegetation provided clear enough evidence to exclude soil form as an indicator.

Mapping

A Garmin Etrex Legend HCx handheld GPS was used to record the position of each soil sample site. Horizontal accuracy was allowed to reach 3m before each point was saved onto the device. The GPS points were then transferred onto a PC using Garmin Mapsource software and then exported into ArcMap 10, a GIS mapping program. The GPS points were overlaid onto the aerial photography, and a map was created of the outermost wetland boundary.

RESULTS

Topography

Starting at the eastern most boundary moving westwards the topography of the site rises over a low primary dune and then dips into a gently sloping valley which runs parallel to the sea shore draining northwards. Further westward and inland, across Minerva Road, the east facing slope of this valley rises more steeply to the highest point of the site, beyond which lies a small valley head which drains toward the north off the site. Further west the topography flattens out slightly to form another valley head also draining northward offsite. Therefore water falling on the site general finds its way into either of these three valleys either by surface flows or as ground water. Due to the generally

sandy nature of the sediments across the site it is likely that ground water flows play an important part in determining the extent and period of soil wetness.

Soil

As the site is relatively undisturbed by recent agricultural activity, the soils across the site were found to be a good indicator of wetland presence. Sticky, black to grey, organic rich sands and dark brown, silty sand both with either feint or distinct orange to red mottling, indicated temporary and seasonal wetlands (Plate 2). Heavier gleyed clays and silty sands indicated the more frequently wet and permanently wet areas.

The soils showed that a small patch of the primary dune immediately west of the railway (A in Figure 1) is seasonally wet forming a hillslope seepage wetland. The soils in this area were generally grey sands with distinct orange mottling.

Large parts of the upper east facing slope, (B in Figure 1) were found to be temporarily or seasonally wet while the lower parts closer to Minerva Road, were found to be seasonally to permanently wet. In the valley bottom soils were dark brown to dark grey sand clays or silts with orange to red mottling indicating seasonal wetness.

The smaller valley head (C in Figure 1) also had elements of hillslope seepage on the east facing slope indicated by dark brown to black silty sand with orange mottling. The bottom of the valley had soils that were stickier due to higher proportions of fine sediments but still had mottling indicating seasonal wetness.

The flatter valley head, (D in Figure 1) had soils characteristic of seasonal wetland, with dark grey to brown sandy silts with orange to red mottling of varying degrees.

Vegetation

Although not pristine, the vegetation showed strong zonation indicating wetland and non-wetland areas fairly accurately.

The vegetation of Area A (Figure 1) was dominated by *Typha capensis, Juncus kraussii,* and *Phragmites australis*. *Kniphofia sp.* was also noted in this area.

Plate 2: The vegetation of Area A (Figure 1).

The vegetation of Area B (Figure 1) was found to be characteristic of larger coastal hillslope seepage wetlands being dominated by sedges such as *Cyperus sphaerospermus* and hydrophytic grasses such as *Ischaemum fasciculatum*. Also common on this slope was *Syzygium cordatum*. Seasonal to

permanently wet areas were indicated by species such as *Fimbristylis sp*. and *Eleocharis sp.* with some large *Syzygium cordatum* individuals at the top of the slope (at B1in Figure 1) and *Cyperus latifolius* lower down the slope (at B2 in Figure 1).

Valley head C has vegetation dominated by grass species such as *Aristida junciformis* and *Cymbopogon validus* while certain patches of the east facing slope (C1 in Figure 1) was dominated by *Ischaemum fasciculatum* indicating slightly longer periods of wetness.

The vegetation found at valley head at D was dominated by sedges and grasses with the fern *Nephrolepis biserrata* being widely distributed throughout the seasonally wet areas. *Syzygium cordatum* was also common in this area. An alien shrub species which appears to be a member of the *Tibouchina* genus was also common throughout this area.

Other notable features
A female bushbuck (*Tragelaphus sylvaticus*) was spotted on the slope labelled as A. Little bee-eater (*Merops pusillus*) was seen feeding in the same area. Extensive evidence of Bushpig (*Potamochoerus larvatus*) spoor was noted in area D.

Plate 3: The vegetation of Area D (Figure 1).

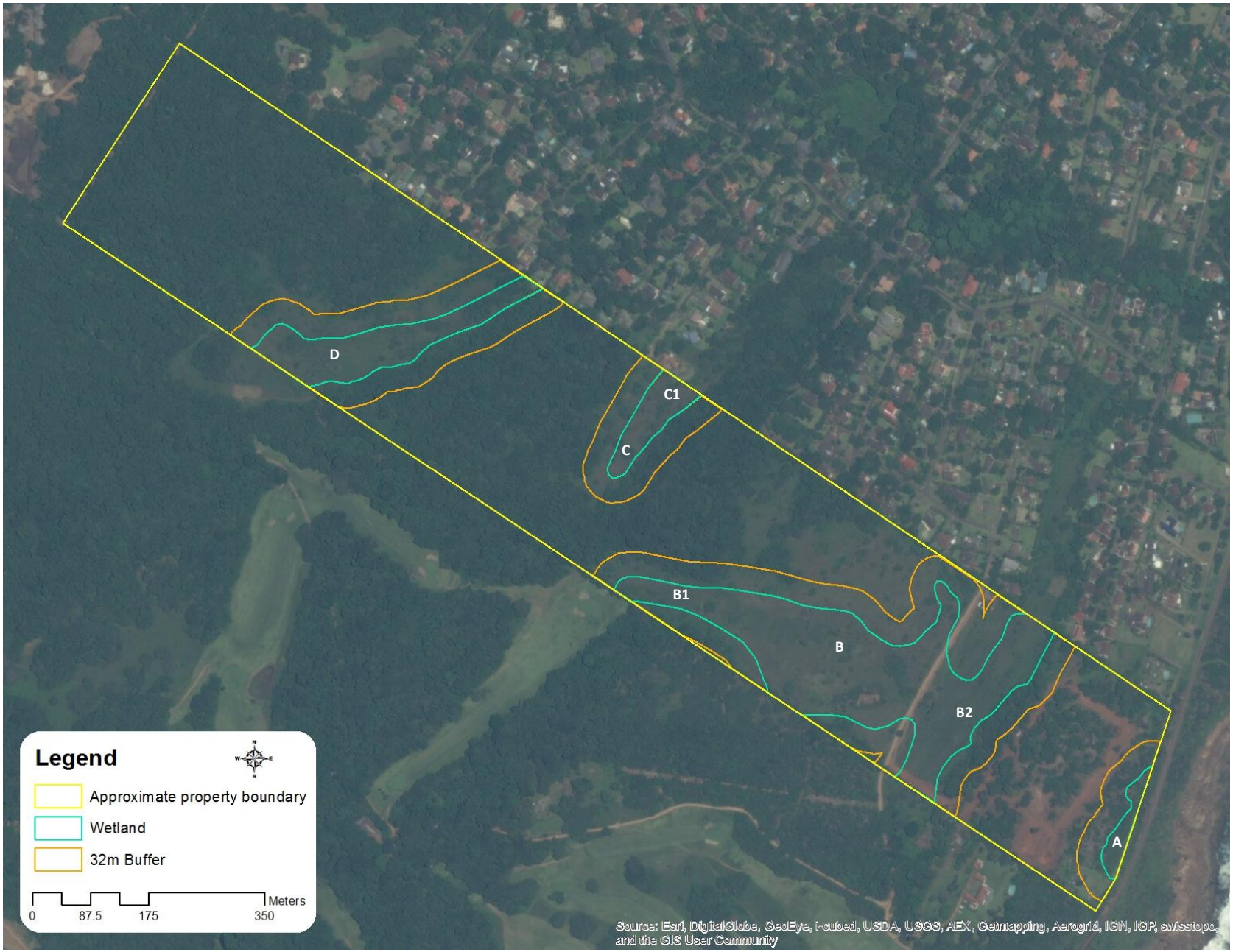

Figure 1: A map of the wetland area on the site showing the boundary of the wetlands as well as a 32m buffer.

ALTERNATIVE PROPOSAL

The applicant presented an alternative layout (Figure 2) and requested feedback on the suitability and possible positive and negative aspects of the changes. The key changes are highlighted in Figure 2 A, B and C.

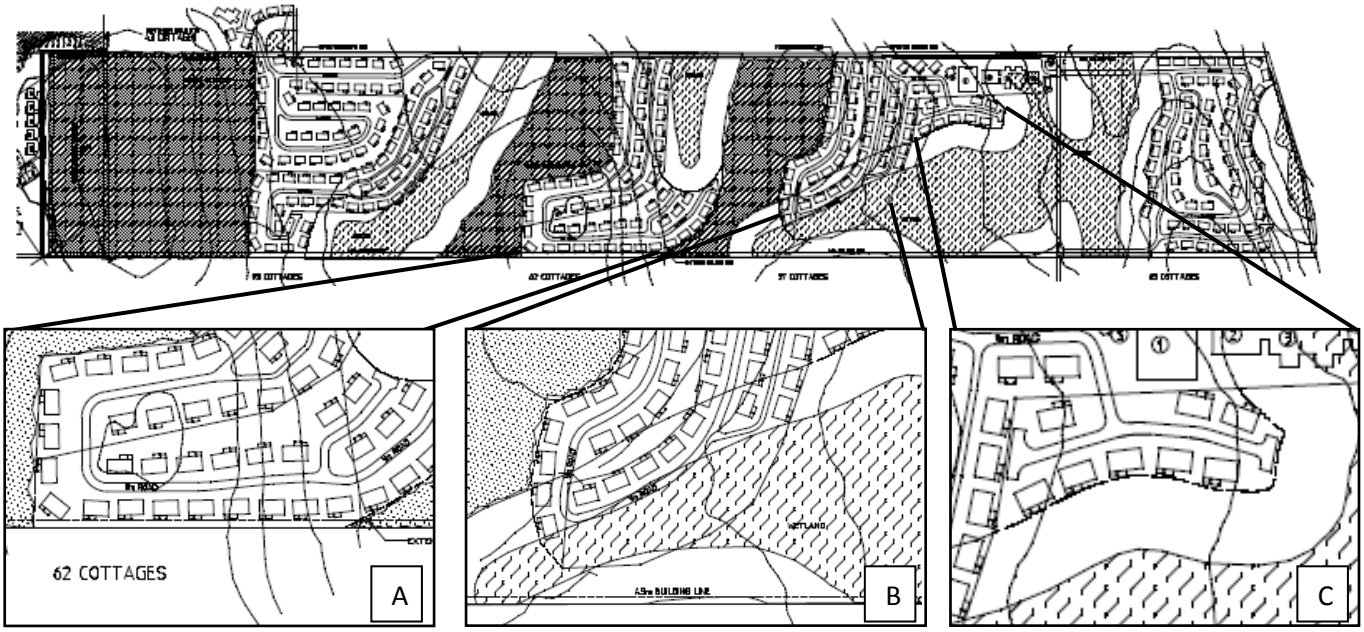

Figure 2: Proposed alternative layout with key amendments highlighted in A, B and C.

The following section describes the key changes and possible resultant positive and negative impacts in respect of wetland functionality and integrity;

(A) The amended layout includes an increase in the footprint and number of units in the south-central section of the site, in close proximity to wetland C and C1 (Figure 1). These units are not located within the wetland or associated buffer and, therefore, will not impact directly on wetland. The increase in density will, however, modify the hydrology and possibly increase runoff intensity. This, if not managed properly, may lead to degradation of the system through scouring and erosion.

(B) The original approved layout included units that would be located within the upper section of wetland B1 (Figure 2). Construction of these units would have resulted in direct loss of a significant portion of wetland B1 and, considering the location at the top of the system, would have limited water flow into wetland B, seriously compromising its functionality. The retraction of units out of the core wetland area will, therefore, avoid direct loss of wetland B1 and have less impact on the hydrology of wetland B.

(C) In order to compensate for the removal of units described in amendment (B), the applicant has proposed to relocate these to a north-east area of the site. As with amendment A, these units are located outside of the wetland and associated buffer but the increased density may affect runoff intensity into wetland B. That said, when comparing this amendment to the original layout. The increased density outside of the wetland and buffer is much more desirable than the loss of wetland B1 and the modification of flow into wetland B.

When looking at this proposal from a holistic perspective, the cumulative impact is likely to be reduced in comparison to the original approved development, in that wetland destruction is avoided, water flow is not impeded and relocation of units is outside of the wetland and buffer

areas. The increased density should be mitigated through the use of an appropriate Stormwater Management Plan that focuses on maintaining natural hydrological regime of the wetland.

DISCUSSION

The results reveal four distinct hydrogeomorphic (HGM) units on the site. Most of these HGM units appear to be strongly controlled by seepage and ground water with units labelled as A, B and B1 in Figure 1 being characteristic of Hill Slope Seepage wetlands. B2 was more similar to an Unchannelled Valley Bottom wetland. Areas C and D were classified as Unchannelled Valley Bottom wetlands with elements of Hill Slope Seepage.

A significant area of 'new' wetland, not recorded in the original 2005 wetland report, including an additional HGM unit (shown as D in Figure 1) has been noted. The primary reason for this may be changes in hydrological conditions on the site, either because alien plants have been removed (as part of site management by the developer) or because of recent high rainfall, which has "activated" previously "dormant" wetlands and facilitated a change in the extent of wetland associated vegetation. Wetland sampling strategies are often guided by vegetation as initial indicators of the presence of possible wetlands. It may have been a case where a period of dry years or the alien plants contributed to a drop in the water table of the site and a resultant shift in vegetation species to terrestrial types, and these areas were consequently and reasonably overlooked in 2005. A significant amount of water runoff was noted within Wetland unit A. Considering that 2014 sampling was undertaken at the end of a dry winter season, the water source may well be a leaking pipe. Pipe infrastructure was noted in close proximity to this system and should be investigated as a possible water source.

Although impacted by past disturbance, such as the construction of Minerva Road, the wetlands on the site appear to be in good condition with characteristic zonation of species and low levels of alien invasion in most cases. The wetland area labelled D in Figure 1 is, however, extensively invaded by what appears to be *Melastoma malabathricum*. Most of the wetlands are likely to be important from an ecosystem function and habitat provision perspective as large tracts of natural vegetation are becoming increasingly rare along the KwaZulu-Natal coast. The wetlands are also likely to be important from a stream flow maintenance perspective, however most of the watercourses into with these wetlands drain have been canalized, and are likely to have a very low biodiversity value. Therefore it is likely that the most important function that these wetlands perform is habitat provision.

Environmental best practice requires that wetlands are protected by a buffer of natural vegetation. Buffers serve to protect habitats from the negative impacts associated with development (edge effect) and provide a level of ecological connectivity between the wetland habitat and terrestrial habitats. The width of such buffers is generally dependent on the primary function of the buffer. For example, certain wetland species require a terrestrial habitat to live out certain stages of their life cycle. Thus the width of the buffer would be determined by the minimum requirements of that species. Buffers also serve to filter out pollutants before they reach a wetland or watercourse. Castelle *et al* (1994) in their review on wetland buffer literature find that that a buffer of at least 32m is required to filter out pollutants such as particulates and phosphates, however this is dependent on variables such slope, soil depth and type, rainfall, and vegetation cover, among others. Thus the width of wetland buffers required is variable and in many cases a wetland buffer of variable width is necessary. The approved 20m buffer is likely to assist in the maintenance of natural physical and chemical characteristics but may not necessarily protect the biological components of these wetland systems (Semlitsch & Bodie, 2003). This could potentially be overcome if the wetland buffer is wider than 20m at certain points along the wetland boundary. The sections of wider buffer

could then act as the required terrestrial habitat or could buffer the wetland from those portions of the development that may have a greater edge effect.

The applicant has proposed an alternative layout to that which was approved. The amendments are likely to result in a net reduction in the impact on the wetlands compared to the previously approved layout, especially wetlands B1 and B. The proposed increase in densities will, however, impact on the hydrology of the catchment and appropriate measures, such as an appropriate Stormwater Management Plan, should be employed to mitigate impacts on the adjacent systems.

When deciding on an appropriate way forward a number of factors need to be taken into account;

- Environmental best practice requires that wetlands are protected with natural vegetation buffers of varying widths depending on the purpose of the buffer.
- The developer acted in good faith by protecting the wetlands in the approved layout with a 20m buffer.
- The developer acted in good faith by initially managing the site periodically to remove most of the serious alien invasive vegetation on the site.
- According to the results of this report, the wetland boundary has changed since 2005 when the original delineation was undertaken.
- Because of this, the original approved layout will result in the transformation of some wetland area. The proposed amended layout will avoid transformation of wetland by relocating units outside of the wetlands and buffers.
- This shift may, however, impact on the terrestrial components (forest and grassland) of the site and will need to be assessed by the relevant specialists.

REFERENCES

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