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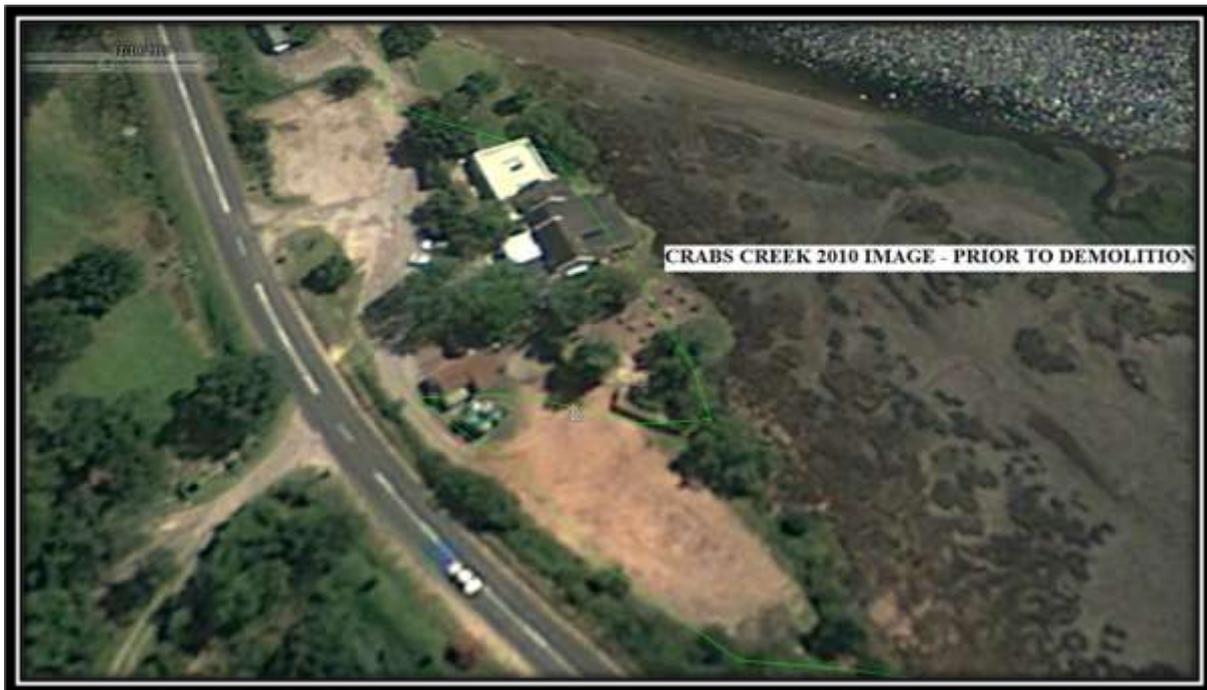
Environmental Surveys and Management Programs

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VEGETATION SENSITIVITY ANALYSIS

Portion 29 of the Farm Uitzicht No. 216

CRABS CREEK, KNYSNA



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Limitations of the study

Botanical surveys based upon a limited sampling time period, may not reflect the actual species composition of the site due to seasonal variations in flowering times. Additionally Fynbos composition may vary depending on maturity or time since last burn.

Author

The author (Dr. Colleen Ebersohn) has a PhD degree in Botany, specializing in Ecology and Vegetation Science. The author has 25 years of experience related to environmental management practices.

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1. Project Description and Terms of Reference:

Project Description:

Eco Route Environmental Consultancy has been appointed as independent environmental practitioners by the applicant, Mr. John Sayers, to ensure compliance in terms of the requirement of Regulation 23(1) of the Environmental Impact Assessment (EIA) Regulations, 2010.

Portion 29 of the Farm Uitzicht NO 216 is situated within the Knysna Municipal Area and is located on the south western bank of the Knysna Lagoon, bordering SanParks.

The property is currently vacant, but was used for tourist facilities that include a restaurant, gift shop and farm store.

The developer intends to develop the property into a low key Resort consisting of 5 accommodation units and a restaurant.

Terms of Reference:

The Department of Environmental Affairs (DEA) as the Competent Authority has requested that a Ecological Specialist is appointed to assess the effects and impacts on the receiving environment including the Knysna Estuary.

The scope of the Ecological Specialist must include:

1. *Literature Review and assessment of existing information:* Conduct a review of existing studies, reports and data of the area and the details of the proposed development.
2. *Site Assessment of the ecosystems that may be impacted upon by the development activities:* Undertake a site assessment of the development area. The assessment will include:
 - An assessment of the impacts associated with the triggered Listed Activities.
 - Ecological impacts of the proposed development on the estuary and the biodiversity in the area.
 - The site is a critical and important supporting area for maintaining corridors, linkages, ecological processes and hydrological processes. It also serves for the conservation of threatened and protected habitats. The potential impact of the development on the Ecological Support Area and the ecological services that it must provide must therefore be assessed.
 - The report must include an assessment of all the proposed alternative layouts.
 - Integration of the results of the above work as input to the site layout planning and landscaping to realize the site potential and minimize the risk of environmental impacts on the estuary.
 - A signed declaration of interest must be included in the report.

3. *Compilation of the report: Impact assessment:* Based on the data and information collected in the previous tasks, describe ecological characteristics of the Knysna Estuary System that may have been impacted. Evaluate the development activities and their impacts, and propose mitigation measures for the development. Describe the potential impacts, the significance of those impacts, and weigh and rank each impact during the project life cycle stages, according to the assessment, ranking, weighting and scaling criteria as laid out in the EIA Regulations. Write up findings and recommendations for EIA process.

An onsite meeting was conducted on 07/07/2016. The following aspects need to be included in the report:

1. The invasive *Latana* species occurring on site.
2. The probability of rehabilitating the upper marsh.
3. Rehabilitation of banks from jetty.
4. The impact of the sawdust that was used in the old parking area
5. Using grass blocks in the parking area
6. The possibility of a landscape pond to ensure that storm water and water that runs from the sewer plant is clear from pollutants.

The Ecological and biodiversity report will form as a basis for the Coastal Engineer report and needs to be submitted to the appointed coastal engineer in order for him to complete his report.

The Terms of Reference guides the scope of work for the specific report. An overview of the current vegetation classification (using VegMap, GRI and Western Heads Vegetation Survey) is given, which describes the dominant vegetation units that would naturally occur on the sites. The Ecological status on the sites and the state of transformation, was determined (using RSA Threatened Ecosystem List according to Section 52 of NEM:BA and the Conservation Planning Report of Critical Biodiversity Areas of the Garden Route).

A list of Species that could in all possibility occur on the site was compiled according to VEGMAP and the conservation status of the plant species was determined according to the Red Data List of South African Plants.

Cognisance is taken of the following situations:

- In terms of the section 52 of the National Environmental Management: Biodiversity Act, (Act No. 10 of 2004) **Knysna Sand Fynbos** a threatened ecosystem occurs on the site, with an ecosystem status of **critically endangered**.
- In terms of the Garden Route Initiative Fine Scale Planning Map “*Ecological Support Area*” occur on the site.
- The size of the property is 4046m² in size.
- The size of the area that has been transformed is 2360.54 m² as a result of previous construction activities: Restaurant, Convenience Store, Store rooms, Water Tanks, Children's Playground Area, Access road, Parking Area and Garden areas on the property. Therefore approximately 58.32% of the property has been transformed; the remaining 41.68% of the property consists of intact indigenous vegetation.
- The presence of an ecotone: transitional zone between the Salt Marsh habitat and the adjacent Terrestrial habitat - this ecotone forms part of an ecological corridor of the Knysna Estuarine system.
- The constraints as identified during the site meeting of 07/07/2016.

The Garden Route Initiative Fine Scale Conservation Map

“The vegetation of the ca. 615 000 ha domain of the Garden Route Initiative was classified and mapped at a scale of 1:50 000 in order to develop surrogate biodiversity units to facilitate to development a conservation plan for the domain.

The vegetation was mapped as untransformed units, as it was perceived to be before European settlement in the region. This proved to be a great challenge as vast areas have been altered to such an extent that only a few remnant patches of vegetation still remain in certain areas.

A classification system that follows a four-tier hierarchy was developed. This facilitates analyses at three different scales, at biome, habitat type and vegetation unit level.

Aquatic and terrestrial systems are recognized, with three aquatic biomes and six terrestrial biomes recognized in the area. Aquatic ecosystems cover more than 13 percent of the surface area, clearly indicating how prominent they are in the domain.

A total of 39 habitat types are recognized; six of these are aquatic habitat types. Descriptions and a photograph are provided for each habitat type.

At the vegetation unit level, 86 units are recognized, 15 in the aquatic ecosystems and 71 in the terrestrial ecosystems. Diagnostic descriptions are provided for each vegetation unit”.

Limitations of the CBA map

“Although electronically possible these maps should not be used beyond a scale of 1:50 000. Zooming beyond this level will result in inaccuracies.

Field mapping was done on hard copy satellite images printed at a scale of approximately 1: 30 000. We believe that field accuracy of the maps is in the order of 100 meter from mapped boundaries, but distortion in the satellite images may result in reduced accuracy in certain areas.

Users should keep the original purpose of this map in mind, to develop a regional conservation plan. This vegetation map is not suitable for small-scale (< 1:50 000) studies or managerial plans.

The vegetation units we recognize and their boundaries are not compatible with those of Mucina and Rutherford (2006), as their map is intended to function at a much larger scale (1: 1 000 000). We do agree conceptually at the higher order level (biome), but differ in many aspects at the lower levels of the classification”. (Vlok, et al Unpublished 1:50 00 maps and Report)

The aim of the desktop assessment is to investigate and report on the current ecological status of the site with regard to the terrestrial habitats that occur on the property.

The following parameters have been assessed:

Ecological Status (Perceived and Present)
Ecological Functionality (Habitat Integrity, Fragmentation, Transformation)
Ecological Rehabilitation Potential

2. Methodology

A desktop study was done, taking into account all of the available Conservation Planning documents. A literature study was undertaken using the relevant literature as well as other applicable information. Site visits and *in situ* surveys and evaluations were carried out.

2.1 Relevant Legislation and Policy Documents

Section 52 the National Environmental Management: Biodiversity Act (Act 10 of 2004), (NEM: BA); National Environmental Management Act (Act No. 107 of 1998); The Environmental Impact Assessment (EIA) Regulations that came into effect on the 2nd of August 2010.

Please note that a declaration of independence has to be made by the specialist consultant, as determined by the Environmental Conservation Act, (Act 73 of 1989).

2.2 Desktop Studies

- Identification of RSA Vegetation Types
- Identification of RSA Ecosystem Status
- Identification of GRI Vegetation Types
- Identification of GRI Ecosystem Status
- Identification of Western Heads Vegetation Type
- Correlation with Red Data Species Lists and the Vegetation Survey

2.3 Ecological Status and Vegetation Sensitivity for the Site under Consideration

Ecological Status and Vegetation Sensitivity: Present Ecological Status

Ecological Status and Vegetation Sensitivity: Perceived Reference State as per Vegetation Descriptions

2.4 Present Ecological Status of Knysna Sand Fynbos (FF d 10) on Crabs Creek

Aspect	Description
Landscape Description	
Aspect, Slope, Topography	Sloping terrain ranging from relative steep drop from the provincial road to flat areas. The property has a predominantly northern aspect.
Substrate	Deep, acid Tertiary sand inland of coastal dunes forming regic sands and soils of Lamotte form (<i>Mucina & Rutherford</i>). The soils are of a sandy nature, typical of these podzolized dunes. The substrate has been altered in the parking lot and children's play area by the substantial addition of saw dust over a period of time.
Community Description	
Vegetation units	<u>RSA Vegetation Classification:</u> Knysna Sand Fynbos <u>GRI Vegetation Classification:</u> Sedgefield Thicket-Fynbos <u>Western Heads Vegetation Classification:</u> Knysna Wet Sandy Fynbos, Salt Marsh, Coastal Forest Thicket.
Vegetation Cover (%)	± 10% Cover: Indigenous Vegetation, mostly restricted to the ecotone and Salt marsh area, interspersed with dense stands of alien Kikuyu lawn grass. ±10% Cover: Indigenous herbal cover species including indigenous grass species. ±10% Cover: Tree species on site predominantly non invasive alien "garden" species. <i>Lantana camara</i> a declared weed and aggressive alien invasive species occur on site, mostly amongst the garden remnant vegetation and along the concrete wall below the provincial road.
Transformed Area (%)	70% - as a result of previous construction activities and parking areas.
Habitat fragmentation	High
Invasive Alien Plants	Moderate
Relative remaining intact habitat:	Ecotone and Salt marsh area
Grazing (livestock)	None evident

Aspect	Description
Hunting	None evident
Conservation (flora)	No formalized conservation
Wetlands	Salt Marsh present
Recreational (sport)	None
Sensitivities	
Conservation importance	Locally moderate and regionally low
Topography	Northern aspect
Rehabilitation potential	The remainder of the Salt marsh on site must be demarcated as a " No Go " Area and the reestablishment of the salt marsh should be encouraged in areas where the Kikuyu grass has invaded.
Community structure	Largely transformed
Patterns of Biodiversity	
Flora	Indigenous Vegetation, mostly restricted to the ecotone and Salt marsh area, interspersed with dense stands of alien Kikuyu lawn grass.
Indigenous Species of Special Concern	None
Alien invasion	Moderate to high - mostly Kikuyu and garden remnant vegetation.
Ecological Processes	
Barriers to gene dispersal	Urban Infrastructure : Transformed areas, Provincial road, National Highway (N2)
Corridors for gene dispersal	Along the ecotone
Community Structure	Mostly garden remnant vegetation intersperced with alien invasive species (<i>Kikuyu and Lantana camara.</i>)
Coastal dunes	Absent on site present.
Climatic gradients	Ecotone present on the site
Riparian Vegetation	Salt marsh
Refugia	No rocky outcrops present on the site

Aspect	Description
Fire	Not important on site
Ecotones/Tension zones	Present between the Salt Marsh and adjacent terrestrial habitat
Erosion	Low, present along the storm water outlet areas.
Carbon storage	Low
Medicinal plants	No medicinal species were noted
Food	The value of the study area as a source of food is expected to be insignificant
Fuel wood (availability)	None
Building materials	Remnants of previous foundations
Grazing	None
Conservation importance	
Current Distribution (extent)	Knysna Sand Fynbos is classified as “ Critically Endangered ” according to NEM:BA list of threatened Ecosystems.
Relative Conservation importance (local)	Intact Knysna Sand Fynbos has a High Importance value, not present on site.
Relative Conservation importance (regional)	Intact Knysna Sand Fynbos has a High Importance value, not present on site.

3. Vegetation Descriptions and Classifications

The vegetation of the site falls within the Cape Floral Kingdom, one of six such plant kingdoms in the world. This kingdom has over 9 000 plant species, 70% of which grow nowhere else in the world (i.e. they are endemic to the Kingdom) (Cowling and Heijnis, 2001). The Kingdom has the highest known concentration of Red Data Book (threatened) species in the world (Cowling and Hilton-Taylor, 1994) although the occurrence of these species is lower in the eastern part of the Kingdom.

Fynbos is generally characterised by three elements: the tough, wiry restioids (Cape Reeds) form the graminoid (grass-like) layer; the heath component is composed of small, narrow-leaved shrubs (the most famous examples are the Ericas); the proteoid component of proteas, cone-bushes and pin-cushions (Campbell & Sigonyela, 2001). The dominant component of the Mosaic is a Grassy Fynbos community. In Grassy Fynbos, true grasses largely replace the restioids although several species of Restios are still found. The grasses are common, widespread species that are fairly drought-hardy (C⁴ grasses).

According to Section 52 of the National Environmental Management: Biodiversity Act (NEM:BA) this vegetation type **Knysna Sand Fynbos** is classified as **Critically Endangered**.

According to the Vegetation of Southern Africa (Mucina & Rutherford, 2006) classification, the vegetation on site is **FFd 10 Knysna Sand Fynbos** with an **Endangered** Ecological Status.

According to the Critical Biodiversity Areas of the Garden Route *Conservation Planning Report 2010 (Holness et al)* this vegetation type **Sedgefield Thicket-Fynbos**: with a **Least Threatened** Ecological Classification.

According to the Western Heads Vegetation Classification (*Regalis Environmental Consultancy – J. Vlok*) the vegetation on site is identified as “**Knysna Wet Sandy Fynbos**”, “**Saltmarsh**” and “**Coastal Forest Thicket**”.

FFd 10 Knysna Sand Fynbos

Distribution

Western Cape Province:

Garden Route coastal flats from Wilderness, generally to the north of the system of lakes, several patches around the Knysna Lagoon, with more isolated patches eastwards to the Robberg peninsula near Plettenberg Bay. Altitude 40-300m.

Vegetation & Landscape Features

Undulating hills and moderately undulating plains covered with a dense, moderately tall, microphyllous shrubland, dominated by species more typical of sandstone fynbos.

Geology & Soils

Deep, acid Tertiary sand inland of coastal dunes forming regic sands and soils of Lamotte form. Land types mainly Hb and Ga.

Climate

MAP 670-1 090mm (mean: 850mm), with a slight peak in autumn and spring. Mean daily maximum and minimum temperatures 27.3 degrees Celsius and 7.3 degrees Celsius for February and July, respectively. Frost incidence: approximately 2 or 3 days per year.

Conservation:

Endangered. Conservation Target 23%. Patches are statutorily conserved in the proposed Garden Route National Park (about 3%) as well as 2% in several private nature reserves. Almost 70% already transformed (pine and gum plantations, cultivation, Knysna urban sprawl, building of roads). Alien *Acacia melanoxylon*, *A. mearnsii* and *A. longifolia* occur locally at low densities. Erosion very low to moderate.

Remark: This is a very poorly researched vegetation unit.

FLORA				
IMPORTANT TAXA				
Small Tree	Tall Shrubs	Low Shrubs	Herbs	Graminoids
<i>Widdringtonia nodiflora</i> LC	<i>Cliffortia linearifolia</i> LC, <i>Leucadendron eucalyptifolium</i> LC, <i>Metalasia densa</i> LC, <i>Passerina corymbosa</i> LC	<i>Anthospermum aethiopicum</i> LC, <i>Berzelia intermedia</i> LC, <i>Cliffortia drepanoides</i> LC, <i>Clutia rubricaulis</i> LC, <i>Erica diaphana</i> LC, <i>E. glandulosa</i> subsp. <i>fourcadei</i> VU, <i>E. glumiflora</i> VU, <i>E. sessiliflora</i> LC, <i>Helichrysum asperum</i> var. <i>asperum</i> LC, <i>Lachnaea diosmoides</i> LC, <i>Leucadendron salignum</i> LC, <i>Leucospermum cuneiforme</i> LC, <i>Lobelia coronopifolia</i> LC, <i>Morella quercifolia</i> LC, <i>Muraltia squarrosa</i> LC, <i>Oedera imbricata</i> LC, <i>Protea cynaroides</i> LC, <i>Stoebe plumosa</i> LC, <i>Tephrosia capensis</i> LC	<i>Geranium incanum</i> LC, <i>Helichrysum felinum</i> LC	<i>Aristida junciformis</i> subsp. <i>galpinii</i> LC, <i>Brachiaria serrata</i> LC, <i>Cynodon dactylon</i> LC, <i>Eragrostis capensis</i> LC, <i>Ficinia bulbosa</i> LC, <i>Heteropogon contortus</i> LC, <i>Ischyrolepsis eleocharis</i> LC, <i>Tetraria cuspidata</i> LC, <i>Thamnochortus cinereus</i> LC, <i>Themeda triandra</i> LC, <i>Tristachya leucothrix</i> LC

(d) Capensis elements also occurring in other than Fynbos units. NT not threatened; LC least concern; VU vulnerable; EN endangered; CR critical endangered; NE not evaluated (exotic); DDD data deficient – insufficiently known.

Ecosystem Status of Knysna Sand Fynbos according to the NEM:BA.

National Environmental Management: Biodiversity Act (NEMBA), 2004 (Act No. 10 of 2004)

National List of Ecosystems that are threatened and in need of protection, in terms of Section 52 of the NEM:BA.

Vegetation Type: Knysna Sand Fynbos (code: FFd 10 – VEGMAP)

Listed as Critically Endangered Criterion A1

Criterion A1: Irreversible loss of Natural Habitat

“Land cover categories that were considered to represent outright loss of natural habitat were cultivated areas, forestry plantations, mines and quarries, and urban or built-up areas” (*Government Gazette No. 34809, 9 December 2011*).

This criterion identifies ecosystems that have undergone loss of natural habitat, impacting on their structure, function and composition. Loss of natural habitat includes outright loss, for example the removal of natural habitat for cultivation, building of infrastructure, mining etc., as well as severe degradation. For this purpose, habitat is considered severely degraded if it would be unable to recover to a natural or near-natural state following the removal of the cause of the degradation (e.g. invasive aliens, over-grazing), even after very long time periods.

For the current phase of listing, Criterion A 1 has been applied to ecosystems defined as national vegetation types in the South African Vegetation Map 18 or as national forest types recognised by DAFF . The thresholds for this criterion are based on the biodiversity targets developed In the National Spatial Biodiversity Assessment (NSBA) 2004. The biodiversity target for a vegetation type is the proportion of the original extent of the vegetation type required to conserve the majority of species associated with that vegetation type.

It is expressed either as a percentage of the original extent of the vegetation type or in hectares. Biodiversity targets for national vegetation types range from 16% to 36%, with higher targets for more species rich vegetation types. For example, a species rich vegetation type with an original extent of 10 000ha could have a biodiversity target of 30% or 3 000ha.

An ecosystem is categorised as critically endangered if the extent of remaining natural habitat in the ecosystem is less than or equal to its biodiversity target. This threshold indicates a loss of species and change in species composition within the ecosystem. For example, a 1 0 000ha ecosystem with a biodiversity target of 30% would be categorised as critically endangered if 3 000ha or less of the ecosystem remained in a natural state (or conversely if more than 7 000ha of the original extent of the ecosystem had been lost).

An ecosystem is categorised as endangered if the extent of remaining natural habitat in the ecosystem is less or equal to than its biodiversity target plus 15%. This threshold provides a buffer for critically endangered ecosystems. For example, the 1 0 000ha ecosystem with a biodiversity target of 30% would be categorised as endangered if 4 500ha (45%) or less of the ecosystem remained in a natural state.

An ecosystem is categorised as vulnerable if the extent of remaining natural habitat in the ecosystem is less than or equal to 60% of the original extent of the ecosystem. This threshold indicates a loss of ecosystem functioning. For example, a 10 000ha ecosystem would be categorised as vulnerable if 6 000ha or less of the ecosystem remained in a natural state.

Note that while the Criterion A thresholds for critically endangered and endangered ecosystems varies depending on the biodiversity target for the ecosystem, the threshold for vulnerable ecosystems is independent of the biodiversity target.

For future phases, it may make sense to apply this criterion to recognised vegetation sub-types as well as to national vegetation types. However, an agreed method for Identifying vegetation sub-type and processes for recognising them would be pre-requisites for this.

Biodiversity targets are calculated based on the species-area curve method (Desmet, P. & Cowling, R. 2004. Using the species-area relationship to set baseline targets for conservation. Ecology and Society)

The systematic biodiversity plan for the forest biome Included targets for national forest types. However, these targets were not set using the species-area curve method developed in the NSBA 2004. For the purpose of listing ecosystems, the biodiversity targets for national forest types were revised using the species-area curve method.

The spatial analysis for this criterion used the best available land cover data. For Free State, Limpopo, North West and Northern Cape the best available land cover data was provided by combining the National Land Cover (NLC) 2000 and the NLC 1996. Eastern Cape, Gauteng, KwaZulu-Natal, Mpumalanga and Western Cape had land cover data layers that improved on the NLC 2000 and NLC 1996. These improved data layers were clipped into the combined NLC 2000 and NLC 1996 to make a new "mosaic" national land cover layer that represented the best available land cover data for the country.

Land cover categories that were considered to represent outright loss of natural habitat were cultivated areas, forestry plantations, mines and quarries, and urban or built-up areas. Information on severe degradation was included where available; however, degradation has to date been poorly mapped in South Africa, and distinctions between moderate and severe degradation are usually not made in available spatial information.

Important Taxa:

The category of Important Taxa includes those species (and lower taxa) that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the Landscape of the vegetation unit.

This list forms a basic floristic profile of the vegetation unit.

Endemic Taxa:

The concept of endemism is determined by the extent of the vegetation unit. This means that a plant taxon is listed as endemic in the description when it occurs exclusively within the vegetation unit concerned. The strict interpretation of the "unit based endemism" has been

relaxed in the Fynbos Biome, where an endemic plant species may have less than 10% of localities outside the vegetation unit in question.

None listed for the vegetation type.

Fynbos Biome

With the exception of excluding Renosterveld, we do not deviate much from the concepts of Mucina and Rutherford (2006) regarding the Fynbos biome. We do, however, recognize mosaic vegetation units with four of our fourteen Fynbos habitat types being mosaic vegetation types.

Apart from fire as an important disturbance regime, we believe that herbivores also played an important role in shaping the vegetation of some of the lowland Fynbos, especially the Dune and Grassy Fynbos habitat types.

In the case of the Dune Fynbos mole-rat activity clearly also plays an important soil disturbance role. New literature question the general recommendation of late summer to autumn fires as being the most appropriate for much of the Garden Route domain, especially for east of the 24° longitude. Limited evidence indicates that late winter and spring fires may be more appropriate for these more eastern areas.

Much more work is however required before a final answer can be given on this question of ecologically correct fire seasons in the eastern region. Whatever the outcome, we believe that high intensity fires are vital to retain endemic and rare large-seeded species such as *Leucospermum glabrum*, *Mimetes pauciflorus* and *Mimetes splendidus*. Low-intensity fires have been practiced over many years in an attempt to protect the afforested areas. This only resulted in the build up of fuel and devastating fires during extreme conditions.

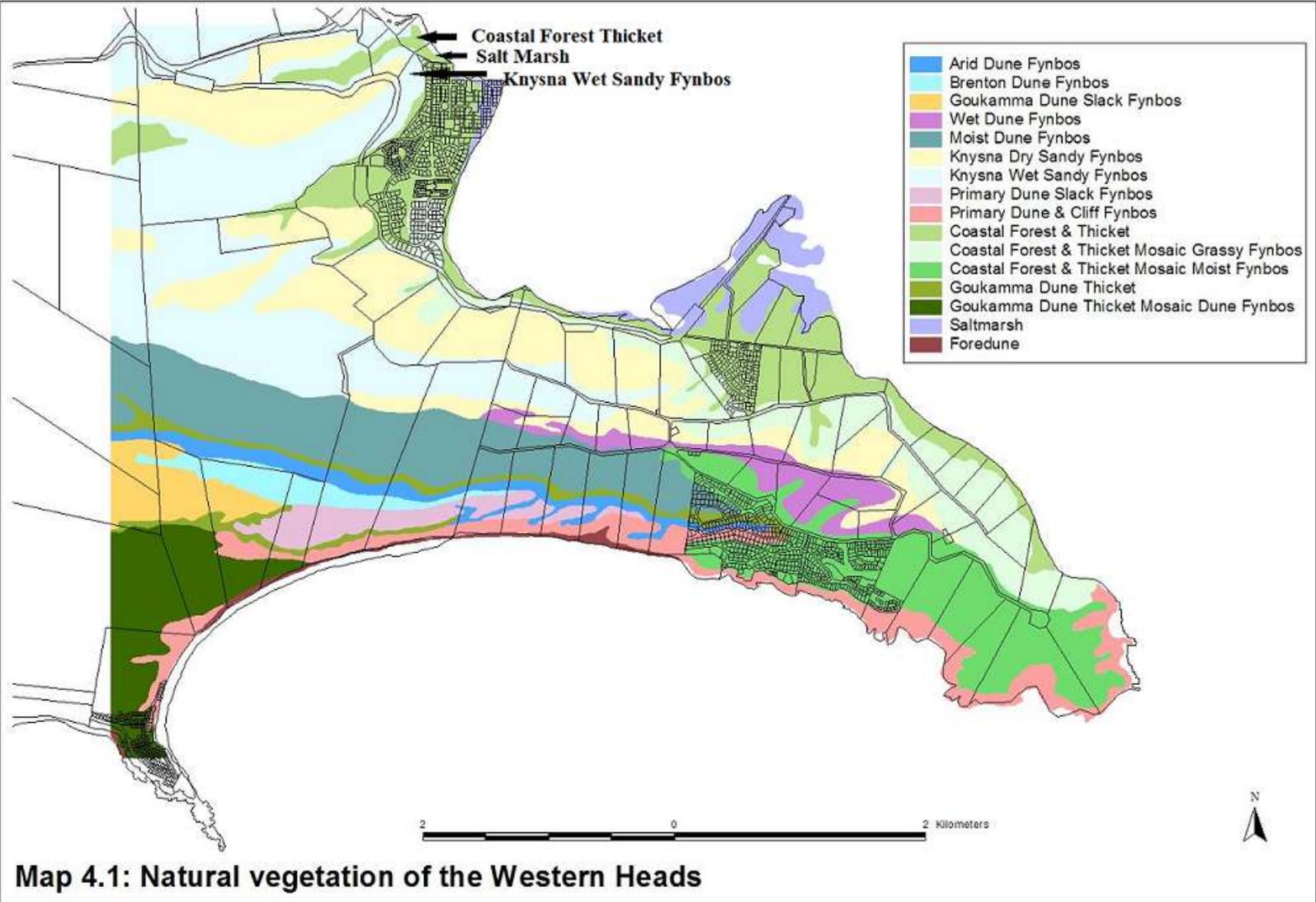
Sedgefield Thicket-Fynbos (Equivalent to Knysna Sand Fynbos) (GRI Vegetation Classification)

Dune Sandplain Mosaic Thicket

This habitat type differs from the Sandplain Fynbos habitat only in having some Thicket bush-clumps present. Only one unit is recognised in this habitat, the **Sedgefield Thicket-Fynbos**.

The bush-clump currently present in this unit are probably more abundant and larger than they used to be as most of this habitat has been protected against fires for many years. In the past browsers probably also contained the extent of these bush-clumps, which consists mostly of Dune Thicket species such as *Azima tertracantha*, *Carissa bispinosa*, *Cussonia thyrsiflora*, *Euclea rasemosa*, *Olea exasperata*, *Rhus glauca*, *Sideroxylon inerme* and *Tarchonanthus camphoratus*, which all can grow rapidly in the absence of fire. These bush-clumps easily overgrow the adjacent matrix Fynbos vegetation in the absence of fire. This results in the loss of the rich biodiversity of the matrix Sandplain Fynbos. Geophyte species endemic to the Sandplain Fynbos, such as *Gladiolus vaginatus* and *Satyrium princeps* will first go extinct without the correct fire regimes, but will soon be followed by endemic shrubs such as *Erica glandulosa subsp. fourcadei*.

The following vegetation types identified by Jan Vlok: Regalis Environmental Services (2005) occur on the site:



Knysna Wet Sandy Fynbos (Jan Vlok: Regalis Environmental Services (2005))

This unit occurs on south facing slopes in the more inland dune systems. It is quite rich in species, many of which shows a distinct affinity with the more upland Mountain Fynbos units. In this unit species such as *Agathosma capensis*, *Anginon difforme*, *Berzelia intermedia*, *Bobartia orientalis*, *Diospyros dichrophylla*, *Drosera cistiflora*, *Erica sparsa*, *Helichrysum felinum*, *Hippia frutescens*, *Leucadendron salignum*, *Leucospermum cuneiforme*, *Mastersiella purpurea*, *Metalasia densa*, *Montinia caryophyllacea*, *Otholobium heterosepalum*, *Phylica axillaris*, *Printzia polifolia*, *Restio triticeus*, *Thamnochortus cinereus* and *Watsonia knysnana* are abundant and characteristic species. The localised endemic *Muraltia knysnaensis* occurs in this unit, but is not restricted to it. This unit is absent from the Goukamma Nature Reserve and is not conserved anywhere else either.

Note: None of the characteristic species were found on site.

Coastal Forest & Thicket (Jan Vlok: Regalis Environmental Services (2005))

This rather uncommon forest type is restricted to the lowlands and is best developed in fire-protected sites along rivers and at river mouths. The presence of subtropical tree species such as *Calodendrum africana*, *Celtis africana*, *Ekebergia capensis* and occasionally *Olea europaea ssp. africana* differentiates this unit from the upland Afromontane forest types. No rare plant species are known from this unit, but it is the habitat of uncommon bird species such as the Knysna Woodpecker (*Campethera notata*). I suspect that some uncommon invertebrates may also be present. Large herbivores (e.g. Elephant) were probably important to retain disturbance regimes, such as controlling lianas that are currently often overgrowing the canopy, but have little evidence to sustain this notion. Few near-pristine examples of this vegetation unit can still be found, but there is a small example in the Goukamma Nature Reserve, along the banks of Groenvlei. It is better developed towards the east, e.g. Alexandria district.

Note: None of the characteristic species were found on site.

Saltmarsh (Jan Vlok: Regalis Environmental Services (2005))

The Saltmarsh vegetation unit is restricted to the outer perimeter of the Knysna estuary. It cannot be mistaken with any of the other vegetation units in the area as it is dominated by characteristic species such as *Chenolea diffusa*, *Cotula coronopifolia*, *Juncus acutus*, *Limonium scabrum*, *Sarcocornia perennis*, *Scirpus maritimus* and *Suaeda fruticosa*. This unit plays an important role to retain the biodiversity and ecological processes of the estuary. Its own health is largely determined by fresh water supply from the uplands and adjacent terrestrial vegetation. This unit is very sensitive to physical disturbance and pollution from adjacent terrestrial activities, including soil erosion.

Note: Typical Salt marsh species occur in the ecotone area on site

Current Condition of the Vegetation (Regalis Environmental Services (2005))

Most of the local vegetation types have been affected by urban development, infestation by alien vegetation and/or altered ecological processes (Map 4.2 and Tables 4.1 & 4.2).

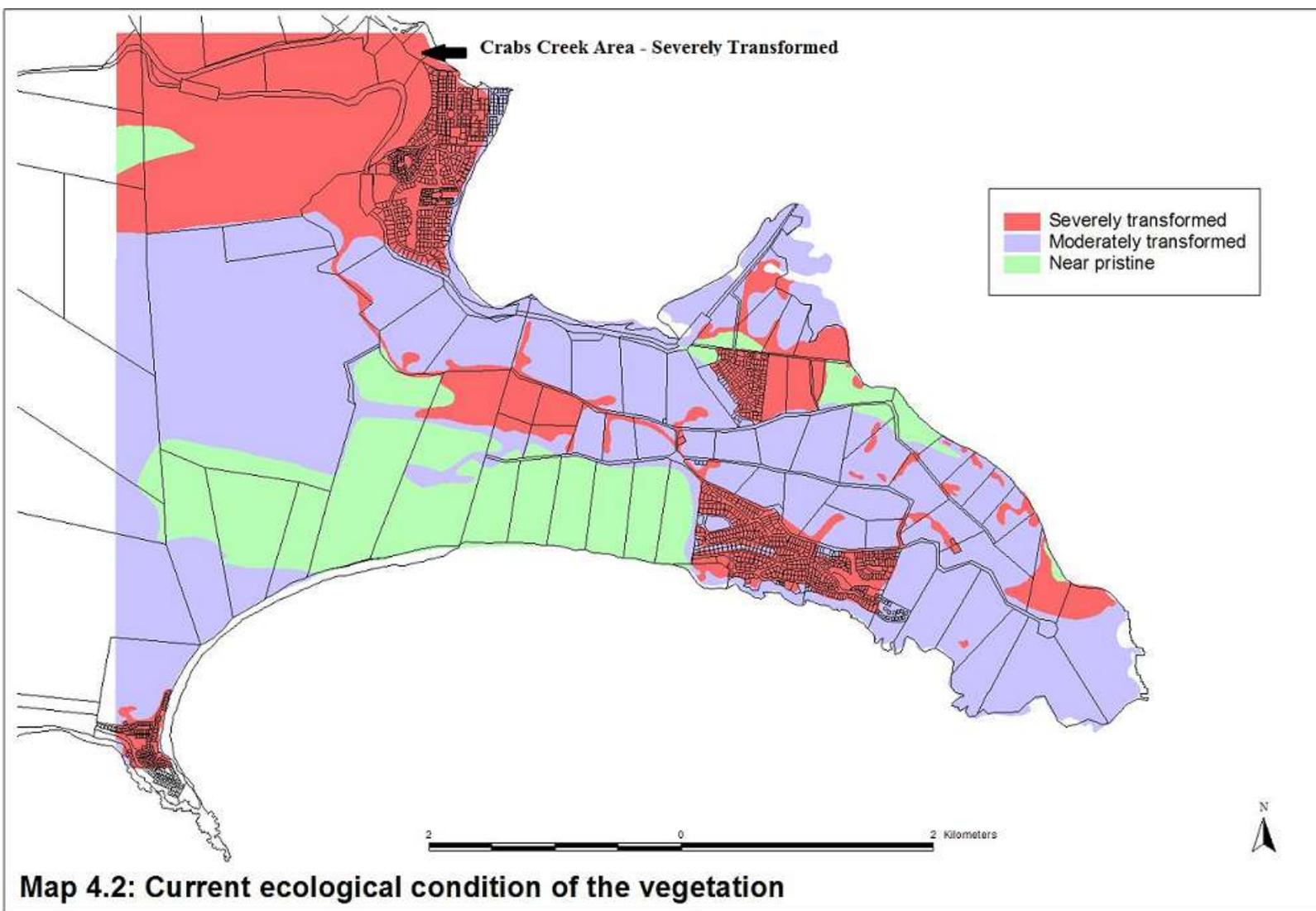
Table 4.1: Spatial extent of the sixteen vegetation units of the Western Heads area and degree to which they have been transformed (percentage of total area).

(Jan Vlok: Regalis Environmental Services (2005))

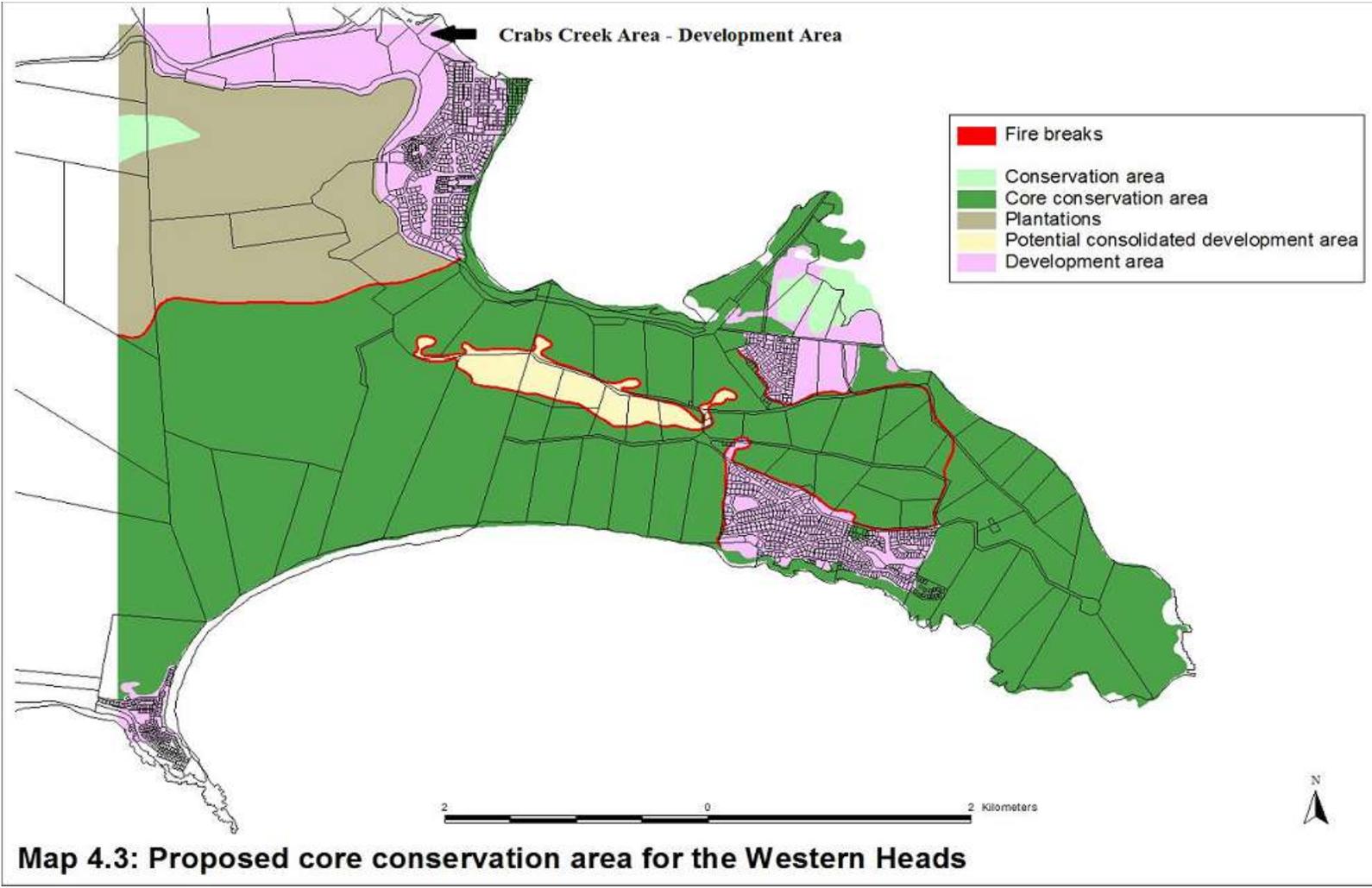
VEGETATION TYPE	TRANSFORMATION			TOTAL AREA (ha)
	SEVERE	MODERATE	PRISTINE	
Foredune	0.0%	31.6%	68.4%	14.8
Brenton Dune Fynbos	0.0%	0.4%	99.6%	37.7
Primary Dune Slack Fynbos	0.0%	0	100.0%	49.8
Goukamma Dune Slack Fynbos	0.0%	32.8%	67.2%	51.9
Goukamma Dune Thicket	10.1%	24.2%	65.7%	52.0
Arid Dune Fynbos	5.7%	5.6%	88.7%	52.8
Wet Dune Fynbos	9.5%	90.5%	0	61.8
Saltmarsh	6.8%	93.1%	0.1%	62.4
Goukamma Dune Thicket Mosaic Dune Fynbos	11.1%	87.3%	1.5%	111.5
Primary Dune & Cliff Fynbos	7.2%	60.5%	32.4%	121.7
Coastal Forest & Thicket Mosaic Grassy Fynbos	19.3%	76.7%	4.0%	184.1
Coastal Forest & Thicket Mosaic Moist Fynbos	29.4%	70.5%	0	213.8
Moist Dune Fynbos	2.2%	55.3%	42.6%	225.3
Coastal Forest & Thicket	64.9%	20.2%	14.9%	257.9
Knysna Dry Sandy Fynbos	34.5%	65.3%	0.2%	354.6
Knysna Wet Sandy Fynbos	54.8%	39.8%	5.4%	446.1

Table 4.2: Spatial extent of the Western Heads vegetation units that are still in a pristine to moderate ecological condition. (Jan Vlok: Regalis Environmental Services (2005))

VEGETATION TYPE	AREA (hectare)	
	PRISTINE	PRIST+MOD
Foredune	10.1	14.8
Brenton Dune Fynbos	37.5	37.7
Goukamma Dune Thicket	34.2	46.8
Arid Dune Fynbos	46.8	49.8
Primary Dune Slack Fynbos	49.8	49.8
Goukamma Dune Slack Fynbos	34.9	51.9
Wet Dune Fynbos	0.0	56.0
Saltmarsh	0.1	58.1
Coastal Forest & Thicket	38.4	90.5
Goukamma Dune Thicket Mosaic Dune Fynbos	1.7	99.1
Primary Dune & Cliff Fynbos	39.4	113.0
Coastal Forest & Thicket Mosaic Grassy Fynbos	7.4	148.5
Coastal Forest & Thicket Mosaic Moist Fynbos	0.0	150.9
Knysna Wet Sandy Fynbos	24.2	201.7
Moist Dune Fynbos	95.9	220.4
Knysna Dry Sandy Fynbos	0.8	232.2



(Jan Vlok: Regalis Environmental Services (2005))



(Jan Vlok: Regalis Environmental Services (2005))

4. Impacts, Mitigation Measures and Significance Rating

Four negative and two positive impacts of significance were identified using the following methodology:

Four factors need to be considered when assessing the significance of impacts, namely:

- A. the relationship of the impact to temporal scales
- B. the relationship of the impact to spatial scales
- C. the actual significance of the impact, and
- D. the degree of confidence placed in the assessment

A. The **temporal scale** defines the significance of the impact at various time scales, as an indication of the duration of the impact.

1. **Short term:** less than 5 years. Many construction phase impacts will be of a short duration.
2. **Medium term:** between 5-20 years, the approximate duration of the mining operation.
3. **Long term:** between 20-40 years, and from a human perspective essentially permanent.
4. **Permanent:** over 40 years, and resulting in a permanent and lasting change that will always be there.

B. The **spatial scale** defines physical extent of the impact.

1. **Localized:** having an impact only within the confined of the development.
2. **Municipal:** having an impact within the municipal area (i.e. the Bitou municipality)
3. **Regional:** having an impact within the regional context (Western Cape)
4. **National:** having an impact at the National Level (South Africa)

C. The **Environmental Significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society. Significance will need to be evaluated with and without mitigation. In many cases, mitigation will take place, as it will have been incorporated into project design. A six-point significance scale has been applied.

1. **Very High:** These impacts are considered by the specialist as constituting a major and usually permanent change to the environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects.
2. **High:** These impacts will usually result in long-term effects on the natural environment. Impacts rated as high are considered by the specialist as constituting an important and usually long-term change to the environment.
3. **Moderate:** These impacts will usually result in medium- to long-term effects on the natural environment. Impacts rated as moderate are considered by the specialist as constituting a fairly important and usually medium term change to the environment. These impacts are real but not substantial.

4. **Low:** These impacts will usually result in medium- to short-term effects on the natural environment. Impacts rated as low are considered by the specialist as constituting a fairly unimportant and usually short-term change to the environment. These impacts are not substantial and are likely to have little real effect.
 5. **No Significance:** There are no primary or secondary effects that are important to the specialist.
 6. **Don't Know:** In certain cases it may not be possible to determine the significance of an impact.
- D. It is also necessary to state the **degree of confidence** with which one has predicted the significance of an impact.
1. **Definite:** More than 90% sure of a particular fact. To use this one will need to have substantial supportive data.
 2. **Probable:** Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
 3. **Possible:** Only over 40% sure of a particular factor of the likelihood of an impact occurring.
 4. **Unsure:** Less than 40% sure of a particular fact or the likelihood of an impact occurring.

Vegetation related impacts identified:

Two negative and two positive vegetation related impacts have been identified:

1. Removal of Alien Invasive Species during construction phase (+VE);
2. Re-instatement of Salt marsh vegetation in areas currently prone to invasion by Kikuyu lawn grass adjacent to the Salt Marsh Area.
3. Re-invasion of Alien Invasive Plant species during operational phases.
4. Impact on Salt Marsh due to construction activities.

5. Conclusions & Recommendations:

- **Knysna Sand Fynbos** is a **Critically Endangered** Ecosystem according to the National Environmental Management: Biodiversity Act (NEM:BA), 2011.
- The property fall within a **Ecological Support Area** according to the GRI Documents, 2010.
- All Invasive plant species should be removed from the site and follow up actions implemented.
- Continuous clearing during rehabilitation and landscaping of emerging invasives is required particularly surrounding the site.
- Appropriate soil erosion control measures should be taken in order to avoid and contain erosion.
- The re-establishment of salt Marsh vegetation should be encouraged and monitored.
- It is clear from the detailed studies carried out by Dr. Jan Vlok of Regalis Environmental Services on the Western Heads Area that portion 29 of the Farm Uitzicht No. 216 fall within the area delineated as "transformed" and designated for "Development".

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