

ANNEXURE E3

GEOTECHNICAL

**FRESHWATER CONSTRAINTS ANALYSIS FOR AREA 19
FOR THE PROPOSED OVERSTRAND MUNICIPALITY
HOUSING DEVELOPMENT, KLEINMOND, WESTERN CAPE**

Prepared for

Guillaume Nel Environmental Consultants

August 2018

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GLOSSARY OF TERMS

Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Estuary:	Partially enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Peat Soils	An accumulation of partially decayed vegetation or organic matter. It is unique to natural areas called peatlands, bogs, mires, moors, or muskegs. The peatland ecosystem is the most efficient carbon sink on the planet because peatland plants capture CO ₂ naturally released from the peat, maintaining an equilibrium.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act 36 of 1998) a watercourse means: <ul style="list-style-type: none"> • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake 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.
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Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.



1. INTRODUCTION

In July 2018 Scientific Aquatic Services (SAS) were requested to undertake a field verification as a pre-feasibility for potential development on Area 19 for the Overstrand Municipality, in order to assess the current housing shortage within Kleinmond, Western Cape, hereafter referred to as the “study area”. The study area is located to the south of the R44 (Main Road), just west of the town of Kleinmond. The Ocean borders the site to the south and the Palmiet Estuary is located approximately 100 m to the south west (Figure 1 and Figure 2).

In order to identify all freshwater resources that may potentially be impacted by any future proposed development, a 500m “zone of investigation” around the study area, in accordance with Regulation 509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500m zone of investigation around the study area – was assessed using desktop methods only and will henceforth be referred to as the “Investigation Area”.

A desktop study was compiled with all relevant information as presented by SANBI's Biodiversity Geographic Information Systems (BGIS) website (<http://bgis.sanbi.org>) as well as the National Freshwater Ecosystem Priority Areas (NFEPA) database, followed by a delineation, using desktop methods that include the use of available digital satellite imagery, of all the freshwater resources situated within the study area as well as the investigation area. Following this, a field verification assessment was undertaken to ground truth the results.

1.2 Assumptions and Limitations

- The freshwater resource delineations as presented in this report were undertaken using various desktop methods including the use of topographic maps, historical and current digital satellite imagery and aerial photographs. Delineations were ground-truthed at selected points of interest as dense vegetation cover made access challenging in some areas. The delineations presented within this report are regarded as a best estimate of the boundaries based on the site conditions present, as observed during a single site assessment undertaken in August 2018 and was undertaken as a rapid assessment for planning purposes and the delineations and assessment undertaken are not definitive. The results obtained are, however, considered sufficiently accurate to allow planning and decision making to take place;
- All freshwater resources identified within the investigation area, as per the desktop databases were included as part of this assessment, however, these resources were not ground-truthed nor were they delineated. This constraints analysis considered the study area only.
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur, however, the delineations as provided in this report are deemed appropriately accurate to fulfil the authorisation requirements;
- Freshwater resources and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater resource boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, the delineations as provided in this report are deemed appropriately accurate to provide guidance for any future development plans.



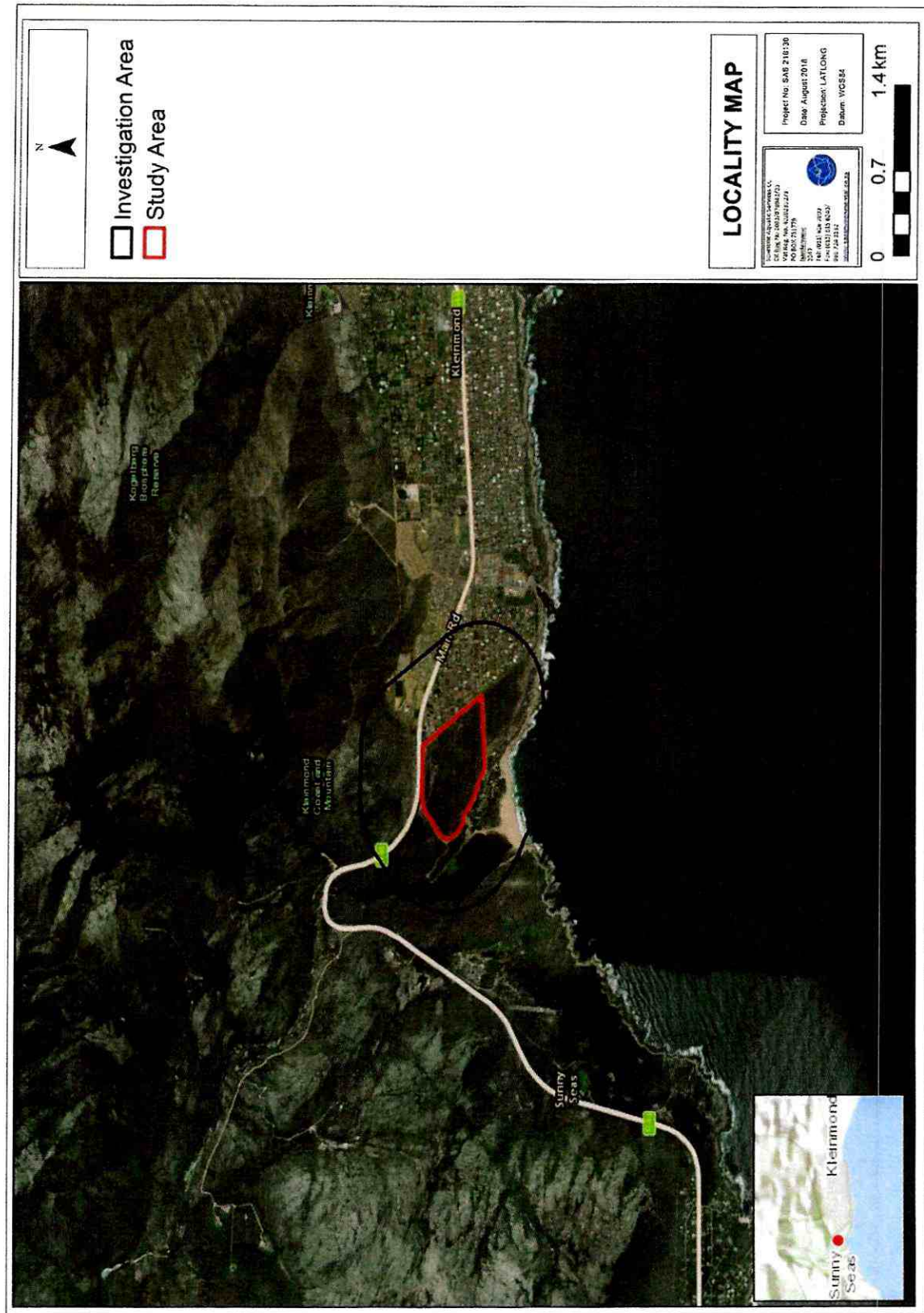


Figure 1: Digital satellite image depicting the study area in relation to the surrounding areas.





2. RESULTS

2.1. Desktop Findings

The following table contains data accessed as part of the desktop assessment and presented as a “dashboard style” report below (Table 1). It is important to note that although all data sources used provide useful and often verifiable, high quality data, the various databases used do not always provide an entirely accurate indication of the subject property’s actual site characteristics at the scale required to inform the environmental authorisation and/or water use authorisation processes, however, this information is considered to be useful as background information to the study. This data was therefore used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the site-specific field verification survey.



Table 1: Desktop data relating to the characteristics of the wetlands associated with the study area.

Aquatic ecoregion and sub-regions in which the study area is located			Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database	
Ecoregion	Southern Folded Mountains		FEPACODE	The majority of the study area is located within a sub-quaternary catchment currently defined as a FEPAC catchment. River FEPAs achieve biodiversity targets for river ecosystems and threatened fish species (important for the <i>Sandelia capensis</i> (DD)) and were identified in rivers that are currently in a good condition (A or B ecological category). Although the FEPAC status applies to the actual river reach, the surrounding land and smaller stream networks need to be managed in a way that maintains the condition of the river reach.
Catchment	Berg			
Quaternary Catchment	Majority within G40D, eastern portion in G40G			
WMA	Breede			
subWMA	Overberg West			
Dominant characteristics of the South Western Coastal Belt Ecoregion Level II (19.04) (Kleynhans <i>et al.</i> , 2007)				
Dominant primary terrain morphology	Plains; low relief, Undulating Hills		NFEPA Wetlands	According to the NFEPA Database a natural unchanneled valley bottom wetland traverses the central portion of the study area. The unchanneled valley bottom wetland is moderately modified, is classified as a FEPAC wetland and is considered important for threatened frog species. Additionally, an estuary is situated approximately 100m west and a natural wetland feature with associated impoundments are situated approximately 235m to the northeast of the study area.
Dominant primary vegetation types	South and South-west coast renosterveld, Dune Thicket, West coast renosterveld			
Altitude (m a.m.s.l.)	0 to 1300			
MAP (mm)	500 to 1000			
Coefficient of Variation (% of MAP)	<20 to 50			
Rainfall concentration index	30 to 50		Wetland Vegetation Type	The study area is situated within the Southwest Sand Fynbos, considered by Mbona <i>et al</i> (2014) to be "Critically Endangered".
Rainfall seasonality	Winter		NFEPA Rivers	The Palmiet River is located within the investigation area, to the west of the study area. According to the NFEPA Database this river is considered natural and unmodified or largely natural (Class AB) NFEPA River, while the PES 1999 data classified the river as moderately modified (Class C).
Mean annual temp. (°C)	16 to 28			
Winter temperature (July)	4 to 16			
Summer temperature (Feb)	10 to 28			
Median annual simulated runoff (mm)	>250			
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)			Importance of the study area according to the Western Cape Biodiversity Spatial Plan (WCBSP, 2017)	
Sub-quaternary reach	G40D – 09369 (Palmiet River)			
Proximity to study area	Traverses western portion of the study area			
Assessed by expert?	Yes			
PES Category Median	B (Largely natural)			
Mean EI Class	High			
Mean ES Class	Very High			
Stream Order	2			
Default Ecological Class (based on median PES and highest EI or ES mean)	A (Very High)			
According to the WCBSP (2017) the study area is situated within the Overstrand Local Municipality. The study area is situated within the Kleinmond Coast and Mountain Nature Reserve which is recognized by the National Environmental Management: Protected Areas Act (NEMPAA) as a protected area.				

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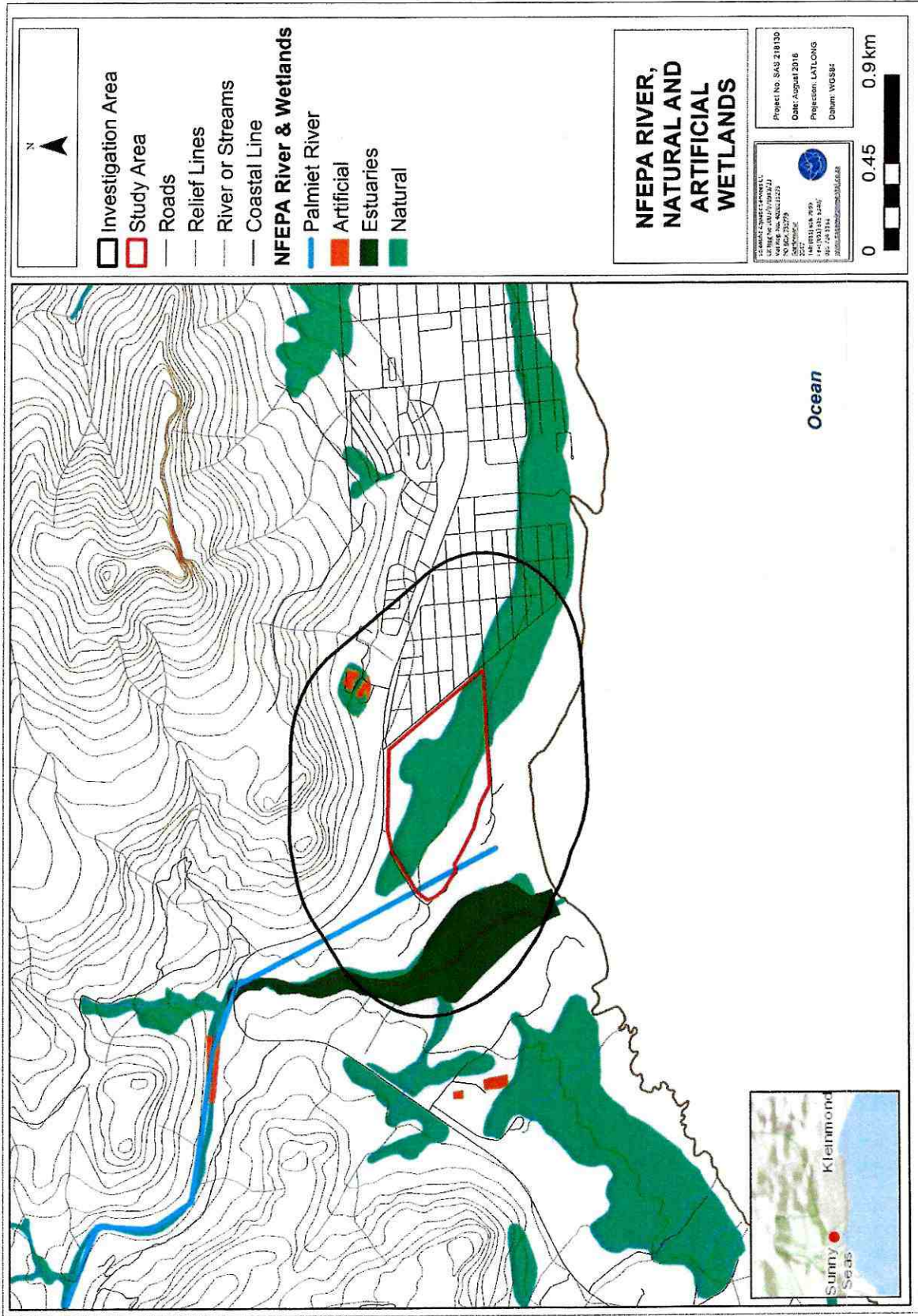


Figure 3: NFEPA Rivers and Wetlands within the study area and investigation zone according to the NFEPA database (2011).



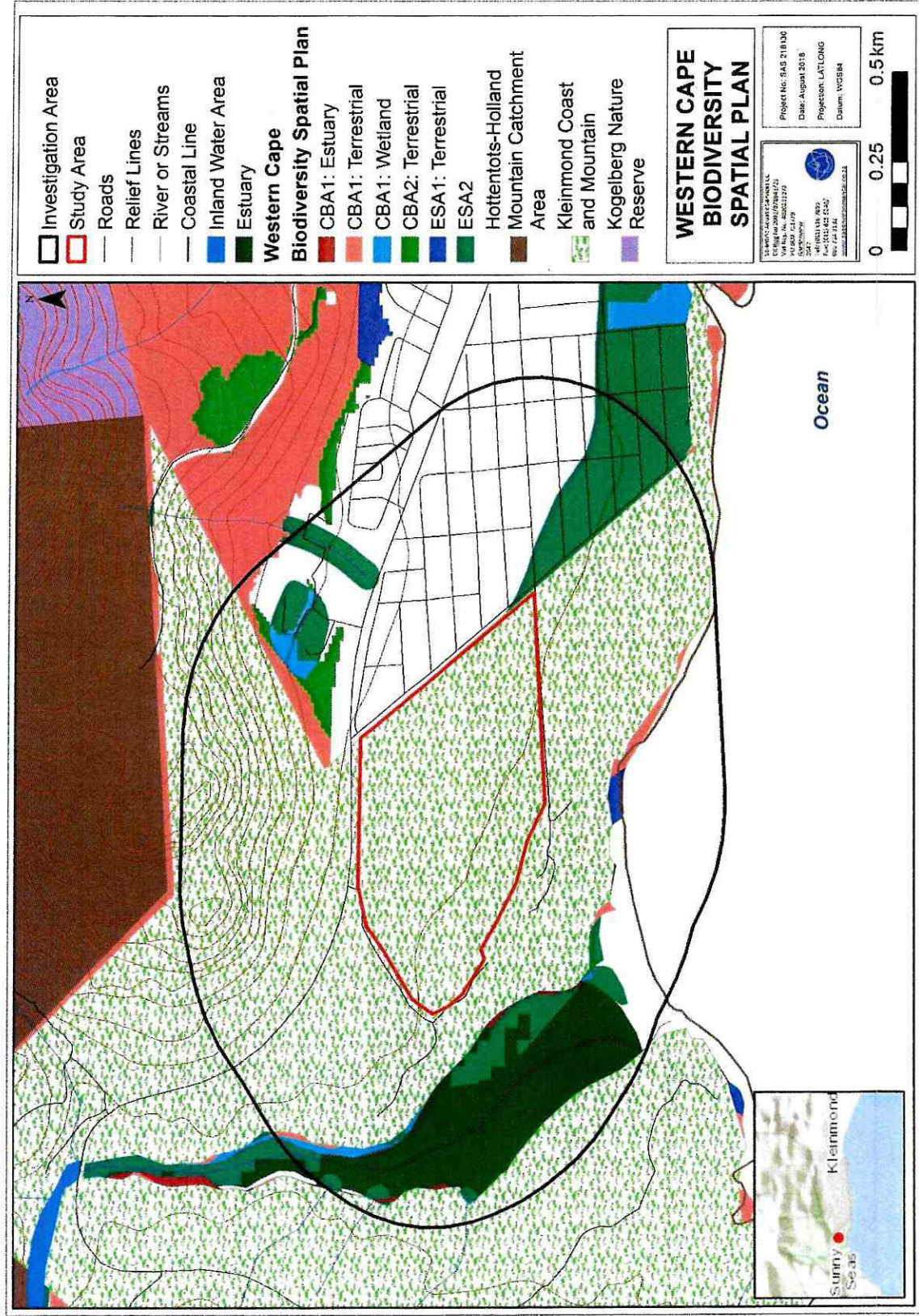


Figure 4: Wetland and Terrestrial CBA and ESAs according to the Western Cape Biodiversity Spatial Plan (2017). The study area falls within the Kleinmond Coast and Mountain Nature Reserve



2.2. Site Verification Results

A site visit was undertaken on the 2nd of August 2018, during which the presence of any areas representing with wetland characteristics as defined by the DWAF (2008) or watercourses as defined by the National Water Act, 1998 (Act 36 of 1998) were identified. The following indicators assist in determining the presence of a watercourse within the study area:

- Terrain units are used to determine in which parts of the landscape a watercourse (including wetlands) was most likely to occur;
- Obligate and facultative wetland species such as *Typha capensis* or *Phragmites australis* could be used in conjunction with terrain units as well as the point where a distinct change in the vegetation composition was observed in order to determine the various wetland boundaries. Obligate species are almost always found in a freshwater feature (>99% of occurrences) while facultative species are usually found in a freshwater feature (76%-99% of occurrences) but are also occasionally found in areas not associated with wetlands or rivers and often in areas of disturbance;
- Surface water and/or saturated soils can be used to determine if there is a permanent zone and to define the outer boundaries (temporary zone) of the wetland; and
- Soil form indicators are used to determine the presence of soils that are associated with prolonged and frequent saturation and a fluctuating water table within 50 cm of the land surface.

It should be noted that in order for an area to be identified as a wetland, at least two (2) of the above indicators should be present (*Pers Comm Prof. F. Ellery*).

3. KEY OBSERVATIONS

1. The study area is approximately 33 hectares in extent and is located just south of the R44 to the west of the town of Kleinmond. The study area is located on a fairly uniform slope, with an average slope ranging between 1, 3% and 0, 3% with a south eastern aspect, towards the ocean.
2. A large humic-based Unchannelled Valley Bottom Wetland was identified traversing most of the study area with an extent of 30 hectares. The wetland can be defined as a peat wetland and was predominantly dominated by *Typha capensis* in the north western regions with the central and southern regions being dominated by largely indigenous fynbos vegetation from the Restionaceae family (Figure 5). Although not formally assessed, the wetland appears to be in a largely Natural State (Present Ecological State Category A/B).



Figure 5: (Left) Unchannelled Valley Bottom Peat Wetland within the study area (Right) *Typha capensis* identified in the northern region of the wetland.

3. The soil profile was investigated with the use of a hand auger in order to determine the outer boundary of the Unchannelled Valley Bottom Peat Wetland. It was noted that the entire system is made up of a thick layer (approximately 60 cm) of peat soils. Peat soils are formed from partially decomposed plant material under anaerobic water saturated conditions. Surface water and saturated soils were observed within the north western region of the system (Figure 6).



Figure 6: (Left) Peat soils observed within the site (Right) Saturated peat soils indicative of wetland conditions.

4. Peatlands are known for their ability to mitigate global climatic impacts through their capacity to store carbon and are also known to be biodiversity hotspots and home to various endangered species. Peat soils act as a sponge and a natural filter, making it highly effective in removing sediment, pollutants and pathogens. It should be noted that there are international initiatives in place to preserve remaining peatlands, not only to protect the local biodiversity and the ecosystem services they provide but also for the critical part they play in global climate regulation (WRC. 2010).

Based on the above, Figure 7 below provides a constraints analysis for future development. The following are applicable:

- Red – This area is the delineated Unchannelled Valley Bottom Peat Wetland and is considered as a “No-go Area” and should be avoided.
- Orange – This area falls within the 32m zone of regulation in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998) and is also considered to be an appropriate conservation buffer for the Unchannelled Valley Bottom Peat Wetland. Development is not recommended within this extent from the wetland due to the ecological importance and sensitivity of the wetland.
- Green – These areas are considered developable from a freshwater resources management and conservation point of view.



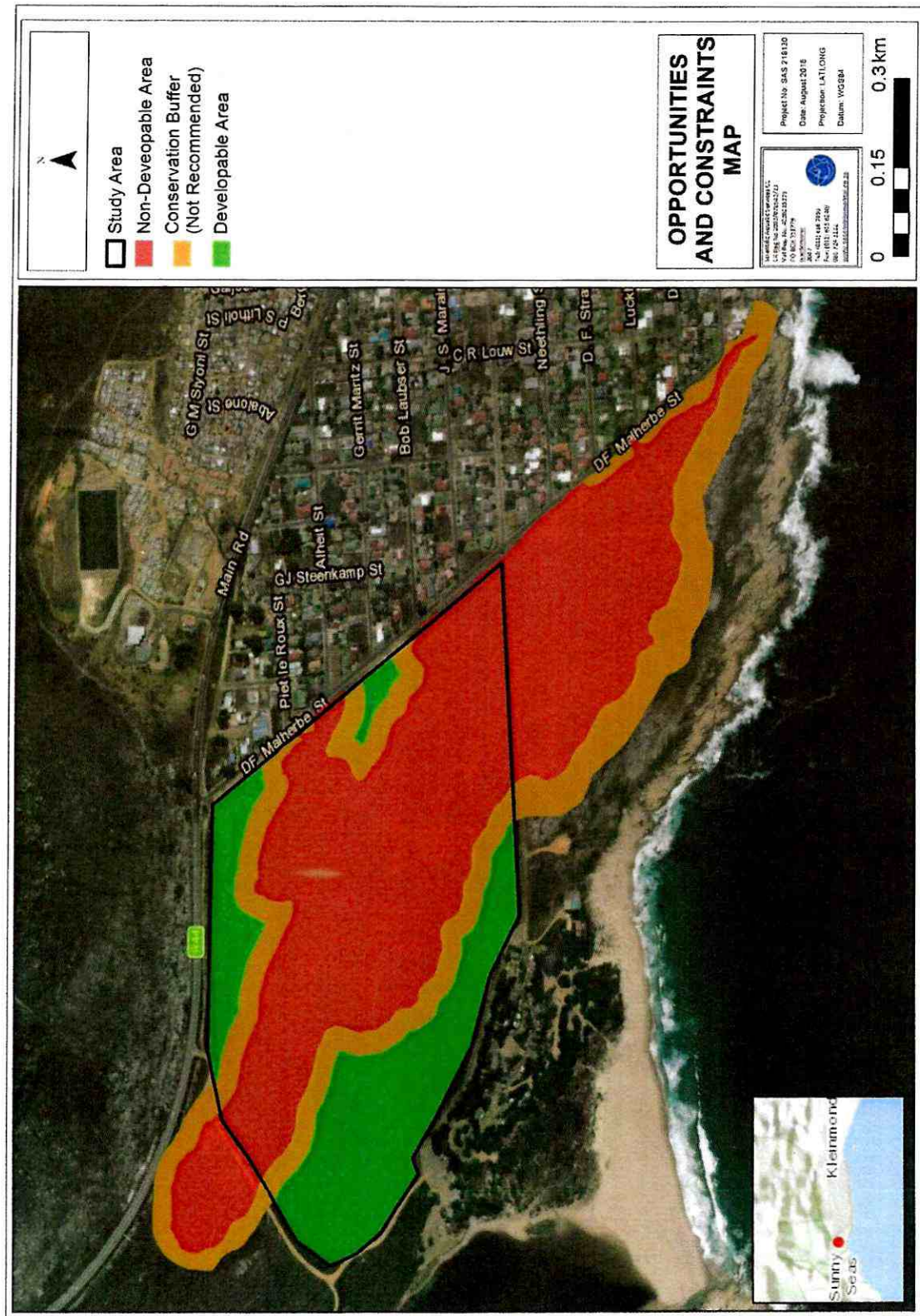


Figure 7: Development Opportunities and Constraints Map of the study area to be considered for future development. The conservation buffer was clipped to the right in line with the existing road and residential area.



4. CONCLUSION

Based on the findings of the study, the following is recommended:

1. Given the findings of this investigation, it is noted that the study area is within close proximity to the sensitive Palmiet Estuary and an extensive Unchannelled Valley Bottom Peat Wetland is located within the study area. Peatlands are known for their ability to mitigate global climatic impacts through their capacity to store carbon and are also known to be biodiversity hotspots and home to various endangered species. This wetland was delineated and is considered a No-go area for future development.
2. A 32m zone of regulation in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) was implemented around the Unchannelled Valley Bottom Peat Wetland and deemed to be an appropriate conservation buffer for the ecological importance and sensitive wetland system. Development is not recommended within this extent from the wetland. In line with this, limited area remaining that could be considered for development.
3. Due to the protection status of the study area, which falls within the Kleinmond Coast and Mountain Nature Reserve as well as the largely natural state of the wetland (located within the critically endangered Southwest Sand Fynbos Wetland Vegetation type) within the site, it is the opinion of the freshwater specialist that this site is considered to be fatally flawed from a freshwater resource management and conservation perspective due to the high ecological importance and sensitivity as well as the ecoservice provision for the Unchannelled Valley Bottom Peat Wetland (although not formally assessed). It is recommended that this site remain a protected area and not be developed in future.

We trust we have interpreted your requirements correctly. Please do not hesitate to contact us if there are aspects of this document that you would like to discuss further.

Yours Faithfully,

Digital Documentation Not Signed for Security Purposes

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Pr. Sci. Nat 117137/17

Co-Author (Desktop Background Information): Sanja Erwee

Reviewed by: Stephen van Staden (Pr.Sci.Nat)



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In order to identify all freshwater resources that may potentially be impacted by any future proposed development, a 500m "zone of investigation" around the study area, in accordance with Regulation 509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500m zone of investigation around the study area – was assessed using desktop methods only and will henceforth be referred to as the "Investigation Area".

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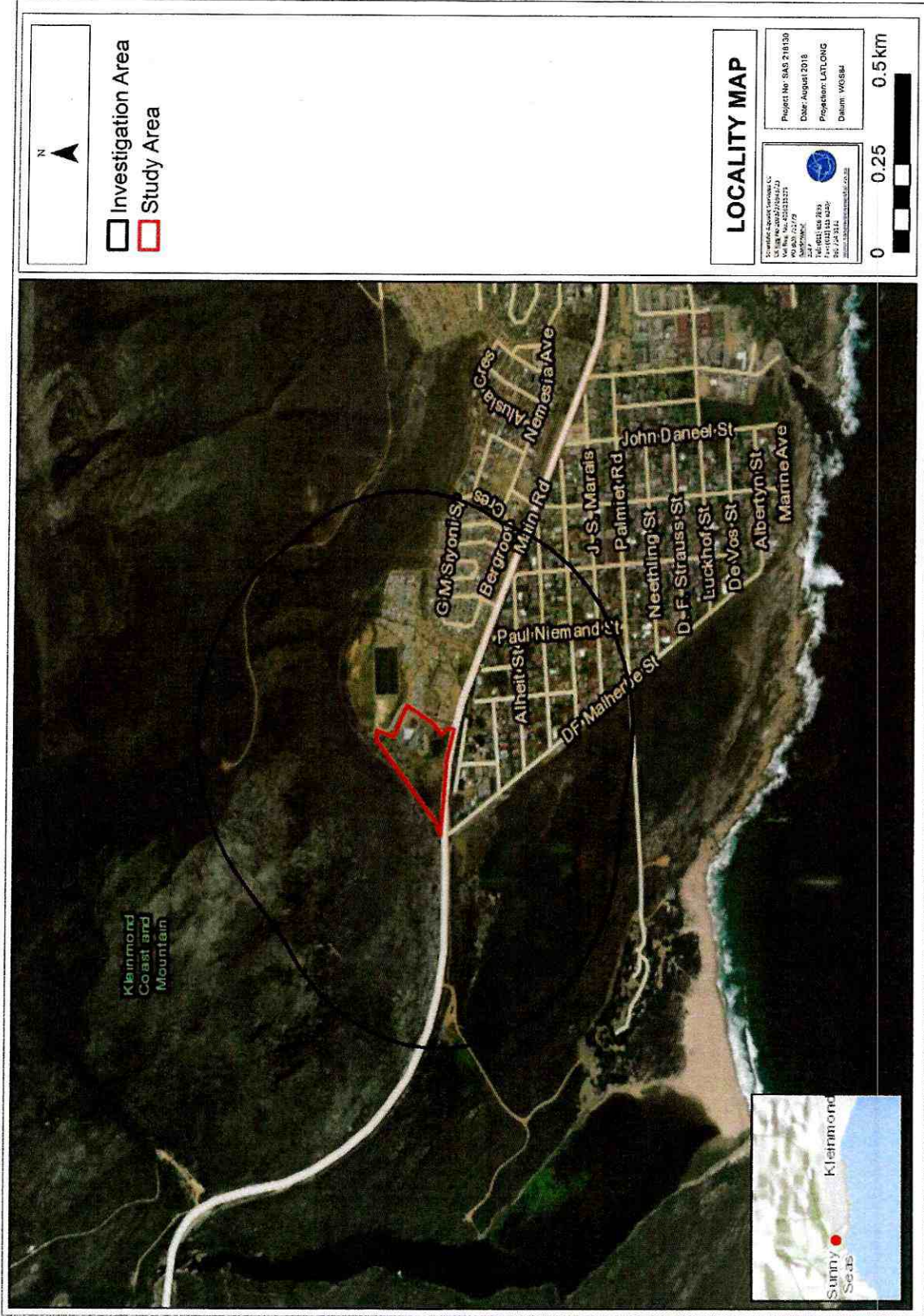


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Dominant morphology	primary terrain	Plains; low relief, Undulating Hills			
Dominant primary vegetation types	South and South-west coast renosterveld, Dune Thicket, West coast renosterveld				
Altitude (m a.m.s.l.)	0 to 1300			Wetland Vegetation Type	The study area is situated within the Southwest Sand Fynbos, considered by Mbona <i>et al</i> (2014) to be "Critically Endangered".
MAP (mm)	500 to 1000				
Coefficient of Variation (% of MAP)	<20 to 50			NFEPA Rivers	The Palmiet River is situated approximately 640m southwest of the study area. According to the NFEPA Database this river is considered natural and unmodified or largely natural (Class AB) NFEPA river, while the PES 1999 data classified the river as moderately modified (Class C).
Rainfall concentration index	30 to 50				
Rainfall seasonality	Winter			Importance of the study area according to the Western Cape Biodiversity Spatial Plan (WCBSP, 2017)	According to the WCBSP (2017) the study area is situated within the Overstrand Local Municipality. The study area comprises of Aquatic (wetland) Category 1 and Terrestrial Category 2 Critical Biodiversity Areas (CBA), and Category 2 Ecological Support Areas (ESA). Aquatic CBAs are areas in a natural condition that are required to meet biodiversity targets for species, ecosystems/ ecological processes and infrastructure. CBA 1 areas need to be maintained in a natural or near natural state with no further loss of natural habitat. Furthermore, degraded areas should be rehabilitated and only low-impact, biodiversity sensitive land uses are appropriate. ESAs are areas that are not essential for meeting biodiversity targets; however, they play an important role in supporting the functioning of protected areas / CBAs and are often vital for delivering ecosystem services. ESA 2 areas are considered to be severely degraded or have no natural cover remaining and therefore require restoration where feasible.
Mean annual temp. (°C)	16 to 28				
Winter temperature (July)	4 to 16				
Summer temperature (Feb)	10 to 28				
Median annual simulated runoff (mm)	>250				
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)					
Sub-quaternary reach	G40D – 09369 (Palmiet River)				
Proximity to study area	Approximately 640m southwest of the study area				
Assessed by expert?	Yes				
PES Category Median	B (Largely natural)				
Mean EI Class	High				
Mean ES Class	Very High				
Stream Order	2				
Default Ecological Class (based on median PES and highest EI or ES mean)	A (Very High)				
CBA = Critical Biodiversity Areas; DD = Data Deficit; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Meters Above Mean Sea Level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; WMA = Water Management Area					

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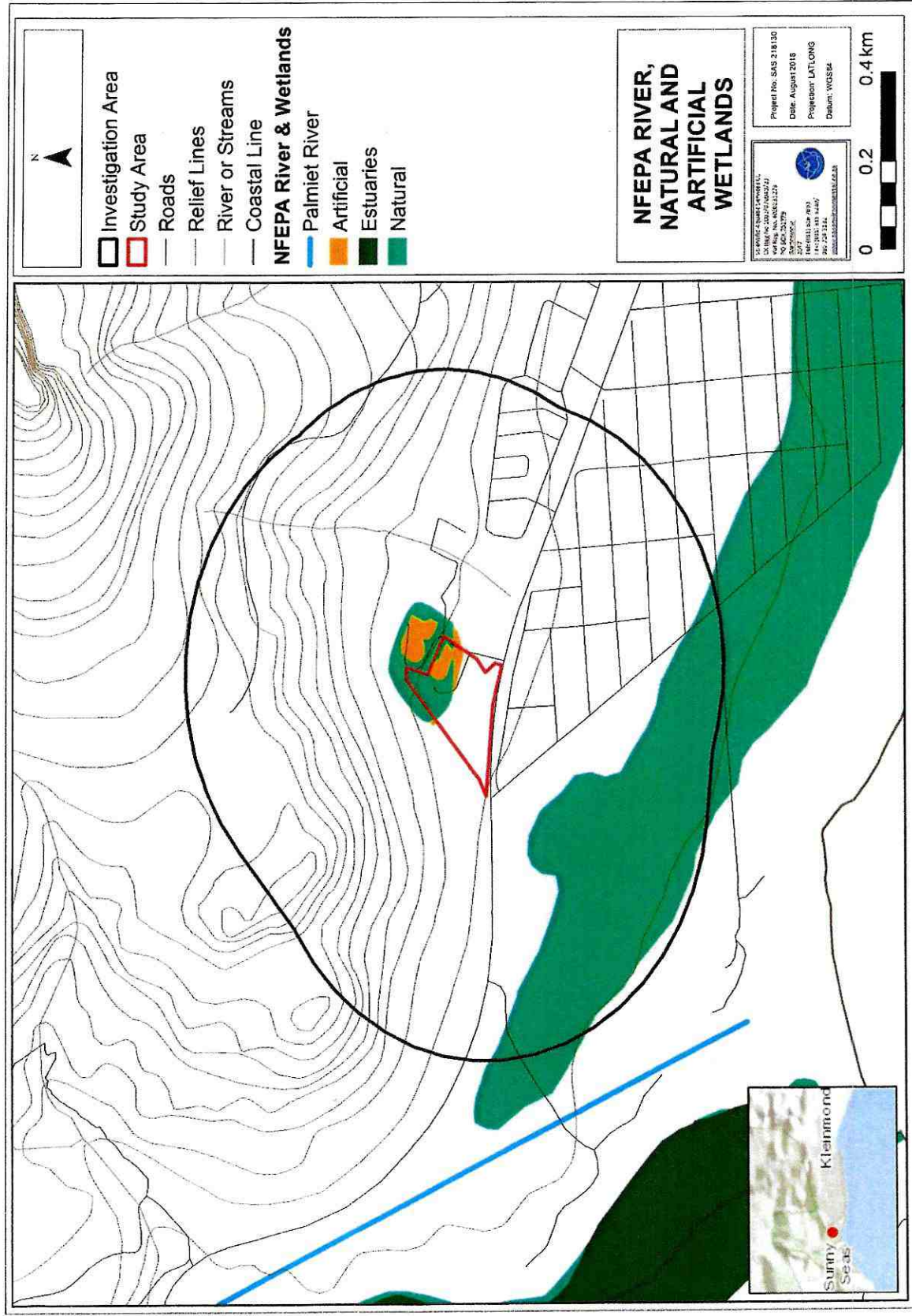


Figure 3: NFEPA Rivers and Wetlands within the study area and investigation zone according to the NFEPA database (2011).



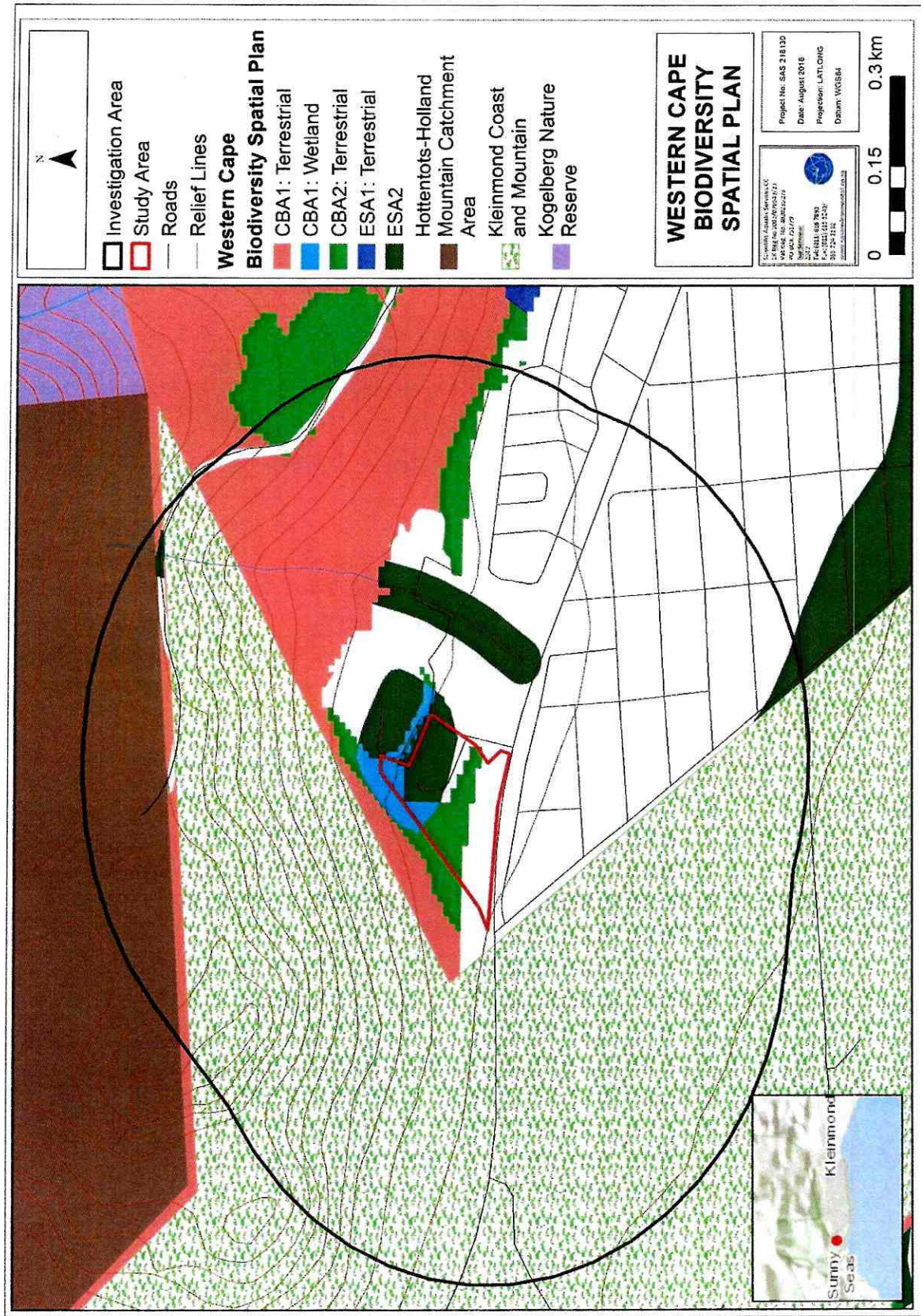


Figure 4: Wetland and Terrestrial CBA and ESAs according to the Western Cape Biodiversity Spatial Plan (2017).



2.2. Site Verification Results

A site visit was undertaken on the 2nd of August 2018, during which the presence of any areas representing with wetland characteristics as defined by the DWAF (2008) or watercourses as defined by the National Water Act, 1998 (Act 36 of 1998) were identified. The following indicators assist in determining the presence of a watercourse within the study area:

- Terrain units are used to determine in which parts of the landscape a watercourse (including wetlands) was most likely to occur;
- Obligate and facultative wetland species such as *Typha capensis*, *Cyperus textilis* or *Phragmites australis* could be used in conjunction with terrain units as well as the point where a distinct change in the vegetation composition was observed in order to determine the various wetland boundaries. Obligate species are almost always found in a freshwater feature (>99% of occurrences) while facultative species are usually found in a freshwater feature (76%-99% of occurrences) but are also occasionally found in areas not associated with wetlands or rivers and often in areas of disturbance;
- Surface water and/or saturated soils can be used to determine if there is a permanent zone and to define the outer boundaries (temporary zone) of the wetland; and
- Soil form indicators are used to determine the presence of soils that are associated with prolonged and frequent saturation and a fluctuating water table within 50 cm of the land surface.

It should be noted that in order for an area to be identified as a wetland, at least two (2) of the above indicators should be present (*Pers Comm Prof. F. Ellery*).

3. KEY OBSERVATIONS

1. The study area is approximately 2,96 hectares in extent and is located just north of the R44 to the west of the town of Kleinmond. The study area is located at the base of the Hottentots-Holland Mountain range with an average slope ranging between 12,3% and 1,3% with a southern aspect, towards the ocean.
2. A Depression Wetland was identified within the south western portion of the study area with an extent of 0,38 hectares. The depression wetland was predominantly dominated by *Ficinia nodosa*, *Ficinia elatior*, *Paspalum urvelli* and *Cyperus textilis*. Various common invasive plant species such as *Lupinus angustifolius*, *Plantago lanceolate* and *Pennisetum clandestinum* were noted to dominate the study area.



Figure 5: (Left) Depression Wetland within the study Area (Right) *Ficinia nodosa* and various common weeds (including *Lupinus angustifolius*) identified within the wetland.



3. Although not formally assessed, the wetland appears to be in a largely degraded state (Present Ecological State Category D), likely as a result of edge effects associated with the waste disposal sorting facility and associated infrastructure located within the eastern portion of the study area. Furthermore, illegal dumping of building rubble and general waste was noted within the northern portion of the site. An excavated channel was identified along the northern portion of the study area, associated with the roads constructed as part of the waste disposal sorting facility, however, did not appear to link to the lower reaches of the study area.



Figure 6: (Left) Waste disposal sorting facility located within the eastern portion of the site; (Right) Excavated channel which has been stabilised by means of a gabion wall, located to the north of the sorting facility.

4. The soil profile was investigated with the use of a hand auger in order to determine the outer boundary of the depression wetland. Gleying and soil saturation were observed at various augered points as well as areas with surface ponding (Figure 6).



Figure 7: (Left) Gleying of soils indicative of wetland conditions (Right) surface water identified within depression wetland.

Based on the above, Figure 8 below provides a constraints analysis for future development. The following are applicable:

- Red – This area is the delineated depression and excavated channel and is considered as a “No-go Area” and should be avoided.
- Orange – This area falls within the 32m zone of regulation in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998) for the depression wetland and the 10m buffer for the excavated channel in terms of the City of Cape Town’s (CoCT) Floodplain and River Corridor Management Policy (2009). This zone of regulation is considered an appropriate conservation buffer and therefore development is not recommended within this extent from the wetland, however, with the relevant authorisations and implementation of mitigation measures, some of this area can potentially be considered as acceptable for development.
- Green – These areas are considered developable from a freshwater resource management and conservation point of view.



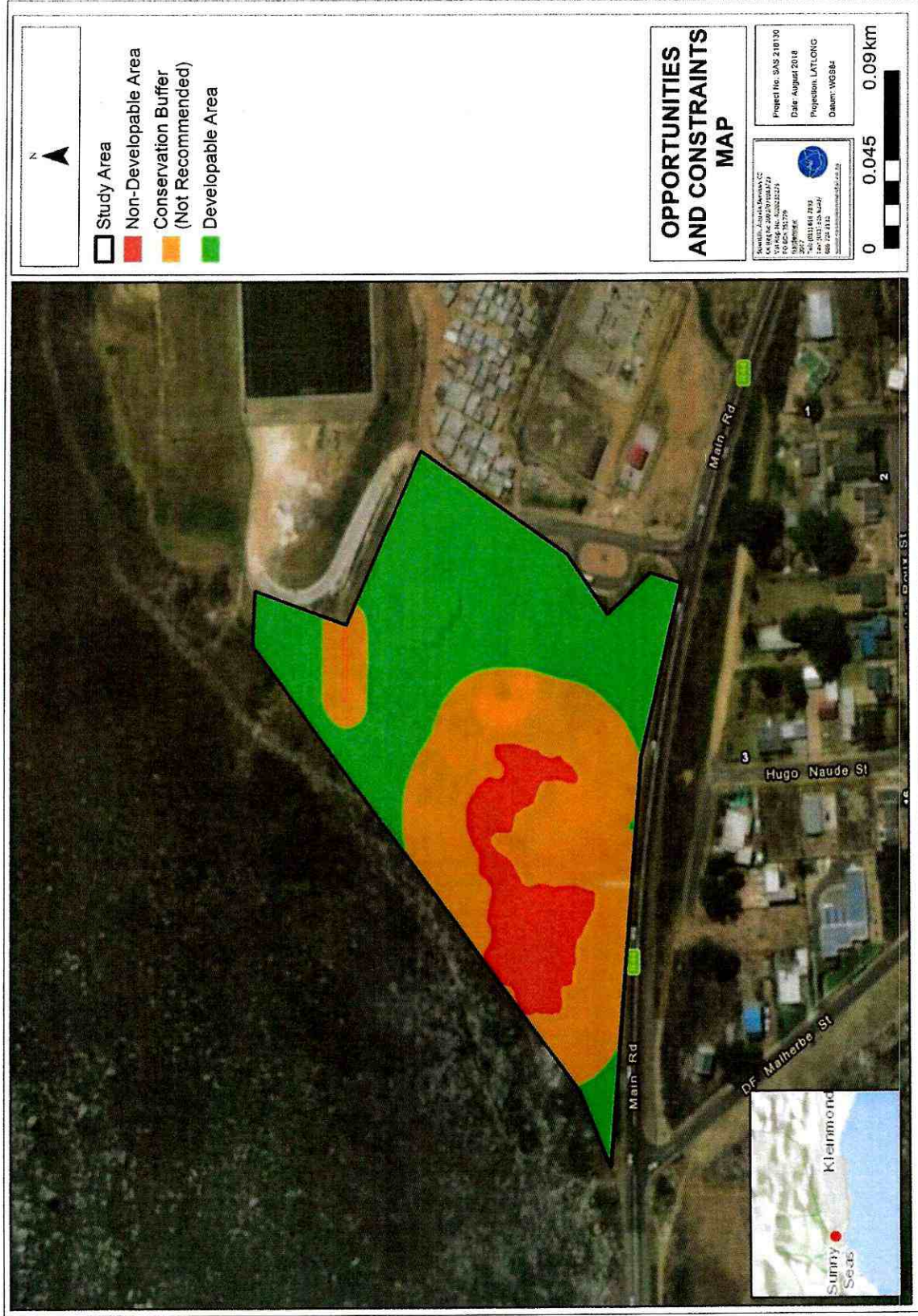


Figure 8: Development Opportunities and Constraints Map of the study area to be considered for future development.



4. CONCLUSION

Based on the findings of the study, the following is recommended:

1. Given the findings of this investigation, it is noted that a depression wetland as well as an excavated channel were located within the study area. The excavated channel does not link to the lower reaches of the study area and is believed to have been excavated with the development of the waste disposal sorting facility. The depression wetland as delineated is considered to be No-go area for future development. could be modified as part of the development and was therefore only indicated as "no recommended: in Figure 8.
2. A 32m zone of of regulation in accordance with the National Environmental Management Act, 1998 (Act 107 of 1998) for the depression as well as its 10m buffer in terms of the City of Cape Town's (CoCT) Floodplain and River Corridor Management Policy (2009) were allocated. These zones of regulation are deemed to be appropriate as a conservation buffer for the sensitive wetland system and therefore development is not recommended within this extent from the wetland. The excavated channel could, however, be realigned as part of the stormwater plan for any future development with the relevant authorisations and implementation of mitigation measures. Furthermore, development of some areas within the 32m zone of regulation from the wetland could be considered as acceptable with the relevant authorisations and implementation of mitigation measures.
3. It is the opinion of the freshwater specialist that the site has already been impacted by the waste disposal storing facility as well as edge effects associated with the R44 road reserve. As such, the site could be further investigated for development provided cognisance is taken of the depression wetland and that this system be included within any potential development plans along with suitable mitigation measures

We trust we have interpreted your requirements correctly. Please do not hesitate to contact us if there are aspects of this document that you would like to discuss further.

Yours Faithfully,

Digital Documentation Not Signed for Security Purposes

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