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Date: 18 March 2024

Agricultural Impact Assessment Report: Proposed Development Project on Portion 16 of the farm Klein Dassenberg No. 20, Atlantis

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Client Representative Planners:
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Image Credits:

This report made use of freely available sector-based images and Geographic Information System (GIS) platforms. Site photographs were taken in person during ground-truth assessment phase.

Declarations:

Consultant	Consultant Declaration of Independence
Name: Earl L Herdien Role: Production Scientist Vocation: Environmentalist, Pedologist, Biodiversity Scientist & Professional Aquatic Scientist SACNASP Registration Number: 400211/11 Email: Pedologists@gmail.com / or alternatively Lymnologist@gmail.com	I, *Earl L Herdien*, declare that I am independent of the client and their consultants, and stand to gain no financial benefit from the proposed activity apart from remuneration for the work performed. All views expressed in this report are my own and the use of all material from other sources has been acknowledged.  …….. Date: 29 February 2024
Name: Dr Christopher N Cupido *Pr.Sci.Nat* Role: Editor Vocation: Environmentalist, Naturalist, Biodiversity Scientist (Professor) SACNASP Registration Number: 400012/12 - Email: kcphyto@gmail.com	I, *Christopher N Cupido*, declare that I am independent of the client and their consultants, and stand to gain no financial benefit from the proposed activity apart from remuneration for the work performed. All views expressed in this report are my own and the use of all material from other sources has been acknowledged.  …….. Date: March 2024

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Acronyms and Abbreviations

Acronyms	Description
CoCT	City of Cape Town
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEA / DFFE	Department of Environmental Affairs (Forestry and Fisheries)
DWAF	Department of Water Affairs and Forestry
DWS (prev. DWAF)	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ELU	Existing Lawful Use
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
ENPAT	Environmental Potential Atlas
IAP	Invasive Alien Plant (Species)
IWRM	Integrated Water Resources Management
NEMA	National Environmental Management Act
NWA	National Water Act
SDG	Sustainable Development Goal
SPLUMA	Spatial Planning and Land Use Management Act

Glossary

Terminology	Description
Agricultural Productivity / Potential / Suitability	The ratio of agricultural output in relation to the agricultural inputs and with respect to market value conditions and the (sustainable) agricultural capacity of the land unit. The agricultural potential and suitability will impact on the (sustainable) agricultural capacity of the land (i.e. sustainable stock or crop farming).
Agricultural Impact	A measure to determine the impact on agricultural potential in consideration with both land and soil capability and in relation to its sensitivity to land use construction, operations and decommissioning.
Arable Land	Existing land which is either naturally fertile or previously cultivated and capable enough to immediately support the production of viable crops without requiring substantial improvements (i.e. alien clearing or fertilizers).
Aquifer	A geological formation which has structures or textures that hold water or permit appreciable water movement through them.
Biodiversity / Biota	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Catchment Management Agency	Empowered directly by the National Department of Water and Sanitation (DWS) and Minister of Water Resources, Catchment Management Agency (i.e. Berg Water Management Area) to undertake water resource management at a regional or catchment level and involve local communities (ie catchment management forums – CMF, water user associations / institutions), within the framework of the national water resource strategy, its Catchment Management Strategy (CMS). Regulation of CMAs is the responsibility of the Minister of Water and Sanitation DWS.
Cultivation	In relation to land, means any act by means of which the topsoil is disturbed mechanically; and "cultivate" has a corresponding meaning.
Development Footprint	The area on which the proposed development will take place and includes any area that will be disturbed.
Ecological Risk Assessment	Evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of one or more stressors (US EPA, 1992)
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species

	and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous
Environment	In terms of the National Environmental Management Act (NEMA) (No 107 of 1998) (as amended), "Environment" means the surroundings within which humans exist and that are made up of: the land, water and atmosphere of the earth; Micro-organisms, plants and animal life; any part or combination of (i) of (ii) and the interrelationships among and between them; and the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Impact	A change to the environment, whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
Environmental Management Framework	An environmental management tool in accordance with integrated environmental management (IEM) NEMA (1998) Chapter 5 and in terms of supplementing SPLUMA in the development of municipal and district Spatial Development Frameworks (SDF's) and in empowering the municipal land use zoning schemes (SPLUMA).
Fallow	Land which was previously cultivated but left idle with no crops growing on it for more than one season.
Grazing capacity	In relation to the veld, means the production capacity over the long term of that veld to meet the feed requirements of animals in such a manner that the natural vegetation thereon does not deteriorate or is not destroyed.
Indicator Species	Species which reveal the qualitative health or condition of its local environment, such as obligatory or alien species.
Integrated Water Resource Management (IWRM)	Integrated water resource management (IWRM) is a sector approach that seeks to reach an appropriate balance between the need to protect and sustain water resources on the one hand, and the need to develop and use.
Land Capability	Refers to the ability and capacity of a land unit to sustain and support a specific land use (i.e. carrying capacity, ecosystem services). Consideration to a number of landscape aspects apply as well as its combined (interrelatedness) understanding of soil, terrain, and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions.
Natural Resources	Generally specific to the distinction to the natural local ecosystem setting and inclusive of the understanding of climate, geology, soil, biota (including invasive alien species, fungi, algae and bacteria) but excluding artificial anthropogenic resources such as concrete (i.e. man-made structures).

Pollution	Is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)- less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality. In reference to water resource management, the NWA S19 and S20 apply.
Rangeland	Land that is not suitable for cultivation of crops but instead for livestock grazing.
Soil Capability or Potential	As with land capability which refers to the "potential" of the land body, whereas in reference to soil, comprising the soils' ability to provide functions which sustain biological life, regulate water and nutrient cycles as well as in respect to its physical landscape "building-block" relations (i.e. stability-sensitivity).
Soil Classification	Soils can be classified into various groupings based on its characteristics, with the primary types of soil classification regarding texture – sand, silt and clay, whereas the percentages of these may vary in a soil body resulting in a compound type such as loam sand, sandy clay, silty clay etc. Soil types may therefore inform on number of agricultural aspects such as drainage or irrigation, soil water storability, organics, salt and toxicity potential, etc.
Soil Conservation Work	Any work which is constructed on land for- (a). the prevention of erosion or the conservation of land which is subject to erosion; (b) the conservation or improvement of the vegetation or the surface of the soil; (c) the drainage of superfluous surface or subterranean water, (d). the conservation or reclamation of any water source; or (e), the prevention of the silting of dams and the pollution of water. But does not include work which is constructed on land in the course of prospecting or mining activities.
Soil Form or Soil Profile	Soil bodies classified in a family type class by diagnosis of the layering of the distinctly associated soil horizons (i.e. Orthic "A" top horizon over a subsoil comprised of an "E" and "G"-horizon implies a Kroonstad soil form). The common understanding is South Africa comprise 73 soil forms which may be placed in 14 groups represented by either organic, humic, vertic, melanic, silicic, calcic, duplex, podzolic, plinthic, oxidic, gleyic, cumulic, lithic and anthropic forms.
Soil Suitability	As with the case of water resource management, soil suitability refers to the "fitness for use" of the soil land use practice intended. A specific crop soil suitability may thus be distinguished as highly or moderately or poorly suitable in the context of the selected crop fitness for use consideration (i.e. Tilth)
Soil Type(taxonomy)	Soils groups may be classed to a readily understood order level and be identified as either Luvisols, Ferralsols, Arenosols, Acrisols, Nitosols, Cambisols and Lithsols. Depending on the classification system utilised, the

	amount of soil types on an order level may vary as well as its potential sub-order groupings (i.e. the USA have classified 12 soil types to an order level; and South African wetland soil classification is still being refined). Soils belonging to the Namib, Fernwood, Hutton and Clovely forms as well as sandy soils with Neocarbonate B horizons are characteristic to South Africa.
Sustainable Agriculture	According to DALRRD, sustainable agriculture is the production and exploitation of agriculture for social and economic means with due consideration to protect the natural resource base, prevent degradation of soil and water, conserve biodiversity and ensuring safe and high-quality supply of agricultural products, the agricultural workers and associated livelihood (i.e. families).
Sustainable Development	According to the World commission on Environment and Development (WCED) 'sustainable development' is "development that meets the needs of the present without compromising the needs of future generations to meet their own needs"
Sustainable Development Goal	SDGs such as SDG2 to achieve the ending of hunger, in achieving food security and improved nutrition and with promoting sustainable agriculture”
Tilth	Tilth refers to the physical condition of soil, in respect to crop suitability and considers factors such as soil formation, aggregate typology, micro-organisms and biodiversity, as well as soil moisture and drainage relations.
Watercourse / Water Resource	River or spring; a natural channel or depression 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 as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks. Generally, all bodies containing water on a permanent, seasonal or temporal scale is defined as a water resource and is protected under the Act (i.e. aquifer, estuaries).
Water Use	Water use in terms of the National Water Act 36 of 1998 Section 21, Section 39, 40, 41 and 155 or other (Schedule 1, ELU, etc.)

Executive Summary

The proposed project, development of Portion 16 of Farm Klein Dassenberg No 20, Atlantis, was screened for environmental management purposes whereupon the NEMA national screening tool as a requirement, an in accordance with the “protocol for the specialist assessment and minimum report content requirements for environmental impacts on agricultural resources” (i.e. agriculture impact assessment protocol), ensue.

From a project site sensitivity perspective, the screening tool generated a guideline which indicated a low (06) to medium (08) sensitivity rating class for the agricultural theme for which an Agricultural Compliance Statement generally serves as a standard qualification requirement. The guideline follows that should any part of the proposed development footprint fall within an area of "very high" or "high" sensitivity, then the assessment and reporting requirements (protocol) prescribed for the "very high" or "high" sensitivity apply to the entire footprint, except in the case of low and medium sensitivity in which case an Agricultural Compliance Statement generally applies. Nevertheless upon site status quo verification investigation and due to the complex nature of the site setting being peri-urban, an Agro- Ecosystem Specialist Assessment was regarded as a more mindful approach to identify and address the potential agricultural resource risk needs of the proposed project and to provide improved clarity for decision-makers (i.e. precautionary principle).

This Agro- Ecosystem Specialist Assessment was consequently undertaken via a conventional three phased project study implementation approach with the first phase being a broad level desktop status quo assessment of the receiving project site natural and agricultural resource environment. The second phase followed with the project site ground-truth assessment which focused on the receiving project site soil and veld condition. The final phase is regarded as the reporting phase which assimilates and constructs a report in the form of a synthesises that includes the provision of a risk assessment and make recommendation on mitigation measures where required.

The study site is located in Klein Dassenberg, falling within the edge of the “Saxonwold Road” agricultural belt. The project site abuts the Witsand township urban fringe, with the Atlantis access road (R304) forming a gateway. The desktop assessment revealed that the project study area may be characterised by a number of unique characteristics, namely, being regarded as a mid-latitude desert climate with limited surface water resources, soils that are associated with the extensive dune systems, and water access that has a high dependency on exploiting the receiving aquifer. Even so the land use history indicates that agriculture is in practise in the broader receiving agricultural belt associated with the project site, but that the project site has long since been decommissioned from any land use activity. The surrounding agricultural activities include irrigation pastures, nurseries and

agro-industry such as Pioneer Foods. However the last evidence of land use activity on the project site dates back to the 2003 period which was associated with the previous site land use decommissioning period. Since then the project site was left fallow and under alien vegetation invasion management. A supplementary assessment of the project site land capability using the new Department of Agriculture GIS Comprehensive Atlas Ver 3.0 indicates that the project site associated with x.

The ground-truth investigation revealed by way of photographic landscape habitat assessment, that the project site veld was in a condition that is regarded as significantly transformed from its Dune Strandveld reference state. The project site is regarded as significantly disturbed with evidence of recent burns, past alien vegetation invasion and habitat erosion (zama-zama). The profiling of project site soils revealed no significant soil structure. The project site is therefore not regarded to comprise any significant soils because the only soil horizon found on the site was unconsolidated sands associated with the reference dune habitat of the region. Even so the site ground profiling indicated two types of sand in the ground, one grey in colour and the other yellow which may be associated with the Springfontein and Witsand member geologies (i.e. possible sub-surface lenses in aquifer).

Potential project activity risks and impacts to agricultural resource quality was identified and modelled via the use and adaptation of conventional sector-based methods (i.e. risk-matrix). Consideration to construction, operations and decommissioning phase risks and impacts included: the potential for alteration and degradation of soil; the potential for increase in weathering and soil erosion; the potential for loss of agricultural land and infrastructure; the potential for destruction of agriculture habitat or loss of arable soil capability; the potential for impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry; the potential for impacts on the neighbouring localised surrounding catchment “Urban” area; the potential for stormwater modification and impairment; the potential for disturbance of existing agriculture practices; the potential for vehicle, machinery, tools or equipment pollution risk; the potential for impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry; the potential for impacts on the broader catchment surrounding urban node and corridor; the potential for decommissioning impact of project activity on site and localised surrounding catchment area.

The adoption of mitigation measures and compliance with environmental management implementation plans are regarded to ensure against undue project activity threats, risks and impacts. Overall the project activity risks and impacts to the receiving environment and in specific to the agricultural resource status quo of the proposed development site was generally determined to be

associated with a low degree of impact. The exceptions are the threat posed by climate change and the potential construction or operations based accidental pollution incidents, as well as when considering the cumulative effect. Due to the project site being located in a water scares area and an exposed aquifer the emergency awareness for pollution management and control must be adequately addressed in the project management planning (i.e. EMPR). Further that stormwater control and a stormwater management plan is highly recommended as a mitigation measure.

The following measures should be considered to be taken into account in respect of environmental management:

- Site establishment, Earthworks, heavy machinery and all construction vehicles must be mindful of undue site erosion and pollution to the receiving aquifer.
- The use of hazardous materials must be avoided as far as possible and where required to be managed and controlled appropriately in order to avoid any site pollution.
- Hydrocarbon spills and site pollution must be avoided (i.e. reduce the likelihood of accidents).
- In the event of soil contamination suitable emergency procedures must be followed and reported to the local and national authorities within 24 hours of the incident occurring (i.e. municipality and department of water and sanitation). The response should include the suitable use and availability of spill kits, drip trays, plastic and other sheeting to absorb and control and remedy the incident as far as possible and to report on the matter after the correct procedure (i.e. report contaminated land, land contamination registry, remedy contamination).
- Construction and operations staff must be trained and aware of pollution and fire prevention best practise protocols.
- Construction and operations based waste must be managed appropriately by the use of professional service providers (i.e. waste disposal certificate).
- Dust and site generated debris must be controlled.
- Impermeable and suitably bunded surfaces must be used for storage tanks and standing vehicles.

Due to the project property size and soil condition, it may be concluded that the project site has low agricultural potential, and that the mitigation of negligible to minor negative agricultural impacts may refer. It is concluded that from an agricultural impact point of view, the proposed project activity can be authorised.

1. Introduction

1.1. Overview

Portion 16 of Farm Klein Dassenberg No 20, Atlantis, is planned for development (i.e. development project or site). Over the past 20 years various development concepts or alternatives were explored for the site such as “The Klein Dassenberg Smallholding Development Framework” prepared by Settlement Planning Services, dated November 2002 (Report Reference No 1313/R2). The current development option proposed for the site pertains to a shopping centre type development.

Figure 1: Location map of the proposed project area

According to Section 24 of the National Environmental Management Act (107 of 1998) (NEMA) and its EIA Regulations (as amended), the proposed development triggers the need for an environmental impact assessment (EIA). KC Phyto Enterprises cc was appointed by ECOS Consulting on behalf of ASAPH Town Planners to provide agriculture impact assessment study to serve as input in the application process for environmental authorisation.

1.2. Aim

The aim of the study is to make determination in informing on the relevant project site receiving environmental status quos, the agriculture resource sensitivity and risks, as well as identifying the impacts posed by the proposed development. Lastly to inform on the mitigation scope where existing

opportunities or constraints on the site may suitably guide the proposed development planning design, construction and operations processes (i.e. soil capability, agriculture potential, agriculture sensitivity, risk mitigation, monitoring and environmental management).

1.3. Terms of Reference

1.3.1. Environmental Impact Assessment Agriculture Sensitivity Specialist Reporting Criteria

The undertaking of an agricultural impact assessment, the scope of this report, is identified by the NEMA national screening tool as a requirement, an in accordance with the “protocol for the specialist assessment and minimum report content requirements for environmental impacts on agricultural resources” (i.e. agriculture impact assessment protocol), as published by the Department of Environmental Affairs (No. 320) in Government Gazette No 43110, on 20 March 2020. These regulations represent the procedures for the assessment and minimum criteria for reporting on identified environmental themes (i.e. Agricultural) in terms of Section 24(5)(a) and (h) and 44 of the NEMA when applying for environmental authorisation. The protocol thus replaces the requirements of Appendix 6 of the NEMA EIA Regulations. The following image was extracted from the EAP project screening report which screens for the environmental sensitivity of the proposed site and in respect to relevant environmental themes requiring qualification.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme			X	
Animal Species Theme			X	
Aquatic Biodiversity Theme				X
Archaeological and Cultural Heritage Theme				X
Civil Aviation Theme		X		
Defence Theme				X
Paleontology Theme				X
Plant Species Theme			X	
Terrestrial Biodiversity Theme	X			

Figure 2: Excerpt from environmental practitioner NEMA Screening Tool indicating that the project site is regarded as of medium sensitivity in respect to its agriculture theme.

The terms of reference were sourced from the agriculture impact assessment protocol, as identified, whereby the following refer:

- An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of "very high" or "high" sensitivity for agricultural resources must submit an Agricultural Agro- Ecosystem Specialist Assessment.

- If any part of the proposed development footprint falls within an area of "very high" or "high" sensitivity, the assessment and reporting requirements prescribed for the "very high" or "high" sensitivity apply to the entire footprint, except in the case of low and medium sensitivity in which case an Agricultural Compliance Statement applies. Development footprint in the context of this protocol means the area on which the proposed development will take place and includes any area that will be disturbed.

1.3.2. In respect of an Agricultural Compliance Statement

In the case of this assessment report the ambit for only requiring to provide for an Agricultural Compliance Statement therefore applies to this report (i.e. agriculture matrix land capability index rating scoring value of “06-08” implies a low to moderate agriculture sensitivity), where the following refer.

- The compliance statement must be prepared by a soil scientist or agricultural specialist registered with the SACNASP.
- The compliance statement must contain as a minimum, the following information:
    - be applicable to the preferred site and proposed development footprint;
    - confirm that the site is of "low" or "medium" sensitivity for agriculture; and
    - indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site.
    - contact details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vitae; a signed statement of independence;
    - a map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;
    - confirmation from the specialist that all reasonable measures have been taken through micro- siting to avoid or minimise fragmentation and disturbance of agricultural activities; a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development;
    - any conditions to which the statement is subjected; in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase

- where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr; and
- a description of the assumptions made as well as any uncertainties or gaps in knowledge or data.

A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

1.3.3. In respect of a detailed level Agro-Ecosystem Specialist Assessment

In the case of this assessment report the ambit for requiring to provide for a detailed level Agro-Ecosystem Specialist Assessment was not triggered as the agriculture sensitivity rating is regarded as only moderate but for reasons of providing for a mindful approach, the following terms of reference was adopted from the NEMA Specialist Assessment Guideline to guide the study instead.

- The Agro-Ecosystem Specialist Assessment must be prepared by a soil scientist or agricultural specialist registered with the SACNASP.
- The Agro-Ecosystem Specialist Report must contain as a minimum, the following information:
  - The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:
    - the extent of the impact of the proposed development on the agricultural resources; and
    - whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.
  - The status quo of the site must be described, including the following aspects which must be considered as a minimum in the baseline description of the agroecosystem:
    - the soil form/s, soil depth (effective and total soil depth), top and sub -soil clay percentage, terrain unit and slope;
    - where applicable, the vegetation composition, available water sources as well as agro- climatic information;
    - the current productivity of the land based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units;
    - the current employment figures (both permanent and casual) for the land E for the past 3 years, expressed as an annual figure; and

- existing impacts on the site, located on a map (e.g. erosion, alien vegetation, non -agricultural infrastructure, waste, etc.)
- change in productivity for all agricultural activities based on the figures of the past 5 years, expressed as an annual figure and broken down into production units;
- change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure; and
- any alternative development footprints within the preferred site which would be of "medium" or "low" sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification.

- This report must contain the findings of the agro- ecosystem specialist assessment and the following information, as a minimum:
  - the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
  - a description of the methodology used to undertake the on -site assessment inclusive of the equipment and models used, as relevant;
  - a map showing the proposed development footprint (including supporting infrastructure) with a 50m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool;
  - an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development;
  - an indication of possible long-term benefits that will be generated by the project fr. relation to the benefits of the agricultural activities on the affected land;
  - additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc.;
  - information on the current agricultural activities being undertaken on adjacent land parcels;
  - an identification of any areas to be avoided, including any buffers;
  - a motivation must be provided if there were development footprints identified as having a "medium" or "low" agriculture sensitivity and that were not considered appropriate;
  - confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro- siting of the proposed development to minimise fragmentation and disturbance of agricultural activities;
  - a substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed

development and a recommendation on the approval or not of the proposed development;

- where identified, proposed impact management outcomes (mitigation) or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and
- a description of the assumptions made and any uncertainties or gaps in knowledge or data

2. Approach to Agricultural Impact Assessment Study

2.1. Approach to implementing the TOR as described

It should be noted that this report, an agricultural impact assessment study, follows a standard or conventional approach even as a compliance statement is deemed as a suitable input for the NEMA EIA process in the context of the project site being classified in an agriculture sensitivity rating of low-moderate sensitivity, in which case an Agricultural Compliance Statement may apply. It should also be noted that compliance to the agriculture assessment guideline was undertaken as far as possible but within the framework of a conventional three phase study approach adopted to implement for the requirements of this study, and therefore transcribed into a detailed level agricultural impact assessment report in order to easier inform on uncertainties which a compliance statement may not adequately address (i.e. soil verification, complex project site setting, land capability index rating 06-08 under verification).

The first phase proposed is a desktop-based reference review study to screen for the “object” property baseline characteristics such as in respect to its regional setting (i.e. climate, topography, geology). The second phase of the study will utilise the desktop assessment to then inform on a ground-truth assessment phase, which seeks to better inform on the relevant receiving environment characteristics, such as to confirm aspects related to land condition, agriculture potential (capability) and in respect to existing land use situation currently taking place on the project property where (i.e. soil classification, habitat condition survey, status quo verification). According to DEAT (2002) it is regarded as essential and important to ensure that relevant information is utilised in order to suitably identify, address and predict impacts and risks to agriculture and impacts and risks to the receiving environment (i.e. status quo and degree of change). The study will conclude with a reporting phase as a third phase to the study which entails the identification and assessment of potential and existing impacts and risks as a synthesis in respect to the project property, the agricultural sensitivity, the project intention, as well as inform on suitable development mitigation measures (i.e. proposed development). The standard environmental sector impact rating methodology applies (i.e. probability and significance). It should be noted that this study also comprise an edit and review process.

The reasoning for implementing a full agricultural impact assessment instead of just a compliance statement is to not only better inform for the project land use planning and management considerations in providing consideration to any existing and potential agricultural impacts and risks due to the property falling within an agricultural zone; but also that the property is located and influenced by the adjoining urban edge complex (i.e. peri-urban fringe, “taxi” R304/Saxonwold Road

interchange, opposite the Witsand Urban Township). As a result a simple compliance statement may not always be regarded as suitable to convey consideration to the myriad of factors or stressors or vectors of disturbances which requiring qualification for in terms adequately making assessment of subject project risks, potential impacts on agricultural resources and in tailoring for specific mitigation (i.e. current status quo uncertainties and vulnerabilities).

2.2. Guidelines supporting Agricultural Impact Assessment

The following guidelines was also utilised to supplement the study and NEMA Impact Assessment Protocol (2020):

- Soil capability is described according to systems used by the Department of Agriculture (ENPAT).
- The agricultural sensitivity description will be undertaken according to the screening tool, published by the Department of Environment, Forestry and Fisheries (DEFF) in Government Notice 320 of Government Notice 43310 published on 20 March 2020.
- From a pedological perspective site soils were classified by use of soil horizon indicators according to the binomial classification system for Southern Africa known as the " red-book".
- Land capability follows the 8 class System for Soil and Land Capability Classification for Agriculture in South Africa; March 1987 & revised January 1991 (Scotney, Ellis, Nott, Taylor, v Niekerk, Verster & Wood), among others (Klingebiel & Montgomery 1961).

The following table or illustration provide an indication on the aspects related to agriculture impact and risk considerations (NEMA Impact Assessment Protocol).

Table 1: Agricultural Impact Assessment Matrix (i.e. Land Capability Index)

CLASS	**LOW SENSITIVITY RATING**	**MEDIUM SENSITIVITY RATING**	**HIGH SENSITIVITY RATING**	**VERY HIGH SENSITIVITY RATING**
DESCRIPTION	Areas are likely to be non-arable land, and is therefore land onto which most development should be steered.	Areas are likely to be very marginal arable land.	Are still preservation worthy, land with an agricultural production potential and suitability for specific crops. All cultivated areas demarcated high value agricultural areas with a priority rating of C and /or D.	Preservation worthy land, Irrigated land; horticulture, other; demarcated high value agricultural areas with a priority rating of A and/or B.
RATING RANGE	1-5	6-7	8-10	11 – 15

3. Desktop Assessment

3.1. Policy Context Setting

3.1.1. Relevant Policy

3.1.1.1. Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA)

The Constitution of the Republic of South Africa (108 of 1996) is regarded as the supreme law of our country. The Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) broadly regarded as the principle implementing policy with respect to Agricultural Resources. In principle CARA aims to provide for control over the utilisation of natural agricultural resources in order to promote conservation of the soil, the water sources, as well as the vegetation and in the combating of weeds and invader plants.

The objectives of the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) are to provide for the conservation of the natural agricultural resources of South Africa by the:

- maintenance of the production potential of land;
- combating and prevention of erosion and weakening or destruction of the water sources; and
- protection of the vegetation and the combating of weeds and invasive plants.

According to the amended regulations (GN R280 of March 2001), declared weeds and invader plants are divided into three categories:

- Category 1 may not be grown and must be eradicated and controlled,
- Category 2 may only be grown in an area demarcated for commercial cultivation purposes and for which a permit has been issued, and must be controlled, and
- Category 3 plants may no longer be planted and existing plants may remain as long as their spread is prevented.

It is regarded the legal duty of the land user or land owner to control invasive alien plants occurring on the land under their control. This implies that should any alien plant species occur within the study area; which will require to be managed for in line with an approved Environmental Management Programme (EMPr).

3.1.1.2. The National Water Act (Act 36 of 1998) (NWA)

The National Water Act (Act 36 of 1998) (NWA) provides for the balance between preservation and exploitation of water resources (i.e. sustainability). The act is mandated to ensure that the nation's - water resources are protected, used, developed, conserved, managed and controlled. As such all water resources in the country falls within the custodianship of the state and the Minister of Water and Sanitation whereby its use is registered, permitted for basic human needs, authorised under General Authorisation (GA) or in the context of a water use licensed (WULA) application. Water use is defined in Section 21 of the Act and which may be subject to use ambits such as referred to in Section 39, 40, 41, and other sections of the Act (i.e. Section 27 motivation) or relevant Schedules of the Act (i.e. Schedule 1 use). Offenses with respect to the Act is commonly processed via Section 151 and the Provision of Administrative Justice Act (Act 3 of 2000) (PAJA)

3.1.1.3. The Constitution of the Republic of South Africa

The Constitution of the Republic of South Africa (Act 108 of 1996) is regarded as the Supreme Law of South Africa. The Constitution famously contains a cornerstone “Bill of Rights” in Chapter 2 which provides for the provision of basic human needs and empowering citizen rights in enshrining human dignity, equality and freedom as the democratic principles it affirms for our country.

Section 24 indicates that everyone in South Africa has a right to an environment that is not harmful to their health, wellbeing, and that the environment is protected for the benefit of present and future generations. These are regarded as achievable via preventing pollution, ecological degradation, promoting conservation and securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (i.e. principles of sustainable development).

Section 25(4)(a) indicates that in respect to property which is not limited to land, that the public interest includes the nations commitment to land reform, to bring about equitable access to all South Africa’s natural resources. Furthermore, Section 27(b) indicates that everyone has the right to have access to sufficient food and water.

3.1.1.4. The National Environmental Management Act (107 of 1998) (NEMA)

Regarded as an umbrella act, the NEMA is mandated to provide for co-operate, environmental governance by establishing principles and policy for decision-making on matters affecting the

environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state.

Beyond ensuring the protection and sustainability of our environment as indicated in Section 24 of the Constitution of the Republic, NEMA also prescribes listed activities and listed areas (i.e. EIA listing Notices). Section 24F of NEMA makes it a criminal offence to conduct a listed activity without an environmental authorization. Further Section 28(1) of the NEMA provides that every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised.

NEMA as an umbrella act integrates its mandate via a suit of supportive acts such as with respect to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA), National Environmental Management: Protected Areas Act (Act 57 of 2003), National Environmental Management: Air Quality Act (Act 39 of 2004), etc.

3.1.1.5. International Agreements

South Africa is a signatory of many international agreements and conventions and thereby duly undertake to fulfil its international obligations such as the Convention on Biological Diversity (1992) or Paris Agreement of 2016 which may limit or disrupt conventional agricultural activity in seeking resource protection in transitioning to a carbon effective economy and in adapting to climate change (COP21). The Comprehensive African Agricultural Development Programme (CAADP) may refer.

3.1.2. Administrative Context

3.1.2.1. The Department of Agriculture, Forestry and Fisheries / Department of Environmental Affairs / Department of Agriculture, Land Reform and Rural Development (DALRRD)

The previous Department of Agriculture, Forestry and Fisheries, rightfully solicits its powers and functions from the Constitution of the Republic. The Department of Forestry, Fisheries and the Environment (DFFE) was renamed on 1 April 2021, from the previous Department of Environment, Forestry and Fisheries (DEFF). In June 2019 the DFFE had been established by incorporating the forestry and fisheries functions from the previous Department of Agriculture, Forestry and Fisheries and now into the Department of Environmental Affairs.

The DFFE mandated to give effect to the right of citizens to an environment that is not harmful to their health or well-being, and to have the environment protected for the benefit of present and future generations. To this end, the Department provides leadership in environmental management, conservation and protection towards sustainability for the benefit of South Africans and the global community (Sourced from DFFE website). Land use is subject to the compliance provisions of the NEMA (i.e. EIA listing notice), its subsidiary policies and those in respect to the Department of Agriculture.

It should be noted that South Africa has both a main and strategic perspective in that organs of state will also collaborate in strategic programmes to expedite specific needs requiring priority such as with the case of the Department of Agriculture, Land Reform and Rural Development (DALRRD) which focus on integrating rural development by way of land reform (i.e. the Land Reform Act 1997) and generally utilising the Cooperative Governance and Department of Traditional Affairs (CoGTa), Municipal Infrastructure Agency (MIA) and where possible further strengthening the services base relationship with the South African Local Government Association (SALGA). The DALRRD is thus mandated to initiate, facilitate, coordinate, catalyse and implement an integrated rural development programme. Its vision is to transform and invigorate the agricultural sector into one that is equitably vibrant in terms of food security, financial viability and sustainable rural development.

3.1.2.2. Spatial Planning Land Use Management Act (Act 16 of 2013)

The Spatial Planning Land Use Management Act (SPLUMA) is a national framework act that empowers provincial governments such as municipalities to enact spatial planning and land use management by-laws on how land use applications are permitted. An owner of land may thus apply in writing to the town clerk or secretary concerned, for a rezoning of the land under the act (i.e. agricultural land class to industrial or urban land use class). The principles of SPLUMA comprises Spatial Justice, Spatial Sustainability, Efficiency, Spatial Resilience and Good Administration.

3.1.2.3. Integrated Policy Context

Due to the South African policy reform environment being dynamic in its consideration to fulfilling its supreme law in the realisation of the ideals and goals of the constitution, a number of local, regional, national and international policy interest and requirements may broadly apply such as in the context of food security, sustainability, transformation, land reformation and land redistribution (i.e. Bill of Rights and land reform policy). In this context the Department of Agriculture, Land Reform and Rural

Development (DALRRD) may apply, among other. Another policy that is being integrated into the agricultural management portfolio would be the impact of climate change and the pro-active adaptation to this threat (i.e. Climate Change Adaptation and Mitigation Plan).

3.2. Physical Characteristics

3.2.1. Climate

The site climate information is sourced from a popular international weather and climate website (weatherandclimate.com), which indicates that the climate of Atlantis is regarded as a mid-latitude desert climate according to the "BWk" classification scheme. The broader more common classification regards the Atlantis region to form part of the Western Cape Mediterranean Climate which is characterized by cold wet winters and dry hot summers. In contrast to this generalised view, average annual temperature for Atlantis average at 19.17°C and is regarded as about 2% lower than the South African averages. Typically rainfall annually average at about 34.78mm which comprise of about 18.77% of the time or 68.5 rainy days. As such Atlantis does not have rain for almost 300days per year (i.e. 297 days) (www.weatherandclimate.com). The following subsection images refer.

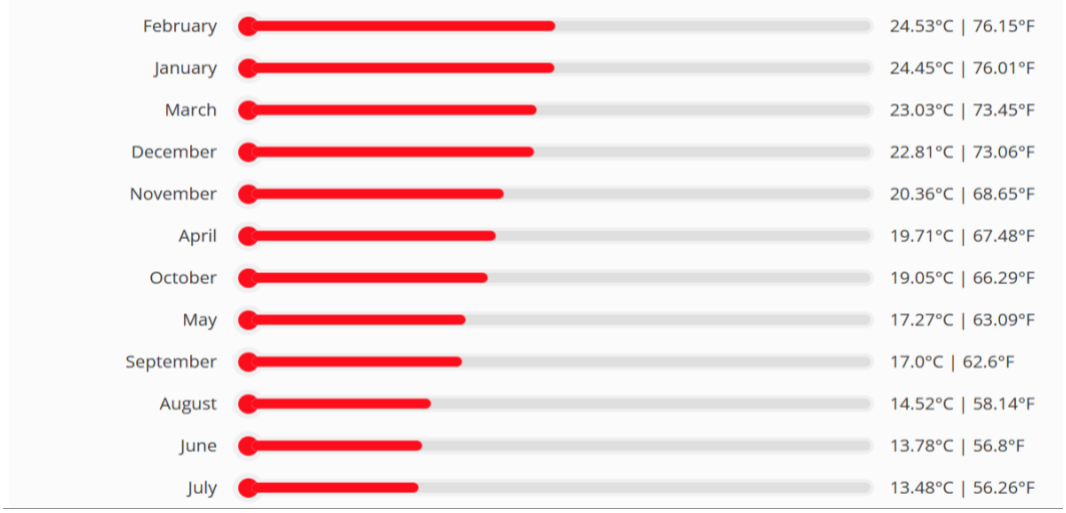

Figure 3: Average Monthly Temperature Graph for Atlantis (Sourced from: www.weatherandclimate.com)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	41.24 (106.23)	42.27 (108.09)	40.21 (104.38)	37.11 (98.8)	31.96 (89.53)	28.87 (83.97)	29.9 (85.82)	32.99 (91.38)	38.14 (100.65)	40.21 (104.38)	40.21 (104.38)	40.21 (104.38)	42.27 (108.09)
Average high °C (°F)	29.2 (84.56)	29.38 (84.88)	27.79 (82.02)	24.32 (75.78)	21.98 (71.56)	18.3 (64.94)	18.11 (64.6)	19.36 (66.85)	21.78 (71.2)	23.9 (75.02)	25.46 (77.83)	27.57 (81.63)	23.93 (75.07)
Daily mean °C (°F)	24.45 (76.01)	24.53 (76.15)	23.03 (73.45)	19.71 (67.48)	17.27 (63.09)	13.78 (56.8)	13.48 (56.26)	14.52 (58.14)	17.0 (62.6)	19.05 (66.29)	20.36 (68.65)	22.81 (73.06)	19.16 (66.49)
Average low °C (°F)	16.41 (61.54)	16.3 (61.34)	14.88 (58.78)	11.37 (52.47)	9.18 (48.52)	6.05 (42.89)	5.4 (41.72)	5.43 (41.77)	7.8 (46.04)	10.16 (50.29)	11.58 (52.84)	14.62 (58.32)	10.76 (51.37)
Record low °C (°F)	8.25 (46.85)	6.19 (43.14)	6.19 (43.14)	2.06 (35.71)	1.03 (33.85)	-1.03 (30.15)	-2.06 (28.29)	-1.03 (30.15)	-1.03 (30.15)	2.06 (35.71)	2.06 (35.71)	8.25 (46.85)	-2.06 (28.29)
Average precipitation mm (inches)	45.41 (1.79)	35.17 (1.38)	30.16 (1.19)	26.2 (1.03)	27.67 (1.09)	34.17 (1.35)	36.78 (1.45)	38.77 (1.53)	28.03 (1.1)	50.2 (1.98)	38.84 (1.53)	26.03 (1.02)	34.78 (1.37)
Average precipitation days (≥ 1.0 mm)	6.94	6.19	5.91	4.88	4.59	5.72	4.59	4.97	5.34	6.94	6.09	6.37	5.71
Average relative humidity (%)	65.54	64.83	66.84	63.77	62.97	61.21	62.4	61.78	63.65	64.81	64.39	65.11	63.95
Mean monthly sunshine hours	13.76	11.85	11.22	10.52	8.38	8.36	8.35	10.3	11.25	12.41	13.62	14.03	11.16

Figure 4: Monthly Climate report for Atlantis (Sourced from: www.weatherandclimate.com)

3.2.2. Topography

Site topography can be regarded as to comprise a coastal lowland tertiary sand dune type, situated on an altitude of 140m-150m above mean sea level (i.e. direct distance from sea is about 11km). The study site topography undulates between 2m-5m and drains from north to south-west. Some reference infrastructure and trees are depicted in the following topographical maps which was sourced for the study area (i.e. reference year 2000). No watercourses are regarded to occur on the study site. The project site surrounding comprises agriculture to the south and east, and then to the west the urban community of Witsand. The study site thus falls within or abuts the urban fringe with the urban corridor gateway zone into Atlantis (R304) on its western boundary, as well as the Saxonwold agriculture route on its southern boundary (Saxonwold Road).

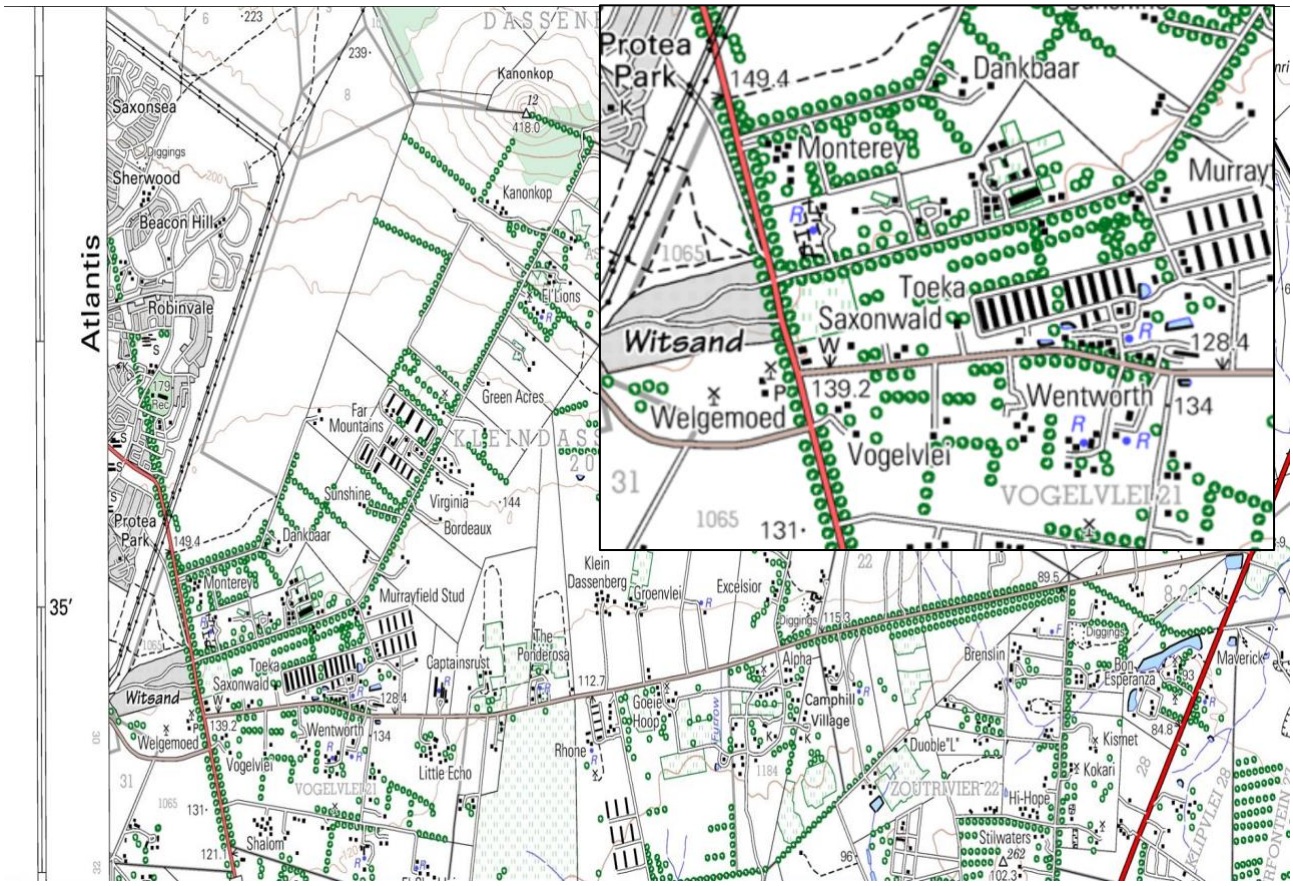

Figure 5: Project Site Topographical Map representing the Year 2000 (Grid Reference 3318DA)

3.2.3. Geology

According to a Geotech Study undertaken for the nearby Atlantis Special Economic Zone (SEZ) (situated 1,5km from the site), the study area terrain is known to be underlain by thick deposits of Quaternary age sands, on top of Precambrian eon sedimentary base strata associated with the Malmesbury Group (Nt), which comprises of greywackes, mudrocks and shales (AECOM 2014). The study site Quaternary sands is regarded to comprise the Springfontein (Qs) as well as the Witzand (Qw) Formation. These sands form part of the broader regional Western Cape Flats Coastal Lowlands (i.e. Sandveld) and follow natural accretion and erosion processes (i.e. migrating dunes). The sands are known to vary between 10m-15m in thickness in the local region of Atlantis and due to its unconsolidated nature being regarded to also represent as the regional primary aquifer (i.e. the secondary aquifer is expressed below the clay basement). It should also be noted that further towards the site north and north-east comprises the intrusive biotite rich granite Dassenberg hills.

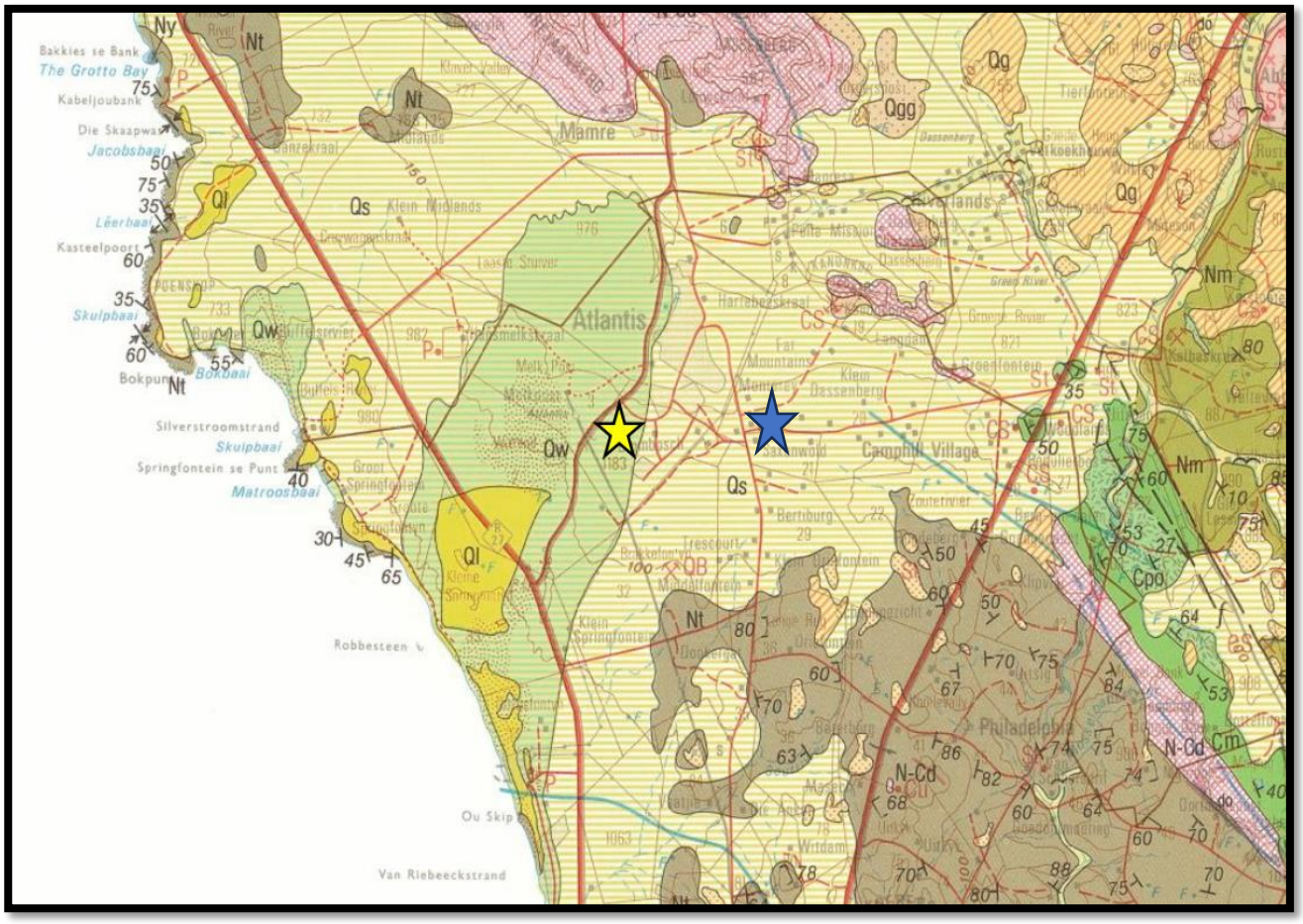

Figure 6: 1:250,000 Geological Survey Series (Map Number 3318, Cape Town).

Image extracted from Atlantis SEZ Geotech Report (yellow star), whereas this agricultural study area is indicated in blue star is 1,5km from the SEZ (AECOM 2014).

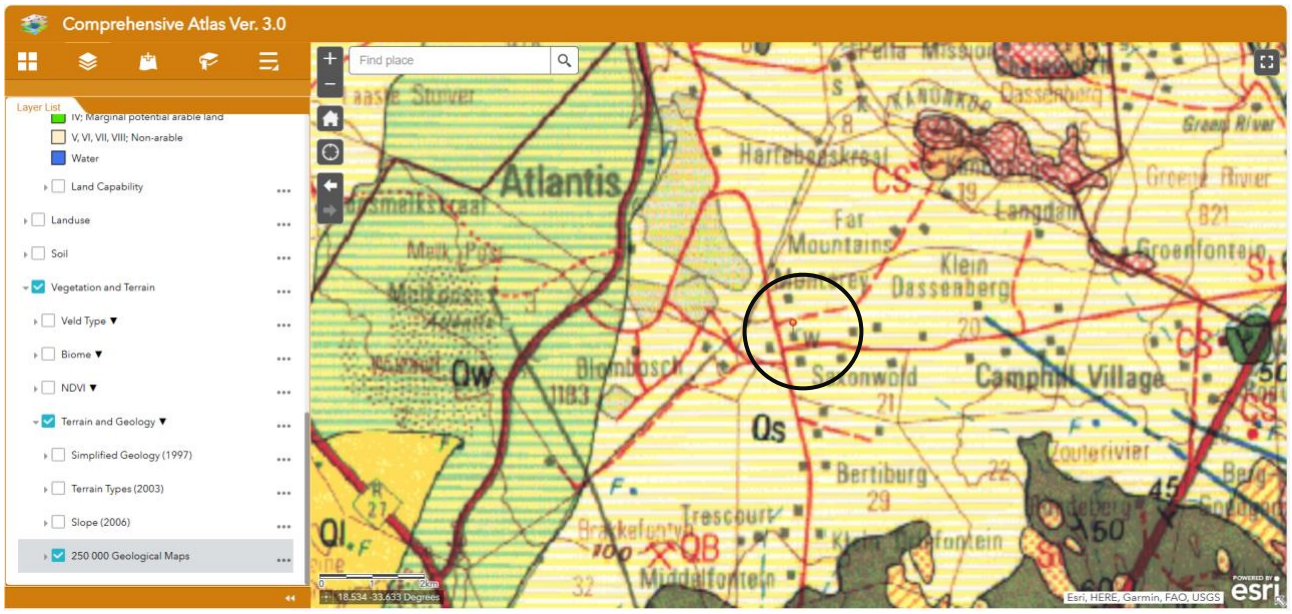

Figure 7: 1:250,000 Geological Map Confirmed with the Department of Agriculture Comprehensive Atlans Ver 3.0

Group	Formation	Lithology	Age	
Sandveld	Witzand	Aeolian, calcareous, quartzose sand	Holocene (0.01 Ma to present)	Quaternary
	Springfontyn	Aeolian, quartzose sand with intermittent clay and peaty layers	Pleistocene (2.6 – 0.01 Ma)	
	Langebaan	Aeolian, calcrete-capped calcareous sandstone		
	Velddrif	Littoral, calcrete-capped coquina		

Figure 8: Lithology of the Cenozoic Formations of the Cape Flats (Fouche 2021)

3.2.4. Soil

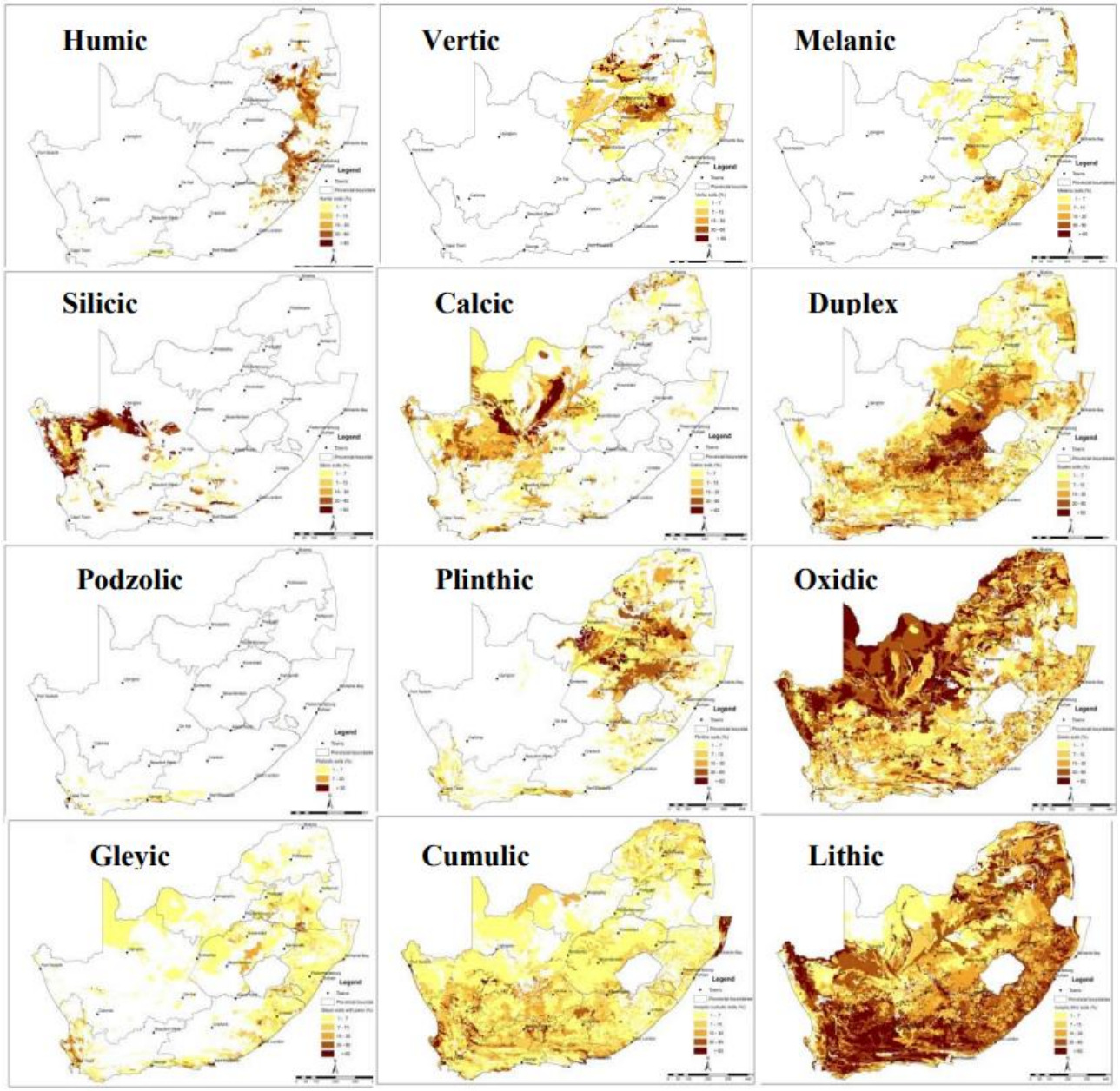

Figure 9: Soil distribution maps of South Africa (Fey 2010a; Fey 2010b)

As indicated in the previous subsection (i.e.geology), the site soils are regarded to be derived from the prominent Quaternary sands which is expressed as a lowland coastal migrating dune-plain complex. Typically the sands from the Witsand member group comprise dunes being of unconsolidated nature namely Aeolian, white in colour with or without pebbles and shells. Although also largely regarded as aeolian calcareous or quarzitic sands (i.e. Witsand), the Springfontein member group also comprise intermittent clay lenses or peaty layers which are associated with alluvial subsoil types (i.e. wetland). The Springfontein member group sands range from light grey, brown, yellow to pale red in colour (AECOM 2014). These alluvial transported soils therefore lie beneath the aeolian soils and occurs at various depths. The alluvial soils are typically classified as slightly silty to silty fine grained sands with occasionally lenses of fine grained sand.

It should be noted that discontinuous horizons of pedogenic material (ferruginous and calcareous sand) may form as irregular expression within the transported soil horizon (i.e. hydropedology, cementation). In general the sand deposits are regarded as fine to medium grained.

According to Sanders *et. al.* (2003), several sand dune geomorphological patterns and landscape processes can be discerned as part of a “Qs/Qw equilibrium” where the migrating process of the shifting sand dune flats landscape (i.e. antidunes) may be suitably characterised (i.e. height of dunes in relation to grain size such as fine sands, the cyclic nature of accretion and erosion processes or significant suspended load determinations).

From a more detailed perspective local sands are known to have a moderate to high degree of porosity in respect to having both fine and course sands, either weakly structured (i.e. Springfontein) or structureless (i.e. Witsand) which both provide in turn a good degree of water interflow and throughflow into the receiving aquifer. The receiving dune sands therefore may also typically overlay calcrete and shale lenses on a deeper shale and/or sedimentary bedrock typical of the Table Mountain Supergroup (TMG). Overall the site soils are associated to the broader Strandveld/Witzand/Sandveld member geological dynamics with near surface soils being regarded as very loose to loose, and improving in consistency with depth.

According to Stroebel *et. al.* (2013), property soils are regarded to be generally of an alkaline nature but one needs being mindful that Aeolian deposits may comprise acidic sands. In respect to agriculture, the sandy soils of the Sandveld group on the west coast are not regarded as suitable for most crops, but are highly suited to seed potato farming. However, that the West Coast is a low rainfall area, and therefore water for irrigation is limited for these potato crops which thereby rely heavily on exploitation of groundwater resources.

Figure 10: Picture taken in person at the Dassenberg R307/R304 interchange, with a remnant sand dune system typically representative of Atlantis sands. Note the Dassenberg hills in the background.

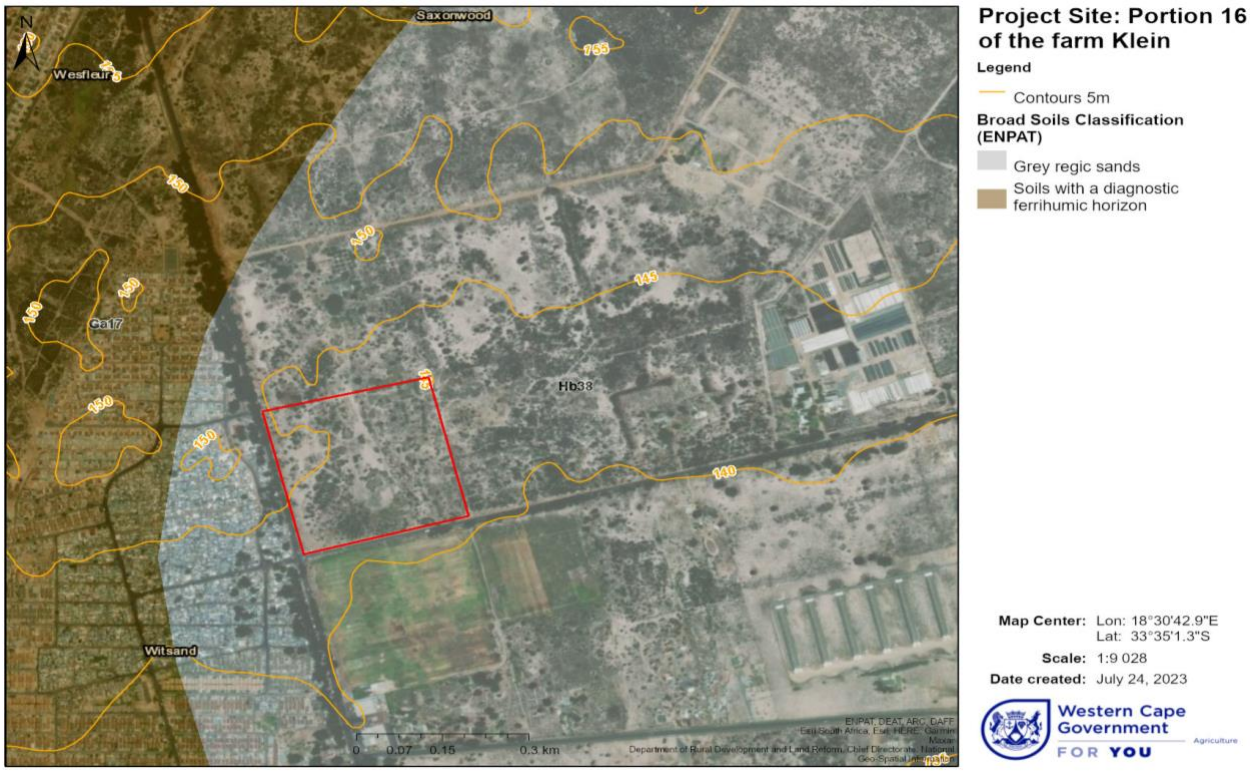

Figure 11: Study site soil map with contour lines (dune on northern site extent indicated as 150m)

3.2.5. Catchment Water Resource Situation

The water resource situation for the study site falls within the context of quaternary catchment G21B, which spans about 20km in breadth (draining north to south) and about 15km in length (draining east to west). Although the broad catchment falls within a drier than average rainfall region, the quaternary catchment does comprise some minor seasonal watercourses, namely: the Buffels River at Silwerstroom located about 12km to the west of the project study site; and then too the Sout River which is located about 10km to the south of the project study site.

In the more immediate and local setting the site area generally comprise water resources (wetland) that may be classed as either artificial (farm dams), urban (detention ponds) and superficial or transformed in nature (stormwater). These water resources may be described as seasonal with the downstream Donkergat River being linked to the Atlantis Waste Water Treatment Works (WWTW) as well as the Atlantis urban stormwater system (i.e. flood control).

Table 2: Study area receiving catchment reference river ecosystem class (from DWS PES 2010)

Quaternary and sub-quaternary reach ref	**G21B – 08896**
Reference River representing catchment area	Sout
PES status	E - Category or Poor Ecological State
Mean Ecological Importance Class	Moderate Ecological Importance
Mean Ecological Sensitivity Class	Highly Sensitive
Recommended Ecological Category	B – Category or Good Ecological State

**Please note that the river closest to the study area is the "highly transformed" Donkergat River and that the Sout River is used to serve as a more suitable reference classification for the receiving study catchment area.*

The catchment sand and dune deposits are characteristic to the G21B catchment which serves to retain and recharge groundwater resources. Overall the catchment characteristics are distinctly different to the neighbouring quaternary catchment G21D which comprise a significant perennial

river known as the Diep River and drains south along the eastern boarder of G21B. The water resources of the study site falls part of the Berg Water Management Area (WMA) which is classified as primary catchment “G”.

Figure 12: Study site (red square) receiving quaternary catchment (white polygon) (Google Earth 2023)

According to Herdien (2023), informed by undertaking a site flow accumulation model conducted on the Department of Agriculture Cape Farm Mapper Geographic Information System (GIS) indicates site drainage being regarded as a low flow accumulation zone, whereupon the study confirmed via ground-truth that a remnant dune towards the site northern and western boundary provides first order drainage via the unconsolidated sands which may express in lower laying areas as a dune slack seep feature. However no surface water resources were evident on the site (i.e. potential sub-surface water). Site stormwater thus drains from the study site in a south and south-westerly direction where it becomes 2nd order drainage.

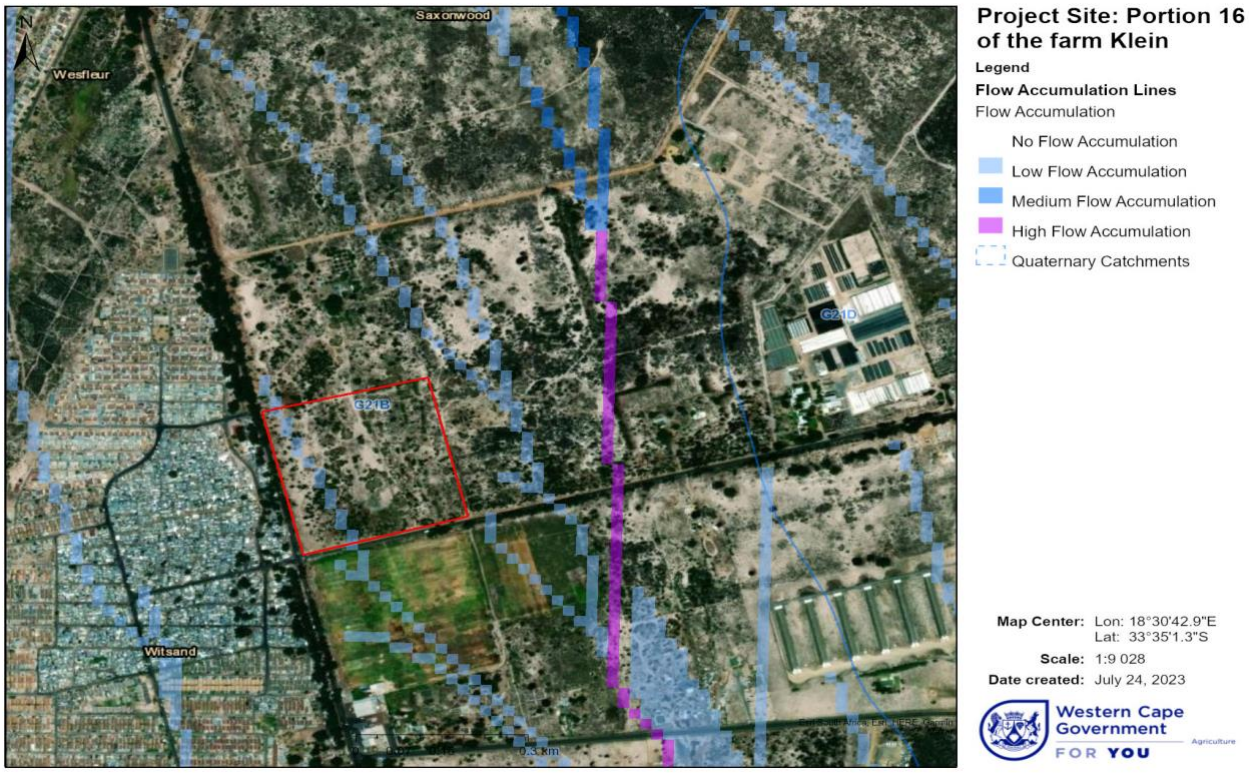

Figure 13: Study site natural flow accumulation model

Overall the localised site context is not regarded to comprise any watercourses or water resources beyond the scope of natural rainfall recharge into the dune filtered aquifer basin (i.e. watershed zone, dune-slack, subsurface and unconfined drainage of the first order – no watercourse). Site sub-catchment water appears to drain southernly and accumulates to a more significant extent outside of the site towards the site south. More information on the site water situation and water use history can be found in the Aquatic Biodiversity Specialist Opinion Compliance Statement Report (Herdien 2023).

3.3. Reference Site Land Use and Agricultural Setting

3.3.1. Current Site Land Use Setting

At present time the project site property does not comprise any land use (i.e. old land). The site is secured by parameter fence. Even so the property site is readily accessed for informal use (i.e. Zama-Zama, dumping). Informal taxi parking and loading activity also takes place on the property corner and urban edge (i.e. Saxonwold/R304 junction).

It should be noted that for the past couple of decades the site has been under alien vegetation and related invasion clearing management (i.e. Port Jackson) and has been subsequently left fallow.
Due to the site being situated on the urban fringe, the current land uses to the surrounding west comprises the mix urban residential community of Witsand (Atlantis) and the Atlantis access motorway known as the R304. The land uses to the property west and south are regarded as agricultural which includes pastures, poultry nurseries and hatcheries as well as agroprocessing (i.e. Pioneer foods). To the north of the project property is a designated conservation area.

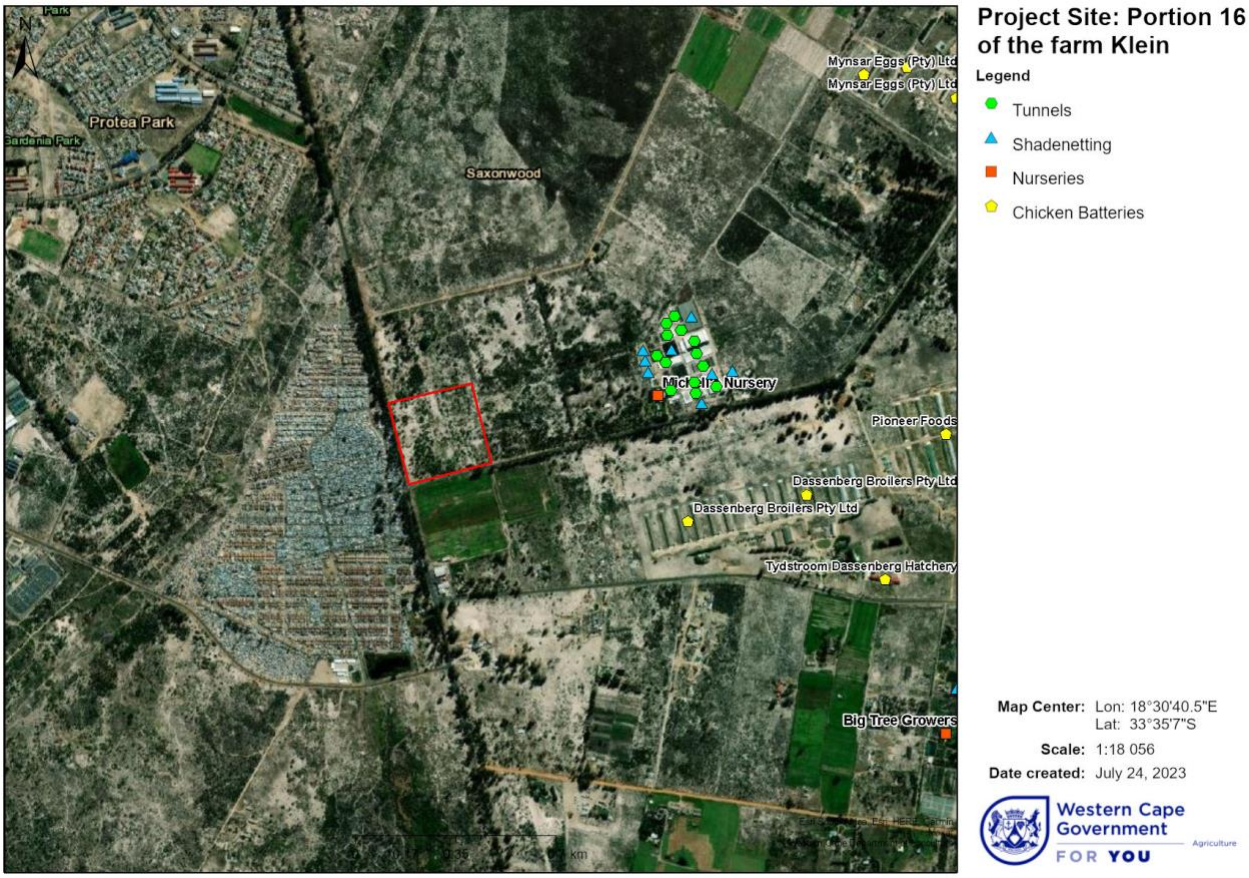

Figure 14: Project area land use setting (Herdien 2023)

3.3.2. Reference and Historic Site Land Use Setting

The site project property has previously comprised land use by previous owners in the form of agro-industry during the 2003 time period and prior. With reference to substantiating on the previous sub-section, the following images refer.

Figure 15: Google Earth Timeline Image representing the Project Site During the February 2003 (Herdien 2023)

Figure 16: Project site "surrounding" land use setting (planted pastures to south during 2017)

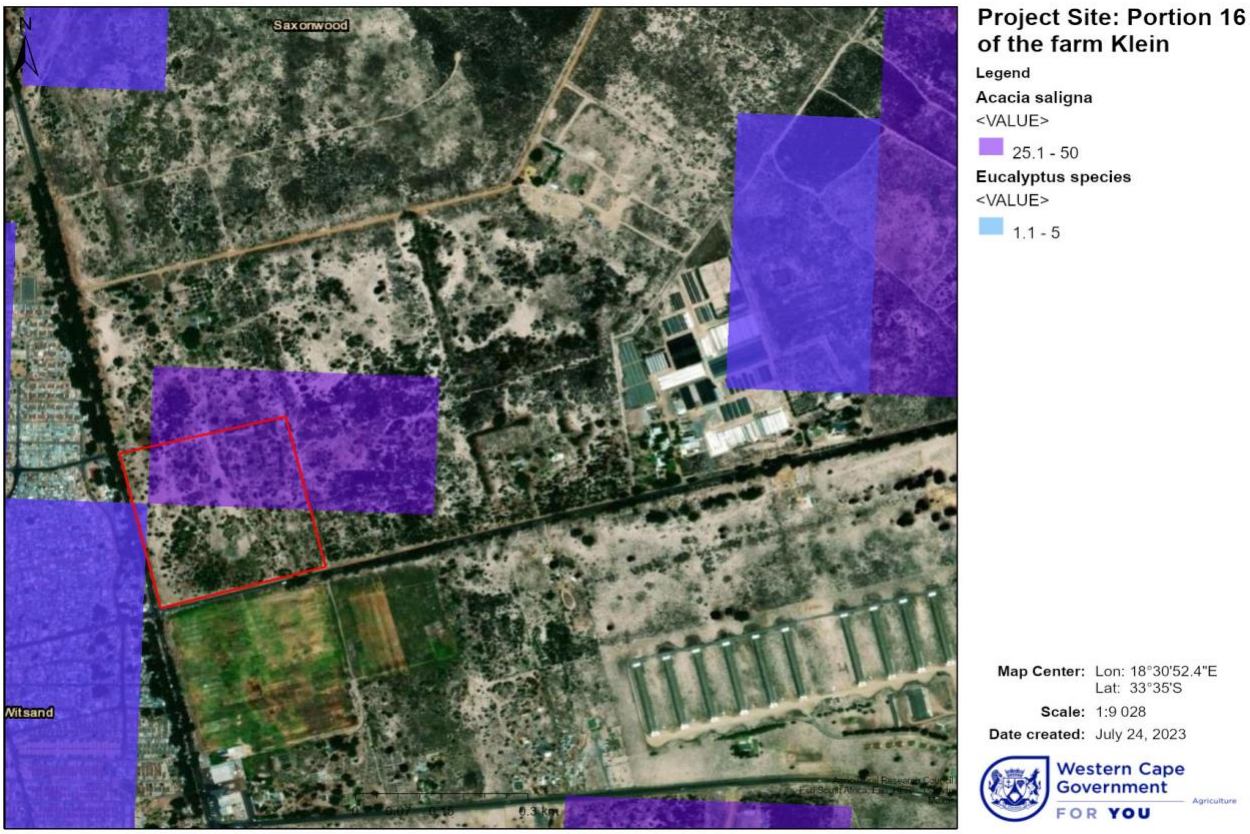

Figure 17: Study site alien vegetation presence model (Herdien 2023)

3.3.3. Land Capability

3.3.3.1. Land Capability Classification

As in the case and this subsection figures and illustrations, land capability is generally presented under classification grouped as land which is either regarded as having very high agriculture capability ranging to land which is considered as comprising low agriculture capability. As in the definitions section of this report, land capability refers to the land unit and its ability or capacity to function and serve to sustain a specific agricultural land use. Ultimately this classification draws relation to its carrying capacity for the proposed agriculture land use as well as with reference to the sustainability of the existing receiving ecosystem (i.e. suitability perspectives). From a superposition, this implies the consideration of all the landscape aspects that combines to the constructed landscape unit level (understanding of soil, terrain, and climate features). It should be noted that land capability is not a detailed or qualified determinant for soil capability and neither for soil suitability but instead provides an initial perspective on the landscape potential. The soil qualifications which is a focus of this report will thus be used to further improve and qualify the detail level understanding of the landscape capabilities (i.e. fine-scale planning). In general facets such as soil suitability is used in the determination of fitness for use and to inform on whether the soil indeed is of high or low capability, to make recommendation on the soil agriculture efficiency in the undertaking for a selected agricultural land use (i.e. crop selection, tilth requirements, organic content, irrigation requirements).

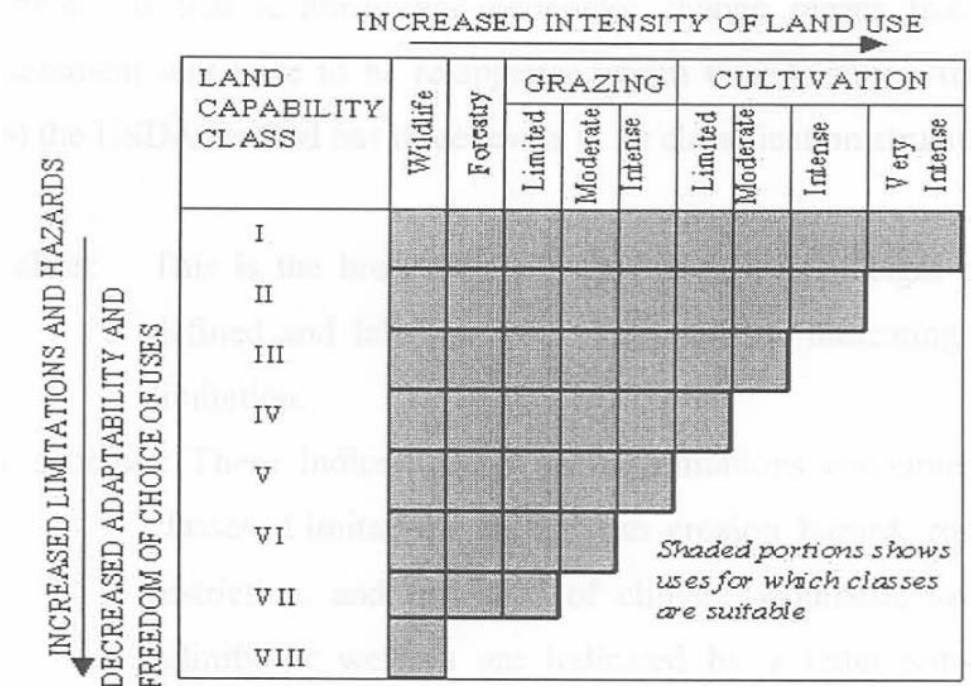

Figure 18: Diagram representing factors considered in determining Land Capability Classes (Davidson 1992)

The following 8 class System for Soil and Land Capability Classification for Agriculture in South Africa, among others (Klingebiel & Montgomery 1961), is made reference to provide for an initial or high level understanding of the project site area land capability which provides the interpretation and framework understanding for land where it may be regarded as either being of high value or low value in terms of its agriculture potential. As previously indicated agriculture capability will however still depend on the soil capability and suitability for a specific proposed agricultural land use. It should also be noted that although land may be classified as limited in its potential for agriculture capability that this type of land may still in instances be regarded as suitable for crops (i.e. capability class iv – marginal potentially arable). On the other hand, land which is classified as in the C order or D order (i.e. non-arable), namely class v-vii may still present an opportunity for rangeland stock, whereas class viii is regarded as not being suitable for agriculture.

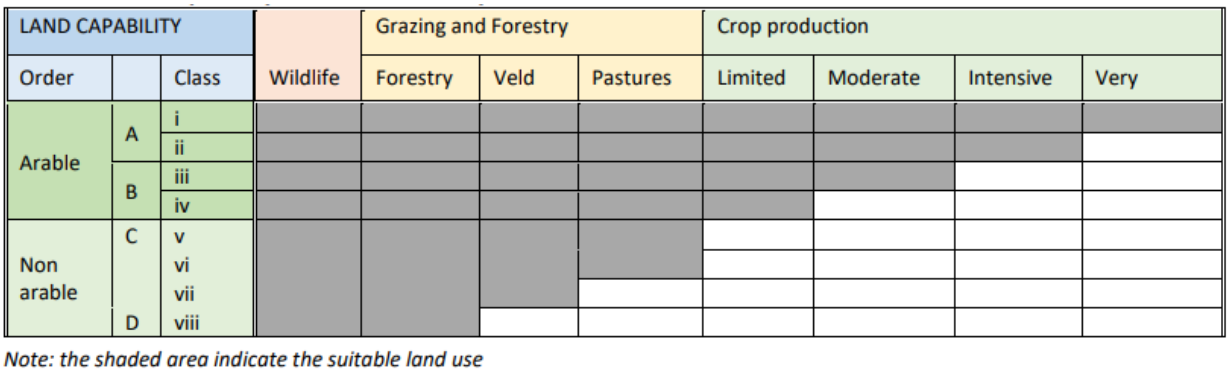

Figure 19: Land Capability Classes in relation to land use intensity and suitability (Index Africa 2021).

Note that the 8 classes of land capability are grouped under 4 order categories:

- Order A: Arable Land – High Potential with few limitations (Class i and ii)
- Order B: Arable Land – Moderate to Severe limitations (Class iii and iv)
- Order C: Grazing and Forestry Land (Class v, vi, vii)
- Order D: Land not suitable for agriculture (Class viii)

According to the Portfolio Committee on Agriculture (Department of Agriculture, Forestry and Fisheries), which released its Integrated Spatial Analysis on land capability and land use for Agriculture and Forestry Cape Town on 27 February 2015 refers.

- Land Capability Definition
    - The extent to which land can meet the needs of one or more uses, under defined conditions of management, without permanent damage.

- Expression of effects of physical factors on the total suitability and potential for use for:
  - Crops that requires regular tillage;
  - Grazing;
  - Forestry; and
  - Wildlife.

- Land capability involves consideration of:
  - The risks of damage from erosion and other causes;
  - The difficulties in land-use caused by physical factors, including climate (rain-fed production); and
  - The production potential.

As previously indicated in this report introduction section, that the National NEMA Screening Tool was used by a project EAP to inform this assessment. The NEMA Screening Tool allows for the production of a Land Capability Map which resulted in indicating that the project site falls within a Low-Moderate Land Capability Class with metric score ranging from 06 to 08 (See following image).

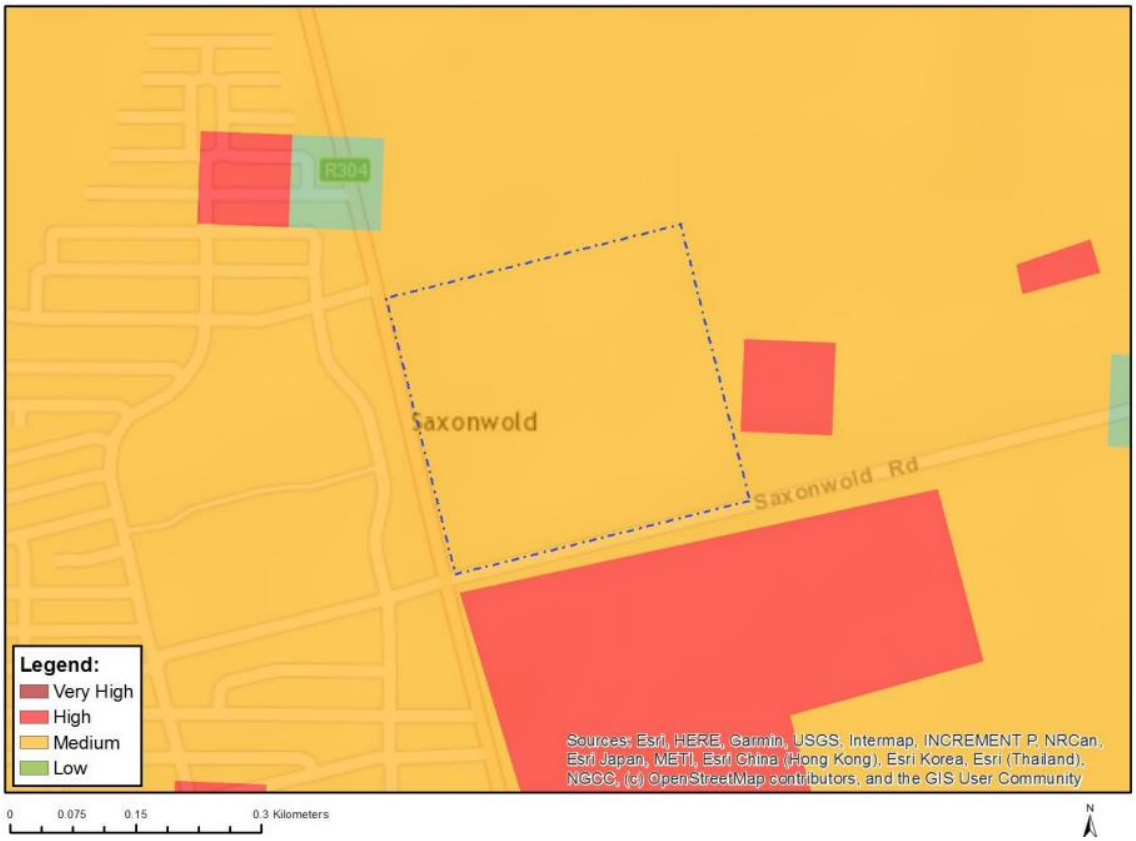

Figure 20: Land Capability Map excerpt taken from the project NEMA Screening Tool Report.

The NEMA Screening Tool as previously indicated in this report Section 1.2. thereby informs on the Environmental Impact Assessment process and which indicates in this case that a specialist opinion qualification statement is a standard requirement. However, it should be noted that in this report Section 2.1., that the approach for qualification of proposed land use risks and impacts to the agricultural theme is regarded as better understood in undertaking in providing a full agricultural impact assessment study instead of just the opinion statement as required.

More commonly regarded is the limiting factor for agricultural in the extensive Atlantis region which is its limited water availability. To this end the municipality has resorted to not only tapping into the receiving regional aquifer but also recycling of treated water and desalination in order to augment its water supply services mix (See following image: Melkbos reservoir).

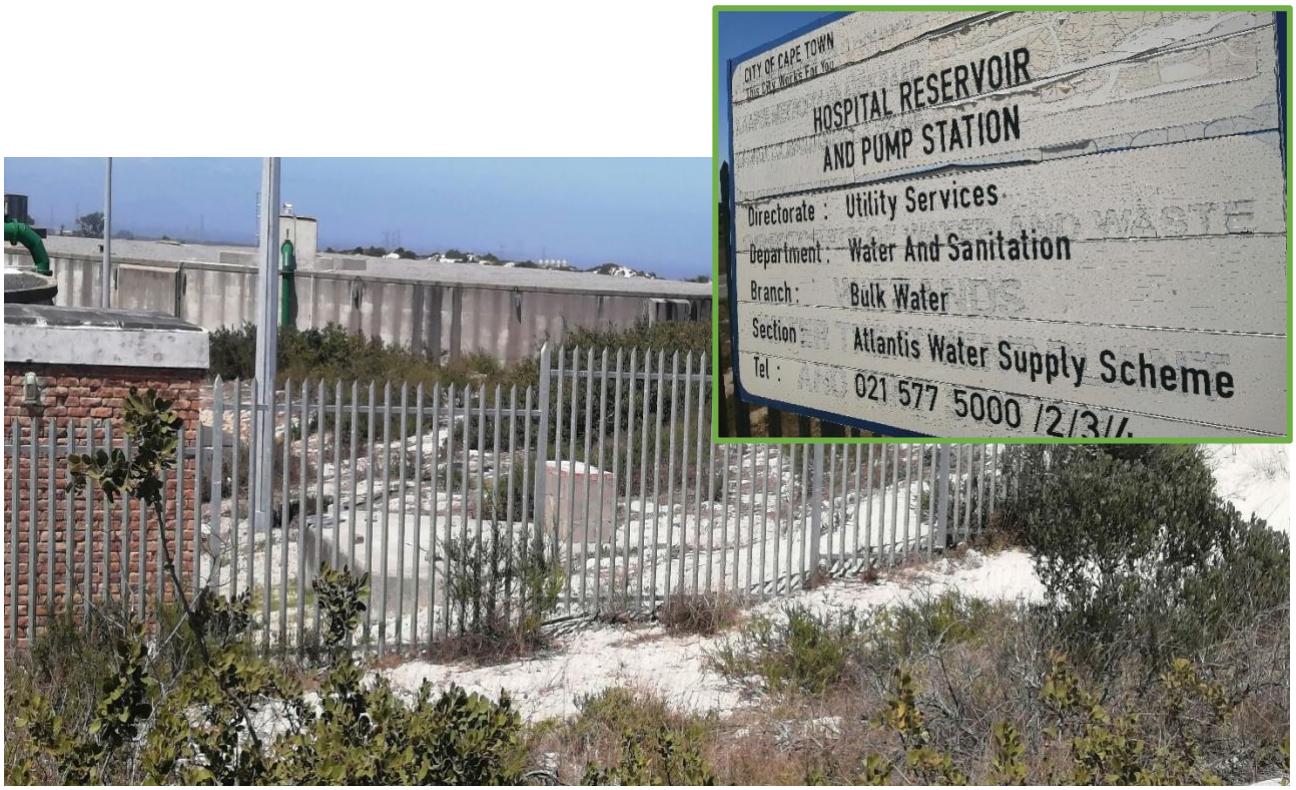

Figure 21: Image of the Melkbos Reservoir which forms part of the Atlantis Water Supply Scheme.

Even as the NEMA Screening Tool was utilised to inform on the project site agriculture status, the Department of Agriculture GIS Comprehensive Atlas Ver 3.0 was also used to confirm in the determination for land capability (See following image). The land capability of the study property and surrounds are regarded as marginal to moderately arable. However it should be noted that the project site is situated within the Atlantis Coastal Plain, which is characterized by sandy soils that are generally not suitable for agriculture, which thereby regards the area as undesirable for most agricultural activities (Atlantis Foundries Draft EIA Report, 2015).

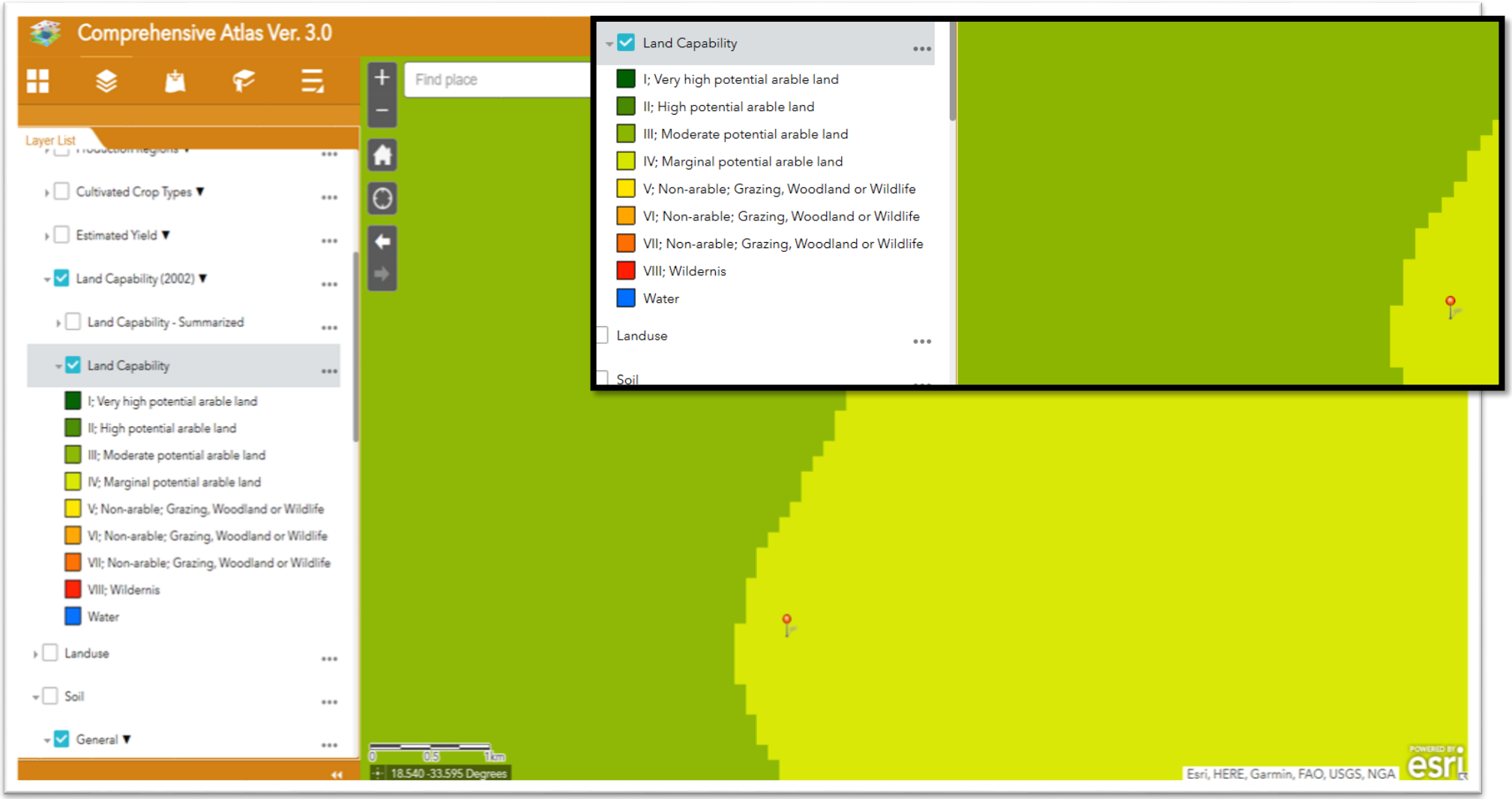

Figure 22: Land Capability Map produced for the study site on the Department of Agriculture GIS Comprehensive Atlas Ver 3.0

3.3.3.2. Stock Agriculture Suitability

Specific stock or dry land and rangeland agriculture remain an option for the region if the veld is available and the activity impact is managed against the natural environment (i.e. in respect to Regulation 10 (1) of CARA, the Department of Agriculture indicates on its grazing capacity map that the grazing capacity for livestock on natural veld is estimated at 8 hectares per large stock unit - LSU), whereby the grazing capacity of veld, refers to the specified number of hectares per large stock unit (Directorate Land Use & Soil Management).

Due to the lower average rainfall experienced in the Western Cape, the province in general is regarded as very limited in respect to its grazing capacity or the ability for the land to sustainably undertake stock farming (LSU / SSU) (2-3 to 20-30 ha per GVE) (Meissner 2013). The rate at which stock can be farmed do therefore vary considerably across the province but in general as in the case with Atlantis that it is regarded as rather limited. As a result it may be viewed that the proposed project does not have a baring or impact on the stock agriculture potential (i.e. due to the small size of the project property).

A myriad of factors such as land type, limited rainfall and important indigenous ecosystem sensitivities (i.e. Cape Floristic Region) further hamper the ability for exploiting stock farming in the cape. As a result only certain towns or places in the broad western cape region are known for stock farming such as the famous Overberg Merino sheep. Stock type is also a considerable factor when considering the impact of an Ostridge to a cow on land being significantly greater than the impact of sheep or goats.

Overall the project site property is limited in size and space and therefore is not regarded as suitable for stock farming.

3.3.3.3. Crop Agriculture Suitability

Due to the diversity in South Africa's ecological and natural resources landscape it is critical to seek advice from a professional to inform on appropriate crop suitability whereas different soil types are more or less suitable for a specific crop, its irrigation, and conversely as specific crops may present a substantial influence from its water and nutrient needs requirements and therefore the sustainability of the agricultural enterprise.

For example, the sandy soils of the Sandveld on the west coast are not suitable for most crops, but have been regarded as highly suited to seed potato farming. However, the West Coast is a low rainfall area, and irrigation of these potato crops is heavily reliant on groundwater. These crops also rely heavily on pesticides and fertilisers, which require replenishing, and which can contaminate the runoff into the freshwater resources in the area. Lately it appears that following seasonal and decades of extreme drought conditions, the pressure and impact on the agriculture especially to the below average rainfall west coast region, or in the case of Sandveld potatoes farming, seems to be facing a negative trend for conventional agriculture. Therefore the sustainable outlook for the Sandveld region potatoes in respect to potatoes farming may be regarded as of a higher risk than during previous decades (i.e. cumulative impact, climate change adaptation, new age agriculture techniques, water use efficiency).

Similar crop factor issues present in the neighbouring water management areas Olifants River citrus valley, in that the citrus fruit is regarded as a high water requirement crop. According to Meerkkotter (2012) and Mahlungulu *et.al.* (2023), soils in the cape flats as well as the winelands vicinity may contain heavy metals or pH ranges which is not suitable for farming or agricultural purposes

One should note that many unqualified concerns such as may pertain to agriculture potential or risks and in respect to refining the agriculture capability of a landscape unit, such as concerning its water availability and in respect to soil quality or suitability will readily impact on agricultural viability the receiving environment and the economy being unlocked. For instance factors such as land size suitability in relation to stock or crop intensity, its resilience to sustain the target exploitation capacity we term economically viable and the costs for management and monitoring of impacts against the natural receiving environment and maintaining soil integrity may apply.

According to Meerkkotter (2012), few agricultural areas in the Cape such as the Joostenbergvlakte/Kraaifontein areas and the Philippi areas, sporadically do contain high levels of cadmium, copper, lead and zinc in some of the soils, in some of the irrigation water resources and thereby taken up by the crops. Similarly in the broader Cape Winelands, heavy metals were found in vineyard soils as well as in grapevine leaf samples (Mahlungulu *et.al.* 2023).

Heavy metals, its potential presence in land zoned for agriculture, and in specific to the study region of Dassenberg or the greater Atlantis will need to be qualified in order to indeed confirm that the soil is suitable for broad or specific use. The groundwater scheme of Atlantis, its industrial zone and the receiving Cape Flats aquifer is now however known to comprise heavy metal trace elements which therefore warrants some unqualified concern to agriculture for the region (Department of Water Affairs 2010).

Overall a mindset change to crop agriculture potential and suitability may apply in the future to offset against the challenges of climate change and with a growing awareness of soil suitability.

4. Ground-truth Assessment

In order to improve the confidence of the desktop assessment, and in alignment with sector specialist policy, a ground-truth assessment of the project site took place during the week of the 24th September 2023. Project site soil profiles undertaken during the aquatic qualification assessment period, dating around the 30 July 2023, was also used to support the project site soil classification (i.e. soil behaviour over time). During this ground-truth assessment period

4.1. Site Photographic landscape Habitat Quality Assessment

A photographic site walk-about-assessment was undertaken as part of the project site ground-truth investigation. This report sub-section provides a snapshot of the project site landscape, its immediate surroundings and the condition of the veld and natural habitat. See following figures of pictures taken at the project site.

Figure 23: Picture captured from Saxonwold Road indicating the project site southwestern boundary fence and access gate looking toward the R304 interchange and the township of Witsand.

Figure 24: Picture captured from the project site southern boundary looking north-west.

Figure 25: Picture captured from the project site west looking east.

Figure 26: Image representing natural veld comprising common Strandveld indigenous sour figs on a very sandy natural substratum.

Figure 27: Picture captured from the project site east looking west.

From the photographic landscape habitat assessment presented, at a snapshot glance, one can deduce that the project property may be regarded as old land left fallow, previously used or disturbed and currently transformed from its natural reference state (i.e. Dune Strandveld). Although natural elements prevail in remnants on the study site in particular the notable high rising reach of the project property north-western dune extent, that most of the project site has previously been mined and the landscape altered for the purposes of old agriculture industry and recent informal access uses (i.e.. zama-zamas). Other landscape pressures include litter and dumpling from informal use access (i.e. Witsand community). Alien vegetation invasion is also a common theme to the region which on the project site has been placed under controlled by eradication practise.

Overall the project property retains its dune sand setting even as most of the dune landscape has been lost over the past century that the soil of the site is completely covered by sand instead of soil serves as testament to its reference state. The natural vegetation of the site is regarded as Strandveld Fynbos habitat but in the current setting which seems largely transformed from its natural

reference state and currently disturbed by weedy grasses amidst pockets of natural daisies and sparsely distributed shrubs regarded as few yet natural remnants. Lastly, worth noting is that taxis are making use of the project site southern boundary as a parking area serving the urban Witsand community located opposite the project site. For more information please refer to the project aquatic and botanical assessment studies.

4.2. Site Soil Assessment and Soil Capability

The subjects of land and soil capability as presented in this report desktop assessment are aided in this study with soil and landscape ground-truth confirmation assessments. In the case of landscape generally the surveyor will make use of a site topography assessment to determine slope and landscape requirements or concerns. Soils on the other hand will either be assessed by test pit shot or profile auger or by means of other geotechnical assessment techniques which may inform for stormwater control, suitable land use management or in serving to guide development stability purposes. In the case of this study a standard 1m3 soil profile by hand was excavated and reinstated for the purposes of detailing for soil typology and classification. The following map indicates the project study site soil assessment sampling points for soil profiles unearthed and assessed. Note that soil profiles were not assessed in the property west and north-west because this area is completely characterised by an elevated dune.

Figure 28: Location of soil profile sampling points for the project study site.

Project site soils were profiled to improve the confidence of the site soil classification as presented in the desktop assessment. As indicated in the desktop assessment and study approach, "A System for Soil and Land Capability Classification for Agriculture in South Africa; March 1987 & revised January 1991 (Scotney, Ellis, Nott, Taylor, v Niekerk, Verster & Wood)" was used to inform the study. The understanding of soil, its dynamics and the implications for land use such as in the case advocating for responsible and mindful agriculture is important. These may relate to stability or erosion or in the context of elements found in the body of the soil landscape which may require suitable management in order to employ a specific land use or in seeking to reduce any risk and impact. Landscapes and receiving soils, their formation processes and their landscape behaviour are thus important dynamics for land use considerations such as in the case of topsoil dominated soils or in the case with deep soils (i.e. deep soils may have a higher variance in chemical composition than topsoil or that the erosion nature of soils vary – dolerites vs dolomite derived soils).

	Soil group	Concept	Diagnostic subsoil horizons	Soil types
5	Silica enriched	Silica enriched; Arid areas	Dorbank	Garies, Oudtshoorn, Traval, Knersvlakte
6	Calcium enriched	Carbonate or gypsum enriched, arid areas	Soft or hard-bank carbonate or gypseous	Molopo, Askham, Kimberley, Plooysburg, Etosha, Gamoep, Addo, Prieska, Brandvlei, Coega
7	Duplex	Noticable enrichment in clay	Pedocutaneous B; Prismacutaneous B	Estcourt, Klapmuts, Sterkspruit, Sepane, Valsrivier, Swartland
8	Podzol	Enriched by metal-humates	Podzol B	Tsitsikamma, Lamotte, Concordia, Houwhoek, Jonkersberg, Witfontein, Pinegrove, Groenkop
9	Plintic	Iron enriched; Flecks and/or hardening	Soft plintic B Hard plintic B	Longlands, Westleigh, Avalon, Lichtenburg, Bainsvlei, Wasbank, Glencoe, Dresden
10	Oxides	Next article		
11	Gleyed			
12	New soils			
13	Stoney			
14	Anthropogenetic			

Figure 29: Grouping of soil types with an orthic topsoil horizon (Fey, 2010a).

In the case of this project study site, one may regard site soil as being atypical to soil classification due to the site being associated with unconsolidated aeolian dune sands. These soils are regarded as either structureless or of weak structure. regarded as aeolian calcareous or quarzitic sands (i.e. Witsand), with the Springfontein member group also comprising intermittent clay lenses or peaty layers which are associated with alluvial subsoil types (i.e. wetland). As such even though on a localised level the site soil did not present any distinct structure that some structure may be present in these soils such as the case with the Duplex and Estcourt types which may present in the Springfontein member group soils associated with sub-surface drainage lines or lenses. Further toward the northern cape the dune soil types may be regarded as of the Dorbank type (i.e. see soil classification guide). Unfortunately as indicated the project study site did not comprise any distinct horizons therefore being regarded as unconsolidated aeolian dune sands (i.e. no significant or distinct organics or mottling evident).

Soil classification: A Taxonomic System for South Africa, provides a specific horizon table for combinations of soil types. According to Fey (2010a), the first number of soil groups with an orthic topsoil, are provided in the following image and which may have referred to the project study site should it have comprised more organics in the topsoil or a proper Orthic A horizon (non-noted). In addition the deeper soils regarded as common in the sub-humid and semi-arid areas of South Africa are known as Duplex of the Estcourt type. Similarly other common types to the region would be Klapmuts. However it is worth noting that Duplex soils are also not best regarded for irrigation agriculture due to the challenges with clay lenses, soil hydraulics and sub soil drainage.

Figure 30: Example of a textbook reference case duplex subsoil enriched with clay (Estcourt type) (sagrainmag.co.za).

Even though the project site does not comprise any noteworthy soils, at least two variations of structureless soils were found on the study site. The first being a grey sand and the latter being a yellow sand topsoil (i.e. the site does not comprise a distinct sub-soil nor presence of mottling). This may indicate a bleaching effect or the presence of iron and clay in the deeper sands in contrast to the dune sands.

Figure 31: Yellow sand landscape unit found in the project site eastern and north-eastern vicinity (sample #7 and #8).

Figure 32: Common grey dune sands predominant landscape unit found in the project site western, central and southern vicinity (sample #2, #4 and #5).

5. Development Risk Synthesis

5.1. Impact Assessment Rating Methodology Adopted for this Study

International and national standards and guidelines were adopted to inform and formulate the framework and contents for the undertaking of this environmental impact assessment study (DEAT 2002; DEAT 2005; DEAT 2009; DEAT 2009; US EPA 1992). In addition, the method in application gleamed to support the standardisation of this study was supplemented from local literature and agriculture assessments managed via established environmental consulting agents from firms such as RHDHV, Digby Wells and Braaf Environmental Practitioners (Memo (sahra.org.za). Similarly is the case with the template and style adapted for synthesising for the required agricultural information aspects scope of this report in being informed by researching the manner of which leading local agricultural sector specialist practitioners undertake to inform on technical aspects such as in the case of soil sensitivity, soil capability and agriculture suitability (i.e. TerraSoil, TerraAfrika, Christo Lubbe and Johann Lanz – potential and proposed reviewer).

Even so it is worth noting that the practitioner undertaking the compilation of this study and specialist assessment report has had prior soil science training with TerraSoil at Elsenberg; and then too that this practitioner has successfully worked as a strategic scientist for the international firm RHDHV having being employed as a senior environmental consultant. Overall the style and manner of reporting is ultimately informed and drawn from my own experience as a soil scientist, a botanist and as a water resource scientist practising in the EIA environment for the past 20 years (i.e. incorporating social and environmental consideration in agricultural resource management).

In seeking to remain within the standardised framework of agricultural assessment practitioners, and in conforming to the sector requirements for making prediction and identification of project environmental impacts (i.e. subject) its effects on the receiving project site (i.e. object – receptor), use was thus made of the significance probability matrix, the sensitivity matrix, in respect to the subject risk and impacts to agriculture, as well as in informing on the suitable mitigation scope, in being aligned with identified land use sector policy guideline frameworks, as far as possible.

The following methods and component metrics are utilised in the application framework of risk assessment (subject) and in order to inform for suitable risk management (object).

Subject project activity impacts, risks or threats hypothesised were broadly identified to include its life-cycle and were modelled according to industry best practise in furnishing for activity consequence and significance rating formulae (models) utilised to make assessment of identified subject stress, hazard and/or disturbance pathways, effects on an object resource quality (i.e. agricultural resource) and are generally represented with the following necessary components:

1. **Consequence** = Type of Impact x (Intensity + Extent + Duration)

Where

2. **Significance** = Consequence x Probability x Nature

And

3. **Probability** = Likelihood of the Effect Occurring

Consideration to the Nature of the type of impact (i.e. degrading or improving) are assigned the value rating of +1 (Positive Impact) or -1 (Negative Impact) respectfully.

The determination of probability or likelihood of a potential impact rating is guided by the following matrix (table 3).

Table 3: Probability Consequence Matrix for Impacts Guide

Probability	Significance																																									
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	**-20**	**-19**	**-18**	**-17**	**-16**	**-15**	**-14**	**-13**	**-12**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
	Consequence																																									

The following table provide a score guide for significance as determined which may be categorised into falling within the ambit range of the 8 classes (i.e. major positive to major negative) as provided (table 4). Lastly a guideline table is provided along with description to serve as an implementation template for impact rating and modelling as undertaken (table 5).

Table 4: Significance Threshold Limits Guide

Score	Description	Rating
109 to 147	A very favorable impact which may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change.	Major (positive)
73 to 108	A favorable impact which may help to justify the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment.	Moderate (positive)
36 to 72	A significant positive impact. However, by itself this impact is insufficient to justify the implementation of the Project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment.	Minor (positive)
3 to 35	A small positive impact. This impact will result in medium to short term effects on the social and/or natural environment.	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. By itself this impact is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the social and/or natural environment. The impacts are reversible and will not result in the loss of irreplaceable aspects.	Negligible (negative)
-36 to -72	A significant negative impact which requires mitigation. By itself this impact is insufficient avoid the implementation of	Minor (negative)

	the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the social and/or natural environment.	
-73 to -108	A significant negative impact which may prevent the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects. The impacts may result in the irreversible damage to irreplaceable environmental or social aspects should mitigation measures not be implemented.	Moderate (negative)
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts will be irreplaceable and irreversible should adequate mitigation and management measures not be successfully implemented.	Major (negative)

Table 5: Impact Assessment Parameter Ratings Weighting Consideration Guide (i.e. adapted from local heritage and social impact assessment templates – SAHRIS/SAHRA)

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*			
7	Very significant impact on the environment. Irreparable and irreplaceable damage to highly valued species, habitat or ecosystem. Persistent severe damage. Irreparable and irreplaceable damage to highly	Noticeable, on-going social and environmental benefits which have improved the livelihoods and living standards of the local community in general and the environmental features.	International - The effect will occur across international borders	Permanent: No Mitigation The impact will remain long after the life of the Project. The	Certain/ Definite. There are sound scientific reasons to expect that the impact will definitely occur.

	valued items of great cultural significance or complete breakdown of social order.			impacts are irreversible.	
6	Significant impact on highly valued species, habitat or ecosystem. Significant management and rehabilitation measures required to prevent irreplaceable impacts. Irreparable damage to highly valued items of cultural significance or breakdown of social order.	Great improvement to livelihoods and living standards of a large percentage of population, as well as significant increase in the quality of the receiving environment.	National Will affect the entire country	Beyond Project Life The impact will remain for some time after the life of a Project.	Almost certain/Highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread positive benefits to local communities which improves livelihoods, as well as a positive improvement to the receiving environment.	Province/ Region Will affect the entire province or region.	Project Life The impact will cease after the operational life span of the Project.	Likely The impact may occur
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense social benefits to some people. Average to intense environmental enhancements.	Municipal Area Will affect the whole municipal area.	Long term 6-15 years to reverse impacts.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some.	Local Extending across the site and to nearby settlements.	Medium term 1-5 years to reverse impacts	Unlikely Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly repairable. Cultural	Low positive impacts experience by very few of population.	Limited Limited to the site and its immediate surroundings	Short term Less than 1 year to completely reverse the impact.	Rare/ improbable Conceivable, with the possibility of the impact materialising being very low as a result of design, historic experience or implementation of

	functions and processes not affected.				adequate mitigation measures.
1	Limited damage to minimal area of low significance that will have no impact on the environment. No irreplaceable loss of a significant aspect to the environment. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level social and environmental benefits felt by very few of the population.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month to completely reverse the impact.	Highly unlikely/None Expected never to happen.

5.2. Identification of Key Potential Risk and Impacts

According to DEAT (2005), all agricultural activities result have adverse effects on the environment, and to this end, DEAT has indicated engaging with the agriculture department and sector as a whole, in order to manage against the negative impacts on the environment such as biodiversity loss. According to the Department of Environmental Affairs and Tourism (2009) the major pressures on South Africa biodiversity are:

- Loss and degradation of natural habitat
- Invasive alien species
- Over-harvesting of species
- Over-abstraction of water, especially for irrigation, and
- Climate change

DEAT (2005) also indicates that the agricultural sector has had the most profound impact on natural habitat across South Africa. The clearing of natural vegetation for crop cultivation has impacted on all biomes some more dramatic such as the case in the Swartland and where Renosterveld (Lowland Fynbos) habitat presides which often comprises rich fertile soils.

It is worth noting that biodiversity and agricultural biodiversity implies two separate perspectives on biodiversity whereas the latter eludes to the richness of potential cultivation in respect to variants which may include GMOs or a variety of cultivars. Even though there may be a high potential for agricultural biodiversity from a species diversity perspective, only some small percentage of potentially viable crops and stock are commonly selected for mass production or agriculture globally (i.e. in spite of improved biotechnology and farming techniques, agricultural biodiversity is generally

monotonous in application and selection by national and global markets).Conversely one may find a positive variance in agricultural biodiversity when considering the agricultural biodiversity within the informal sector and more localised societal sectors.

In general the objectives of environmental impact assessment (EIA) are implemented using a mindful or systematic approach, in evaluating the effects imposed by a proposed project or specific proposed land use on a land unit. It may include the determination of existing and reference integrity status quo in respect to either the reference ecosystem or both (the existing condition of the receiving project landscape footprint area under land use activity – cultivation area). Further that the environmental effects or responses will vary in contrast when the existing land use change to another such as concerning the development of an urban or industrial structure (i.e. like steel and/or concrete) on agricultural land or where placing natural land under irrigation, for the purposes of cultivation or for other agriculture uses (i.e. transformation of landscape soil and hydropedology). As previously indicated the agriculture sector controls the impact of stock agriculture by managing stock on a sustainable basis as determined by the regional stock per area factor. Based on these assessments, effective measures must be considered to prevent or minimize any undue and adverse effects of land use practise (i.e. sustainable management practise). Otherwise in respect to agriculture in south Africa, DEAT (2006) makes reference to the high hopes invested in the use and application of biotechnology and the role of advance technology to the sector but also that a comprehensive management framework is yet required for agriculture holistically (i.e. monitoring of GMOs impact on biodiversity, agricultural soil suitability – pH, soil chemical and heavy metal constraints)

In respect to agriculture, the identification and determination of potential impacts and risks from planned projects to potentially cause or disturb or alter agricultural soil resource quality, its sensitivity, its suitability, may be regarded as an important principle focus to agricultural impact assessment reporting amongst other. As previously indicated, from an impact assessment practitioner perspective, the impact pathway of a proposed activity and the potential change away from a perceived reference state or existing land use integrity setting will therefore require management and control as a focus. Factors such as land use zoning scheme applicability are in mind as well as the degree and scale of impact, its magnitude and its intensity or likelihood are regarded as commonplace to consider in addressing or contemplating potential project development and proposed operational activities by way of mitigation and in implementing a precautionary approach (i.e. responsible sustainable development). Lastly where onsite impact mitigation is not possible that guidelines are available to planners, environmental practitioners and in ensure that the decision-

making framework at a last resort may consider trade-offs where impacts are unavoidable (DEAT 2009).

In general the agricultural risk and impact scope may be viewed as comprising elements related to the landscape soil and then elements related to the landscape habitat or biodiversity. Proposed development risks in respect to potential pollution or accidents may include the receiving downstream immediate and surrounding water table (i.e. Aquifer), the site receiving atmospheric environment (construction-based dust) and then lastly any negative effects to the surrounding neighboring social environment (i.e. Witsand Urban area and the neighboring farming community).

The following comprises a list of potential project activity risks and impact description criteria:

- Construction Phase: Alteration and degradation of soil
- Construction Phase: Increase in weathering and soil erosion potential
- Construction Phase: Loss of agricultural land and Infrastructure
- Construction Phase: Destruction of agriculture habitat or loss of arable soil capability or potential
- Construction Phase: Impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry
- Construction Phase: Impacts on the neighbouring localised surrounding catchment “Urban” area
- Construction and Operations Phase: Stormwater modification and impairment
- Construction and Operations Phase: Disturbance of existing agriculture practices (i.e. Existing cultivation, stock or agri-industry)
- Construction and Operations Phase: vehicle, machinery, tools or equipment pollution risk
- Operations Phase Impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry
- Construction and Operations Impacts on the broader catchment surrounding urban node and corridor (Atlantis Heritage Gateway – Witsand community)
- Decommissioning impact of project activity on site and localised surrounding catchment area

One should note again that as can be discerned from the listed potential proposed project activity impacts, that the focus for agricultural impacts is generally concerning the receiving agriculture soil integrity and the related knock on effects (i.e. alteration of soil and potential for pollution). All risks and potential impacts identified are regarded as potentially significant if not managed against. The

proposed development EIA, EMPR and related compliance management (ECO) must ensure that potential impacts are managed against with suitable oversight and risk mitigation measures (i.e. land use permit general and specific conditions).

5.3. Proposed Land Use Agricultural Impact Assessment

5.3.1. Agricultural Agro-Ecosystem Assessment Context in terms of Land Use Impact Assessment

According to the NEMA Screening Tool, the receiving project site comprises a medium to high sensitivity in respect to its agricultural land capability scoring a rating range from “06 to 08”. Land with moderate agricultural potential, is commonly understood to require significant interventions to achieve viable and sustainable food production. Conversely land with high potential may be better suited for cultivation and require less intervention. Significant interventions in the context of land with medium sensitivity rating may therefore be require to enable sustainable agricultural production which may include requirements such as terracing, contour management (i.e. soil erosion vulnerability), high levels of fertility correction (i.e. fertiliser requirements), lower stocking rate (i.e. sustainable stock per area formula), supplementary feed etc. Extensive areas of land are generally required for viable agriculture production with the case of the subject property being a small area. The significance of land use impacts on land regarded as medium or high sensitivity will also therefore differ due to its sensitivity setting (i.e. consideration to impacts on both natural resources and agricultural capability).

Table 6: Agricultural Impact Assessment Matrix (i.e. Land Capability Index)

CLASS	**LOW SENSITIVITY RATING**	**MEDIUM SENSITIVITY RATING**	**HIGH SENSITIVITY RATING**	**VERY HIGH SENSITIVITY RATING**
DESCRIPTION	Areas are likely to be non-arable land, and is therefore land onto which most development should be steered.	Areas are likely to be very marginal arable land.	Preservation worthy, land with agricultural production potential and suitability for specific crops. High value agricultural areas (i.e. cultivation) with a priority rating of C and /or D.	Preservation worthy land, Irrigated land; horticulture, other; demarcated high value agricultural areas with a priority rating of A and/or B.
RATING RANGE	1-5	**6-7**	**8-10**	11 – 15

The proposed land use (proposed project) impact assessment are transcribed and provided as standardised as possible for decision-making convenience in identifying and addressing risks and

potential impacts to the existing natural environment and more specifically the agricultural resource potential. In following convention the nature, scale, and duration of effects on the receiving project environment and whether such effects are positive (beneficial) or negative (detrimental) are provided. Risks and impacts are duly assessed from a project life-cycle view comprising construction (including planning), operations; and lastly decommissioning scope. The significance comprises a synthesis of impact characteristics like intensity, scale or magnitude and importantly the probability. Consequently, these aspects support prescription of suitable mitigation measures (i.e. economy of scale).

5.3.2. Construction Phase Impact Significance Prediction Model

As presented in this report Section 5.2. “Identification of Key Potential Risk and Impacts” the following is considered:

- Alteration and degradation of soil
- Increase in weathering and soil erosion potential
- Loss of agricultural land and Infrastructure
- Destruction of agriculture habitat or loss of arable soil capability or potential
- Impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry
- Impacts on the neighbouring localised surrounding catchment “Urban” area
- Stormwater modification and impairment
- Vehicle, machinery, tools or equipment use pollution risk

It is worth noting that the identified impact or “Disturbance of existing agriculture practices (i.e. Existing cultivation, stock or agri-industry)” was considered within the scope of addressing the impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry. Similarly there are a myriad of factors which effect upon stormwater management which were not adequately identified but also considered within the assessment of stormwater medication such as in the case of the generation of dust or turbidity, salinity or flow alteration. Moreover in the case of soil alteration and degradation or in the case with soil erosion risk and loss of agricultural land and habitat that the direct impact of site establishment, landscape alteration works like drilling, trenching, excavation and in being mindful of any of the proposed land use potential impacts are considered even where not specifically identified (i.e. contributing and associative effects).

Table 7: Construction Phase Impact Assessment Parameter Scoring

Impact Nature / Risk Metric	Type (-7 to +7)		Intensity (0 to 7)	Extent - Spatial Scale (0 to 7)	Duration - Reversibility (0 to 7)	Consequence (-147+147)	Probability - likelihood (0 to 7)	Significance (-21+21)
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*						
Alteration and degradation of soil	-2 minor	0 negligible	3 Average	3 local	5 project lifetime	-22 negligible	5 Likely	-5
Increase in weathering and soil erosion potential	-2 minor	0 negligible	3 Average	3 local	5 project lifetime	-22 negligible	3 Unlikely	-7 to -8
Loss of agricultural land and Infrastructure	-2 minor	0 negligible	1 Low	3 local	5 project lifetime	-16 negligible	3 Unlikely	-6
Destruction of agriculture habitat or loss of arable soil capability or potential	-1 limited	0 Negligible	1 Low	3 local	5 project lifetime	-9 negligible	4 Probable	-3
Impacts to neighbouring localised	-2 minor	0 Negligible	1 Low	5 regional	4 long term	-20 negligible	3 Unlikely	-8

surrounding catchment area agricultural cultivation and industry								
Impacts on the neighbouring localised surrounding catchment “Urban” area	-1 limited	+1 Limited	1 Low	5 regional	3 Medium	-9 negligible	3 Unlikely	-3
Stormwater modification and impairment	-3 moderate	+1 limited	2 Minor	5 regional	3 Medium	-20 negligible	3 Unlikely	-7 to -8
Vehicle, machinery, tools or equipment use pollution risk	-3 moderate	0 negligible	1 Low	5 regional	3 medium	-27 negligible	3 Unlikely	-9

5.3.3. Operations Phase Impact Significance Prediction Model

As presented in this report Section 5.2. “Identification of Key Potential Risk and Impacts” the following is considered:

- Stormwater modification and impairment
- Disturbance of existing agriculture practices (i.e. Existing cultivation, stock or agri-industry)
- Vehicle, machinery, tools or equipment use pollution risk
- Impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry
- Impacts on the broader catchment surrounding urban node and corridor (Atlantis Heritage Gateway – Witsand community)

Operational phase impacts generally relate to the possibility of nuisances such as accidental pollution of the project area and the knock on effect of it or in specific to malpractice such as being in non-compliance with the professional code of conduct, the environmental management plan and/or the conditions of the environmental authorisation, among other (i.e. NEMA duty of care principle).

Table 8: Operations Phase Impact Assessment Parameter Scoring

Impact Nature / Risk Metric	Type (-7 to +7)		Intensity (0 to 7)	Extent - Spatial Scale (0 to 7)	Duration - Reversibility (0 to 7)	Consequence (-147+147)	Probability -likelihood (0 to 7)	Significance (-21+21)
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*						
Stormwater modification and impairment	-2 minor	0 negligible	3 Average	3 local	5 project lifetime	-22 negligible	5 Likely	-7 to -8
Disturbance of existing agriculture practices	-2 minor	0 negligible	3 Average	3 local	5 project lifetime	-22 negligible	3 Unlikely	-7 to -8
Vehicle, machinery, tools or equipment use pollution risk	-2 minor	0 negligible	1 Low	3 local	5 project lifetime	-16 negligible	3 Unlikely	-6
Impacts on the neighbouring localised surrounding catchment area agricultural cultivation and agriculture industry	-1 limited	0 Negligible	1 Low	3 local	5 project lifetime	-9 negligible	4 Probable	-3

Impacts on the broader catchment surrounding urban node and corridor (Atlantis Heritage Gateway – Witsand community)	-2 minor	0 Negligible	1 Low	5 regional	4 long term	-20 negligible	3 Unlikely	-8

5.3.4. Decommissioning Phase Impact Significance Prediction Model

As presented in this report Section 5.2. “Identification of Key Potential Risk and Impacts”, the decommissioning phase impact of project activity on site and localised surrounding catchment area must be considered in order to fully assess the life-cycle impact of the proposed project.

Table 9: Decommissioning Phase Impact Assessment Parameter Scoring

Impact Nature / Risk Metric	Type (-7 to +7)		Intensity (0 to 7)	Extent - Spatial Scale (0 to 7)	Duration - Reversibility (0 to 7)	Consequence (-147+147)	Probability -likelihood (0 to 7)	Significance (-21+21)
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*						
Decommissioning of project	-1 Negligible	0 negligible	3 Average	3 local	5 project lifetime	-11 negligible	5 Likely	-3

5.3.5. Cumulative Impact Significance Prediction Model

Drawing from the project activity risks and impacts identified as relevant to construction, operations and decommissioning phases, the cumulative impact of the proposed development may be estimated. These may include an understanding of combined and knock on effects, as well as in respect to mounting threats and pressures such as climate change and the need to suitably adapt resource management accordingly (i.e. sustainability). Ultimately a superposition on the subject risks and impacts was consequently assumed to estimate the cumulative impact to the project site receiving agricultural resource quality and characteristics.

Table 10: Cumulative Impact Assessment Parameter Scoring

Impact Nature / Risk Metric	Type (-7 to +7)		Intensity (0 to 7)	Extent - Spatial Scale (0 to 7)	Duration - Reversibility (0 to 7)	Consequence (-147+147)	Probability -likelihood (0 to 7)	Significance (-21+21)
	Negative Impacts (Type of Impact = -1)	*Positive Impacts (Type of Impact = +1)*						
Climate Change Effect	-2 minor	0 negligible	3 Average	3 local	5 project lifetime	-22 negligible	5 Likely	-7 to -8
Cumulative effect of the project construction, operations and decommissioning phase risks and impacts (including Climate change)	-2 minor	0 negligible	3 Average	5 regional	5 project lifetime	-26-27 negligible	5 Likely	-9

5.3.6. Impacts in respect to considering the “no-go” alternative

The project no-go alternative assumes the continuation of the existing land use situation on the project site and that the project activity proposed land use will not be implemented.

Due to the project site land use status being deemed as being out of commission from its past agro-industry uses and that the project property may also be regarded as old land left fallow, the implications of considering the no-go alternative does not support the interest of any land use being undertaken on the project site. The project site landscape may thus be regarded as left idle and its economic, social and environmental potential unexploited beyond its current disturbed setting (i.e. existing land use threats from surrounding vectors and informal use).

5.4. Prescription of Risk Mitigation Measures and Input Consideration for Environmental Management Programme (EMPr)

The prescription of risk mitigation measures are generally aligned in support of existing industry policy sector norms, standards and best practise, as far as possible (DEAT 2002, 2005, 2009). However, these may not include specific measures identified in this report that are recommended to be taken up in project implementation management (i.e. EMPR) to further ensure for suitable impact management planning and effective use of environmental management implementation measures (i.e. Duty of care).

The adoption of mitigation measures and compliance with environmental management implementation plans (i.e. EIA EA ROD conditions) thus ensures against undue project activity threats, risks and impacts. Overall the project activity risks and impacts to the receiving environment and in specific to the agricultural resource status quo of the proposed development site was generally determined to be associated with a low degree of impact. The exceptions are the threat posed by climate change and the potential construction or operations based accidental pollution incidents. Due to the project site being located in a water scarce area and an exposed aquifer the emergency awareness for pollution management and control must be adequately addressed in the project management planning (i.e. EMPR). Further to that stormwater control and a stormwater management plan is highly recommended as a mitigation measure.

As a result the following measures should be considered to be taken into account:

- Site establishment, Earthworks, heavy machinery and all construction vehicles must be mindful of undue site erosion and pollution to the receiving aquifer.
- The use of hazardous materials must be avoided as far as possible and where required to be managed and controlled appropriately in order to avoid any site pollution.
- Hydrocarbon spills and site pollution must be avoided (i.e. reduce the likelihood of accidents).
- In the event of soil contamination suitable emergency procedures must be followed and reported to the local and national authorities within 24 hours of the incident occurring (i.e. municipality and department of water and sanitation). The response should include the suitable use and availability of spill kits, drip trays, plastic and other sheeting to absorb and control and remedy the incident as far as possible and to report on the matter after the correct procedure (i.e. report contaminated land, land contamination registry, remedy contamination).
- Construction and operations staff must be trained and aware of pollution and fire prevention best practise protocols.
- Construction and operations based waste must be managed appropriately by the use of professional service providers (i.e. waste disposal certificate).
- Dust and site generated debris must be controlled.
- Impermeable and suitably bunded surfaces must be used for storage tanks and standing vehicles.

6. Conclusion

Due to the project property size and soil condition it may be concluded that the project site has low agricultural potential, and that the mitigation of negligible to minor negative agricultural impacts may refer. The proposed activity impacts may be mitigated with compliance to an approved Environmental Management Programme (EMPr) and in being responsible, being mindful in the duty of care for the environment. It is concluded that from an agricultural impact point of view, that the proposed project activity can be authorised.

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8. Appendix. Production Consultant Curriculum Vitae / Resume

Personal Details

Full name : Earl Lesley Herdien *Pr.Sci.Nat.*

Nationality : South African

Independent EAP and Water Use Adviser

Profession / Soil, Aquatic and Life Scientist

Career : Strategic and Specialist Environmental Management Consultant

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Membership in Professional Societies:

- Registered as a Professional Natural Scientist with SACNASP (Reg. No. 400211/11)
- Society of Soil Science South Africa (SSSSA)

Education:

BSc (Hons), Environmental Law, Biodiversity and Conservation Biology, University of the Western Cape, South Africa - **2005**

BSc, Environmental Science, Biodiversity and Conservation Biology, University of the Western Cape (Nominated for Prestigious Golden Key Awards) - **2004**

Majors: Environmental Science, Botany and Zoology I, 2 and 3

Employment History Summary:

2016 – current Independent Consultant / KC Phyto (Pty) Ltd NED

Soil Scientist, Aquatic Scientist and Life Scientist

2013 – 2015 National Department of Water and Sanitation Western Cape Region

Catchment Management Scientist and Resource Protection Scientist

2010 – 2013 Royal Haskoning DHV (Previously SSI Engineers and Environmental Consultants)

Senior Environmental Consultant

Water, Transport, Aviation and Planning Sectors

2008 – 2010 BlueScience

Environmental Consultant (professional mentorship experience and training)

2005 – 2008 CapeNature (professional mentorship experience and training)

Conservation Scientist

2003 – 2004 South African National Biodiversity Institute (SANBI)

Agriculture Development Technician (Prestigious Mandela Internship)

2002 – 2003 University of the Western Cape (UWC)

Marine Biologist Research Assistant to MSc and PhD students as well as assisting Professors with research

In-house consultant for Marine EIA's/Core Samples biota identification to family level. Field school demonstrator.

Experience Portfolio Overview:

Soil Assessments

- Soil profile and soil classification is undertaken readily as part of all ground-truth wetland delineation assessments in accordance with national guidelines and policy
- Soil assessments is readily undertaken as part of water use licence application where relevant
- Soil assessments is commonly undertaken as part of agricultural impact assessment reports (in current)
- Soil assessments is commonly undertaken as part of riparian zone delineation determinations as part of floodline investigation and in implementing the River Health Programme (i.e. VEGRAII3/4 & RVI Eco classification modelling).

Biodiversity Monitoring and Management (2003-current)

- Undertook hundreds of biodiversity surveys across South Africa, with special interests in wetland and riparian vegetation as well as alien invasive plants and weeds and land rehabilitation
- Skilled in herbarium protocols, taxonomy and molecular ecology (sampled, extracted and sequenced 20 specimens into the National DNA Bank at the Leslie Hill Lab). Worked actively at SANBI (NBI/NBG)/ CAPENATURE/ BOLUS UCT/ UWC Herbariums and voluntary for CREW (Rare and Endangered *Spp*.)

- Participant as an I&AP/conservation authority/environmental practitioner providing active input from biodiversity and watercourse conservation strategic perspectives for policy planning and implementation

Air Quality Monitoring and Management (2009-current)

- Supporting consultant assisting UCT air-quality network monitoring of the quantity and effects of nitrogen deposition within natural Fynbos ecosystems in the Cape
- Supporting consultant for Grindrod Matola terminal air-quality monitoring network establishment and production assessment in Maputo (SADC)

Water Quality (WQ) Monitoring and Management (2005-current)

- WQ Monitoring for the Breede WMA (40 sites) testing against DWS recreational standards
- Supervised WQ Monitoring for the Stellenbosch and Cape Winelands municipal areas rivers (20 sites)
- Undertook water treatment works compliance monitoring (i.e. Stellenbosch and Franschoek WWTW)
- Undertook construction based WQ monitoring for EIA EMPR of Calgro M3 Fleurhof dam (AMD)
- Undertook seasonal WQ monitoring and established a WQ monitoring network for Grindrod Coal Terminal Expansion (Matola) Maputo (SADC)
- WQ of Zambezi floodplain for a 20000ha Biofuel development in Caia District Sofala Province (SADC)
- Supported the compilation of Blue and Green Drop information for the Western Cape Environmental Outlook Report as well as for the National Environmental Outlook Report and for the iLemba EMF

River Monitoring and Management (2005-current)

- Produced fact sheets for River Health and biomonitoring for various organisations
- Provided lectures, mentorships, and courses in the field of Integrated Environmental Management and Resource Directed Measures (Water Resource/Watercourse Monitoring and Management)
- Provided numerous specialist management planning reports across South Africa relating to capturing, qualifying and quantifying Ecoclassification based EcoStatus or Ecological State models, contextualising development related impacts/risks and relevant associated aquatic features aspects with respect to “resource quality” by utilising various biomonitoring indices and water monitoring instrumentation
- Undertook thousands of site level biomonitoring and resource quality index assessments for the National River Health Programme and as part of private consulting practise
- Actively participated in the establishing of the Reserves, Classification and Resource Quality Objectives of significant rivers for the establishment of operational CMAs in the Western Cape

Wetland/Estuarine Monitoring and Management (2005-current)

- Numerous delineations and ground-truth mapping investigations

- Obligate Vegetation assessments including significant work experience in Genotyping
- Soil and Wetland classification assessments
- Wetland/Estuary health, Importance and Sensitivity classification
- Wetland Buffer, Monitoring, Management (EMPr) and Rehabilitation Reports

Strategic Environmental and Sustainability Management (2008-current)

- EIA's, WULA's, Scoping Reports and EMP's for mining and energy sectors across South Africa (ESKOM UCG, Transmission dev 33kV-765kV, SANRAL borrow-pits dev, Black Mountain Vedanta Ore mines management MPRDA, SolAfrica Upington 75MW CSP dev, CoCT mix dev, Sand mining, Prospecting)
- EIA's, WULA's, Scoping Reports and EMPs for rail, road and water service infrastructure (Agriculture, PRAZA, SANRAL, Municipal and District pipe, stormwater, servitudes and water treatment plants)
- EIA's, WULA's, Scoping Reports and EMP's for private mix residential, industry, golf estates
- Development of estuary off-set plan for Richards Bay IDZ
- Development of EMFs for Northern Cape, KwaZulu Natal and Gauteng DM's
- Development of EMS's and specialised EMPr for Amatole DM, Drift Sands Nature Reserve, De Zalze Golf Estate, Mount Royal Golf Estate, Tokai Steenberg Estate
- Supporting Consultant to the Department of National Treasury (OCPO) Bulk Fuel Sourcing Strategy
- Currently undertaking University of the Western Cape (UWC) integrated WULA (NWA S21a & i water uses)

EIA and WULA Specialist Regulation, Compliance and Enforcement (2005-2008 and 2013-2015)

- Acted as an official advisory and specialist resource, providing permit application technical evaluation assessments and commenting on biodiversity matters in terms of CARA/NEMA/NEM:BA for CapeNature
- Acted as an official advisory and specialist resource, providing permit application technical evaluation assessments and commenting on water use matters for EIA/WULA in terms of the NWA for the Department of Water and Sanitation Western Cape Region
- Conducted numerous official site inspections with recommendations for crises/disaster management, compliance contraventions (NEMA S24G and NWA S19), as well as public health and safety
- Produced specialist reports and talks for relevant related water and conservation forums/organisations as mandated by serving as a civil servant on a broad spectrum of environmental issues
- Undertook groundwater compliance surveys of numerous landfills operated by the City of Cape Town
- Undertook Environmental Water Requirements (EWR) monitoring for the Berg and Olifants/Doorn Water Management Areas EWR sites as well as Resource Quality Objectives (RQO) compliance monitoring

Popular Publications: State of the Environment Reporting (SoER 2005-current)

- Contributing and 1st author for the Olifants/Doorn water management area's SoER (Rivers) and technical reports (40 sites, 4 seasons RHP indices monitoring, modelling and recommendations) (2006)

- Contributing and 1st author for the Gouritz water management area's SoER (Rivers) and technical reports (37 sites, 4 seasons RHP indices monitoring, modelling and recommendations) (2007)
- Contributing and 1st author to CapeNature's Flagship Review publication on the Status of Biodiversity in the Western Cape: State of Rivers Report (2007)
- Contributing and 1st author for the Breede water management area's SoER (Rivers) (100 sites, 4 seasons RHP indices monitoring, modelling and recommendations) (2011)
- Contributing and 1st author to the Gauteng State of Environment Report (2011)
- Contributing and 1st author to the National Environmental Outlook Report (2012)
- Contributing and 1st author to the Western Cape Environmental Outlook Report (2013)