WATERCOURSE AND ECOLOGICAL ASSESSMENT

THE PROPOSED CONSTRUCTION OF CHICKEN BROILER HOUSES FOR THE PRODUCTION OF POULTRY ON PORTION 78 OF THE FARM MEZEG 77, RAMOTSHERE MOILOA LOCAL MUNICIPALITY, ZEERUST, NORTH-WEST PROVINCE

AUGUST 2019

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I, **Jacob Schrijvershof,** declare that -

- I act as the independent specialist in this matter;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist assessment relevant to this application, including knowledge of the National Environmental Management Act (Act 107 of 1998) (NEMA) and the National Water Act (Act 36 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this report are true and correct;
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B (1) of the National Environmental Management Act, 1998 (Act 107 of 1998); and
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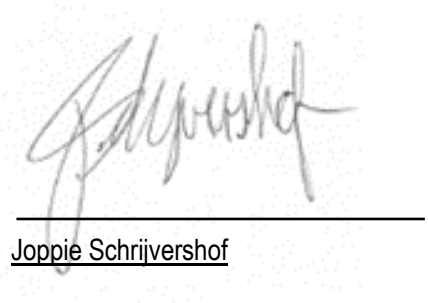

Joppie Schrijvershof

Executive summary

The purpose of this report is to summarise the Watercourse and Ecological findings for the Environmental Authorisation process in terms of the National Environmental Management Act (Act No 107 of 1998) for the proposed construction of chicken broiler houses for the production of poultry on Portion 78 of the Farm Mezeg 77, Ramotshere Moiloa Local Municipality near Zeerust which is located within the North-West Province.

The scope of work entailed to the Watercourse and Ecological Desktop Assessment includes the following:

- Assess the area for any watercourses in the vicinity of any regulated areas;
- An literature examination of Endemic and Red Data faunal and floral species within the study area;
- Identify potential negative impacts on any biodiversity from the proposed development and assess the significance of these impacts; and
- Provide recommended mitigation measures for the identified impacts in order to avert or lower the significance of the negative impacts.

A summary of the results obtained during the study:

- From the desktop NFEPA database, two seep wetlands were identified within the area;
- From the site delineation it was established that no wetlands were present within 500 m of the development and that the seep wetlands were found to be the farm dams;
- One 'A' section channel was identified within the 100 m regulated area of the proposed activity. 'A' section channels are those that do not have baseflow and convey surface runoff immediately after a storm event and are not associated with a riparian zone;
- This channel was found to be in a moderately modified (Category C) according to the Riparian Vegetation Assessment Index state due to the landscape transformation win the non-marginal zone and the presence of alien invasive plants;
- The proposed development falls within the Zeerust Thornveld vegetation type;
- No plant species of conservation concern were identified during the site visit within the proposed development area, but could occur in the Mountain and Bushveld reaches surrounding the farm, according to the expected species listed in **Appendix B**;

- Almost the entire application area falls within an Ecological Support Area, with a small top portion within a Critical Biodiversity area;
- No protected or any threatened ecosystems are present within the study area;
- No Important Bird Areas are found within or in close proximity to the study area.
- Although some protected faunal (vulnerable, endangered and critically endangered) species are thought to occur within the area, it is most likely that they would occur within protected areas within close proximity of the study area, but have been fenced off from the transformed areas. All faunal species are listed in **Appendix A**; and
- A site alternative has been recommended as the initial proposed development area overlaps with the 100 m regulated area of the 'A' section channel in terms of in terms National Water Act, 1998 (Act No 36 of 1998) under the Section 21 c and i water uses.

A number of potential impacts relating to proliferation of alien invasive species, sedimentation and erosion due to increase runoff and impacts on water quality and biodiversity might occur as a result of the construction and the operational chicken poultry farm.

The significance of potential impacts on biodiversity within the area was rated as a low risk for the construction and operational phases. Key mitigation measures include:

- Active stormwater management must be implemented to stop silt and sediments from entering the channel;
- Disturbed soils and stockpiled soils must be protected from erosional features;
- The prevention of alien invasive vegetation encroachment; and
- Protect as much indigenous vegetation and habitat as possible

It is recommended that the mitigation measure be incorporated into an EMPr with an Alien Invasive Plant management programme.

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LIST OF ABBREVIATIONS AND ACCRONYMS

CBA:	Critical Biodiversity Area
EA:	Environmental Authorisation
ESA:	Ecological Support Areas
DEM:	Digital Elevation Model
DWS:	Department of Water Affairs and Sanitation
DWAF:	Department of Water Affairs and Forestry
IUCN:	International Union for Conservation of Nature
MAP:	Mean Annual Precipitation
MAMSL:	Meters Above Mean Sea Level
NEMA:	National Environmental Management Act (No. 107 of 1998) [as amended]
NEMBA:	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMWA:	National Waste Act, 2008 (Act No. 59 of 2008)
NFEPA:	National Freshwater Priority Area
QDS:	Quaternary Degree Square
SANBI:	South African National Biodiversity Institute
WMA	Water Management Area

1 INTRODUCTION

1.1 Background

Oasis Environmental Specialists (Pty) Ltd was appointed by EKO Environmental (Pty) Ltd to conduct the Watercourse and Ecological Assessment for the Environmental Authorisation in terms of the National Environmental Management Act (Act No. 107 of 1998) the proposed construction of chicken broiler houses for the production of poultry on Portion 78 of the Farm Mezeg 77, Ramotshere Moiloa Local Municipality, near Zeerust located in the North-West Province.

The site can be accessed by a tar road by turning left off the N4 after leaving the town of Zeerust in an easterly direction and driving for approximately 7 km (please refer to locality maps below). One then proceeds to drive along the tar road for approximately 24 km before reaching the proposed site location (**Figure 1**).

The applicant is looking to construct eight chicken broiler houses each with a maximum capacity of 48 000 chickens. The construction of the chicken broiler houses will require the clearance of approximately six hectares of agricultural land. The applicant will make use of the borehole on the farm to supply the chickens with the necessary water supply. The borehole is registered and has sufficient capacity for this activity. Electricity will be extended to the proposed site from the existing electrical infrastructure on the farm. The farm already has access to electricity and stormwater will be diverted around the site area to enter the natural drainage patterns.

General waste (i.e. paper, plastic, glass bottles, etc.) will be collected and disposed of at an authorised landfill site at Zeerust on a regular basis. Any carcasses will be assembled for transport to be used for crocodile feed by a local crocodile farmer. No waste will be incinerated or dumped on the site. The applicant will obtain a letter of agreement between himself and a nearby crocodile farmer concerning the removal of the carcasses.

The development area falls within the quarter degree square 2526AD. The site is currently surrounded by existing agricultural activities and open transformed grassland, rocky mountains and bushveld (**Figure 2)**.

1.2 Legal framework

1.2.1 National Environmental Management Act (Act No. 107 of 1998)

The EIA Regulations, promulgated under NEMA, focus primarily on creating a framework for co-operative environmental governance. NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by State Departments and to provide for matters connected therewith.

In terms of the EIA Regulations of 2010 and activities listed in GN No. 544 and 546 (requiring a Basic Assessment process) and GN No. 545 (requiring a S&EIR process), the following listed activities are deemed to be applicable to the proposed chicken abattoir based on the information provided by the project proponent.

1.2.2 National Waste Act, 2008 (Act No. 59 of 2008)

The NEMWA aims at promoting sustainable waste management practices through the implementation of "Integrated Waste Management Planning", where "Integrated Waste Management Planning is viewed as a holistic approach of managing waste, aimed at optimising waste management practises to ensure that the implementation thereof yields practical solutions that are environmentally, economically and socially sustainable and acceptable to the public and all relevant spheres of government". In terms of General Notice 718 of 2009, the following listed activities have been deemed to be applicable to the proposed chicken abattoir based on the information provided by the project proponent**.**

1.2.3 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) aims to provide management of the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected as well as integrated management of water resources with the delegation of powers to institutions at the regional or catchment level. The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in responsible ways. Of specific importance to this application is Section 19 of the NWA, which states that an owner of land, a person in control of land or a person who occupies or uses the land which thereby causes, has caused or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring and must therefore comply with any prescribed waste standard or management practices.

Regulations GN 704 dated June 1999 under the NWA, 1998 (Act 36 of 1998) stipulates that no development activities may take place within the 1:100 year floodline of a watercourse, or within 100 m of the watercourse, whichever is the furthest.

Regulations GN 509 dated August 2016 under the Section 21 c and i water uses of the NWA, 1998 (Act No 36 of 1998) stipulates the:

"Extent of a watercourse" as:

(a) The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam.

"Regulated area of a watercourse" for section 21(c) or (i) of the Act water uses in terms of this Notice means:

(a) The outer edge of the 1 in 100 year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;

(b) In the absence of a determined 1 in 100 year flood line or riparian area the area within **100m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or

(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

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

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

This Act is applicable to this application for environmental authorisation, in the sense that it requires the project applicant to consider the protection and management of local biodiversity. This report serves as an ecological assessment being undertaken to assess the flora and fauna for the proposed project development of the Mezeg chicken poultry farm.

In terms of the Biodiversity Act, the "developer" has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not solely by listed activities as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities; thereby ensuring that all development within the area is in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.
- A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 of NEM: BA (Act No. 10 of 2004).

- Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

1.3 Scope of work

The scope of work entailed to the Wetland Desktop Assessment following:

- Assess the area for any watercourses in the vicinity of any regulated areas;
- An literature examination on any Endemic and Red Data faunal and floral species within the study area;
- Identify potential negative impacts on any biodiversity from the proposed development and assess the significance of these impacts; and
- Provide recommended mitigation measures for the identified impacts in order to avert or lower the significance of the negative impacts.

1.4 Assumptions and Limitations

It is difficult to apply pure scientific methods within a natural environment with limitations, where consequential assumptions need to be made. While every care is taken to ensure that the data presented is qualitatively adequate, inevitably conditions are never of such a nature that the data is entirely satisfactory. To conduct a comprehensive, completely factually based biodiversity study, requires an extensive amount of time over different seasons. Unfortunately, such comprehensive studies are generally limited by budget constraints and most importantly by time constraints subject to submission of EA Applications.

It should be noted that the findings of this study were largely based on desktop/historical assessments. Visibility of faunal and floral indicators vary throughout seasons and it is therefore noted that, if in future, any further indicators are found on site, the author cannot be held liable for conclusions deducted in good faith based on the available resources and information provided at the time of the study. It is important that this report be viewed and acted upon with these limitations in mind.

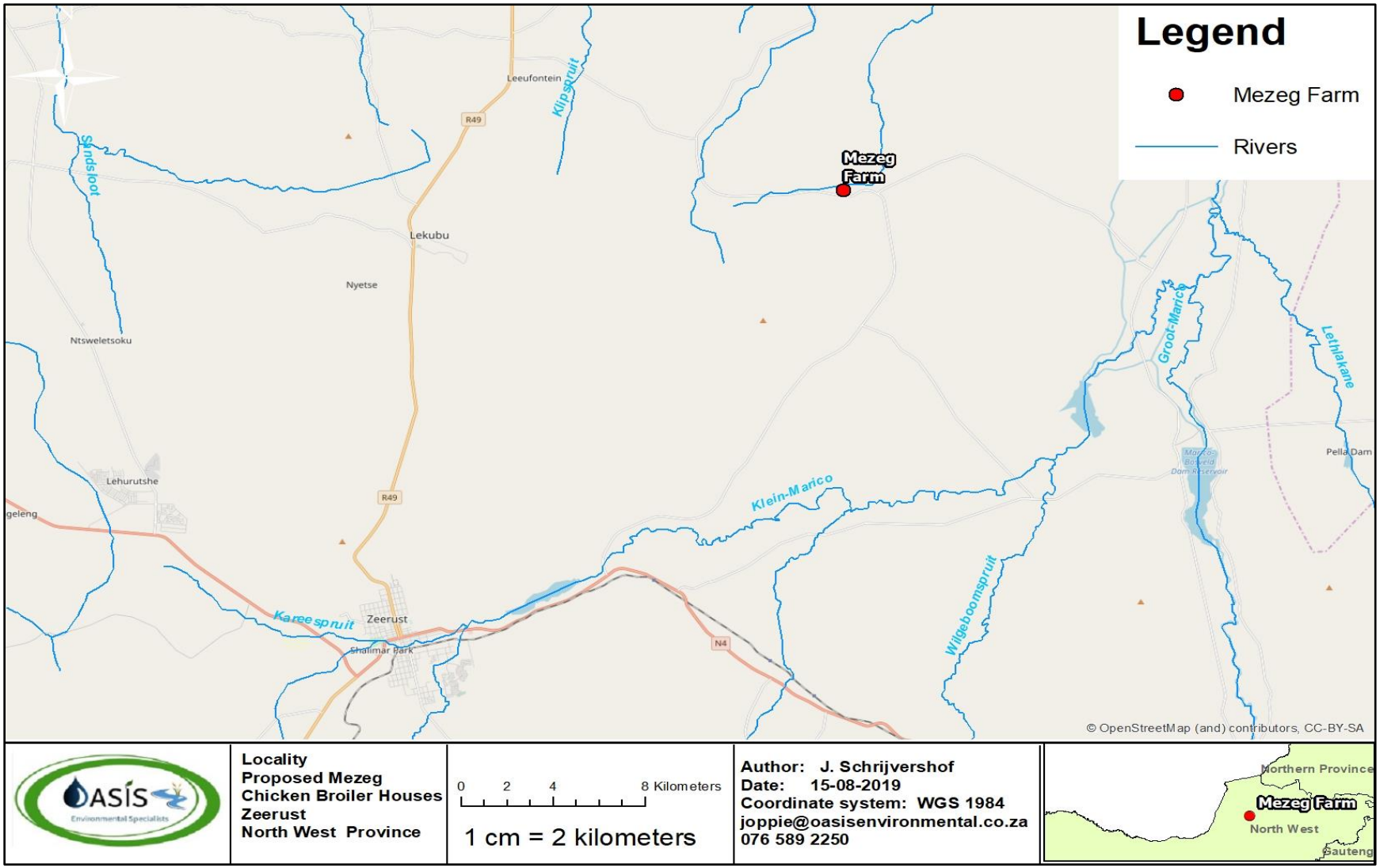

Figure 1: Locality of the proposed Mezeg chicken broiler houses.

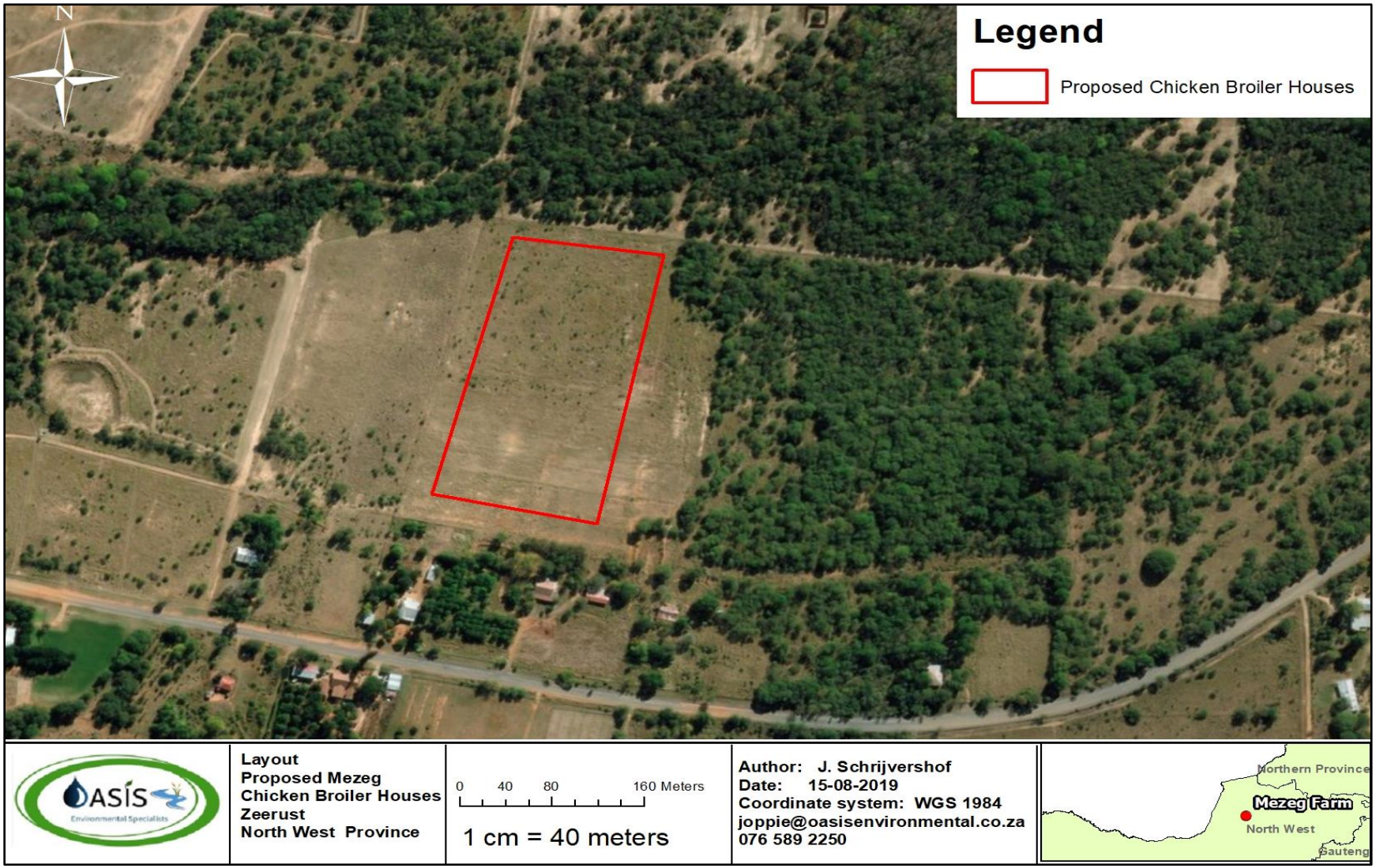

Figure 2: Layout of the proposed Mezeg chicken broiler houses.

2 Methodology

This section details the different techniques and methods utilised to obtain the data for this report in order to finally assess the wetland and riparian conditions of the site based on the various inputs as explained below.

2.1 Desktop Watercourse Assessment

For the purpose of this assessment, wetlands and pans are considered as those ecosystems defined by the National Water Act No. 36 of 1998 as:

Wetlands: ''*Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil'';* and

Examination of the National Freshwater Ecosystem Priority Areas (NFEPA)'s databases were undertaken for the project. The NFEPA project aims to produce maps which provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs. FEPAs are determined through a process of systematic biodiversity planning and involved collaboration of over 100 freshwater researchers and practitioners. They are identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries (MacFarlane *et al*., 2014).

The assessment of the study site involved the investigation of aerial photography, GIS databases including the NFEPA and South African National Wetland maps as well as literature reviews of the study site in order to determine the likelihood of wetland areas within this site.

The following data sources and GIS information provided in **Table 1** was utilised to inform the delineation.

Table 1: Information used to inform the desktop assessment.

DATA	USE	SOURCE
Latest and Historic Google Earth ™ imagery	Used to assist with identifying potential areas within the study boundary for the presence of wetland systems.	Google Earth PRO™ On-line
River line	Mapping of watercourses outside of the study site.	Surveyor General
National Wetland Classification System	Assistance with information collection about the site and surrounding areas.	SANBI
National Freshwater Ecosystem Priority Area maps and database	Information gathering regarding the presence of FEPA wetlands on the site and within surrounding areas.	Water Research Commission, Implementation: Manual and Maps for FEPA area

Figure 3 below represents and describes all specific wetland types and have been divided into eight units. These units are described as follows (Kotze *et al*., 2008):

Channel (river, including the banks) - an open conduit with clearly defined margins that continuously or periodically contains flowing water. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow.

Channelled valley-bottom wetland - a mostly flat valley-bottom wetland dissected by and typically elevated above a channel. Dominant water inputs to these areas are typically from the channel, either as surface flow resulting from overtopping of the channel bank/s or as interflow, or from adjacent valley-side slopes (as overland flow or interflow).

Un-channelled valley-bottom wetland - a mostly flat valley-bottom wetland area without a major channel running through it, characterised by an absence of distinct channel banks and the prevalence of diffuse flows, even during and after high rainfall events.

Floodplain wetland - the mostly flat or gently sloping wetland area adjacent to and formed by a Lowland or Upland Floodplain river, and subject to periodic inundation by overtopping of the channel bank.

Depression - a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates. Dominant water sources are precipitation, ground water discharge, interflow and (diffuse or concentrated) overland flow.

Flat - a near-level wetland area (i.e. with little or no relief) with little or no gradient, situated on a plain or a bench in terms of landscape setting. The primary source of water is precipitation.

Hillslope seep - a wetland area located on (gentle to steep) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope.

Valley head seep - a gently-sloping, typically concave wetland area located on a valley floor at the head of a drainage line, with water inputs mainly from subsurface flow.

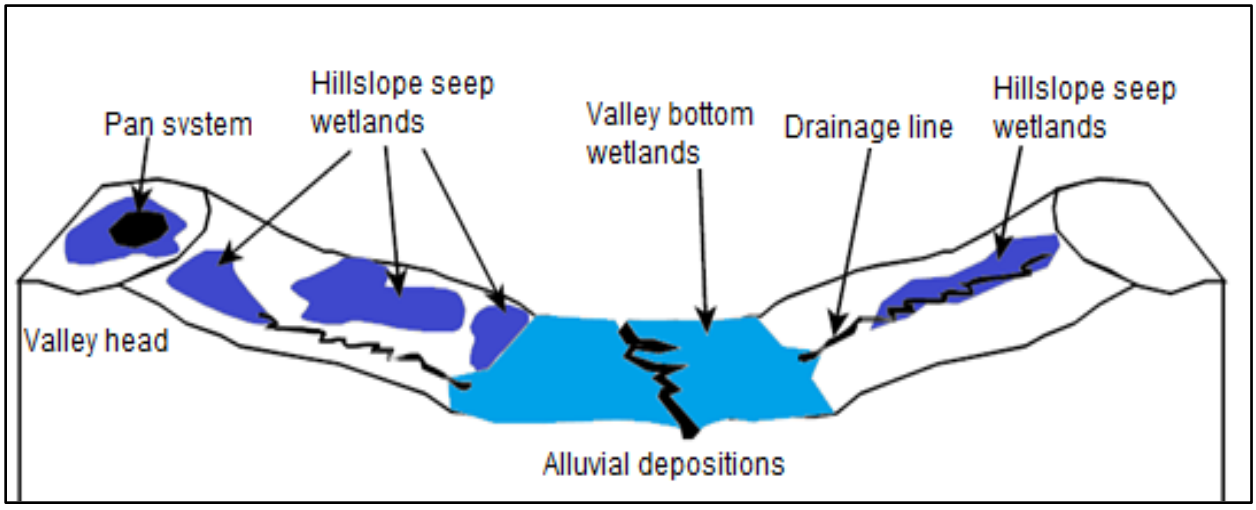

Figure 3: Diagrammatic representation of common wetland systems identified in Southern Africa (based on Kotze *et al*., 2008).

2.1.1 Riparian Assessment

Riparian areas were delineated based on topographic setting, vegetative indicators as well as the presence or absence of alluvial soils as described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005) requirements. This manual separates the classification of watercourses into three (3)

separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area (**Figure 4**). The classification system separates channels into: those that do not have baseflow ('A' Sections); those that sometimes have baseflow ('B' Sections) or non-perennial o those that always have baseflow ('C' Sections) or perennial. 'A' Section channels convey surface runoff immediately after a storm event and are not associated with a riparian zone. 'B' Section channels are categorised as channels that sometimes have baseflow, dependant on rainfall events and are therefore non-perennial. They are in contact with the zone of saturation often enough to have vegetation associated with saturated conditions as well as gleyed soil within the channel confines. 'B' Section channels are considered hydrologically sensitive as they are associated with riparian habitats.

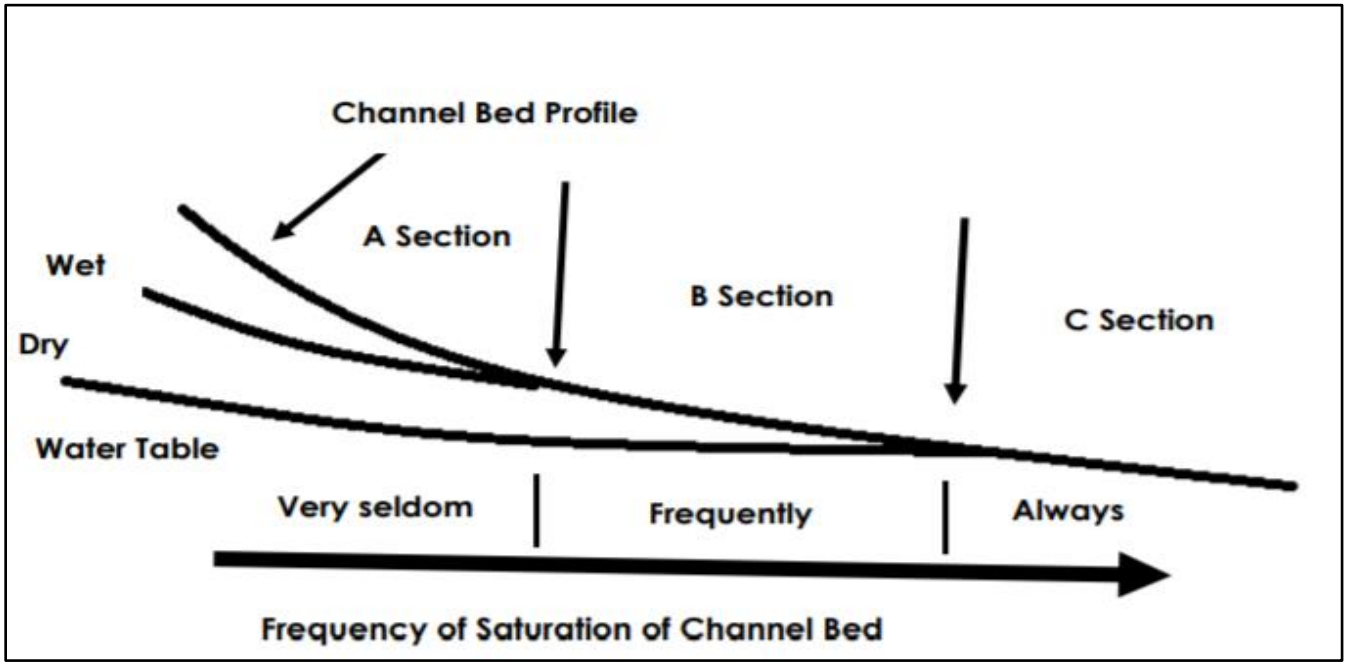

Figure 4: Different zones of wetness found in channels (DWAF, 2005).

Riparian areas perform numerous vital functions including the protection and enhancement of water resources through the following resources:

- Aiding in the storage of water and flood prevention;
- Stabilising stream banks;
- Improving water quality by trapping sediment and nutrients;
- Maintaining natural water temperatures for aquatic species;

- Providing foraging and roosting habitats for birds and other animals;
- Providing corridors for dispersal and migration of different species; and
- Acting as a buffer between aquatic ecosystems and adjacent land uses.

2.1.2 Riparian Vegetation Response Assessment Index (VEGRAI)

Riparian vegetation areas are divided into two sub-zones, marginal and non-marginal zones. This is important given that riparian vegetation distribution and species composition varies in different sub-zones, which has implications for flow-related impacts. The Ecological Category of the riparian zone is then assessed using the Riparian Vegetation Response Assessment Index (VEGRAI) level 3 (Kleynhans *et al*., 2007).

Since all VEGRAI assessments are relative to the natural unmodified conditions (reference state) it is necessary and important to define and describe the reference state for the study area. This is done (in part) before going into the field, using historic aerial imagery, present and historic species distributions, general vegetation descriptions of the study area, any anecdotal data available and knowledge of the area and comparison of the study area characteristics to other comparable sections of the stream that might be in a better state. With this information, the reference (and present state) is quantified on site; the assessor reconstructs and quantifies the reference state from the present state by understanding how visible impacts have caused the vegetation to change and respond. Impacts on riparian vegetation at the site are then described and rated. It is important to distinguish between a visible / known impact (such as flow manipulation) and the response of riparian vegetation to other impacts such as erosion and sedimentation, alien invasive species and pollution. If there is no response to riparian vegetation, the impact is noted but not rated since it has no visible / known effect. These impacts are then rated according to a scale from 0 (No Impact) to 5 (Critical Impact). Once the riparian zone and sub- zones have been delineated, the reference and present states have been described and quantified (basal cover is used) and species description for the study area has been compiled, the VEGRAI metrics are rated and qualified (Kleynhans *et al*., 2007).

The riparian ecological integrity was assessed using the spreadsheet tool that is composed of a series of metrics and metric groups, each of which is rated in the field with the guidance of data collection sheets. The metrics in VEGRAI describe the following attributes associated with both the woody and non-woody components of the lower and upper zones of the riparian zone:

- Removal of the riparian vegetation;
- Invasion by alien invasive species;
- Flow modification; and
- Impacts on water quality.

Results from the lower and upper zones of the riparian vegetation are then combined and weighted with a value that reflects the perceived importance of that particular criterion in determining habitat integrity, allowing this to be numerically expressed in relation to the perceived benchmark. The score is then placed into one of six classes, namely A to F (Kleynhans *et al*., 2007) (**Table 2**).

Table 2: Intermediate habitat integrity and VEGRAI categories (Kleynhans *et al*., 2007).

Category	Description	Score
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0

2.2 Desktop Ecological Assessment

It is important to note that many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have previously been disturbed. Assessing the impacts of a proposed project often requires evaluating the conservation value of the site relative to other natural areas in the surrounding area.

Thus, the general approach and angle adopted for this type of study is to identify any potential faunal species that may be affected by the proposed development. This means that the focus of this report will be on rare, threatened, protected and conservation-worthy species. The general approach adopted for this type of study is thus to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws.

Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which is most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National Legislation protecting environmental and biodiversity resources.

A desktop assessment was conducted to establish whether any potentially sensitive species/receptors might occur within the study area. The South African National Biodiversity Institute's online biodiversity tool, ADU (Animal Demography Unit) Virtual Museum was used to query a species list (**Appendix A**) for the 2526AD Quarter Degree Square (QDS) within which the study area is situated. To describe the overall site characteristics, and to identify points of interest within the site for evaluation, Google Earth Imagery and the 1:50 000 topographical maps were examined.

This was conducted by researching all available information resources including, but not limited to, the following:

- International Union for Conservation of Nature (IUCN) Red List of Threatened Species;
- The Endangered Wildlife Trust's Red List of Mammals of South Africa, Lesotho and Swaziland; and
- NEMBA List of Threatened or Protected Species (TOPS List);
- Animal Demography Unit (ADU) Virtual Museum;
- SANBI Biodiversity GIS tool; and
- Important Bird and Biodiversity Areas (IBAs) (Birdlife South Africa, 2016).

Biodiversity areas represent terrestrial and aquatic sites identified as Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESA), Other Natural Areas and No Natural Remaining Areas conducted by SANBI.

2.2.1 Critical Biodiversity Areas

Critical Biodiversity Areas are those areas required to meet biodiversity thresholds. CBA's are areas of terrestrial or aquatic features (or riparian vegetation alongside CBA aquatic features) which must be protected in their natural state to maintain biodiversity and ecosystem functioning (Desmet *et al*., 2013). According to Desmet *et al* (2013), these CBAs include:

i) Areas that need to be protected in order to meet national biodiversity pattern thresholds (target area);

ii) Areas required to ensure the continued existence and functioning of species and ecosystems (including the delivery of ecosystem services); and/or

iii) Important locations for biodiversity features or rare species.

2.2.2 Ecological Support Areas

Ecological Support Areas (ESA) are supporting zones required to prevent the degradation of Critical Biodiversity Areas and Protected Areas. An ESA may include an aquatic or terrestrial feature. ESAs can be further subdivided into Critical Ecological Support Areas (CESA) and Other Ecological Support Areas (OESA). Critical Ecological Support Areas are aquatic features, with their terrestrial buffers, which fall within priority sub-catchments, whose protection is required in order to support the aquatic and terrestrial CBAs. An example might be a river reach which feeds directly into a CBA. Other Ecological Support Areas are all remaining aquatic ecosystems (not classed as CESA or CBA), with their terrestrial buffers, which have a less direct impact on the CBA, e.g. a wetland that is geographically isolated from a CBA, but contributes to ecological processes such as groundwater recharge, thereby indirectly impacting on a CBA downstream. (Desmet *et al.*, 2010).

2.2.3 Other Natural Areas

Other Natural Areas are areas of lesser biodiversity importance whose protection is not required in order to meet national biodiversity thresholds. Other Natural Areas may withstand some loss in terms of biodiversity through the conversion of their natural state for development. However, if all Critical Biodiversity Areas are not protected, certain Other Natural Areas will need to be reclassified as Critical Biodiversity Areas in order to meet thresholds. (Desmet *et al.*, 2010).

No Natural Remaining Areas are those areas that have been irreversibly transformed through urban development, plantation and agriculture and poor land management. As a result, these areas no longer contribute to the biodiversity

of the region. However, in some cases transformed land may be classified as an ESA or CBA if they still support biodiversity (Desmet *et al.,* 2010).

2.2.4 Threatened Ecosystems

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver *et al*., 2012). Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Driver *et al*., 2012).

2.2.5 Important Bird Areas

Important Bird Areas are areas that are important for the long-term survival of threatened, restricted avian species (Birdlife South Africa, 2016). BirdLife's Important Bird and Biodiversity Area concept has been developed and applied for over 30 years. Considerable effort has been devoted to refining and agreeing a set of simple but robust criteria that can be applied worldwide.

Important Bird and Biodiversity Areas (IBAs) are:

- Places of international significance for the conservation of birds and other biodiversity;
- Recognised world-wide as practical tools for conservation;
- Distinct areas amenable to practical conservation action;
- Identified using robust, standardised criteria; and
- Sites that together form part of a wider integrated approach to the conservation and sustainable use of the natural environment.

2.3 Significance and Risk of impacts

Significance scoring assesses and predicts the significance of environmental impacts through evaluation of the following factors; probability of the impact; duration of the impact; extent of the impact; and magnitude of the impact. The significance of environmental impacts is then assessed considering any proposed mitigations. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required. Each of the above impact factors have been used to assess each potential impact using ranking scales as seen in **Table 3**.

Impact scores given "with mitigation" are based on the assumption that the mitigation measures recommended in this assessment are implemented correctly and rehabilitation of the site is undertaken. Failure to implement mitigation measures will keep impacts at an unacceptably high level.

Unknown parameters are given the highest score (5) as significance scoring follows the Precautionary Principle. The Precautionary Principle is based on the following statement: *When the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.*

Table 3: Significance scoring used for each potential impact.

Probability	Duration
1 - very improbable	1 - very short duration (0-1years)
2 - improbable	2- short duration (2-5 years)
3 - probable	3 - medium term (5-15 years)
4 - highly probable	4 - long term (>15 years)
5 - definite	5 - permanent/unknown
Extent	**Magnitude**
1 - limited to the site	2 – minor
2 - limited to the local area	4 – low
3 - limited to the region	6 – moderate
4 - national	8 – high
5 - international	10 – very high

Significance Points = (Magnitude + Duration + Extent) x Probability. The maximum value is 100 Significance Points.

Potential Environmental Impacts are rated as high, moderate or low significance as per the following:

<30 significance points = Low environmental significance

31-59 significance points = Moderate environmental significance

>60 significance points = High environmental significance

3 Findings

3.1 Watercourse Desktop Assessment

3.1.1 Quaternary catchment and Land Use

The site falls within the quaternary drainage region A31J which is part of the Limpopo Water Management Area (**Figure 5**). The Limpopo water management area is the northern most water management area in the country and represents part of the South African portion of the Limpopo Basin which is also shared by Botswana, Zimbabwe and Mozambique. The water management area shares international boundaries with Botswana and Zimbabwe, where the Limpopo River demarcates the entire length of the international boundaries before flowing into Mozambique where it discharges into the Indian Ocean. Within South Africa it borders on the Luvuvhu and Letaba, Olifants, and Crocodile (West) and Marico water management areas. (DWS, 2016). The reference data available is illustrated in **Table 4** below.

Table 4: Sub-Quaternary reach desktop data (DWS, 2016).

SQR		**A31J-00810**
Category	Name	-
	Ecoregion	Western Bankenveld
	Length (km)	26,59
	Ecological importance	High
	Ecological Sensitivity	High
	Present Ecological Status	Moderately modified
	Class	**C**

Present land use in the water management area is characterised by patches of rain fed cultivation in the central and southern part of the water management area, (DWS, 2016). The natural veld is used for sheep and cattle grazing and to a lesser extent game farming (**Figure 6**).

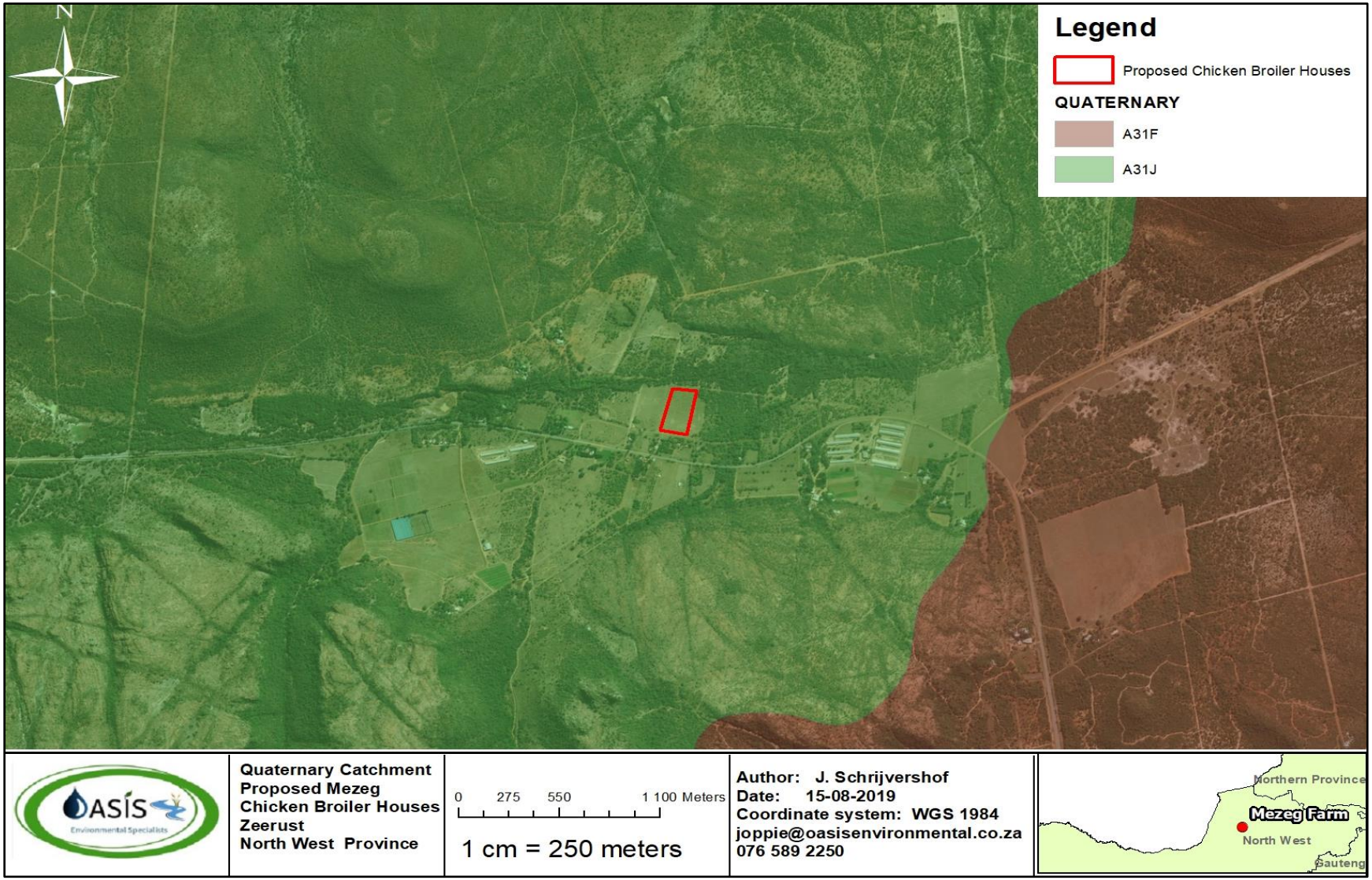

Figure 5: Quaternary Catchment map.

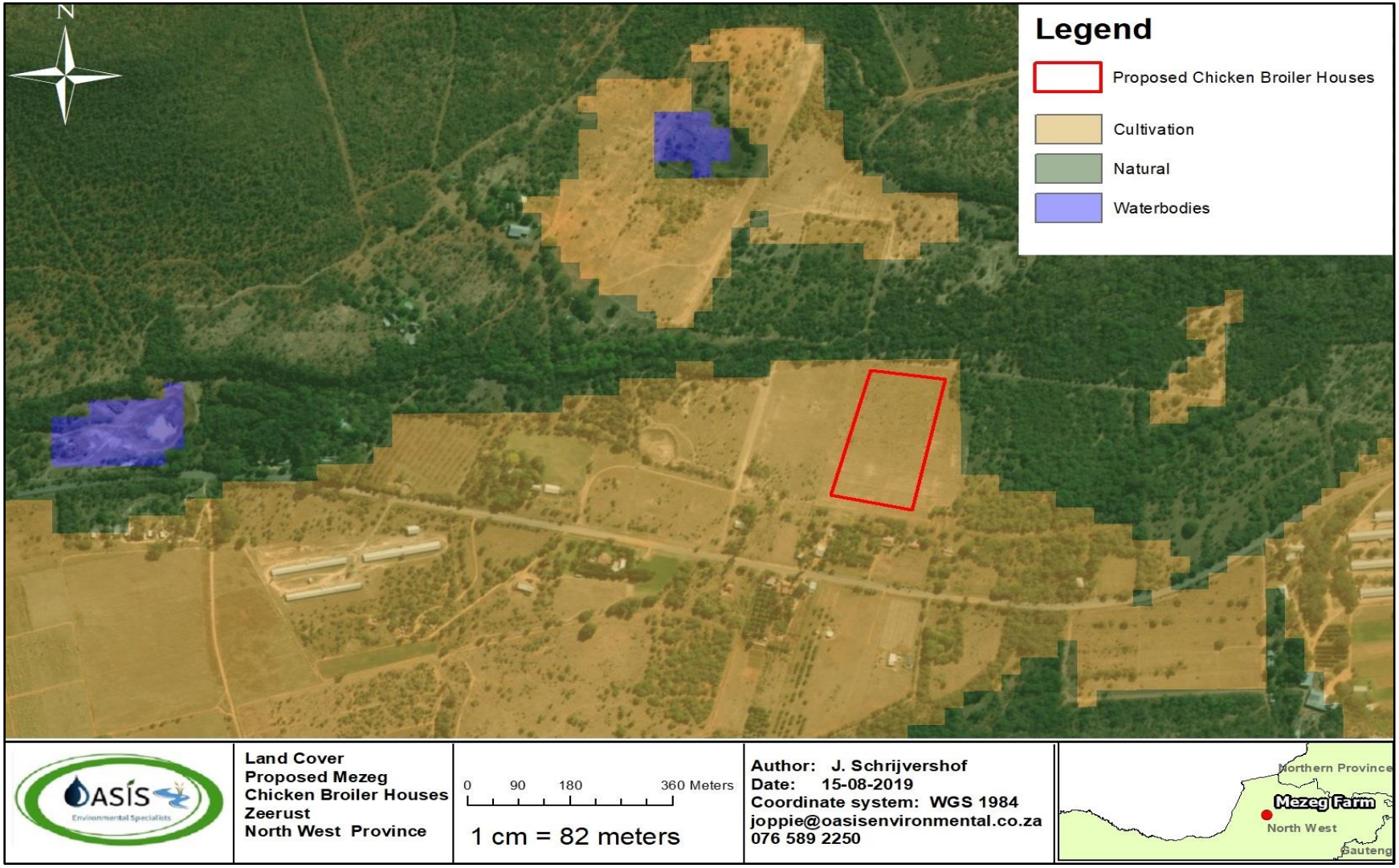

Figure 6: Land cover map.

3.1.2 NFEPA Wetlands

Examination of the National Freshwater Ecosystem Priority Areas (NFEPA) database was undertaken for the study area. The NFEPA project aims to produce maps which provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. They are identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands/pans and estuaries (MacFarlane *et al*., 2014). Identification of FEPA Wetlands is based on a combination of special features and modelled wetland conditions that include expert knowledge on features of conservation importance as well as available spatial data on the occurrence of threatened frogs and wetland-dependent birds.

Two small segments of Seep wetlands were identified within the application area according to the NFEPA wetlands database (**Figure 7**). These wetlands were identified to be farm dams during the field assessment.

Ground-truthing the existence and condition of FEPA wetlands is important to understand local conditions which have an impact on the wetland system, their functional integrity and health.

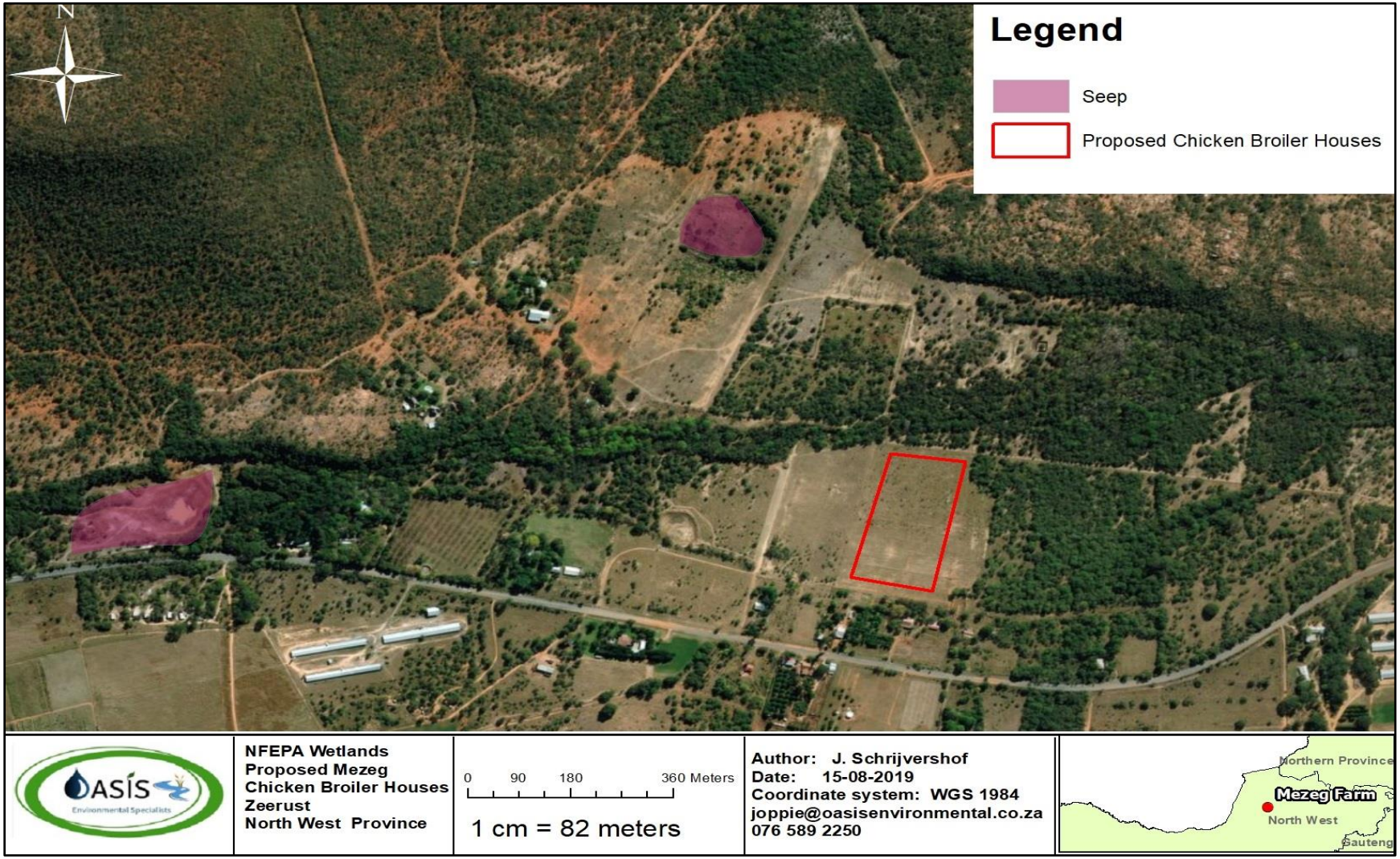

Figure 7: NFEPA Wetlands map.

3.1.3 Terrain Indicator

The topography of an area is generally a good practical indicator for identifying those parts in the landscape where wetlands and pans are likely to occur. Generally, wetlands occur as a valley bottom unit however wetlands can also occur on steep to mid slopes where groundwater discharge is taking place through seeps and where pans can collect water in a depression (DWAF, 2005). In order to classify a wetland/pan system, the localised landscape setting must be taken into consideration through ground-truthing of the study site after initial desktop investigations (Ollis *et al*., 2014).

The area ranges in altitude from 1089 m to 1379 m above sea level. A Digital Elevation Model (DEM) of the aerial photography of the site revealed that the topography of the landscape is relatively mountainous through the landscape. These mountains are incised with numerous valleys. The landscape is eventually drained by the Sandsloot and Marico rivers and its tributaries. (**Figure 8**).

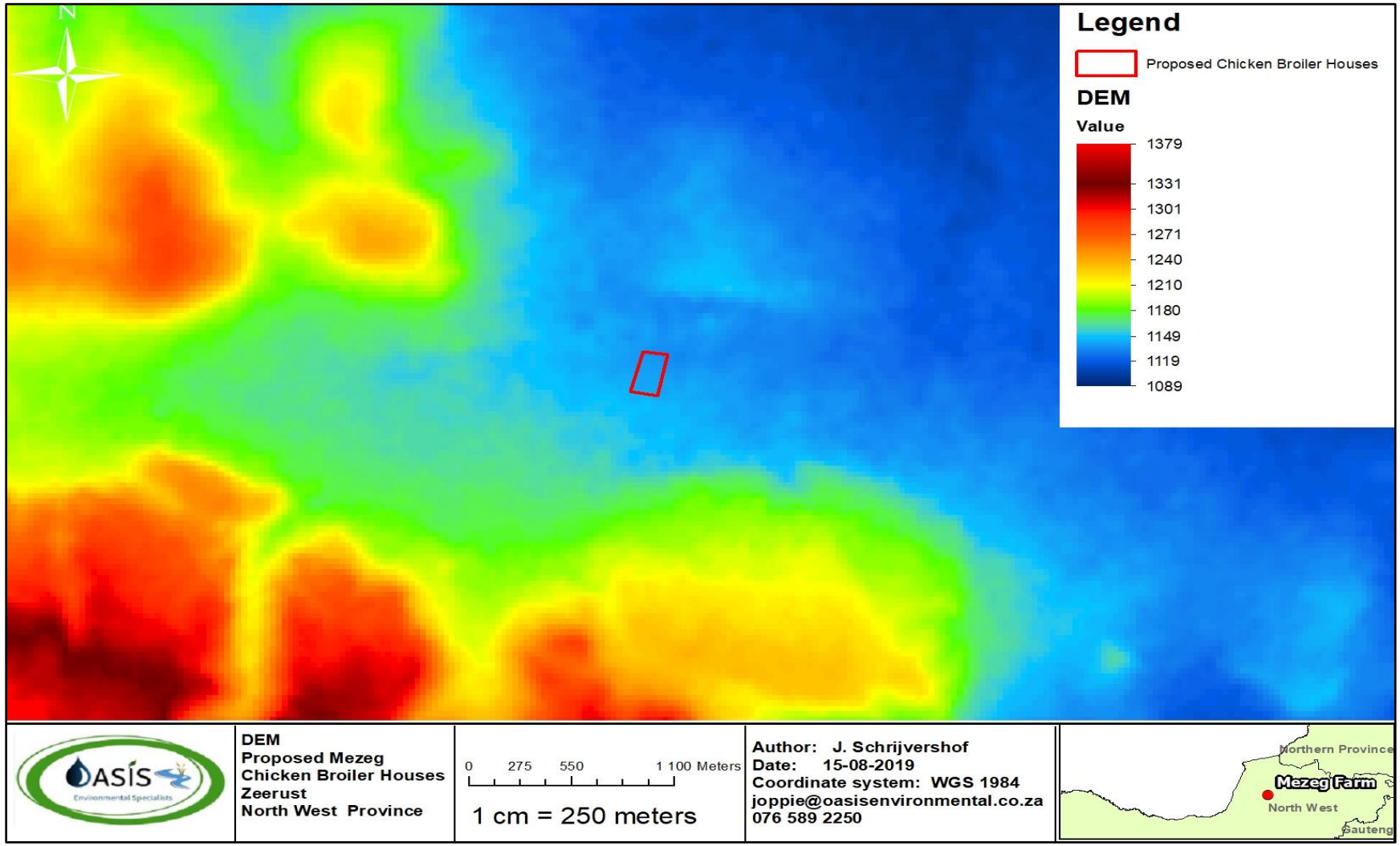

Figure 8: Digital Elevation Model map.

3.2 Ecological Desktop Assessment

3.2.1 Vegetation

3.2.1.1 Zeerust Thornveld

Distribution: Extends along the plains from the Lobatsi River in the west via Zeerust, Groot Marico and Mabaalstad to the flats between the Pilanesberg and western end of the Magaliesberg in the east (including the valley of the lower Selons River) (Mucina and Rutherford, 2006). Altitude ranges between 1000 m and 1250 m (Mucina and Rutherford, 2006).

Vegetation & Landscape Features: Deciduous, open to dense short thorny woodland, dominated by *Vachellia* and *Senegalia* species with herbaceous layer of mainly grasses on deep, high base-status and some clay soils on plains and lowlands, also between rocky ridges of the Dwarsberg-Swartruggens Mountain Bushveld (Mucina and Rutherford, 2006).

Geology & Soils: The geology of the area consists of Pretoria shale, slate, hornfels and quartzite with diabase sills in certain areas (Mucina and Rutherford, 2006). The sediments are of the Pretoria Group which also may consist of carbonates, volcanic rocks, breccias and diamictites (Mucina and Rutherford, 2006). Red-yellow apedal soils dominate the landscape and are freely draining soils (Mucina and Rutherford, 2006). They may have a high base status with some vertic or melanic clays (Mucina and Rutherford (2006). There are no known dunes and the soil is generally deep (> 300 mm) (Mucina and Rutherford, 2006). The soil is considered to be of intermediate suitability for arable agriculture in regions where the climate may permit agriculture (Mucina and Rutherford, 2006).

Climate: Summer rainfall with very dry winters and the MAP has a relatively narrow range between 550 mm to 600 mm (Mucina and Rutherford, 2006). Frost fairly frequent in winter with mean monthly maximum and minimum temperatures for Marico weather station 36.7°C and –0.4°C for January and June, respectively (Mucina and Rutherford, 2006).

Endemic Taxon: Low Shrub: *Rhus maricoana*.

Conservation: Spread between four reserves including the Pienaar and Marico Bushveld Nature Reserves (Mucina and Rutherford, 2006). Some 16% transformed mainly by cultivation, with some urban or built-up. A few areas with scattered plants of the alien *Cereus jamacaru* and several other alien species very scattered elsewhere and erosion is mainly very low to low (Mucina and Rutherford, 2006).

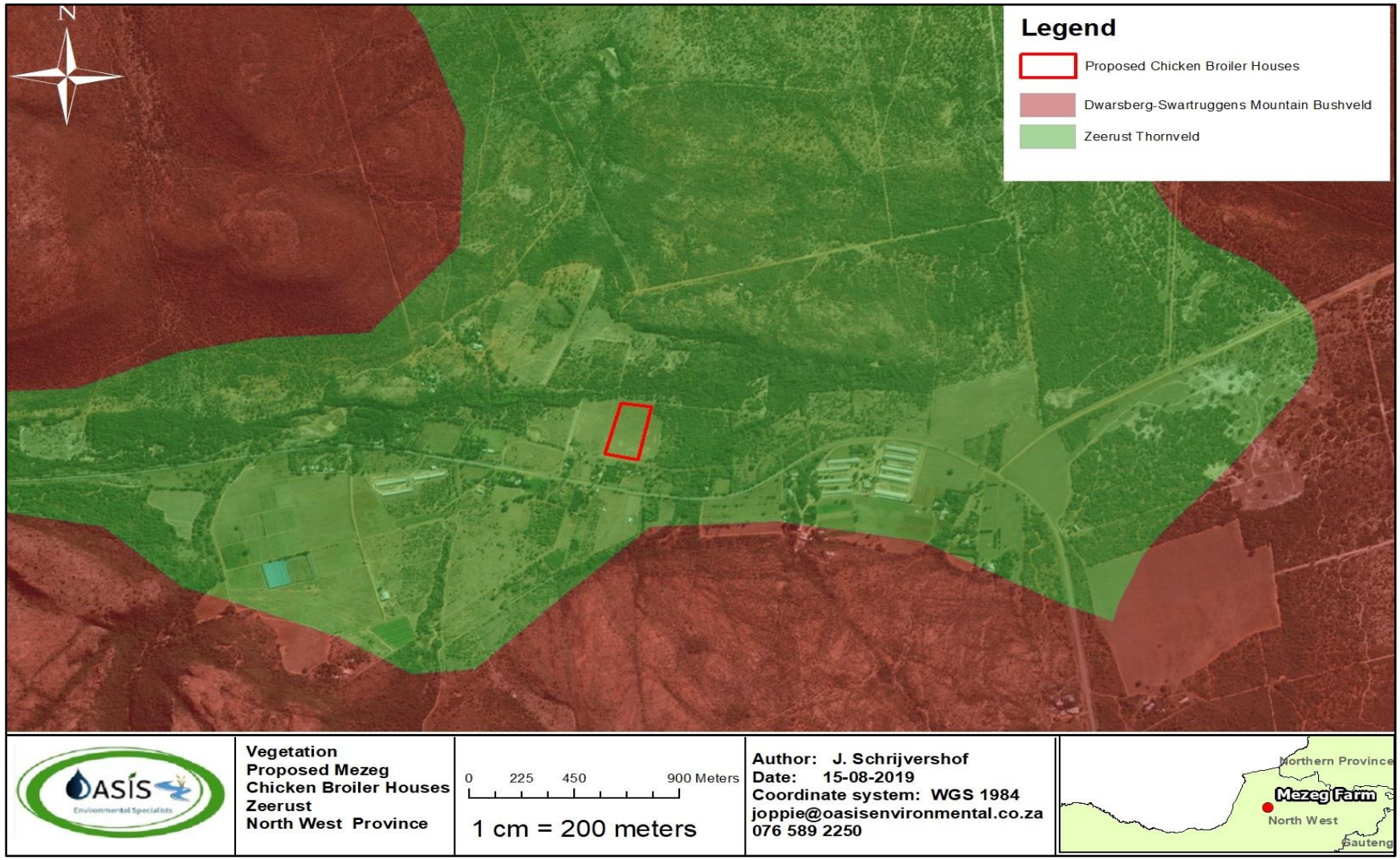

Figure 9: Farm Mezeg proposed chicken broiler houses - Vegetation map.

3.2.2 Critical Biodiversity Areas

According to the Critical Biodiversity Areas datasets provided by SANBI (2019), almost the entire application area falls within Ecological Support Area 2 as seen in **Figure 10**. Only a top portion lies within a Critical Biodiversity Area 2, which is in close proximity to a non-perennial channel.

3.2.3 Threatened Ecosystems and Protected areas

The proposed development does not overlap with any threatened ecosystems and/or protected areas.

3.2.4 Important Bird Areas

The proposed prospection project not fall within close proximity to any Important Bird Areas (IBAs).

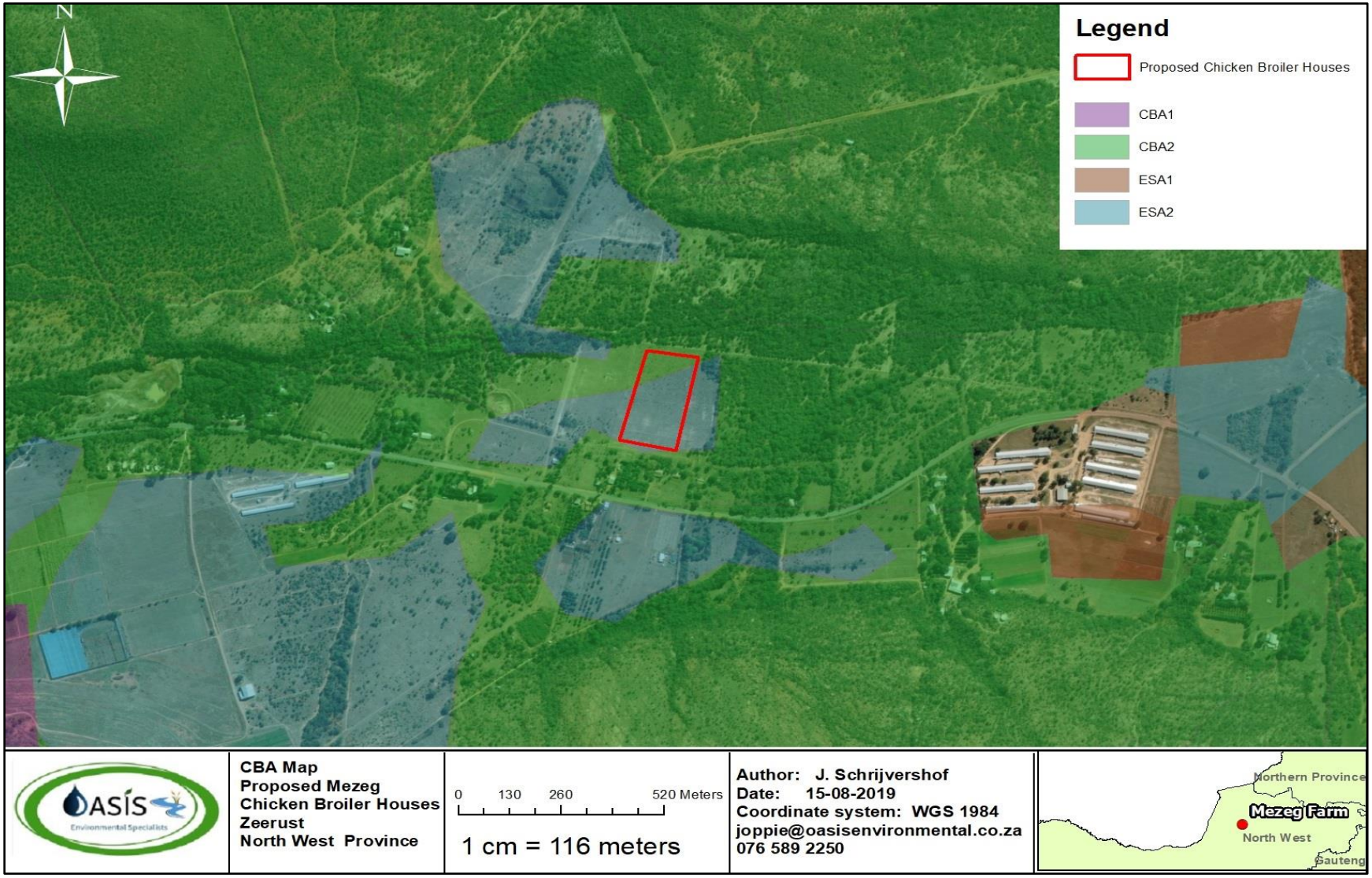

Figure 10: Farm Mezeg proposed chicken broiler houses – Critical Biodiversity Areas map.

4 Results

4.1 Watercourse Assessment

According to DWAF (2005), vegetation is regarded as a key component to be used in the delineation procedure for wetlands. Vegetation also forms a central part of the wetland definition in the National Water Act, Act 36 of 1998. However, using vegetation as a primary wetland indicator requires an undisturbed condition (DWAF, 2005). Disturbances included the presence of minor alien invasive species, minor erosion, grazing and agricultural activities within the area.

No wetland conditions were identified based on the soil and vegetation characteristics within 500 m of the proposed chicken broiler development.

One 'A' section channel was identified in close proximity to the development (**Figure 11**). 'A' Section channels convey surface runoff immediately after a storm event and are not associated with a riparian zone. The 100 m of the channel's regulated area overlaps with the proposed development as per regulations GN 509 dated August 2016 under the Section 21 c and i water uses of the NWA, 1998 (Act No 36 of 1998) (**Figure 12**).

Figure 11: Overall downstream view of the 'A' section channel.

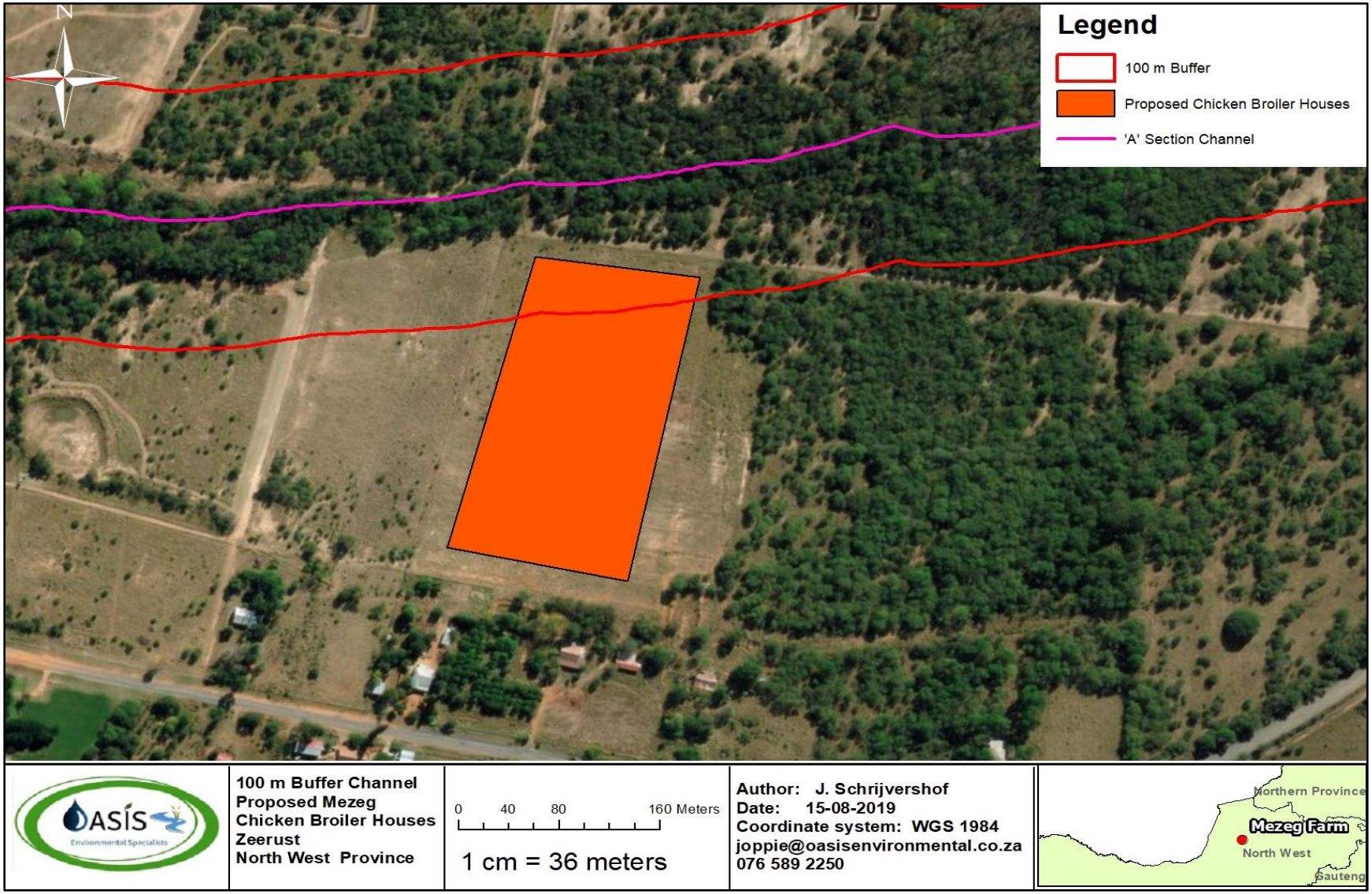

Figure 12: Farm Mezeg proposed chicken broiler houses – Channel and 100 m buffer map.

4.1.1 Riparian Vegetation (VEGRAI)

The riparian ecological integrity was assessed for the 'A' section channel using the Riparian Vegetation Response Assessment Index (VEGRAI) (Kleynhans *et al.,* 2008).

Results from the lower and upper zones of the riparian vegetation are then combined and weighted with a value that reflects the perceived importance of that particular criterion in determining habitat integrity, allowing this to be numerically expressed in relation to the perceived benchmark. These values are then summed to produce a score that reflects the overall habitat integrity of the riparian unit. The score is then placed into one of six classes **(Table 5).**

Table 5: Riparian Ecological Category Scores.

Unit	Score (%)	Class	Confidence
'A' Section Channel	71,2	**C**	3,2

The riparian habitat associated with the 'A' Section channels has been classified as **moderately modified, Category C** with a minor loss of natural habitat, biota and basic ecosystem functions due to adjacent poultry farming and upstream damming. Some alien invasive plant species were also identified within the non-marginal zone of the riparian areas of the channel.

4.2 Ecological Assessment

4.2.1 Habitat Units

The ecological assessment described three distinguishable habitat features, i.e. Mountainous Vegetation, Bushveld Vegetation and Transformed Grasslands (**Figure 13 and Figure 15**). The area has a fair abundance of indigenous vegetation within the Mountainous and Bushveld areas. Faunal activity was very low which could be due to the small size of the site and the fact that it falls within a transformed grassland and that the site is fenced off from the rest of the natural areas, with a suitable game fence (**Figure 14**).

During the site visit African Warthog (*Phacochoerus africanus*) and Impala (*Aepyceros melampus*) were identified within the Bushveld Areas. The Mountain and Bushveld could be regarded as **highly sensitive** areas and the Transformed areas as **low sensitive** areas.

A detailed list of faunal species is listed in **Appendix A** and for the floral species listed in **Appendix B** for that specific area with their respective conservation statuses.

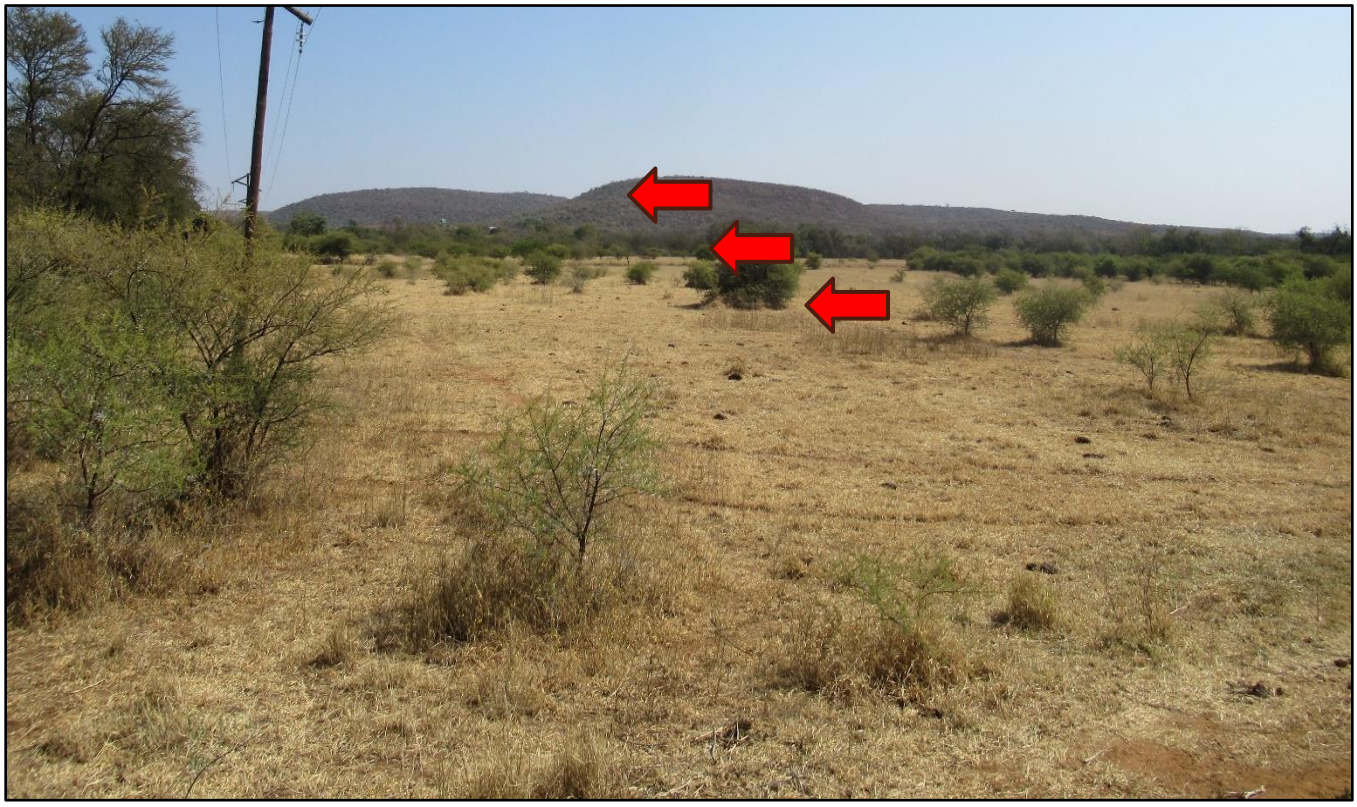

Figure 13: Overall view of the habitat units: Mountain Areas, Bushveld Areas and Transformed Grassland.

Figure 14: A game fence separating the transformed areas and the natural areas

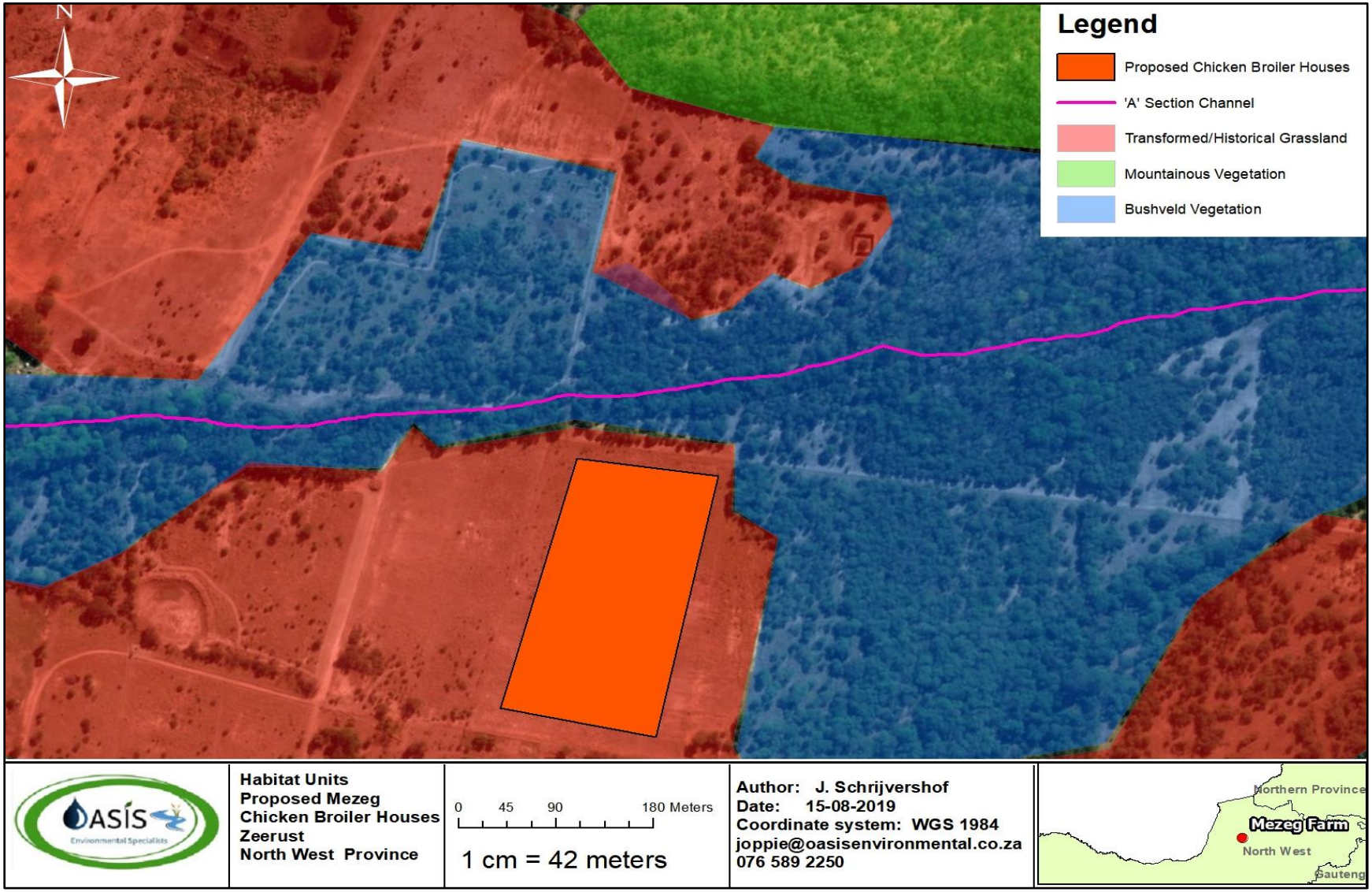

Figure 15: Farm Mezeg proposed chicken broiler houses – Habitat Units map.

4.2.2 Alien Invasive Vegetation

National Environmental Management: Biodiversity Act (No. 10 of 2004) categories for invasive species according to Section 21 are as follows:

- **Category 1a:** Species requiring compulsory control;
- **Category 1b:** Invasive species controlled by an invasive species management programme;
- **Category 2:** Invasive species controlled by area, and;
- **Category 3:** Invasive species controlled by activity.

Certain species have different alien invasive categories for different provinces in South Africa, where **Table 6** lists the alien species identified on site as well as their respective alien categories.

Table 6: Alien Invasive Plants identified within the development area.

Species Name	Common Name	Category
Datura ferox	Large Thorn Apple	1b
Solanum incanum	Thorn Apple	-
Cardiospermum grandiflorum	Balloon Vine	1b

5 Impacts

Any development activity in a natural system will have an impact on the surrounding environment, usually in a negative way. The purpose of the impact assessment is to identify and assess the significance of the current impacts likely to be caused by the proposed chicken poultry farm to any biodiversity and to provide a description of the mitigation required in order to minimise or offset any such potential impacts on the natural environment.

Impacts that have been identified are predominantly associated with cumulative impacts include increased levels of erosion due to increased runoff, proliferation of alien invasive species, possible water quality alterations and impacts on indigenous faunal and floral species. Mitigation measures stated must be used to minimise the ecological impacts of the operational process. Mitigation actions and scores are listed in **Section 5.5**, **Table 7 and Table 8**, which outlines the construction and operational impacts before and after mitigation actions have been imposed.

5.1 Sedimentation and Erosion due to increased runoff

The construction phase of the proposed chicken broiler houses will increase the transport of sediment to the channel due to hardened surfaces, during flooding events which will increase the turbidity within the system. Increased sediments will settle on the substrate, which will restrict and displace substrate-dwelling species downstream, these impacts can be mitigated to a limited degree.

Stormwater management needs to take into consideration the deposition of silts transported after rainfall events into the surface water resources, again leading to smothering of the aquatic habitat, ultimately displacing aquatic species. Erosion must be strictly controlled through the utilisation of silt traps, silt fencing, gabions, etc. This is especially pertinent within areas of steeper gradients. Some impacts are inevitable due to the very nature of the impact for e.g. grazing. The most significant impacting features will result from the further fragmentation of the river habitat and the consequences to aquatic communities and conservation within the region.

5.2 Impacts on water quantity and quality

Due to the nature of chicken poultry farming, the potential might be there of organic waste entering the channel areas directly or indirectly during the operations phase. Without careful management and insufficient storm-water structures; there is a risk that waste water may enter the environment and further contaminate downstream wetland and riverine areas, but this may be very limited or eradicated, when applying the correct mitigation measures as prescribed. Untreated waste water entering wetland/river areas will impact negatively on the integrity and functioning of the aquatic ecosystems (including vegetation and

living organisms) and could have a negative impact on downstream water resources. Large amounts of nutrients and bacteria associated with waste water discharge can result in reductions in water quality, disruption of trophic pathways, increased algal blooms and reduction in dissolved oxygen levels, impacting on aquatic biotic diversity and generally leading to the degradation of the wetland area affected (MacFarlane *et al*., 2014).

5.3 Loss of Indigenous Vegetation

Alien invasive plants present onsite have the ability to out-compete and replace indigenous flora, which will in turn impact on natural biodiversity. Edge habitat is characterised by a predominance of generalist and alien species that are usually highly competitive species which can invade areas of established vegetation, resulting in a loss of sedentary species of mature habitats which are normally considered sensitive. In addition, certain alien plants exacerbate soil erosion whilst others contribute to a reduction in stream flows. Although the impact is initiated during the construction phase, it is really an operational issue as recovery of vegetation community types is a long-term process. The significance of this impact is negated by the existing disturbance regime in the project area, characterised by already dense infestations of alien plants in riparian areas and wetlands (MacFarlane *et al*., 2014).

A suitable alien invasive eradication and management programme must be implemented to prevent any further spread of alien invasive plants.

5.4 Disturbance of faunal species

The construction of the proposed chicken poultry farm will cause the destruction and clearing of some indigenous vegetation. Although the study area was not considered to be in a pristine condition it supported some indigenous vegetation. The construction of the proposed chicken abattoir is also unlikely to disturb faunal species within the study area, due to the natural areas being fenced off from the proposed development area. Although faunal activity was considered very low to none in the transformed areas, higher faunal activity was recorded within the natural areas. The destruction and clearing of the natural vegetation within the study area will therefore have minor to zero impacts on faunal activity and habitat.

Table 7: Scoring of each impact with and without mitigation measures for the construction phase the chicken poultry farm.

Impacts associated with the pre-construction and construction phase of the activities										
Impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation		
Construction Phase										
Sedimentation and Erosion	3	1	1	1	2	1	4	2	**21 (LOW)**	**4 (LOW)**
Impacts to Water Quality	3	1	1	1	1	1	4	2	**18 (LOW)**	**4 (LOW)**
Loss of Indigenous Vegetation and Habitat	3	2	1	1	1	1	4	2	**18 (LOW)**	**8 (LOW)**
Disturbance of faunal species	3	2	1	1	2	1	4	2	**21 (LOW)**	**8 (LOW)**

Table 8: Scoring of each impact with and without mitigation measures for the operational phase for the chicken poultry farm.

Impacts associated with the operational phase of the activities										
Impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation		
Operational Phase										
Sedimentation and Erosion of Watercourses	3	2	1	1	2	1	4	2	**21 (LOW)**	**8 (LOW)**
Impacts to Water Quality	3	2	1	1	2	1	4	2	**21 (LOW)**	**8 (LOW)**
Loss of Indigenous Vegetation and Habitat	3	2	1	1	1	1	4	2	**18 (LOW)**	**8 (LOW)**
Disturbance of faunal species	3	2	1	1	2	1	4	2	**21 (LOW)**	**8 (LOW)**

5.5 Mitigation

5.5.1 Construction phase

- Ensure that all stockpiles are well managed and have measures such as to minimise the mobilisation of sediments by the use of sand bags, hessian sheets, etc.;
- Dumping of any excess rubble, building material or refuse must be prohibited within riparian habitats;
- Dumping of materials must only take place at designated and properly managed areas;
- Make use of existing infrastructure such as existing roads as to minimise impacts;
- Construction activities (excavations, etc.) must take place within the low flow period of the channel;
- The area which will be impacted on by the proposed development should be fenced of and no people or vehicles should be allowed into the natural areas surrounding the construction area; and
- Building material, ablution facilities or construction vehicles should not be stored in areas containing natural vegetation but the disturbed areas adjacent to the study area should be used.

5.5.2 Operational phase

- Should any signs of erosion be found, remedial action such as backfilling, compaction and re-vegetation must be taken immediately to avoid exacerbation of the erosion;
- No stockpiling of any materials may take place adjacent to the channel;
- Ensure that all stockpiles are well managed and have measures to minimise the mobilisation of sediments such as the use of sand bags, hessian sheets, etc.;
- Erosion control measures must be implemented in areas sensitive to erosion and where erosion has already occurred such as edges of slopes, exposed soil etc. These measures include but are not limited to - the use of sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which are used in the protection of slopes;
- Do not allow surface water or storm water to be concentrated, or to flow down cut or fill slopes without erosion protection measures being in place;
- It is crucial that the contamination of the surface waters through deleterious effluents and runoff water be avoided;

- Maintenance of stormwater drains must be undertaken as sensitively as possible to prevent adverse impacts to the environment and any watercourses;
- Any disturbed areas should be rehabilitated in line with the rehabilitation guidelines, this includes the clearing of alien vegetation, following the guidelines of a suitable alien invasive plant management plan;
- The site must be regularly monitored for re-growth of alien invasive species, and any new seedlings etc. eradicated using methods appropriate for the particular species, whether mechanical, chemical or biological;
- Any pump stations will need to be fenced/secured to prevent unauthorized access by humans/wildlife which could cause damage to infrastructure and cause accidental malfunction and/or spillage of untreated waste water;
- The pump station will need to be placed within a suitably lined, impermeable bunded area with the capacity to hold untreated waste water in an emergency and provide for sufficient time for maintenance staff to address any faults/ problems. This is to limit the risk of untreated waste material (sewage or sludge) overflowing in the event of any leakage or accidental spillage;
- Protect as much indigenous vegetation as possible; and
- Mitigation measures must be implemented with a suitable EMPr.

6 Site alternative

The application area overlaps with the 100 m regulated area as illustrated in **Figure 12** as per regulations GN 509 dated August 2016 under the Section 21 c and i water uses of the NWA, 1998 (Act No 36 of 1998).

A newly proposed site alternative has been suggested as illustrated in **Figure 16** and does not trigger a Water Use Authorisation in terms National Water Act, 1998 (Act No 36 of 1998) under the Section 21 c and i water uses. The project footprint has been designed to fall outside of the 100 m regulated area of the channel and has been shifted and widened to have the same area and extend in hectares as the initial proposed area.

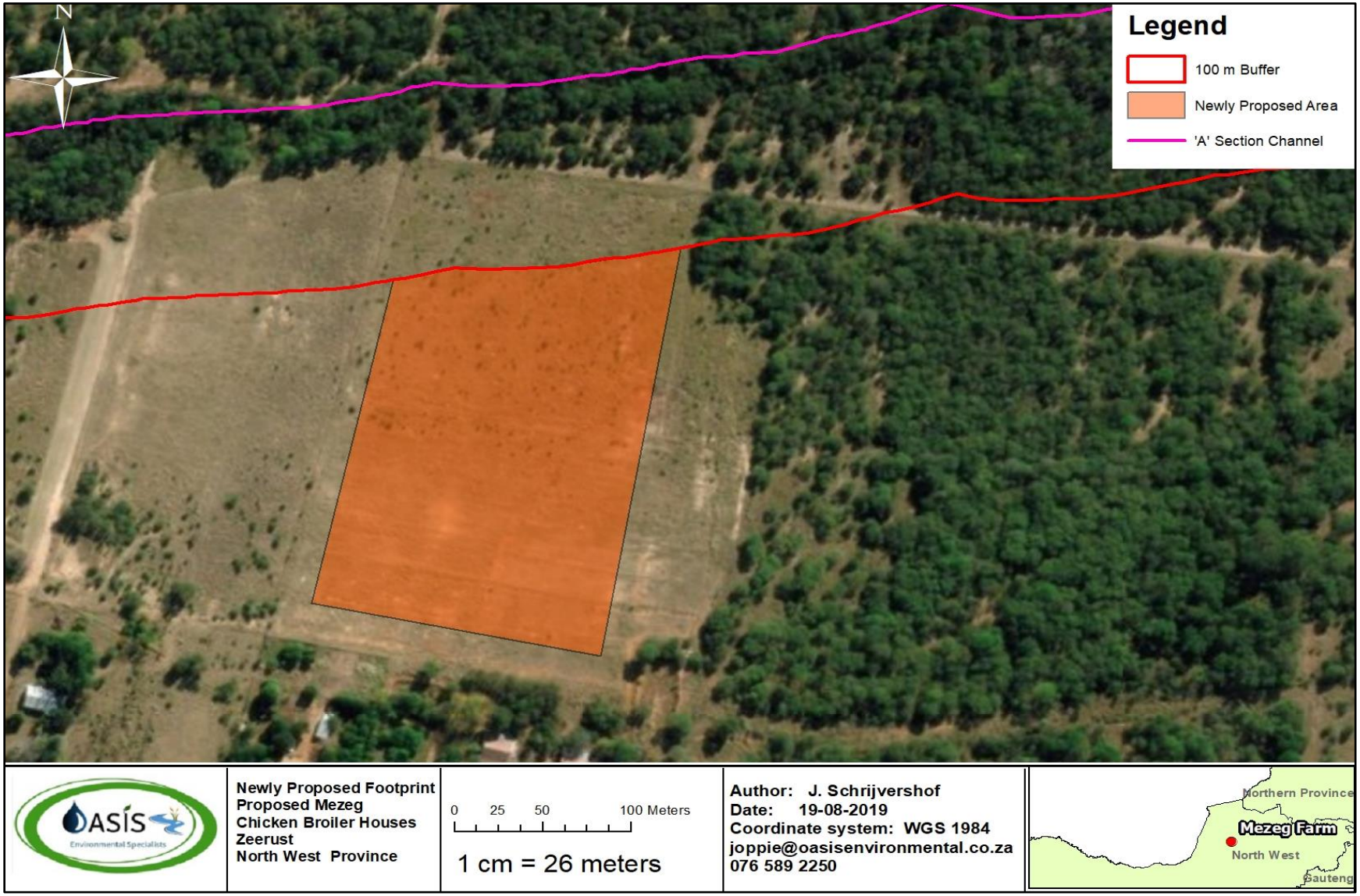

Figure 16: Farm Mezeg newly proposed chicken broiler houses area.

7 Conclusion

From the NFEPA database, two seep wetlands were identified within the project boundary. Based on the site delineation, no wetlands were found in the area and the seep wetlands were found to be the farm dams. One 'A' section channel was identified within the 100 m buffer of the proposed activity. 'A' section channels are those that do not have baseflow and convey surface runoff immediately after a storm event and are not associated with a riparian zone. This channel was found to be in a moderately modified (Category C) state due to the landscape transformation within the non-marginal zone and the presence of alien invasive plants.

The Mezeg farm boundary falls within the Zeerust Thornveld vegetation type. No plant species of conservation concern were identified during the site visit within the proposed development area, but could be found beyond the reaches in the Mountain and Bushveld according to the expected species listed in **Appendix B**.

A number of potential impacts relating to proliferation of alien invasive species, sedimentation and erosion and impacts on water quality and biodiversity might occur as a result of the construction and the operational of the proposed chicken poultry farm.

The significance of potential impacts on biodiversity within the area was rated as a **low significance** for the construction and operational phases. Key mitigation measures include:

- Active stormwater management must be implemented to stop silt and sediments from entering the channel;
- Disturbed soils and stockpiled soils must be protected from erosional features;
- The prevention of alien invasive vegetation encroachment; and
- Protect as much indigenous vegetation and habitat as possible

Almost the entire application area falls within an Ecological Support Area, with a small top portion within a Critical Biodiversity area. No protected areas nor any threatened ecosystems are present within the study area. No IBA's are found within or in close proximity to the study area.

Although some protected (vulnerable, endangered and critically endangered) species are thought to occur within the area, it is most likely that they would occur within protected areas within close proximity of the study area, but have been fenced off from the transformed areas. All faunal species are listed in **Appendix A**.

It is recommended that the mitigation measure be incorporated into an EMPr with an Alien Invasive Plant management programme.

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APPENDIX A – FAUNAL SPECIES LIST

Insecta			
Scarabaeidae	*Scarabaeus subaeneus*		
Lycaenidae	*Aloeides taikosama*	Dusky copper	Least Concern (SABCA 2013)
Lycaenidae	*Axiocerses tjoane tjoane*	Eastern scarlet	Least Concern (SABCA 2013)
Lycaenidae	*Cigaritis ella*	Ella's bar	Least Concern (SABCA 2013)
Lycaenidae	*Tarucus sybaris sybaris*	Dotted blue	Least Concern (SABCA 2013)
Nymphalidae	*Acraea anemosa*	Broad-bordered acraea	Least Concern (SABCA 2013)
Nymphalidae	*Acraea caldarena caldarena*	Black-tipped acraea	Least Concern (SABCA 2013)
Nymphalidae	*Acraea stenobea*	Suffused acraea	Least Concern (SABCA 2013)
Nymphalidae	*Charaxes saturnus saturnus*	Foxy charaxes	Least Concern (SABCA 2013)
Nymphalidae	*Charaxes vansoni*	Van Son's charaxes	Least Concern (SABCA 2013)
Nymphalidae	*Danaus chrysippus orientis*	African monarch, Plain tiger	Least Concern (SABCA 2013)
Nymphalidae	*Junonia hierta cebrene*	Yellow pansy	Least Concern (SABCA 2013)
Nymphalidae	*Phalanta phalantha aethiopica*	African leopard	Least Concern (SABCA 2013)
Nymphalidae	*Telchinia rahira rahira*	Marsh acraea	Least Concern (SABCA 2013)
Pieridae	*Colotis annae annae*	Scarlet tip	Least Concern (SABCA 2013)

Pieridae	*Colotis antevippe gavisa*	Red tip	Least Concern (SABCA 2013)
Pieridae	*Colotis euippe omphale*	Smoky orange tip	Least Concern (LC)
Pieridae	*Colotis evagore antigone*	Small orange tip	Least Concern (SABCA 2013)
Pieridae	*Colotis evenina evenina*	Orange tip	Least Concern (SABCA 2013)
Pieridae	*Colotis lais*	Kalahari orange tip	Least Concern (SABCA 2013)
Pieridae	*Teracolus subfasciatus*	Lemon traveller	Least Concern (SABCA 2013)
Arachnida			
Theraphosidae:	*Idiothele mira*		
Theraphosidae:	*Harpactira pulchripes*		
Theraphosidae:	*Ceratogyrus paulseni*		
Amphibia			
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Schismaderma carens*	Red Toad	Least Concern
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern
Bufonidae	*Sclerophrys garmani*	Olive Toad	Least Concern
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	Least Concern
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern
Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog	Least Concern
Ptychadenidae	*Ptychadena mossambica*	Broadbanded Grass Frog	Least Concern

Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern
Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog	Least Concern (2013)
Reptilia			
Viperidae:	*Bitis xeropaga*	(Desert Mountain Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis schneideri*	(Namaqua Dwarf Adder), Least Concern (SARCA 2014)	Least Concern (SARCA 2014)
Viperidae:	*Bitis rubida*	(Red Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis inornata*	(Plain Mountain Adder)	Endangered (SARCA 2014)
Viperidae:	*Bitis cornuta*	(Many-horned Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis caudalis*	(Horned Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis atropos*	(Cape Berg Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis atropos*	(Berg Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis atropos*	(Drakensberg Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis atropos*	(Zimbabwe Berg Adder)	Least Concern (SARCA 2014)
Viperidae:	*Bitis armata*	(Southern Adder)	Vulnerable (SARCA 2014)
Viperidae:	*Bitis albanica*	(Albany Adder)	Critically Endangered (SARCA 2014)

Lamprophiidae:	*Lamprophis fiskii*	(Fisk's House Snake)	Least Concern (SARCA 2014)
Cordylidae:	*Ouroborus cataphractus*	(Armadillo Girdled Lizard)	Least Concern (SARCA 2014)
Chamaeleonidae:	*Rhampholeon chapmanorum*	(Chapman's Pygmy Chameleon)	
Elapidae	*Naja mossambica*	Mozambique Spitting Cobra	Least Concern (SARCA 2014)
Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophylax tritaeniatus*	Striped Grass Snake	Least Concern (SARCA 2014)
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern (SARCA 2014)
Mammalia			
Bathyergidae	*Cryptomys hottentotus*	Southern African Mole-rat	Least Concern (2016)
Bovidae	*Aepyceros melampus*	Impala	Least Concern
Bovidae	*Alcelaphus buselaphus*	Hartebeest	
Bovidae	*Connochaetes taurinus taurinus*		Least Concern (2016)
Bovidae	*Damaliscus lunatus lunatus*	(Southern African) Tsessebe	Vulnerable (2016)
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern (2016)
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*		Least Concern (2016)
Bovidae	*Oryx gazella*	Gemsbok	Least Concern (2016)

Bovidae	*Pelea capreolus*	Vaal Rhebok	Near Threatened (2016)
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (2016)
Bovidae	*Redunca arundinum*	Southern Reedbuck	Least Concern (2016)
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	Least Concern
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern (2016)
Bovidae	*Syncerus caffer*	African Buffalo	Least Concern (2008)
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern (2016)
Bovidae	*Tragelaphus angasii*	Nyala	Least Concern (2016)
Bovidae	*Tragelaphus scriptus*	Bushbuck	Least Concern
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern (2016)
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern (2016)
Equidae	*Equus quagga*	Plains Zebra	Least Concern (2016)
Felidae	*Acinonyx jubatus*	Cheetah	Vulnerable (2016)
Felidae	*Caracal caracal*	Caracal	Least Concern (2016)
Felidae	*Leptailurus serval*	Serval	Near Threatened (2016)
Galagidae	*Galago moholi*	Mohol Bushbaby	Least Concern (2016)
Giraffidae	*Giraffa giraffa giraffa*	South African Giraffe	Least Concern (2016)
Herpestidae	*Atilax paludinosus*	Marsh Mongoose	Least Concern (2016)
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern (2016)
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened (2015)
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern

Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant Shrew	Least Concern (2016)
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	Least Concern (2016)
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	Least Concern
Muridae	*Lemniscomys rosalia*	Single-Striped Lemniscomys	Least Concern (2016)
Muridae	*Mastomys sp.*	Multimammate Mice	
Mustelidae	*Aonyx capensis*	African Clawless Otter	Near Threatened (2016)
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern (2016)
Sciuridae	*Paraxerus cepapi*	Smith's Bush Squirrel	Least Concern (2016)
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	Near Threatened (2016)
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern (2016)
Suidae	*Potamochoerus larvatus koiropotamus*	Bush-pig (subspecies koiropotamus)	Least Concern (2016)
Suidae	*Potamochoerus porcus*	Red River Hog	
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)

APPENDIX B – FLORAL SPECIES LIST

Anacardiaceae	Low Shrub	*Rhus maricoana*	Vulnerable
Acanthaceae	Herbs	*Blepharis integrifolia*	Least Concern
Acanthaceae	Low Shrubs	*Chaetacanthus costatus*	Least Concern
Amaranthaceae	Herbs	*Kyphocarpa angustifolia*	Least Concern
Anacardiaceae	Low Shrubs	*Rhus grandidens*	Least Concern
Anacardiaceae	Small Trees	*Rhus lancea*	
Asteraceae	Herbs	*Dicoma anomala*	
Capparaceae	Herbs	*Cleome maculata*	Least Concern
Celastraceae	Tall Shrubs	*Mystroxylon aethiopicum subsp. burkeanum*	Least Concern
Combretaceae	Small Trees	*Terminalia sericea*	Least Concern
Ebenaceae	Tall Shrubs	*Diospyros lycioides subsp. lycioides*	Least Concern
Fabaceae	Herbs	*Chamaecrista absus*	Least Concern
Fabaceae	Herbs	*Chamaecrista mimosoides*	Least Concern
Fabaceae	Low Shrubs	*Indigofera filipes*	Least Concern
Fabaceae	Low Shrubs	*Stylosanthes fruticosa*	Least Concern
Fabaceae	Small Trees	*Senegalia cinereal*	Least Concern
Fabaceae	Small Trees	*Senegalia mellifera*	Least Concern
Fabaceae	Small Trees	*Vachellia nilotica*	Least Concern

Fabaceae	Small Trees	*Vachellia tortilis*	Least Concern
Fabaceae	Small Trees	*Peltophorum africanum*	Least Concern
Fabaceae	Tall Trees	*Senegalia burkei*	Least Concern
Fabaceae	Tall Trees	*Vachellia erioloba*	Least Concern
Lamiaceae	Low Shrubs	*Clerodendrum ternatum*	Least Concern
Malvaceae	Low Shrubs	*Sida chrysantha*	Least Concern
Malvaceae	Tall Shrubs	*Grewia flava*	Least Concern
Molluginaceae	Herbs	*Limeum viscosum*	
Phytolaccaceae	Herbs	*Lophiocarpus tenuissimus*	Least Concern
Poaceae	Graminoids	*Aristida congesta*	Least Concern
Poaceae	Graminoids	*Cymbopogon pospischilii*	Least Concern
Poaceae	Graminoids	*Eragrostis lehmanniana*	Least Concern
Poaceae	Graminoids	*Panicum maximum*	Least Concern
Rubiaceae	Low Shrubs	*Agathisanthemum bojeri*	Least Concern

GLOSSARY

Catchment: The area where water from atmospheric precipitation becomes concentrated and drains downslope into a river, lake or wetland. The term includes all land surface, streams, rivers and lakes between the source and where the water enters the ocean.

Invasive alien species: Invasive alien species means any non-indigenous plant or animal species whose establishment and spread outside of its natural range threatens natural ecosystems, habitats or other species or has the potential to threaten ecosystems, habitats or other species.

Mitigate/Mitigation: Mitigating wetland impacts refers to reactive practical actions that minimise or reduce *in situ* wetland impacts. Examples of mitigation include "changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed activity, as well as restoration or rehabilitation of sites". Mitigation actions can take place anywhere, as long as their effect is to reduce the effect on the site where change in ecological character is likely, or the values of the site are affected by those changes (Ramsar Convention, 2012).

Watercourse: Means a river or spring; a natural channel in which water flows regularly or intermittently: a wetland, lake or dam into which, or from which, water flows: und any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks (National Water Act, 1998).