

# **SITE VERIFICATION REPORT – Knopfontein Chicken Farm – Flora, Fauna & Terrestrial Biodiversity Theme**

Commissioned by

**Green Environmental (Ltd)**

Compiled by

**EkolInfo CC & Associates**

September 2025

## **EkolInfo CC**

P.O. Box 72847  
Lynwood Ridge  
0040  
Pretoria  
Gauteng  
RSA  
<http://www.ekoinfo.co.za>

Member: Willem de Frey  
Registration no: CC1995/34111/23


Tel: 012-365-2546  
Fax: 012-365-3217  
Email: [wdefrey@ekoinfo.co.za](mailto:wdefrey@ekoinfo.co.za)



**25 Years**

1995 - 2020

## CONTRIBUTING ASSOCIATES

<b>Company</b>	EkolInfo CC				
<b>Person</b>	Willem de Frey				
<b>Qualifications</b>	MSc Wildlife Management – UP, 1999				
<b>Field expertise of</b>	Flora, Ecology, Soil, Wetlands, GIS				
<b>Years experience</b>	25 – Full time				
<b>Professional Registration</b>	Pr.Sci.Nat. - Botany & Ecology (400100/02)				
<b>Component</b>	Flora, Fauna, Terrestrial & Wetlands				
<b>Telephone</b>	012 365 2546				
<b>Fax</b>	012 365 3217				
<b>Cell phone</b>	082 579 5049				
<b>Email</b>	wdefrey@ekoinfo.co.za				
<b>Logo</b>					

### DISCLAIMER AND COPY RIGHT

EkolInfo CC and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions (SACNASP) within their spheres of expertise as determined by their peers. They have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science, namely: objectivity, transparency and repeatability while applying internationally and nationally accepted scientific methods.

The report and its content remain the intellectual property of EkolInfo CC and its associates until all accounts had been settled in full, whereby it may only be used in the project for which had been prepared for. Once released within the public domain via the Environmental Impact Assessment (EIA) process, it would be sincerely appreciated that the source is referenced when used to support approaches or results in projects of a similar nature or environment.

<b>Report Status</b>	<b>Version</b>	<b>File Route</b>
FINAL	1	C:\02_Projects\01_EkolInfo\20250827Eko_KnopfonteinSiteVerification_GreenEnv\Reports\tx\EkolInfo CC Knopfontein Chicken Farm Site Verification Green Env.docx

# 1 EXECUTIVE SUMMARY

Green Environmental (Ltd) hired EkolInfo CC & Associates to conduct a site verification survey for a proposed chicken farm on a portion of the farm Knopfontein 101 in the Northwest Province. This report, compiled by Willem de Frey, a registered scientific professional, verifies the environmental sensitivity of the site regarding flora, fauna, and terrestrial biodiversity themes. The site visit was conducted on September 13, 2025.

## Key Findings

**Flora and Fauna:** The site verification confirmed the low sensitivity status for both plant and animal themes as identified by the national environmental screening tool. While a sensitive plant species (sensitive species 1261) has a moderate potential to occur in the untransformed eastern section of the study area, the western section is historically cultivated. The eastern part represents persistent natural vegetation, which provides potential habitat for generalist animals like mongooses, porcupines, and jackals.

**Wetland Conditions:** A significant finding is the presence of human-induced wetland conditions on the site: Despite a model suggesting a low to moderate probability of wetlands, all four soil types sampled were associated with wetland conditions, with some areas now considered seasonal wetlands due to increased soil moisture from adjacent cultivated fields. The soil types recorded were Pinedene, Sepane, Wasbank, and Longlands.

## Recommendations and Conclusion

The report recommends that the chicken farm footprint be moved to a different location if possible, to avoid the current human-induced wetland areas and to minimize the transformation of persistent natural vegetation. An alternative location with a lower probability of wetlands is suggested, but it would require a detailed wetland delineation to clarify its status. The project would result in a 2% transformation of Portion 21 of the farm Knopfontein 101.

## TABLE OF CONTENT

<b>1 EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>2 INTRODUCTION .....</b>	<b>5</b>
<b><u>2.1 Scope of work/ Terms of reference.....</u></b>	<b><u>5</u></b>
<b>3 STUDY AREA .....</b>	<b>8</b>
<b>4 METHOD STATEMENT .....</b>	<b>8</b>
<b><u>4.1.1 Limitations And Assumptions .....</u></b>	<b><u>8</u></b>
<b>5 RESULTS.....</b>	<b>13</b>
<b><u>5.1 Ecological Condition And Wetland Assessment.....</u></b>	<b><u>13</u></b>
<b><u>5.1.1 Ecological Condition.....</u></b>	<b><u>13</u></b>
<b><u>5.1.2 Wetland Potential .....</u></b>	<b><u>13</u></b>
<b><u>5.2 Flora Species Of Conservation Concern.....</u></b>	<b><u>17</u></b>
<b><u>5.3 Fauna Species Of Conservation Concern.....</u></b>	<b><u>17</u></b>
<b>6 CONCLUSION.....</b>	<b>17</b>
<b>7 REFERENCES .....</b>	<b>19</b>
<b>8 APPENDIX A – ABRIDGE CV, PRINCIPLE CONSULTANT .....</b>	<b>22</b>
<b>9 APPENDIX B – GROUND BASED DIGITAL IMAGERY .....</b>	<b>24</b>
<b>10 APPENDIX C – WETNESS INDEX OVERVIEW .....</b>	<b>26</b>

## LIST OF FIGURES

Figure 1: Regional orientation of the proposed chicken farm – Northwest Province, South Africa .....	6
Figure 2: National Environmental Screening Tool – Flora, Fauna &Terrestrial Biodiversity Themes .....	7
Figure 3: Local orientation of the proposed chicken farm development footprint .....	9
Figure 4: Regional vegetation (2018) and Northwest Province Biodiversity Sector Plan (2015) associated with the proposed chicken farm development area .....	10
Figure 5: The land cover 2022 classification indicates that the eastern section of the study area represents mainly natural vegetation (woodland & grassland).....	11
Figure 6: Overview of the change in land cover that occurred within the study area from 1990 to 2022..	12
Figure 7: Distribution of the four observation points across the study area with the SAGA wetness index high probability areas.....	14
Figure 8: Old image from 1944 showing the untransformed nature of the western section of the study area .....	15
Figure 9: Old image from 1963 showing the transformed nature of the western section of the study area, with the current infrastructure .....	16
Figure 10: Possible alternative location for the proposed chicken farm with a lower probability of wetlands being present. ....	18

## 2 INTRODUCTION

Green Environmental Services (Pty) Ltd appointed EkoInfo CC to do a site verification survey of the flora, fauna and terrestrial biodiversity components based on the environmental screening tool results for the proposed chicken farm development on a portion of the farm Knopfontein 101, in the Northwest Province (Figure 1). The verification concerns the flora, fauna and terrestrial biodiversity themes (Figure 2).

### 2.1 Scope of work/ Terms of reference

The scope of work is based on the protocol for the specialist assessment and minimum report content requirements for environmental impacts with regards to the flora, fauna and terrestrial biodiversity<sup>1</sup>.

This document concerns the site verification and minimum report content requirements, which require the following:

“Prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a site sensitivity verification.

2.1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist.

2.2. The site sensitivity verification must be undertaken through the use of:

- (a) a desk top analysis, using satellite imagery;
- (b) a preliminary on-site inspection; and
- (c) any other available and relevant information.

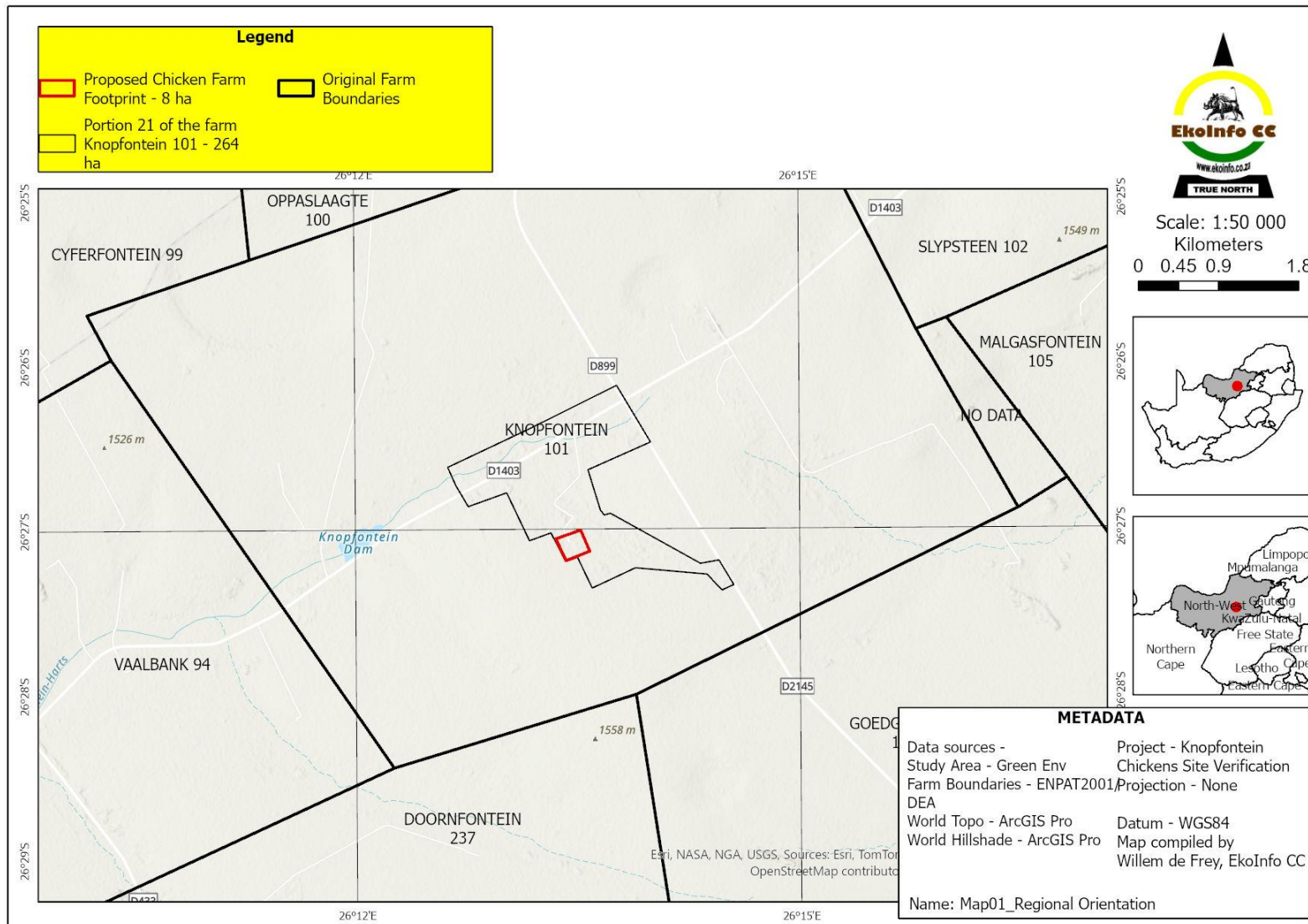
2.3. The outcome of the site sensitivity verification must be recorded in the form of a report that:

- (a) confirms or disputes the current use of the land and environmental sensitivity as identified by the screening tool;
- (b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
- (c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.”

Willem de Frey, a registered scientific professional in the fields of ecological – and botanical science with more than 25 years’ experience facilitated the study. The site visit was done on the 13<sup>th</sup> of September 2025.

---

<sup>1</sup> <https://www.sanbi.org/news/national-protocols-and-guidelines-standardise-requirements-for-specialist-studies-in-eias/>



**Figure 1: Regional orientation of the proposed chicken farm – Northwest Province, South Africa**

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at [eladatarequests@sanbi.org.za](mailto:eladatarequests@sanbi.org.za) listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

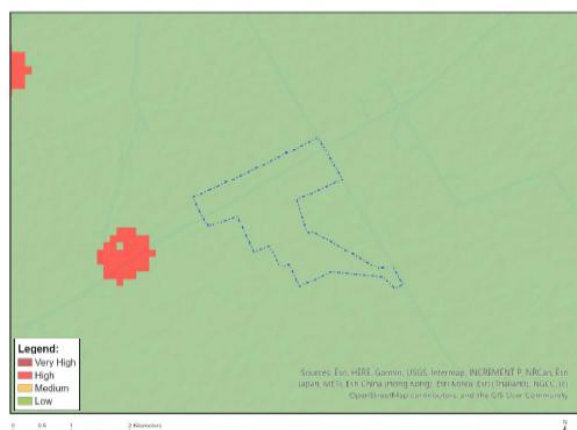
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 1261

#### A – Relative Plant Species Theme Sensitivity

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at [eladatarequests@sanbi.org.za](mailto:eladatarequests@sanbi.org.za) listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Subject to confirmation

#### B – Relative Animal Species Theme Sensitivity

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	CBA1
Very High	ESA2
Very High	National Protected Area Expansion Strategy (NPAES)
Very High	EN Vaal-vet Sandy Grassland

#### C – Relative Terrestrial Biodiversity Theme Sensitivity

Figure 2: National Environmental Screening Tool – Flora, Fauna &Terrestrial Biodiversity Themes



### 3 STUDY AREA

The proposed chicken farm is located on a portion 21 of the farm Knopfontein 101 (Figure 3). It is evident that the study area is located within an agricultural landscape. On a regional scale it is associated with a single regional vegetation unit, namely Vaal – Vet Sandy Grassland (Figure 4). The conservation status of this regional vegetation unit on a national scale is Endangered.

The north to northeastern side of the proposed footprint is associated with Critical Biodiversity Area (CBA2) (Figure 4).

According to the 2022 land cover classification, the western section of the study area represents cultivated fields, while the eastern section consists of a mosaic of dense forest and woodland and natural grassland (Figure 5). Most of the area remained unchanged as far back as 1990 and therefore represent persistent natural vegetation (Figure 6). The changed that did occur was in physiognomic structure mainly between grassland, shrubland/ woodland and wetland.

### 4 METHOD STATEMENT

Willem de Frey a registered professional scientist in the field of ecological – and botanical science did a site visit on the 13<sup>th</sup> of September 2025. Systematic sites were selected within the proposed chicken farm development site using GIS software. At each of the sites the status of the vegetation was documented:

1. Natural or Cultivated
2. If natural a species list was compiled.

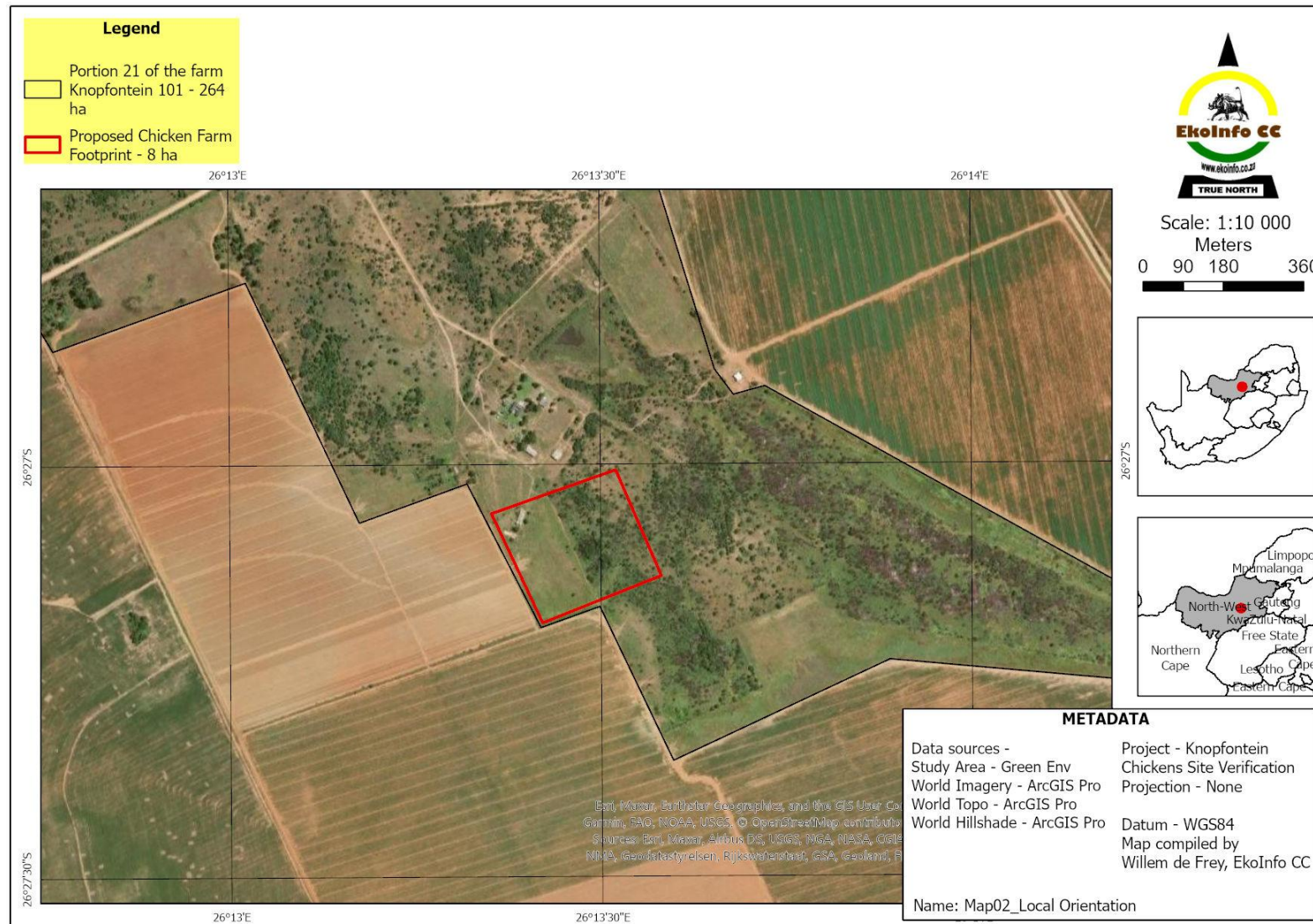
In addition, the soil form was documented to provide context to why the area was cultivated or not.

Georeferenced digital images were taken with ground and aerial based remote sensor. The ground-based images were documented using a Garmin Montana 680 GPS receiver. The aerial-based images were taken with a DJI Mavic Air drone. Images were taken in all four major wind directions, as well as video imagery in a 360° panoramic view. Unfortunately, due technical issues the drone images could not be captured.

#### 4.1.1 Limitations And Assumptions

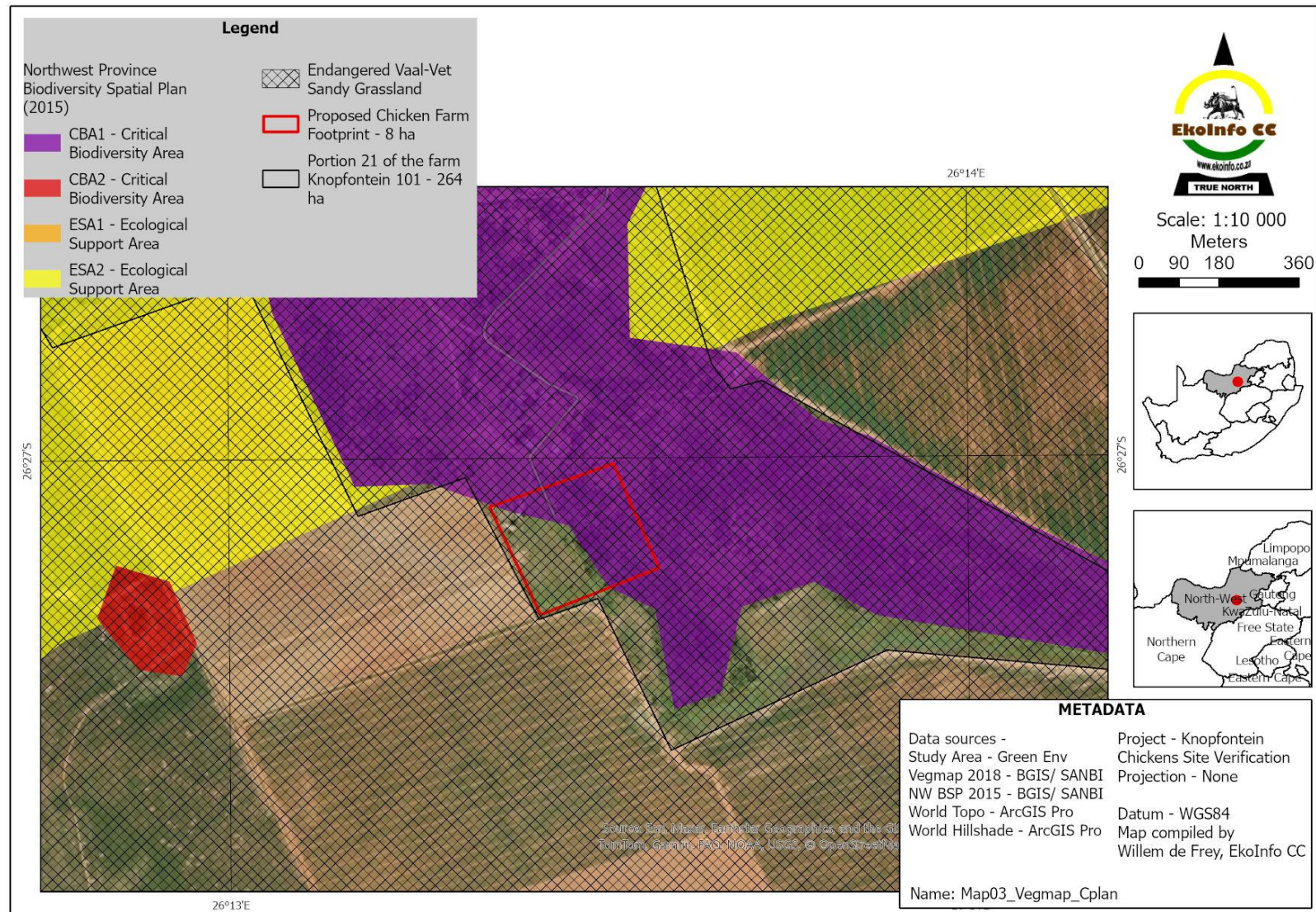
1. This study represents a site verification assessment in accordance with the national environmental screening tool guidelines. It does not represent a full EIA assessment that could be used in a BAP or Scoping-EIA process.
2. Only qualitative data was collected
3. It is assumed that information from third parties (engineers, government institutions) are accurate.





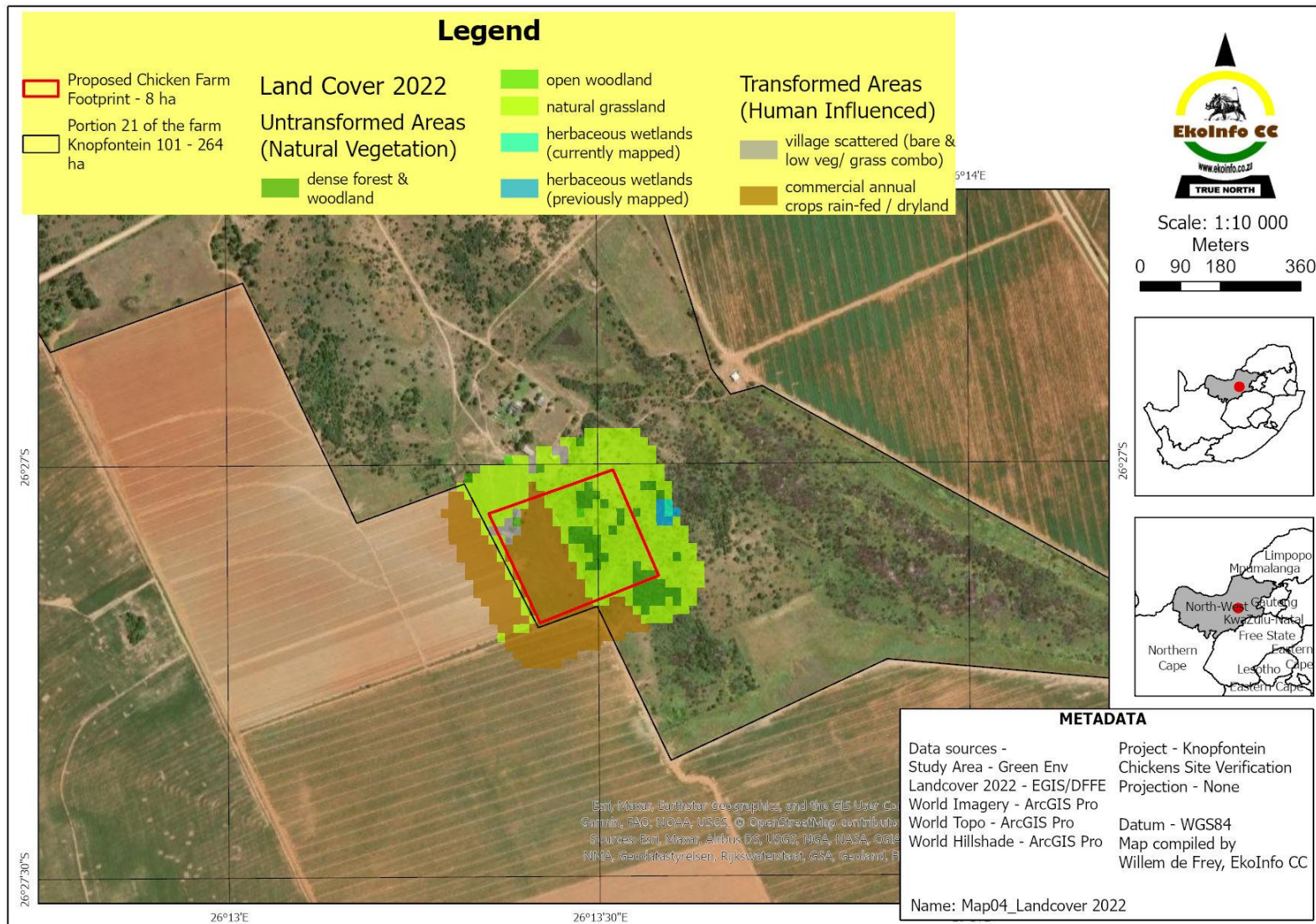
**Figure 3: Local orientation of the proposed chicken farm development footprint**





**Figure 4: Regional vegetation (2018) and Northwest Province Biodiversity Sector Plan (2015) associated with the proposed chicken farm development area**





**Figure 5: The land cover 2022 classification indicates that the eastern section of the study area represents mainly natural vegetation (woodland & grassland)**

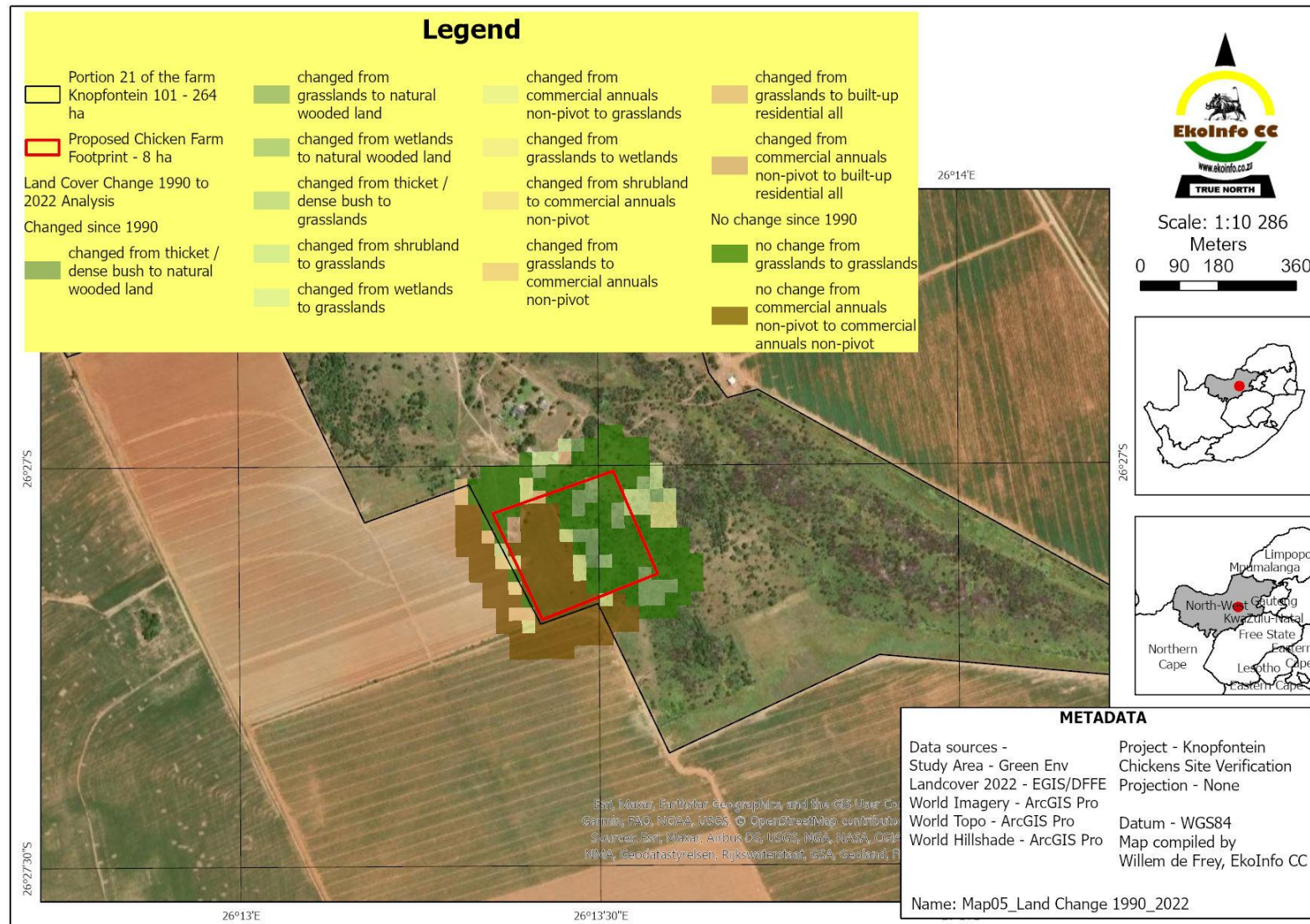


Figure 6: Overview of the change in land cover that occurred within the study area from 1990 to 2022



## 5 RESULTS

### 5.1 Ecological Condition And Wetland Assessment

#### 5.1.1 Ecological Condition

During the site verification visit (Figure 7), it was confirmed that plots one and three are located in previously cultivated land, while plots two and four are located in persistent natural vegetation. Prominent species at plots one and three are

Graminoids: *Cynodon dactylon*, *Eragrostis gummiflua*, *Hyparrhenia hirta*, ***Pennisetum clandestinum***<sup>2</sup>

Forbs: *Arctotis arctotoides*, *Bidens pilosa*, *Helichrysum caespititium*, *Senecio consanguineus*

Woody species: *Asparagus laricinus*, ***Pyracantha angustifolia***<sup>3</sup>, *Seriphium plumosum*, *Vachellia karroo*, *Ziziphus mucronate*

Most of these species are associated with disturbance (Van Oudtshoorn 1991, Van Wyk & Malan 1988).

Plots two and four contains the same disturbance species, but the following species are associated with untransformed or persistent vegetation (climax species):

Graminoids: *Cymbopogon caesius*, *Eragrostis plana*, *Themeda triandra*

Forbs: *Berkheya radula*, *Hermannia depressa*, *Lobelia erinus*

Woody species: *Diospyros lycioides*, *Searsia lancea*, *S. pyroides*

The following declared alien invasive species was noted in this area: *Opuntia ficus-indica*.

These observations confirms the land cover 2022 classification of the area, with the western section representing historically cultivated fields and the eastern section natural vegetation (woodland and grassland) (Figure 5, Figure 6).

#### 5.1.2 Wetland Potential

The following soil forms were recorded (Appendix B):

- Plot 1 – Pinedene (1 100 mm deep, estimated % clay (A horizon) – 13)
- Plot 2 – Valsrivier (900 mm > deep, estimated % clay (A horizon) – 25)
- Plot 3 – Wasbank (700 mm deep, estimated % clay (A horizon) – 11)
- Plot 4 – Longlands (800 mm > deep, estimated % clay (A horizon) – 25)

Except for the Valsrivier soil form, all the other soils are associated with temporary to seasonal wetlands (DWS 2005). The vegetation observed support this observation with species such as *Lobelia erinus* and *Seriphium plumosum*, known to grow in seasonally wet areas.

It is possible that the Valsrivier could represent the Sepane, as both soil forms have a pedocutanic B horizon, with the C-horizon, consisting of unconsolidated materials with (Sepane) or without (Valsrivier) signs of wetness (Soil Classification Workgroup 1991).

It had been observed that natural areas adjacent to cultivated fields often receive more soil moisture through the soil profile, than if the area was not ploughed. This is especially evident in areas with a gentle slope towards low lying areas. Therefore, this area would have been under natural conditions at best temporary wetlands during years of above normal rainfall, but now becomes seasonal wet, which would explain why the cultivation on the western section had been stopped. This increase in soil moisture is evident between the images from 1944 (Figure 8) and 1963 (Figure 9) as indicated by the darker shades in the 1963 images.

<sup>2</sup> Currently named *Cenchrus clandestinus*

<sup>3</sup> Species in bold and underlined = Declared alien invasive species

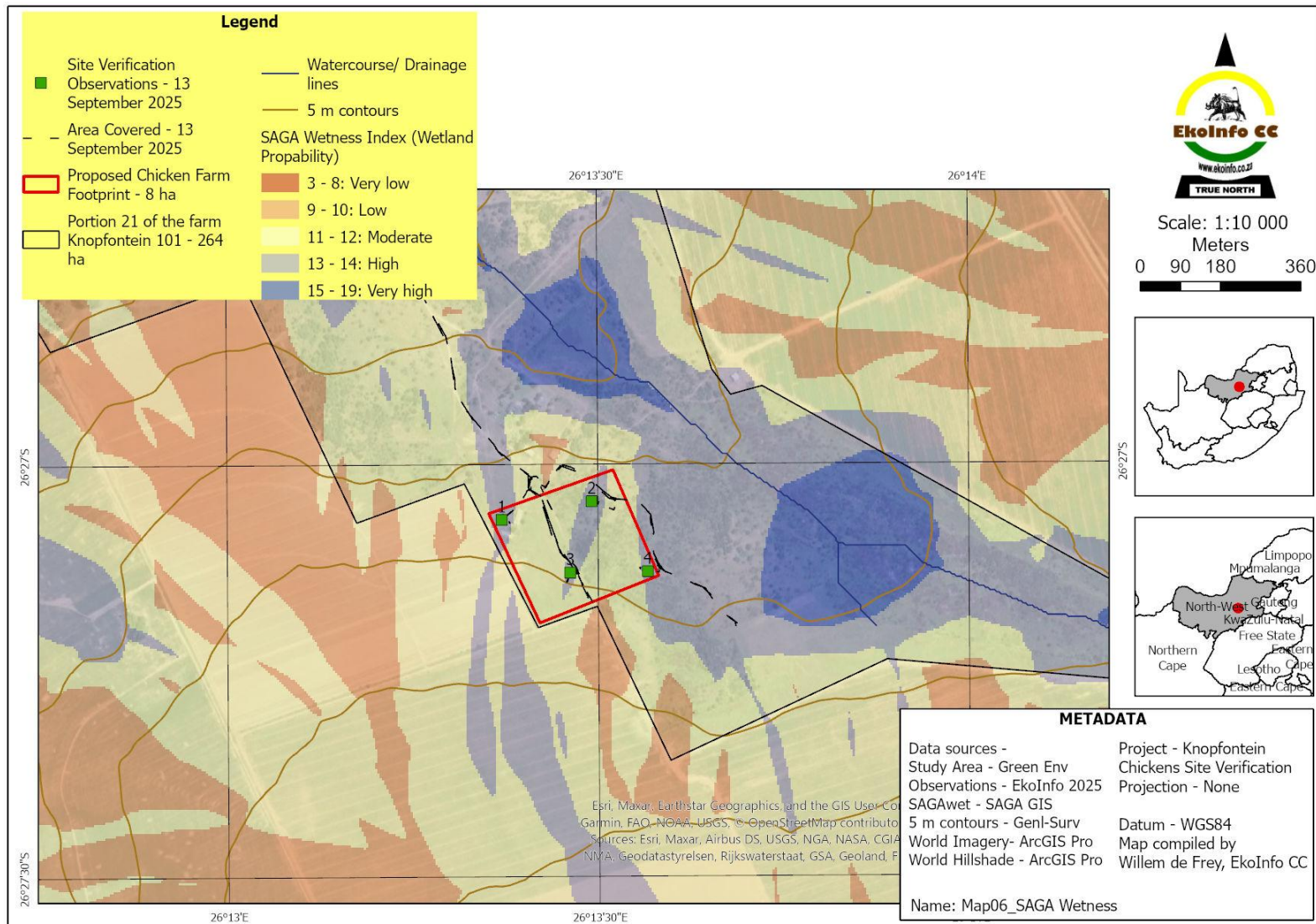
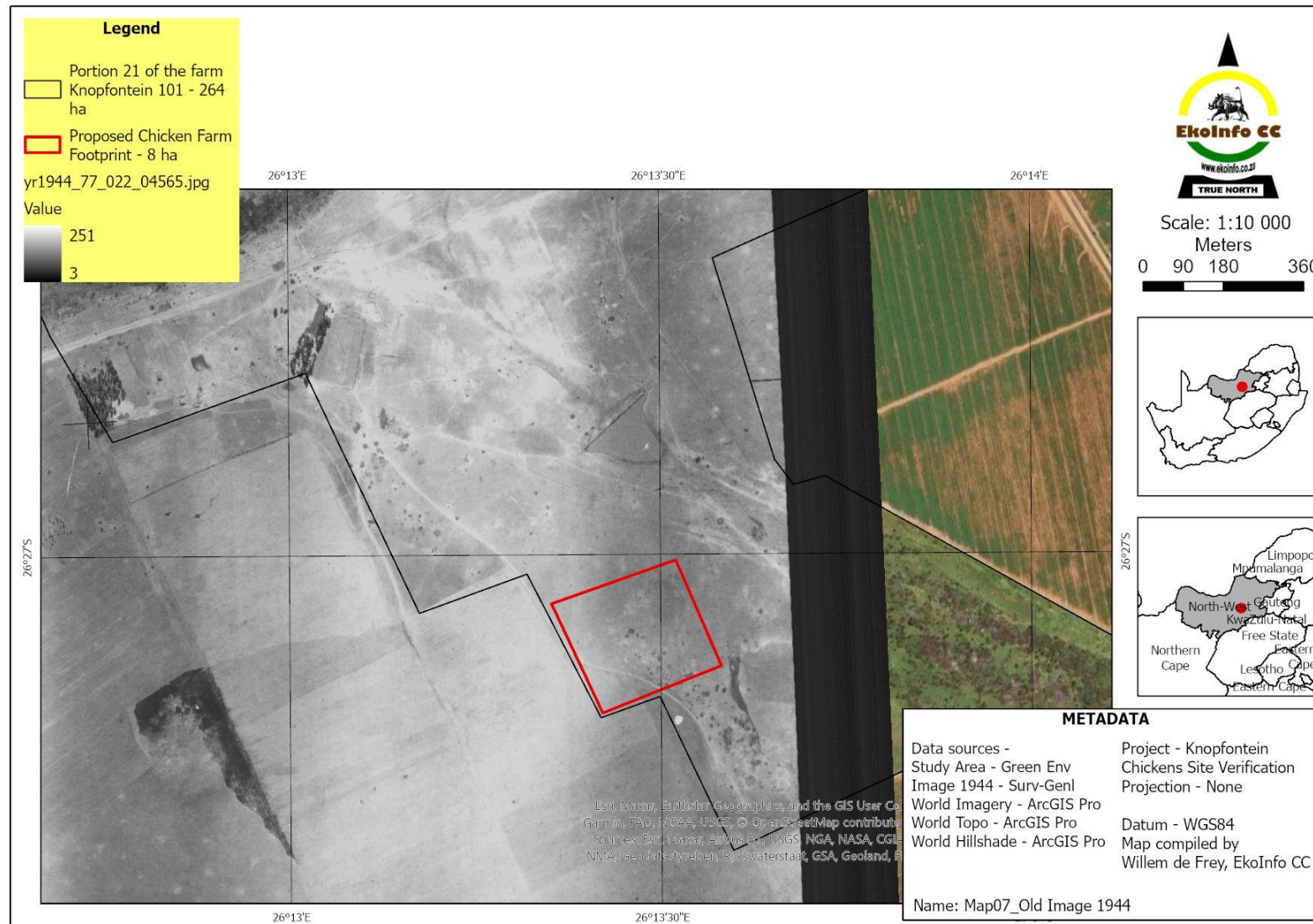


Figure 7: Distribution of the four observation points across the study area with the SAGA wetness index high probability areas



**Figure 8: Old image from 1944 showing the untransformed nature of the western section of the study area**





Figure 9: Old image from 1963 showing the transformed nature of the western section of the study area, with the current infrastructure

## 5.2 Flora Species Of Conservation Concern

A single species is listed as a species of conservation concern (Figure 2), namely sensitive species 1261. This vulnerable species from the Apocynaceae family grows on sandy loam soils in association with thorn trees and Themeda-grassland. Based on the observations made during the site verification visit, it is possible for this species to occur along the eastern section of the study area. The study area also overlaps with the potential area of occurrence of this species. Therefore, there is a moderate probability for the species to occur within the study area and surrounding untransformed areas (persistent vegetation).

## 5.3 Fauna Species Of Conservation Concern

According to the screening report (Figure 2), the area is considered to be of low sensitivity with regards to fauna. The site verification visit confirmed this low status, specifically with regards to the western section, the eastern section represents persistent natural vegetation, and therefore potential habitat for a variety of animals, although most likely generalists for example mongooses, porcupines, jackal, duikers.

# 6 CONCLUSION

Based on the observations of the site verification study, the low sensitivity of the plant and animal themes are confirmed. There is a moderate potential for the sensitive plant species to occur in the area. The main caveat is the human induced wetland conditions within the study area. Based on the available model, the probability for wetland should be very low to moderate, with isolated potential for high probability, but all of the soils surveyed are associated with wetland conditions.

It is recommended that, if possible, the footprint should be moved away from the current position. Approximately 6 ha (245 m x 245 m) is required for an alternative footprint. Figure 10 shows a possible alternative location of the proposed chicken farm footprint in an area with a lower potential for wetlands. However, this will have to be verified. **It is recommended that a detail wetland delineation be done to clarify the status of the wetlands whether in the current footprint or the alternative footprint.** Both areas are close to cultivated land and the down slope side and therefore might have experienced similar increase in soil moisture.

Both footprints will result in the transformation of persistent natural vegetation and therefore has the potential to destroy habitat for the plant species of conservation concern (sensitive species 1261). The proposed chicken farm footprint will add 2% transformation to the site, namely Portion 21 of the Farm Knopfontein 101.

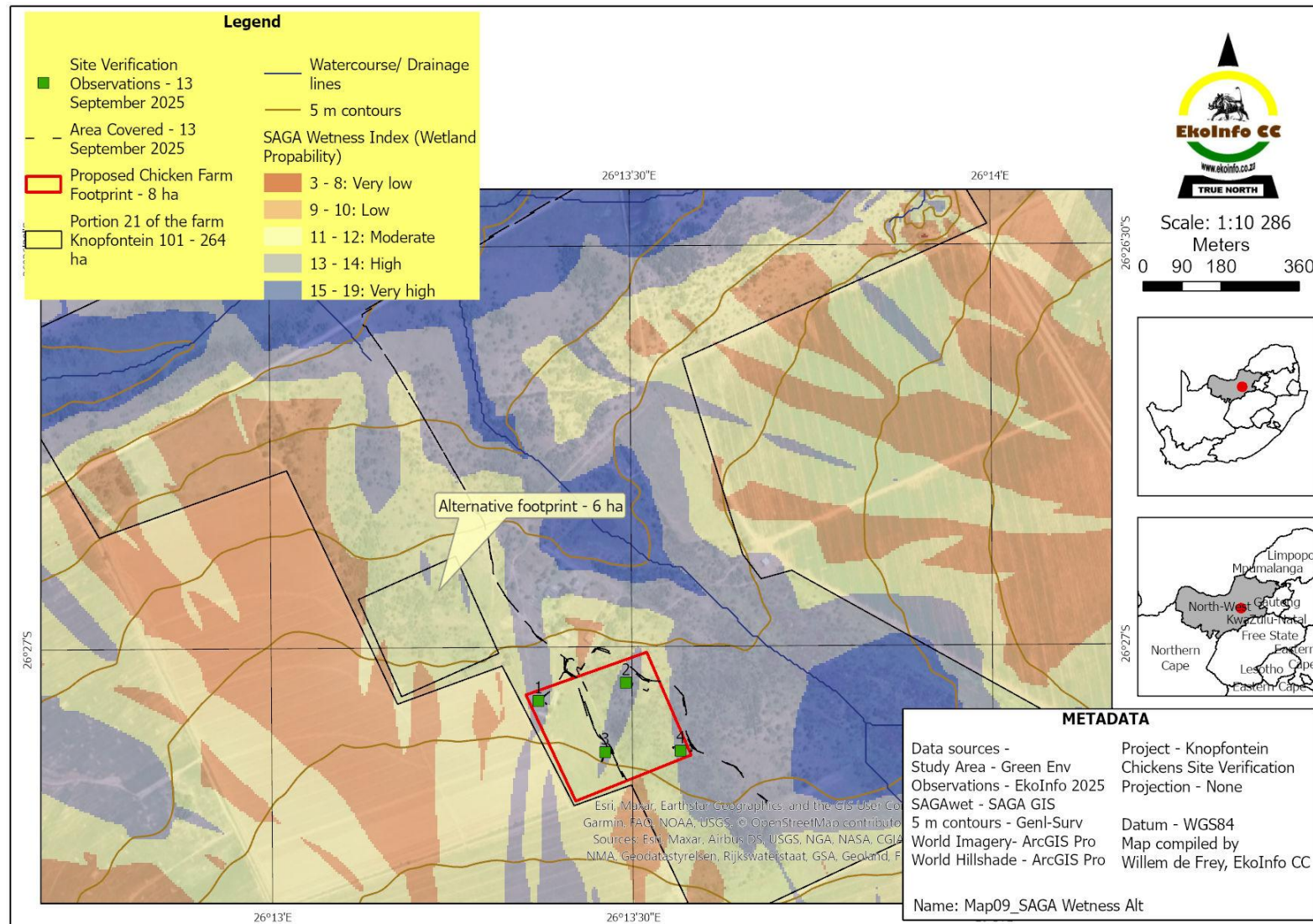


Figure 10: Possible alternative location for the proposed chicken farm with a lower probability of wetlands being present.



## 7 REFERENCES

- BARBOUR, M.G.BURK, J.H. & PITTS, W.D. 1980. Terrestrial Plant Ecology. Benjamin/Cummings Publishing Company, California.
- BROMILOW. C. 2010. Probleemplanten en Indringeronkruiden van Suid - Afrika. Briza Publikasies BK
- BROWN, L.R., DU PREEZ, P.J., BEZUIDENHOUT, H., BREDENKAMP, G.J., MOSTERT, T.H.C. & COLLINS, N.B., 2013, 'Guidelines for phytosociological classifications and descriptions of vegetation in southern Africa', Koedoe 55(1), Art. #1103, 10 pages. <http://dx.doi.org/10.4102/koedoe.v55i1.1103>
- BOTHMA, J du P. 1995. Wildspasbestuur Nuwe uitgebreide uitgawe. 2de Uit. Struik Uitgewers
- COATES-PALGRAVE, M. 2002. Keith Coates-Palgrave Trees of Southern Africa, 3 rd edn, 2nd imp. Struik Publishers, Cape Town
- COWAN, G.I. (ed) 1995. Wetlands of South Africa. Department of Environmental Affairs and Tourism, Pretoria
- DE FREY, W.H. 1999. PHYTOSOCIOLOGY OF SOUTHEASTERN MPUMALANGA HIGH ALTITUDE GRASSLANDS. MSc. Thesis, University of Pretoria.
- DWAF. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Department of Water Affairs and Forestry
- DYER, C. (Director) (2014) New names for the African Acacia species in Vachellia and Senegalia , Southern Forests: a Journal of Forest Science, 76:4, iii-iii, DOI: 10.2989/20702620.2014.980090
- EDWARDS, D. 1983. A broad-scale structural classification of vegetation for practical purposes. Bothalia 14, 3 & 4: 705 - 712.
- EWART-SMITH, J., OLLIS, D., DAY, J & MALAN, H 2006. NATIONAL WETLAND INVENTORY: Development of a Wetland Classification System for South Africa. The Water Research Commission (WRC)
- FEY, M. 2010. Soils of South Africa. Cambridge
- FORMAN, R.T.T., SPERLING, D., BISSONETTE, J.A., CLEVINGER, A.P., CUTSHALL, C.D., DALE, V.H., FAHRIG, L., FRANCE, R., GOLDMAN, C.R., HEANUE, K., JONES, J.A., SWANSON, F.J., TURRENTINE, T., WINTER, T.C. 2003. ROAD ECOLOGY Science and Solutions. Island Press.
- GERMISHUIZEN, G & MEYER, N.L. (eds) 2003. Plants of southern Africa: an annotated checklist. Strelitzia 14. National Botanical Institute, Pretoria.
- GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L. BARKER, N.P., ANDERSON, H.M. & DALWITZ, M.J. 1990. GRASSES OF SOUTHERN AFRICA. National Botanical Gardens, South Africa
- GDARD. 2014. GDARD REQUIREMENTS FOR BIODIVERSITY ASSESSMENTS VERSION 3. Department Of Agriculture, Conservation And Environment Directorate Of Nature Conservation. Enquiries: Phuti.Matlamela@gauteng.gov.za SCIENTIFIC SERVICES
- GOLDING, J (Ed.s), 2002. Southern African Plant Red Data Lists. Sabonet Report no. 14. Southern African Botanical Diversity Network. Pretoria
- HENNEKENS, S.M. 1996. TURBO(VEG) Software package for input, processing, and presentation of phytosociological data. User's guide. University of Lancaster.

- HILTY, J.A., LIDICKER JR., W.Z. & MERENLENDER, A.M. 2006. CORRIDOR ECOLOGY The Science and Practice of Linking Landscapes for Biodiversity Conservation. Island Press
- JOHNSON, M.R., ANHAEUSSER, C.R. & THOMAS, R.J. (Eds) 2006. The Geology of South Africa. Geological Society of South Africa, Johannesburg/ Council of Geoscience, Pretoria, 691 pp
- KENT, M. & COKER, P. 1992. Vegetation Description and Analysis: A practical Approach. John Wiley & Sons, Chichester
- KRUGER, G.P. 1983. 1: 2 500 000 scale. Terrain morphological map of southern Africa Soil & Irrigation Institute. Dept. of Agriculture.
- LAND TYPE SURVEY STAFF. 1985. Land types of the maps 2628 East Rand, 2630 Mbabane. Mem. agric. nat. Resour. S. Afr. No. 5
- LAND TYPE SURVEY STAFF. 1987. Land types of the maps 2526 Rustenburg, 2528 Pretoria. Mem. agric. nat. Resour. S. Afr. No. 8
- LE ROUX, J. 2002. The Biodiversity of South Africa 2002 Indicators, Trends and Human Impacts. Endangered Wildlife Trust
- LEISTNER, O.A. (ed) 2000. Seed plants of southern Africa: families and genera. Strelitzia 10. National Botanical Institute, Pretoria
- LINDENMAYER, D.B. & FISCHER, J. 2006. Habitat Fragmentation And Landscape Change An Ecological And Conservation Synthesis. Island Press, USA
- MC MURTY, D., GROBLER, L, GROBLER, J. & BURNS, S. 2008. Field Guide to the ORCHIDS of Northern South Africa and Swaziland. Umdaus Press, Hatfield
- McCARTHY, T. & RUBIDGE, B. 2005. The Story Of EARTH & LIFE A southern African perspective on a 4.6-billion-year journey. Struik Publishers
- MUCINA, L. & RUTHERFORD, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- NEL, J., MAREE, G., ROUX, D., MOOLMAN, J., KLEYNHANS, N., SILBERBAUER, M. & DRIVER, A. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific
- NEL, J.L., DRIVER, A., STRYDOM, W.F., MAHERRY, A., PETERSEN, C., HILL, L., ROUX, D.J., NIENABER, S., VAN DEVENTER, H., SWARTZ, E., & SMITH-ADAO, L.B. 2011. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report No. TT 500/11
- READ, H.H. & WATSON, J. 1983. Introduction to Geology Volume 1 PRINCIPLES. Macmillan Press Ltd, Hong Kong
- NORMAN, N. & WHITFIELD, G. 2006. A traveller's guide to South Africa's rocks and landforms Geological Journeys. Struik Publishers
- RETIEF, E. & HERMAN, P.P.J. 1997. Plants of the northern provinces of South Africa: keys and diagnostic characters. Strelitzia 6: 1 – 681.
- ROUGET, M., REYERS, B., JONAS, Z., DESMET, P., DRIVER, A., MAZE, K., EGOH, B. & COWLING, R.M. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.
- SMIT, N. 2008. Field Guide to the Acacias of South Africa. Briza Publications

- SOIL CLASSIFICATION WORKGROUP 1991. Soil classification a taxonomic system for South Africa. Memiors oor die Natuurlike Landbouhulpbronne van Suid-Afrika Nr. 15.
- STRAHLER, A.N. & STRAHLER, A.H. 1987. Modern Physical Geography Third Edition. Wiley & Sons, New York
- STRAHLER, A.N. 1962. Physical Geography. John Wiley & Sons, New York
- TAINTON, N. 1999. Veld Management in South Africa. University of Natal Press
- TURNER, M.G., GARDNER, R.H., & O'NEILL, R.V. 2001. Landscape Ecology In Theory And Practice Pattern And Process. Springer, USA
- VAN ANDEL, J & ARONSON, J (Eds). 2006. RESTORATION ECOLOGY - The New Frontier. Blackwell Publishing
- VAN OUDTSHOORN, F.P. 1991. Gids tot grasse van Suid-Afrika. Briza Publikasies Bk. Arcadia.
- VAN WYK, A.E. & SMITH, G.F. 2001. Regions of Floristic Endemism in Southern Africa. Umdaus Press, Hatfield
- VAN WYK, B. & MALAN, S. 1988. Veldgids tot die veldblomme van die Witwatersrand- & Pretoria-gebied. Struik Uitgewers, Kaapstad.
- VAN WYK, B-E., VAN OUDTSHOORN, B. & GERICKE, N. 2000. Medicinal Plants of South Africa. Briza
- VAN WYK, B. & VAN WYK, P. 1997. Field Guide to Trees of Southern Africa. Struik Nature, Cape Town
- VAN WYK, B., VAN WYK, P. & VAN WYK, B-E. 2000. Photo Guide to Trees of Southern Africa. Briza Publications
- VILJOEN, M.J. & REIMOLD, W.U. 1999. An Introduction to South Africa's Geological and Mining Heritage. Mintek
- WHITE, R.E. 1987. Introduction to the Principles and Practice of Soil Science. Blackwell Scientific Publications, Australia
- WIENS, J.A., MOSS, M.R., TURNER, M.G. & MLADENOFF, D.J. 2006. Foundation Papers In Landscape Ecology. Columbia University Press, New York

## 8 APPENDIX A – ABRIDGE CV, PRINCIPLE CONSULTANT

Name of firm: EkolInfo cc Environmental and Wildlife Management Consultancy

Name of staff: WILLEM HENDRIK DE FREY

Profession: Environmental and Wildlife Management consultant

Years with firm: Since 1995

Nationality: RSA

Membership of professional societies:

The South African Council for Natural Scientific Professions (Reg no 400100/02)

Categories: Botanical Science and Ecological Science

Currently in the process of affiliating to:

South African Association of Botanist (SAAB)

Grassland Society of Southern Africa

South African Institute of Ecologist and Environmental Scientists (SAIE)

### KEY QUALIFICATIONS:

Mr W de Frey has been involved in the discipline of ecology since 1989. During this period he prepared himself for a profession in environmental and wildlife management, by attending courses in chemistry, geology, pedology and statistics, while majoring in Botany and Zoology. His working knowledge was obtained while completing projects for his post-graduate studies in wildlife management in both the Savanna and Grassland Biomes. In addition to his academic publications, he has contributed to numerous reports regarding EMPR's, EIA's, vegetation - and soil surveys and monitoring since the registration of his own consultation close corporation in 1995. He is actively involved in the management and marketing of his close corporation while completing tasks in his field of expertise namely soil, vegetation science and Geographical Information Systems. Mr W de Frey is task orientated with consideration of people's needs and safety. He beliefs in a holistic approach to environmental and wildlife management and has therefore established a network with individuals in related fields. He is also assisting previously disadvantaged persons in establishing a presence in the environmental industry, namely Lordwick Makhura of Baagi Environmental Consultancy CC and a joint venture company Bonolo Biodiversity And Environmental Management consisting of Baagi Environmental Consultancy CC and Disa Mphago Community Helpers CC.

### EDUCATION:

1992 BSc Botany & Zoology, University of Pretoria

Course	Content	Level
Chemistry	Organic and Inorganic chemistry	1 <sup>st</sup> year
Geology	Introduction/ Geomorphology, Stratigraphy, Structural, Sedimentology Palaeontology, Crystallography	1 <sup>st</sup> and 2 <sup>nd</sup> year
Pedology	Introduction, soil classification, soil fertility, soil ecology, soil physics	1 <sup>st</sup> and 2 <sup>nd</sup> year
Botany	Morphology, Anatomy, Physiology, Taxonomy, Mycology, Ecology, Reproductive biology	1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> year
Zoology	Taxonomy (Vertebrates and Invertebrates), Physiology (mainly vertebrates), Ecology (mainly vertebrates), Animal behaviour (mainly vertebrates)	1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> year
Statistics	Sampling methods, Statistical Analysis, Probabilities	1 <sup>st</sup> year

1993 BSc (Hons) (Cum laude) Wildlife Management, University of Pretoria

Dissertation: 'N HOLISTIESE EKOLOGIESE BENADERING TOT DIE DRAKRAGBEPALING VAN 'N GEMENGDE WILD- EN BEESBOERDERY IN DIE UBOMBO DISTRIK, MET ENKELE BESTUURS AANBEVELINGS, 1993

1999 MSc (Cum laude) Wildlife Management, University of Pretoria

Thesis: PHYTOSOCIOLOGY OF THE MPUMALANGA HIGH ALTITUDE GRASSLANDS, 1999



## COURSES/ WORKSHOPS ATTENDED

1. Red List And Threatened Species Assessment Training Workshop, Hosted by the Conservation Breeding Specialist Group Southern Africa & Endangered Wildlife Trust, December 2003
2. National State of the Environment Workshop, Hosted by DEAT and SRK, ESKOM Convention Centre – November 2004
3. Gauteng Red Data Flora Workshop, Hosted by SANBI and GDACE – November 2005
4. Gauteng Flora Minimum Requirement Workshop, Hosted by GDACE Nature Conservation – August 2007

## EMPLOYMENT RECORD:

1986 – 1987

5 Signals Regiment, SADF

1998 – 1993 – Parttime

Council of Geoscience, Palaeontology Section

University of Pretoria, Botany Department

Academy of Marksmanship, Range Officer

U Huisoppasser, Own enterprise

1994 – 1995

University of Pretoria, Botany Department, Assistant researcher

1995 – present

EkolInfo cc Environmental and Wildlife Management Consultancy, Founding member and consultant

Overall EkolInfo CC's principal consultant completed or administrated more than 58 vegetation studies as part of Environmental Impact Assessments within all of South Africa's nine provinces and adjacent countries such as Botswana and Mozambique with a focus on either terrestrial vegetation and/ or wetlands. Some projects were on provincial level such as the Mpumalanga and Gauteng Degradation Projects coordinated by the Institute for Soil, Climate and Water and sponsored by National Department of Agriculture. The majority of projects were on local scale from 5 ha to 50 000 ha or more for local developers and corporate institutions (SASOL, Anglo Coal, BHP Billington, Ingwe Coal, Deneys Rietz Attorneys, ESKOM) facilitated independently or as a subcontractor/ specialist for the following institutions: Oryx Environmental CC, African EPA, Arcuss Gibb, Digby Wells and Associates, Nature and Business Alliance and Eyethu Engineers, Strategic Environmental Focus.

## COMMUNITY SERVICE

1. Substitute lecture – 2nd & 3rd year Botany Practical (Vegetation Survey Methods), University of Pretoria -1994 & 1995
2. Guest lecture – Wetland Vegetation Communities (2nd year students), Department of Landscape Architecture, University of Pretoria – 1996 & 1997
3. Guest lecture – Principles of Ecology (1st year students), Department of Landscape Architecture, University of Pretoria – 2002
4. Guest lecture – Principles of vegetation survey and mapping for EIA's (3rd year students), Department of Landscape Architecture, University of Pretoria – 2003
5. Referee – ILASA Merits Awards (Environmental Planning), Institute for Landscape Architects of South Africa - 2003

## LANGUAGES:

Language	Capability
----------	------------

English & Afrikaans	Speak, Read, Write - sufficient
---------------------	---------------------------------

Sepedi (Northern Sotho)	Speak, Read, Write – insufficient
-------------------------	-----------------------------------

## 9 APPENDIX B – GROUND BASED DIGITAL IMAGERY

**Note**

1. The photo sequence is plot 1, 2, 4 and 3
2. Image facing sequence: North, East, South, West
3. Image five is the soil profile, and image 6 is the field test soil sausage for the soil texture determination

Plot no	Name	Date Time	Direction	Longitude	Latitude	Altitude (m)
1	DSC09275.jpg	2025-09-13 8:45:36	345.916	26.22282	-26.4511	1492.97
	DSC09276.jpg	2025-09-13 8:45:42	80.0715	26.22283	-26.4511	1493.95
	DSC09277.jpg	2025-09-13 8:45:48	186.352	26.22283	-26.4511	1493.94
	DSC09278.jpg	2025-09-13 8:45:54	274.112	26.22283	-26.4511	1493.94
	DSC09279.jpg	2025-09-13 8:51:48	205.713	26.22282	-26.4511	1491.59
	DSC09280.jpg	2025-09-13 8:54:39	219.879	26.22284	-26.4511	1490.72
2	DSC09281.jpg	2025-09-13 9:28:55	345.238	26.22486	-26.4507	1488.36
	DSC09282.jpg	2025-09-13 9:29:01	124.2	26.22487	-26.4507	1488.37
	DSC09283.jpg	2025-09-13 9:29:08	188.41	26.22487	-26.4507	1490.99
	DSC09284.jpg	2025-09-13 9:29:15	244.47	26.22487	-26.4507	1490.99
	DSC09285.jpg	2025-09-13 9:40:02	282.936	26.2249	-26.4508	1490.14
	DSC09286.jpg	2025-09-13 9:41:55	314.593	26.2249	-26.4508	1490.41
4	DSC09287.jpg	2025-09-13 10:09:20	346.391	26.2261	-26.4522	1501.11
	DSC09288.jpg	2025-09-13 10:09:26	95.5603	26.22611	-26.4522	1501.12
	DSC09289.jpg	2025-09-13 10:09:32	198.078	26.22611	-26.4522	1501.91
	DSC09290.jpg	2025-09-13 10:09:38	256.783	26.22612	-26.4522	1501.92
	DSC09291.jpg	2025-09-13 10:15:15	97.8273	26.22613	-26.4522	1502.62
	DSC09292.jpg	2025-09-13 10:18:36	132.016	26.22612	-26.4522	1502.45
3	DSC09293.jpg	2025-09-13 10:43:10	344.608	26.22438	-26.4522	1505.13
	DSC09294.jpg	2025-09-13 10:43:15	58.3507	26.22439	-26.4522	1505.11
	DSC09295.jpg	2025-09-13 10:43:21	176.212	26.22439	-26.4522	1505.11
	DSC09296.jpg	2025-09-13 10:43:27	270.872	26.22439	-26.4522	1505.1
	DSC09299.jpg	2025-09-13 10:54:20	3.94902	26.22437	-26.4522	1504.04
	DSC09300.jpg	2025-09-13 10:56:11	39.4664	26.22437	-26.4522	1503.93

Please refer to the images on the next page.





DSC09275



DSC09276



DSC09277



DSC09278



DSC09279



DSC09280



DSC09281



DSC09282



DSC09283



DSC09284



DSC09285



DSC09286



DSC09287



DSC09288



DSC09289



DSC09290



DSC09291



DSC09292



DSC09293



DSC09294



DSC09295



DSC09296



DSC09299



DSC09300

## 10 APPENDIX C – WETNESS INDEX OVERVIEW

A **wetness index** in GIS is a spatial metric used to predict the distribution and persistence of surface or subsurface water in a landscape based on topography. It is particularly useful in hydrological modeling, soil moisture estimation, and ecological studies. Wetness indexes help identify areas prone to water accumulation, making them important for understanding flood risks, vegetation patterns, and habitat suitability.

### Purpose of a Wetness Index

The wetness index reflects:

1. **Water Accumulation:** Predicts zones where water is likely to collect due to topography.
2. **Soil Saturation:** Indicates areas with higher potential for soil saturation.
3. **Hydrological Connectivity:** Helps in modeling runoff and drainage patterns.
4. **Environmental Applications:** Supports agricultural planning, wetland identification, and habitat conservation.
- 5.

### Topographic Wetness Index (TWI)

The **Topographic Wetness Index (TWI)**, or **Topowet**, is a widely used index calculated as:

$$TWI = \ln(\alpha / \tan\beta)$$

- $\alpha$ : **Upslope contributing area per unit width ( $m^2/m$ )** – the area draining into a point, reflecting water input.
- $\tan\beta$ : **Slope angle (radians)** – representing water flow potential (steeper slopes promote faster drainage).

#### Key Features:

- Highlights areas where water accumulates based on slope and upslope area.
- Commonly used for hydrological and soil moisture studies.
- Assumes uniform soil properties and water flow.

### SAGA Wetness Index (SWI)

The **SAGA Wetness Index (SWI)**, developed in the SAGA GIS software, is a modified version of TWI that incorporates additional considerations for areas with minimal slope. It is calculated as:

$$SWI = \ln(\alpha / \tan\beta + 1)$$

#### Key Features:

- Addresses issues in areas with very low slope angles ( $\tan\beta$  approaches 0), which can cause TWI to become unrealistically high.
- Adds a constant (+1) to the slope term, stabilizing the index in flat areas.
- Provides more realistic wetness predictions in low-relief landscapes and floodplains.

### Differences Between TWI and SWI

Aspect	TWI (Topowet)	SWI (SAGA Wetness Index)
<b>Slope Adjustment</b>	No correction for flat areas; sensitive to small $\tan\beta$ .	Adds 1 to $\tan\beta$ , stabilizing calculations in flat areas.
<b>Application Focus</b>	Better for steep and moderate slopes.	More effective for flat or gently sloping terrain.
<b>Calculation Simplicity</b>	Straightforward logarithmic function.	Slightly more complex, with added slope term.
<b>Usability in GIS</b>	Used in various GIS platforms.	Primarily available in SAGA GIS but adaptable.

### When to Use Each

- Use **TWI** for areas with moderate to steep slopes where slope and water accumulation dominate hydrology.
- Use **SWI** in low-relief or floodplain environments where small slopes can exaggerate wetness predictions.

Both indexes are valuable tools, and the choice depends on the topography and the hydrological characteristics of the study area.