AQUATIC SITE SENSITIVITY VERIFICATION REPORT FOR THE PROPOSED NDAU 1 SOLAR ENERGY FARM, NEAR POLOKWANE, IN THE LIMPOPO PROVINCE.

JUNE 2023

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1. SPECIALIST DETAILS, EXPERTISE AND DECLARATION

1.1. QUALIFICATIONS OF SPECIALIST CONSULTANT

Name: Antonia Belcher
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Email: toni@bluescience.co.za
Profession: Aquatic Scientist (P. Sci. Nat. 400040/10)
Fields of Expertise: Specialist in freshwater assessments, monitoring and reporting
Years in Profession: 30+ years

Toni Belcher worked for the Department of Water Affairs and Forestry for more than 17 years. During this period, she worked for the Directorate Water Quality Management, the Institute for Water Quality Studies and the Western Cape Regional Office and has built up a wide skills base on water resource management and water resource quality for rivers, estuaries and the coastal marine environment. Since leaving the Department in 2007, she has been working in her private capacity and was co-owner of BlueScience (Pty) Ltd, working in the field of water resource management and has been involved in more than 500 aquatic ecosystem assessments for environmental impact assessment and water use authorisation purposes. In 2006 she was awarded a Woman in Water award for Environmental Education and was a runner up for the Woman in Water prize for Water Research.

Professional Qualifications:

1984 Matriculation Lawson Brown High School
1987 B.Sc. – Mathematics, Applied Mathematics University of Port Elizabeth
1989 B.Sc. (Hons) – Oceanography University of Port Elizabeth
1998 M.Sc. – Environmental Management (cum laude) Potchefstroom University

Key Skills: Areas of specialisation: Aquatic ecosystem assessments, Monitoring and evaluation of water resources, Water resource legislation and authorisations, River classification and Resource Quality Objectives, River Reserve determination and implementation, Water Quality Assessments, Biomonitoring, River and Wetland Rehabilitation Plans, Catchment management, River maintenance management, Water education.

Summary of Experience:

1987 – 1988	Part-time field researcher, Department of Oceanography, University of Port Elizabeth
1989 – 1990	Mathematics tutor and administrator, Master Maths, Randburg and Braamfontein Colleges, Johannesburg
1991 – 1995	Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria
1995 – 1999	Hydrologist and Assistant Director, Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria
1999 – 2007	Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town
2007 – 2012	Self-employed – Aquatic Specialist
2013 – 2020	Senior Aquatic Specialist and part-owner, BlueScience
2020 – present	Self-employed– Aquatic Specialist

1.2. DECLARATION OF INDEPENDENCE

I, A**ntonia Belcher,** as the appointed specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
  - ~~am not independent, but another specialist that meets the general requirements set out in Regulation 13 of GN No. 326 have been appointed to review my work (Note: a declaration by the review specialist must be submitted);~~
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the Applicant, the Department and registered interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;
- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the NEMA EIA Regulations, 2014 (as amended).

Date: 8 June 2023

Name of company: -

Signature of the specialists: 

2. INTRODUCTION

2.1. SCOPE OF STUDY

This analysis report is an aquatic ecosystem constraints assessment into the proposed solar farms and associated infrastructure on a group of three properties collectively referred to as the Ndau Solar Farms. The site lies between the town of Mokopane, and the city of Polokwane and falls within the jurisdiction of the Polekwane Local Municipality within the greater Capricorn District Municipality in the Limpopo Province. The assessment is based on a desktop analysis of existing data and mapping available for the area that was originally undertaken by Flori Scientific Services as well as a site visit and field assessment undertaken in January 2023.

The Ndau project comprises the following three facilities: **Ndau Solar Energy Facility 1** and associated infrastructure; Ndau Solar Energy Facility 2 and associated infrastructure; and Ndau Battery Energy Facility and associated infrastructure. Each facility will require a stand-alone Environmental Authorisation (EA), with a separate application and Scoping and Environmental Impact Assessment process. The total extent of the Ndau site is approximately 633.17 ha. The area lies in the Sand River Sub-Catchment of the Limpopo River. Details of the watercourses in the study area are provided in the table below.

Table 1. Water resource information related to the site assessed.

Descriptor	Name / Details	Notes
Water Management Area	Limpopo	
Catchment Area	Leeuspruit Tributary of the Sand River	Limpopo River
Quaternary Catchment	A71A	
Present Ecological State	Sand River: D category (largely modified)	DWA 2012 (Appendix A)
Ecological Importance and Ecological Sensitivity	High Importance and Moderate Sensitivity	

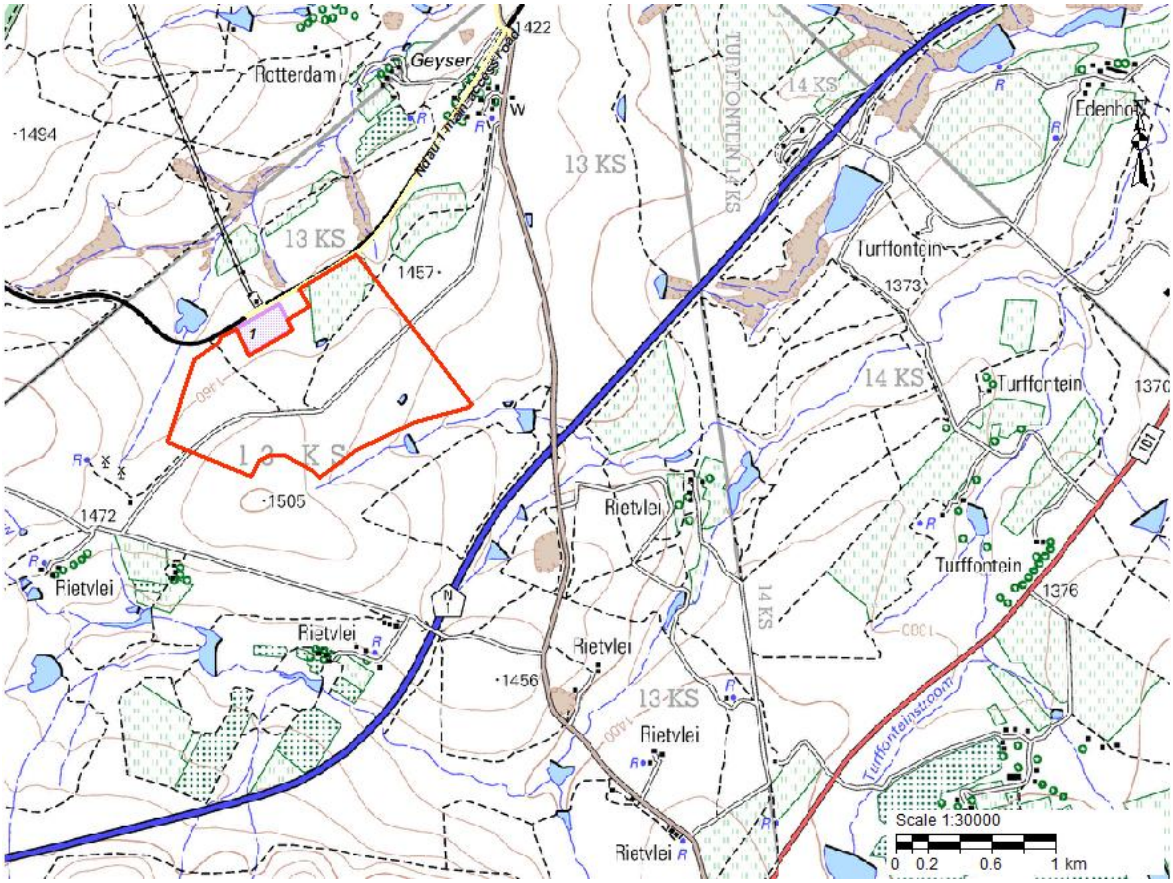

Figure 1. A topographical map of the study area indicating the locality of the site (red polygon)

ABO Ndau Solar Energy Facility 1 (Pty) Ltd proposes the development of Ndau 1, a photovoltaic (PV) solar energy generation facility, of up to 120MWac in capacity, and associated infrastructure located on Portion 19 of the Farm Rietvley No. 13, 27 km south-west of Polokwane. The proposed development area has been defined in a manner which has considered the environmental sensitivities present on the affected property and which intentionally remains beyond highly sensitive areas.

The proposed facility would comprise the following:

- Solar Field/Solar Arrays (up to approximately 3.5m in height);
- Internal access roads (existing farm roads would be used where possible, the maximum road width would be up to approximately 10m);
- A main access road (width of up to approximately 10m): The proposed facility would be accessed from the north via an existing unnamed road.
- Internal electrical reticulation (low- and medium voltage lines) to be placed underground where feasible;
- An on-site substation hub and associated infrastructure (substation, transformation infrastructure, collector infrastructure, step-up infrastructure, battery energy storage system etc.) including auxiliary buildings (such as operation & maintenance buildings, admin buildings, workshops, gatehouse, security building, offices, visitor centre, warehouses, etc.) contained within up to approximately a 5 ha footprint; and
- Perimeter fencing.

A temporary laydown area would be established during the construction period but would be within the development footprint i.e., within the fenced area allocated for development. The laydown area would move as required while construction is underway.

Application for grid connection will be made through a separate process and assessed accordingly. An on-site grid connection to integrate into the national network via a 132 kV or 275 kV line is under consideration.

Water would be required for sanitation by operational staff, for washing solar panels and for dust control on internal roads (where necessary). Water would preferably be sourced from the local municipality in terms of a Service Level Agreement established between the Municipality and the facility. If this is not possible, then other options for water supply will be investigated. Where required, a storage tank (i.e., Jo-Jo tank) of up to approximately 10,000L may be used on site for temporary water storage.

Sanitation requirements would be minimal, given that there would only be a small staff complement during the operations of the facility. Sanitation for auxiliary buildings would be connected to the existing municipal sewage system. If the Municipality does not approve, or have the capacity for such a connection, sewage would be stored in a conservancy tank and collected either by a honey-sucker truck or by a service provider for treatment at a licensed disposal site. Alternatively, a standalone system would be used (i.e., porta-loos) which would be regularly serviced by an independent contractor. Note that it is **not** intended to make use of soakaways or on-site treatment solutions.

Refuse/solid waste produced on site would also be minimal (approximately two wheelie bins per week are anticipated) and would ideally be removed by the Municipality, however, if this is not possible, the facility would employ private contractors to remove the refuse and dispose of it appropriately.

There are no specific stormwater and/or landscaping initiatives proposed as part of the proposed solar facility at this stage, but any interventions prescribed by the relevant specialist/s through the environmental impact assessment process would be implemented.

Water and sanitation requirements during the construction phase will be the primary responsibility of the appointed Contractor. It would be preferable for water to be sourced from the local Municipality, if available, with alternative arrangements to be made where required (for example transporting water to site with trucks).

Solid waste produced during the construction phase would be managed in accordance with the specifications of the site-specific Environmental Management Programme (EMPr).

Alternatives:

The proposed development as described above has been assessed with the following alternatives:

1) Technology: With regard to the proposed BESS, the technology thereof is dynamic and so the specific type/technology to be developed would be selected based on market demands and technology available at the time of construction. Therefore, both Lithium-ion and redox-flow are assessed as technology alternatives, with Lithium-ion being the current preferred technology.

2.2. TERMS OF REFERENCE

It is requested that the Specialist undertake the following:

Aquatic and Wetland Delineation Sensitivity Verification and Impact Assessment: This report includes the findings of the above as well as the outcomes of a site visit and field verification exercise to revise the initial mapping and provide interpretation of the aquatic ecosystem sensitivity,

- Site Visit;
- Site Sensitivity Verification Report (one per cluster);
    - The DFFE Environmental Screening Report outcomes need to be confirmed/disputed as part of the Site Sensitivity Verification.
- Updated Sensitivity mapping;
- Sensitivity shapefiles and KMZ files; and
- Draft Impact Assessment Reports.

The Specialist is required to undertake a site visit for the buildable areas of the solar plants and associated connection to verify the findings of the Environmental Screening Report and provide a sensitivity report with maps and shapefiles based on the findings, to identify a development footprint. It is also desired that both potential grid connection corridors at each site be assessed with desktop-level data. This will then be followed by the Impact Assessment Reports once the exact sites have been confirmed. The S&EIR at this point will only cover the PV facilities and BESS – the only grid connections that will be included are potential on-site and/or Loop-in Loop-out (LiLo) solutions.

2.3. METHODOLOGY AND LIMITATIONS OF THE STUDY

Input into this report was informed by a desktop assessment for the study area as well as field verification that was undertaken on 17 January 2023. The timing of the site visit was deemed suitable for the assessment as the area has summer rainfall and had recently received rain that assisted with the delineation and assessment of aquatic features.

The 1 in 50000 topographical rivers cover was used as a basis and refined based on knowledge of the aquatic features in the area as well as Satellite imagery. The SANBI Biodiversity GIS, Cape Farm Mapper and Freshwater Biodiversity Information System websites were consulted to identify any constraints in terms of features of aquatic biodiversity conservation importance within the area. This information/data was used to inform the resource protection-related recommendations.

2.4. USE OF THIS REPORT

This report reflects the professional judgment of its author. The full and unedited content of this should be presented to the regulatory authority. Any summary of these findings should only be produced in consultation with the author.

3. DESCRIPTION OF THE STUDY AREA

3.1. GENERAL OVERVIEW

The proposed project comprises Ndau 1 which is located on Portion 19 of the farm Rietvley No 13. The study area is in the Plateau Bushveld of the Savanna Biome. The topography comprises low hills with eroded valleys that form the upper reaches of the Leeuspruit River, a tributary of the Sand River (Figure 4). Drainage is predominately northeast. The Leeuspruit River rises on the low hills within and immediately to the southwest of the sites and flows in the north-easterly direction and then eastwards to join the Sand River approximately 7 km east of the study sites. The Sand River passes approximately 2km to the southeast of the study area.

The area normally receives about 536mm of rain per year, mostly during summer. On average, it receives no rainfall for the months of May/June to August/September and the highest rainfall (92mm) occurs in January (Figure 2). As a result of the very low rainfall in winter, the smaller rivers near the sites are highly seasonal, only flowing in the summer months.

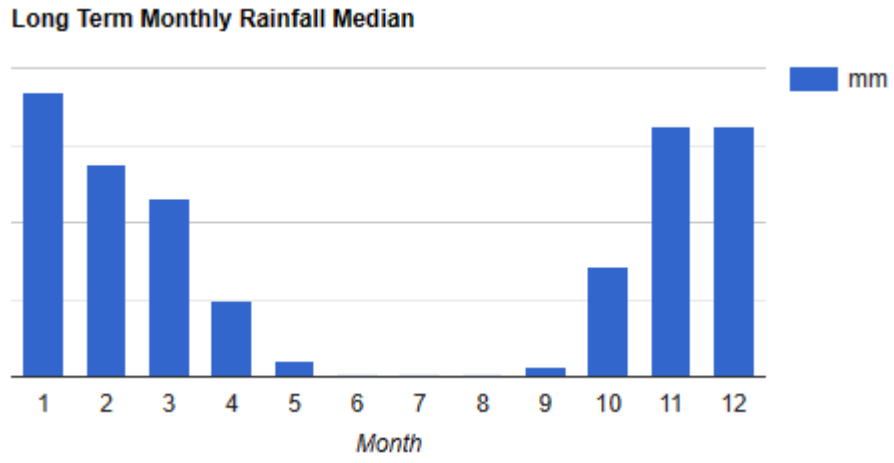

Figure 2. Average monthly rainfall for the area (SA Atlas of Climatology and Agrohydrology, R.E. Schulze, 2009 – obtained from CapeFarmMapper, 2023)

As mentioned, the area lies in a strategic water source area for groundwater, the Upper Sand (Polokwane) Aquifer which covers a large area of about 96.5 km^2 in the upper Sand River Catchment. A major intergranular and fractured aquifer occurs within the area, with the water table typically occurring at depths of about 18 m below ground level with a yield of more than 5 liters a second. The surface and groundwater quality are good, with natural electrical conductivity concentrations of less than 70 mS/m. The recharge of the aquifer is estimated to be about 20.7 mm/a. The aquifer has a medium susceptibility and vulnerability to contamination.

The geology of the area comprises light to dark grey migmatitic tonalite, trondhjemite, granodiorite, monzodiorite, leucogneiss of the Goudplaats-Hout River Gneiss Suite. The associated soils tend to be freely drained, structureless soils of the Glenrosa and Mispah forms.

The natural vegetation of the study area is mapped as comprising Polokwane Plateau Bushveld vegetation (Least Concern) of the Central Bushveld Bioregion. This vegetation comprises a short open tree layer with a well-developed grass layer. Typical indigenous plants occurring within the site and surrounding area includes silky acacia *Vachellia rehmanniana*, sweet thorn *Vachellia karroo*, weeping boerbean *Schotia brachypetala*, buffalo-thorn *Ziziphus mucronata*, wild pear *Dombeya rotundifolia*, African elm *Celtis africana*, marula *Sclerocarya birrea ssp. Caffra*, bushwillow *Combretum molle*, wild currant *Searsia pyroides var. pyroides*, African sumac *Searsia lancea*, gwarrie *Euclea undulata*, wild cotton *Asclepia fruticosa*, num-num *Carissa bispinosa*, kangaroo grass *Themeda triandra,* curly leaf grass *Eragrostis rigidior*, and Natal grass *Melinis repens.* Instream aquatic vegetation includes bulrush *Typha capensis, Cyperus digitatus,* matjiesgoed *Cyperus sexangularis, Kyllinga melanosperma, Schoenoplectus muricinux*, and pennywart *Centella asiatica*.

Invasive alien species occurring are *Eucalyptus* spp., Indian Fig Opuntia *Opuntia ficus-indica*, torch cactus *Echinopsis spochiana*, lantana *Lantana camara*, Spanish reed *Arundo donax*, syringa *Melia azedarach*, thistle *Cirsium sp.,* and pompom weed *Campuloclinium macrocephalum.*

The typical land cover of the area comprises a mix of natural bushveld and cleared grassland used for livestock grazing. The town of Polekwane lies approximately 25 km to the northeast and Mokopane lies approximately 24km to the southwest. The formally protected areas mapping. Percy Fyfe Nature Reserve occurs about 2 km to the northwest of the site.

Several amphibian species such as Boulenger sand frog *Topopterna cryptotis*, African red toad *Schismaderma carens*, guttural tad *Sclerophys gutturalis* have been recorded in the wider area. The only amphibian species of conservation concern that occurs in the area is the Giant Bullfrog (Near Threatened), which breeds in ephemeral pans and farm dams and has been recorded in the larger Sand River, to the east of the site.

3.2. CONSERVATION VALUE OF AQUATIC FEATURES

Three sets of conservation mapping at a national, provincial and local scale are of relevance to the identification of aquatic features of ecological and biodiversity conservation importance. These are the 2011 National Freshwater Ecosystem Priority Areas (FEPA) map, the 2018 National Wetland Map (version 5), and the 2018 provincial Limpopo Province Map of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs).

FEPAs are intended to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting the sustainable use of water resources. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries. The river and wetland FEPAs are required to be maintained in a largely natural ecological state, while Fish Support Areas should not be allowed to degrade from their existing ecological condition. In terms of FEPA mapped within the study area, the sites lie within an Upper sub-catchment to FEPA River Sub-catchment. The site contains artificial FEPA wetlands that are associated with dams (Figure 5). These have low aquatic ecosystem significance but may provide aquatic habitat for biota, such as the giant bullfrog mentioned above. Figure 6 shows the National Wetland Map version 5 for the area together with the FEPA Wetlands. There are no wetlands mapped within the sites for this map layer.

In the 2018 Limpopo Critical Biodiversity Areas mapping (Figure 7), the site is mapped as an ESA where it would be important to maintain ecological services in support of the adjacent CBA area. It would be important to maintain the river corridors and ensure no downstream impacts on the large Sand River system.

3.3. AQUATIC BIODIVERSITY SENSITIVITY MAPPING

In terms of the DFFE Screening Tool, the study site lies mostly within an area considered Very High Aquatic Combined Biodiversity Sensitivity (Figure 3). The site is located within a Strategic Water Source area for groundwater (Upper Sand (Polokwane) Aquifer System) that covers the upper Sand River Catchment however the proposed project is unlikely to impact the resource. As mentioned in Section 3.2 above, there are no Aquatic CBAs (only a terrestrial CBA) or FEPA River Sub catchments within the study area.

The site contains some artificial FEPA wetlands that are associated with dams. The wider area is also mapped as an ESA where it would be important to maintain ecological services in support of the adjacent CBA area which includes the formally protected Percy Fyfe Nature Reserve near the sites. The sub-catchment is also mapped as an Upper Catchment, where it is important to manage the water resource to not impact the downstream (Sand River) FEPA catchment.

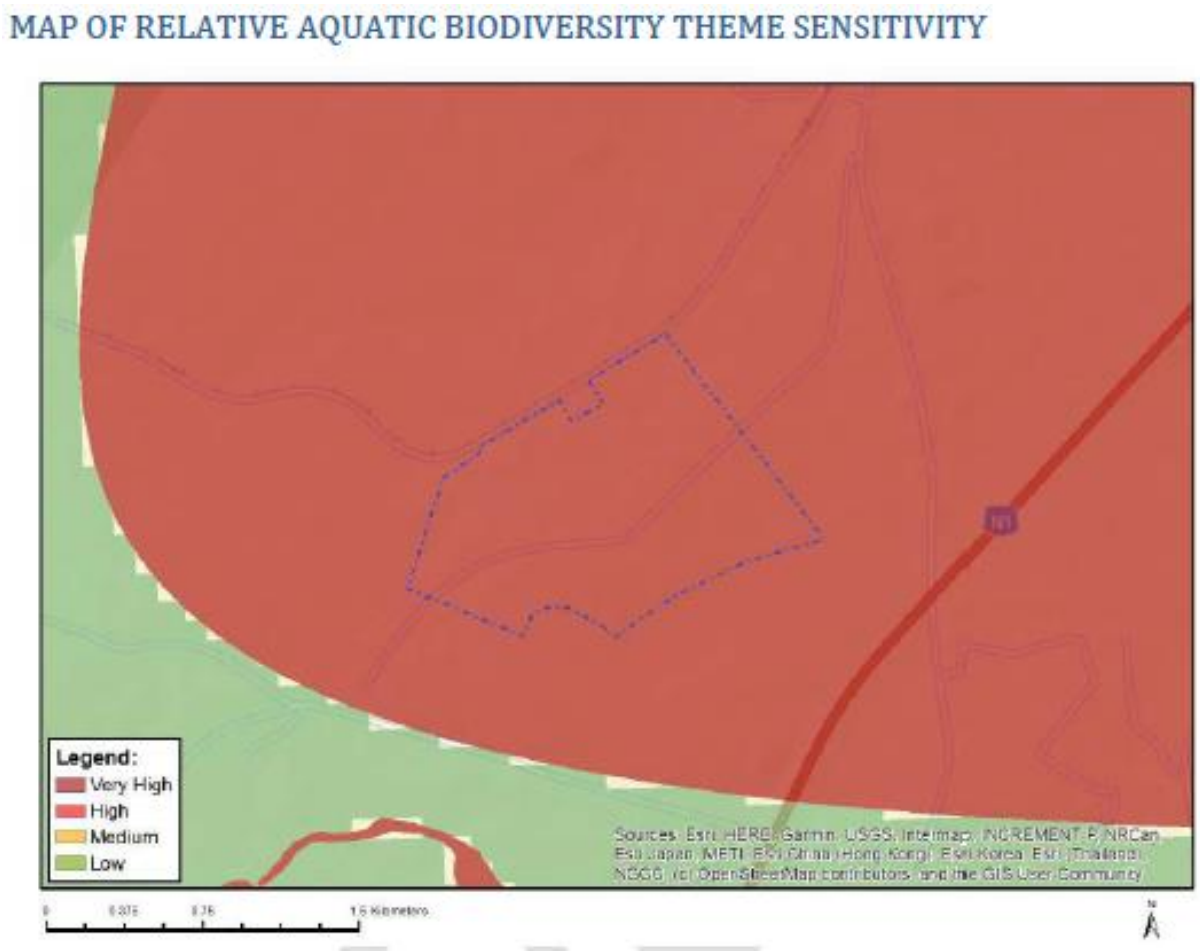

Figure 3. DFFE Screening Map for the area in terms of Aquatic Biodiversity Combined Sensitivity

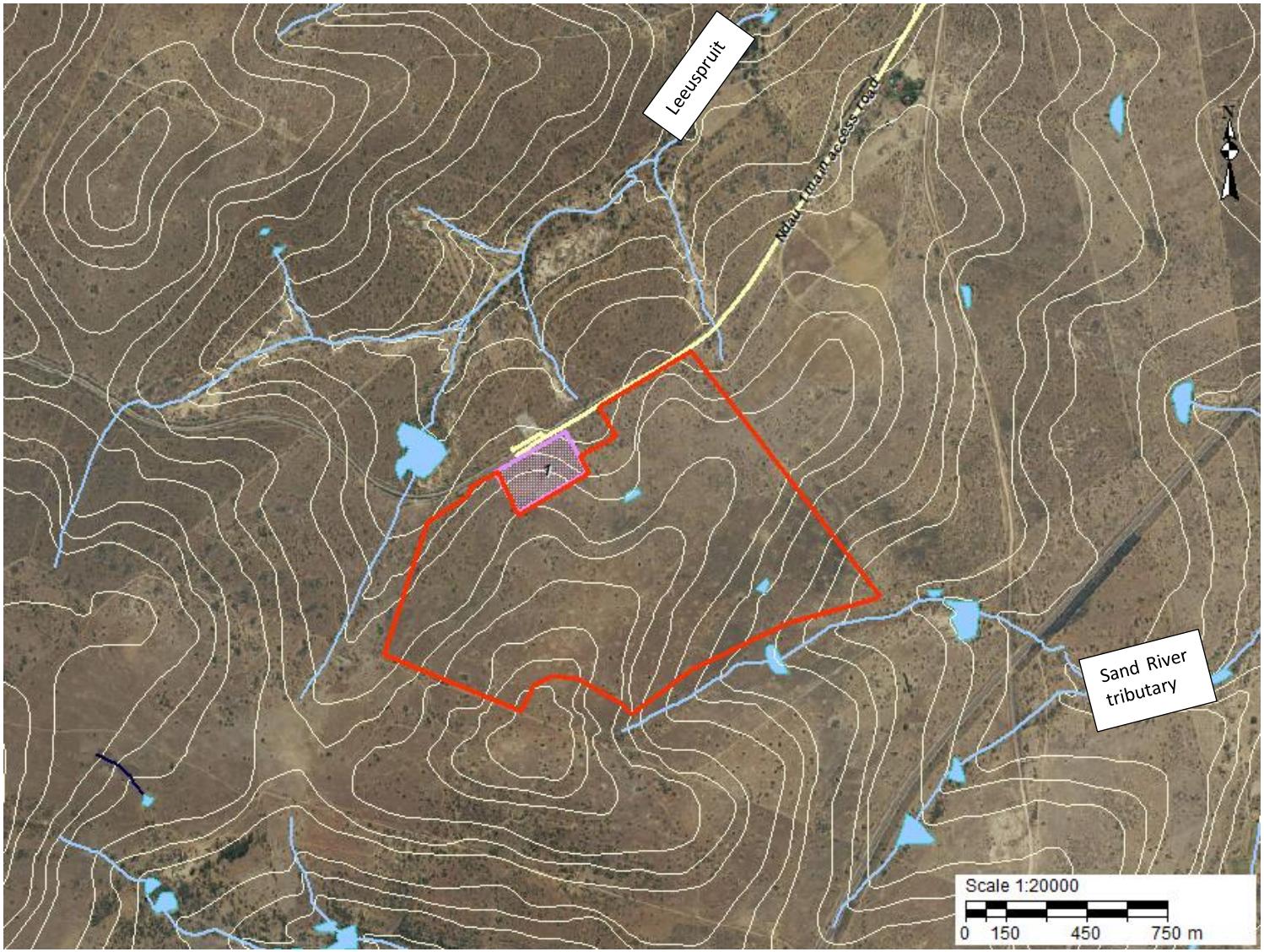

Figure 4. Rivers map for study site (red polygon represents the study boundaries) overlaid on a 2018 Orthophotograph of the area

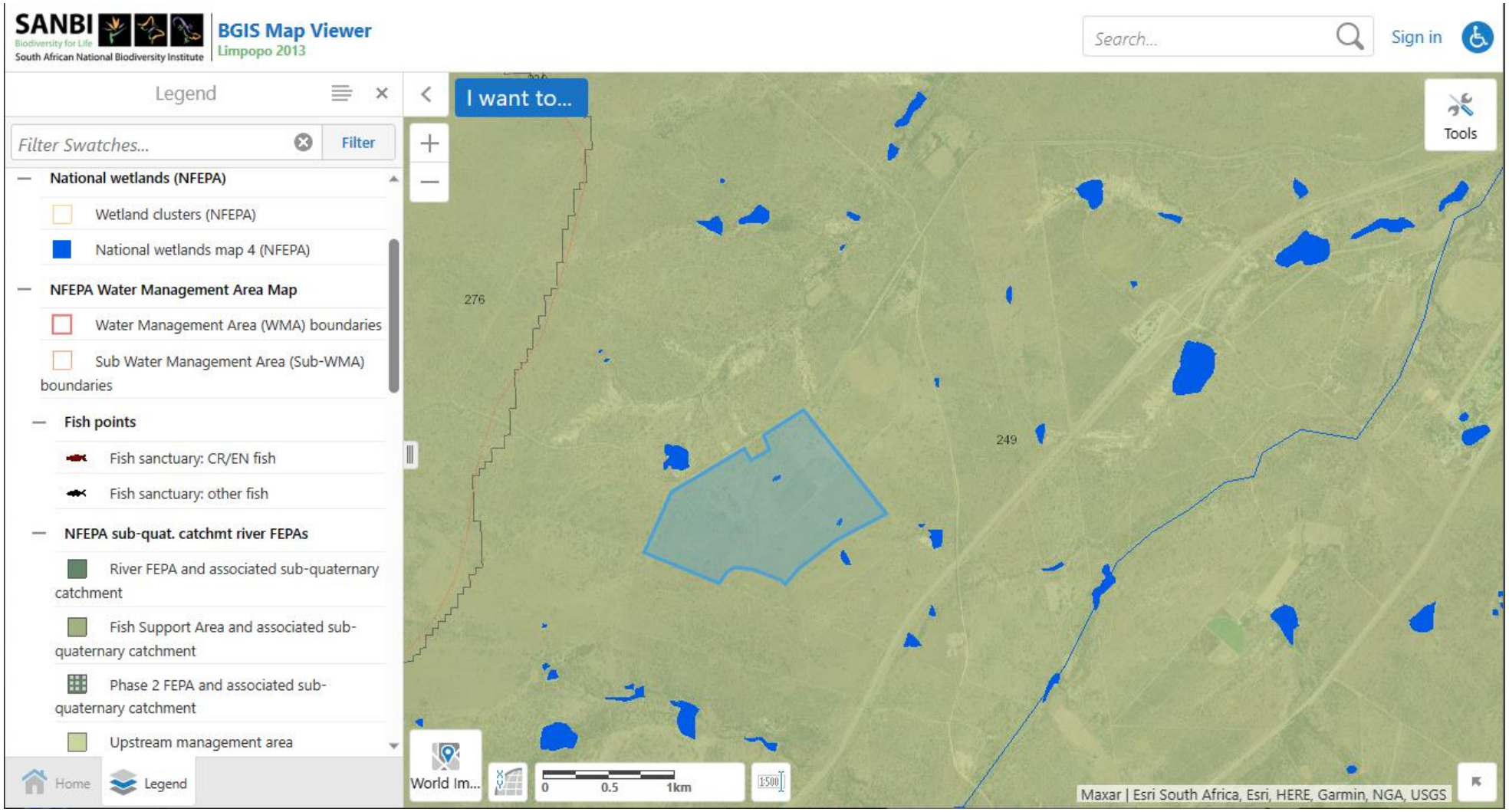

Figure 5. National Freshwater Ecosystem Priority Areas for the study site (SANBI Biodiversity GIS, 2023)

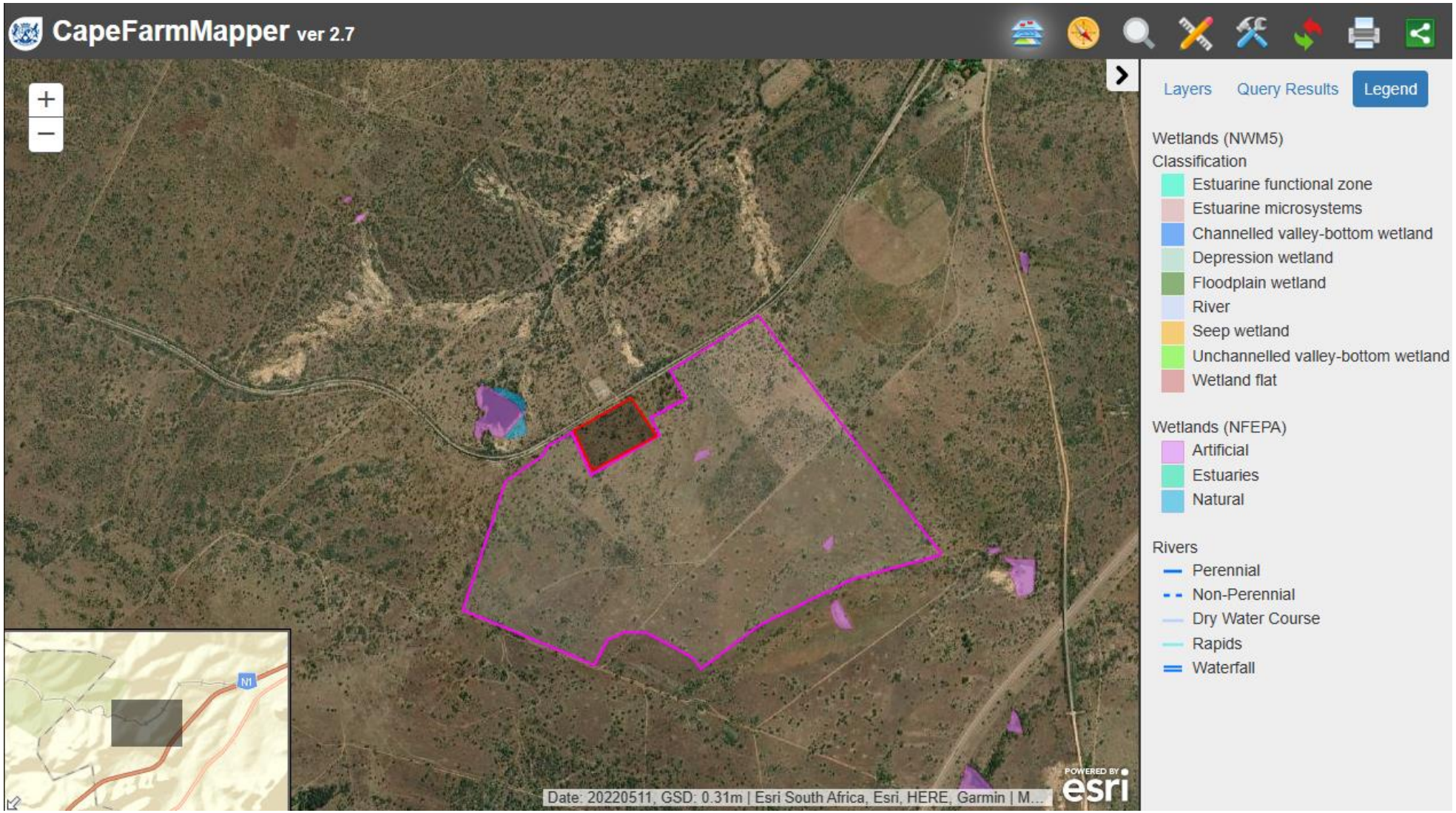

Figure 6. National Wetland map and National Freshwater Ecosystem Priority Areas map for the study site, where the red polygon indicates the study boundaries (CapeFarmMapper, 2023)

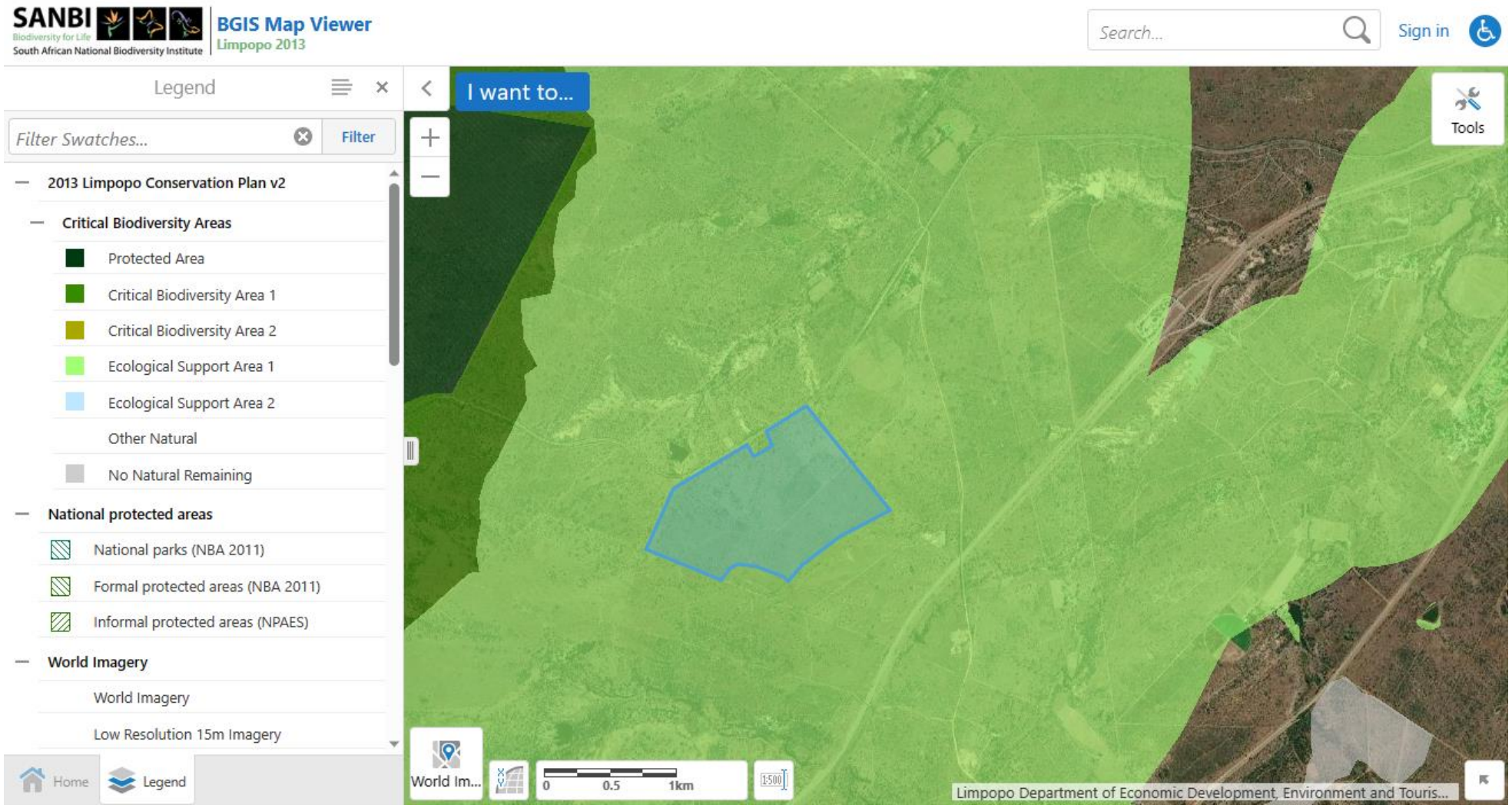

Figure 7. Limpopo Critical Biodiversity Areas map for the study site, where the red polygon indicates the study boundaries (SANBI Biodiversity GIS, 2023)

4. SITE VERIFICATION OUTCOMES

The initial desktop screening assessment undertaken by Flori Scientific Services in August 2022 indicated that the Bloed River, Sand River and a few small seasonal streams/drainage lines are present on the site, but the project will have no impact on these. No distinctive or large wetlands were deemed to be present. Figure 8 shows the aquatic constraints map resulting from the desktop assessment. The entire site was however indicated to be of very high sensitivity but requiring further investigation.

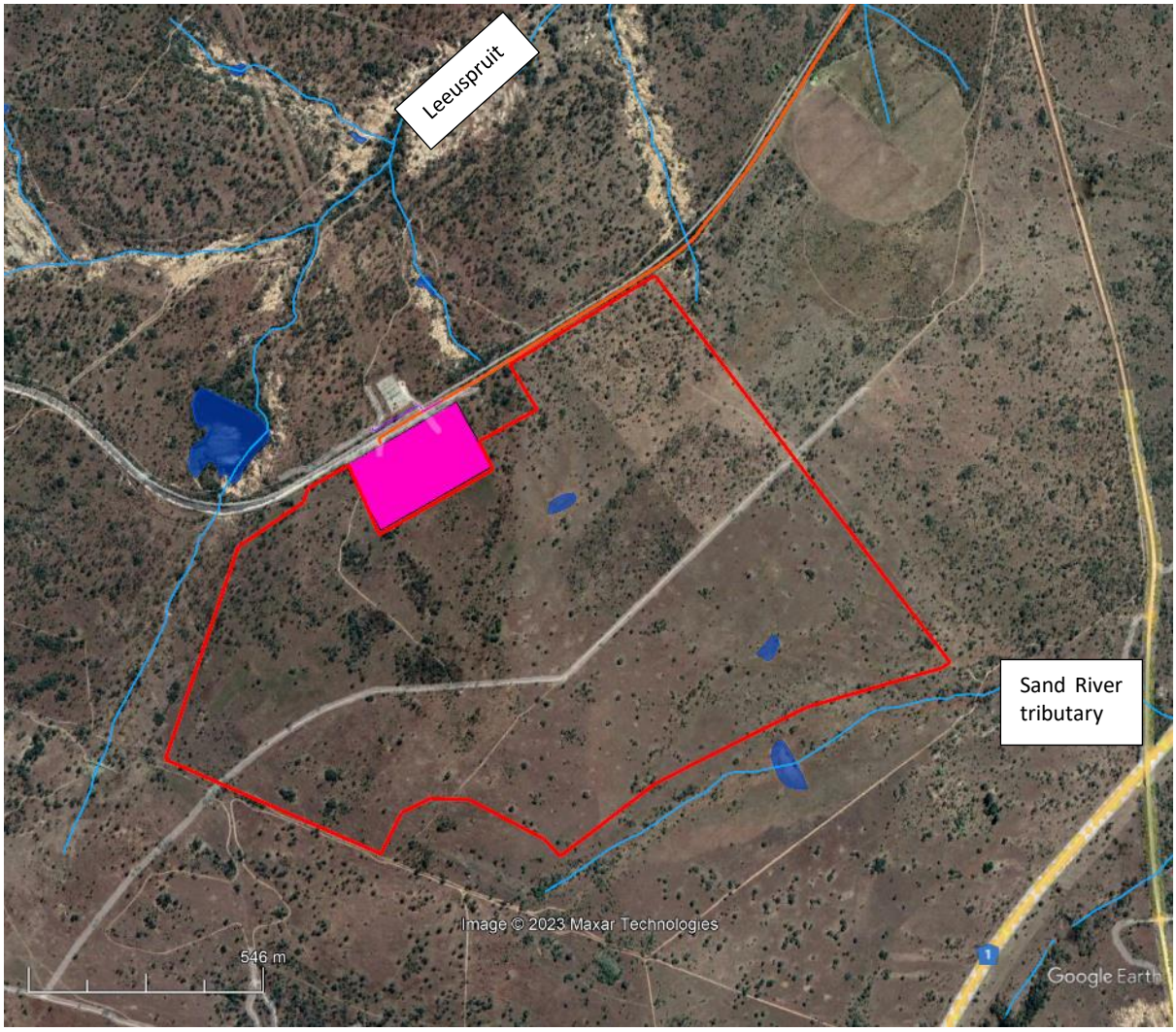

Figure 8. Google Earth image showing aquatic constraints mapped in the desktop assessment of the site with the yellow area indicating the potential wet area.

Past imagery of the site from 1948 and again in 2003 (Figure 9 indicates that the site was already significantly modified in 1948, and the watercourses already severely eroded. The later image shows less disturbance of cover vegetation has taken place in recent years with cultivation being focused on the southern bank of the larger watercourse. There had been a significant increase in the dams that have been created along the watercourses - In 1948 there appear to have been no dams but by 2003 all of the dams within the site appear to have been constructed-.

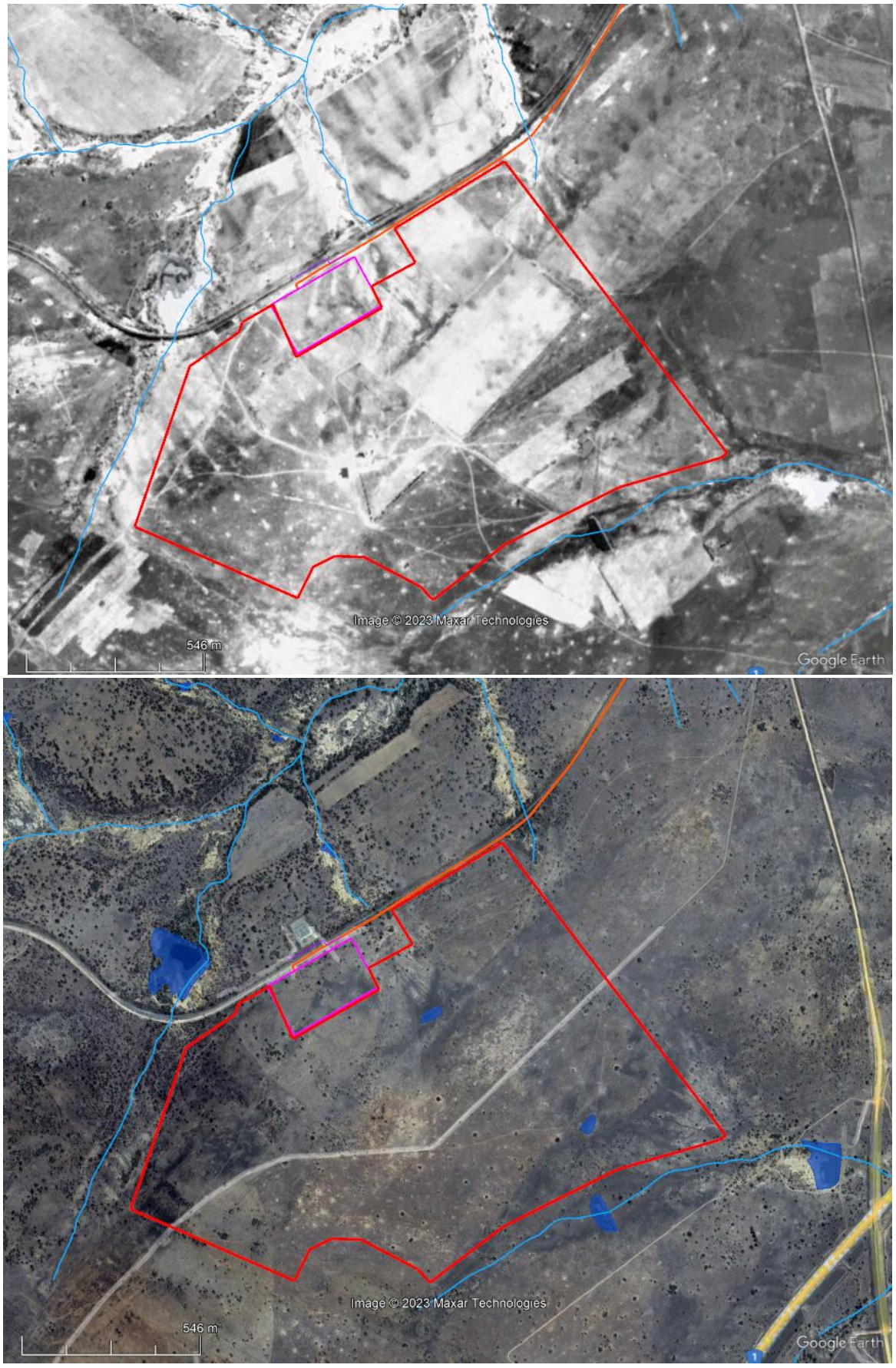

Figure 9. Aerial image of the sites taken in 1948 (top) and a more recent Google Earth image from November 2003 (bottom) with the small drainage feature and wet area mapped

Site verification of the aquatic features detemined the watercourses to be seasonal streams that have been signifcantly modified by the deep erosion that has taken place within the watercourse channels, as well as flow modification associated with the number of instream dams. In general, the eroded watercourse channels have resulted in the loss of the indigenous riparian vegetation, where in some places it has been replaced with alien plants. The watercourses as a result are in a moderately to largely modified condition instream and seriously modified in their riparian zones. While the smaller watercourses draining the valley sites are of low ecological importance, they are sensitive to disturbance and within the steeper slopes very sensitive to erosion which can impact on the aquatic ecological integrity of the watercourses as well as larger river system.

The larger streams on the valley floor are deemed to be of moderate importance. Although they may not provide valuable habitat for biota they do provide important corridors for the movement of biota, especially given that they connect the more important Sand River with higher-lying areas such as that within the Percy Fyfe Nature Reserve. These larger watercourses are also particularly sensitive to disturbance and changes to flow as well as erosion on the steeper slopes. As has been described for the smaller watercourses above, this can have quite a significant impact on the ecological integrity of the large aquatic ecosystems.

An image of the watercourse near the site is provided below. The constraints mapping is included in the following section.

Figure 10. View of the larger main channel of the Leeuspruit River that drains north of the site

5. AQUATIC CONSTRAINTS MAPPING AND AQUATIC SENSITIVITY

The aquatic constraints and sensitivity mapping are shown in Figures 11 and 12. The aquatic features of significance that are recommended to be avoided comprise the upper Leeuspruit River and its smaller tributaries. Given the highly erosive character of the soils adjacent to the watercourses, it is advised that no activities take place on the steeper slopes of the sites. It is also important that stormwater management of the site ensures no concentration of flows that can result in further erosion of the watercourses. It is recommended

that a variable buffer or setback area be provided for in the proposed layout for this site as indicated in the Google Earth image below.

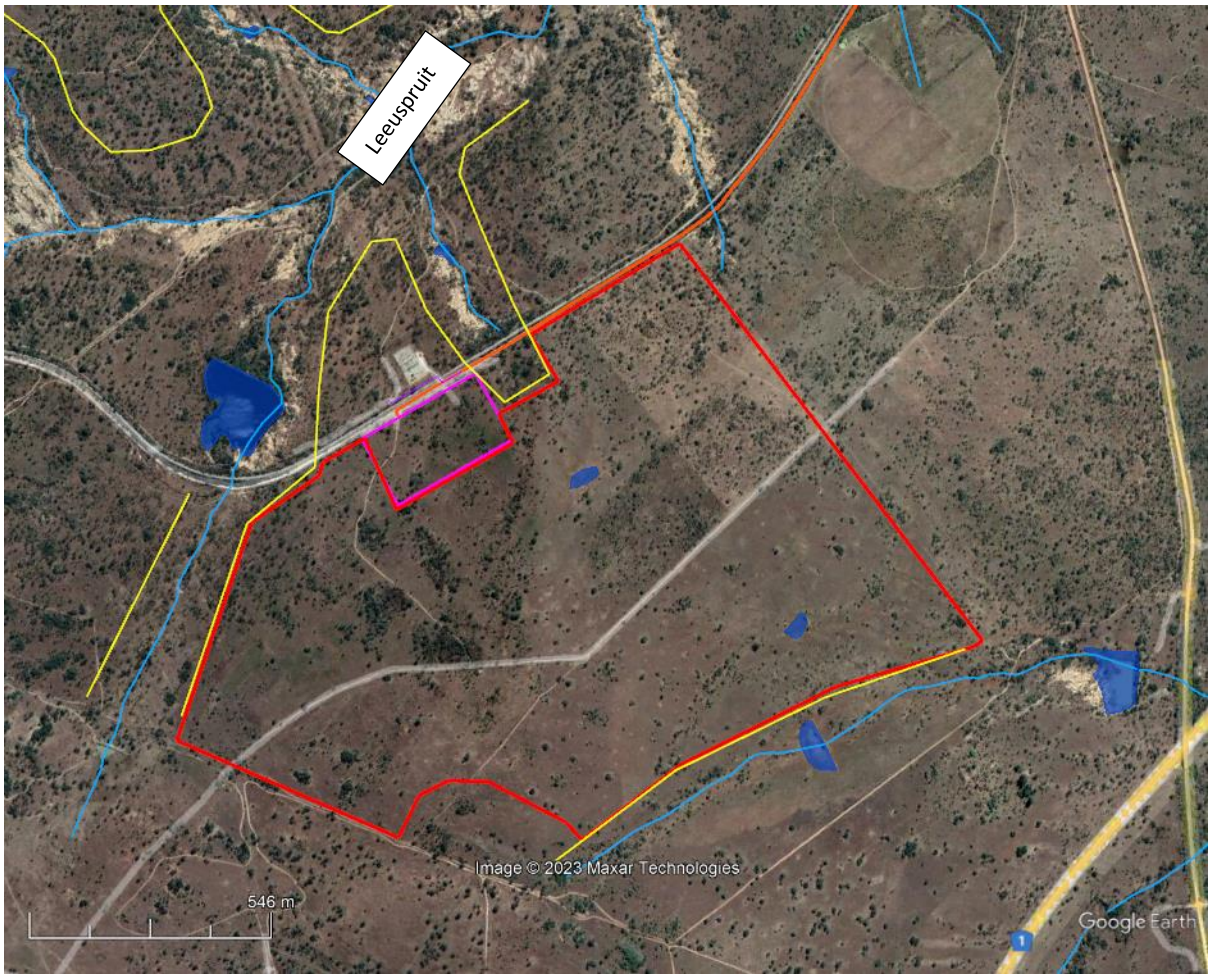

Figure 11. Google Earth image with the aquatic constraints and recommended buffer/development setback lines (yellow lines) shown.

Most of the potential aquatic ecosystem impacts of the proposed solar farms are likely to take place during the construction phase. The potential aquatic ecosystem impacts of the proposed activities during construction include:

- Disturbance and possibly loss of terrestrial habitat adjacent to the watercourses with an increased risk to the already highly eroded streams;
- The removal of indigenous vegetation that has the potential to result in further alien vegetation infestation within the aquatic features;
- Demand for water for construction could place stress on the existing available water resources – the area is a strategic water source area of groundwater;
- Facilities and roads, if not adequately designed, could increase the erosion potential at the site; and
- Increased sedimentation and risks of contamination of surface water runoff during construction.

During the operational phase for all the proposed works, the potential impacts would include:

- Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the infrastructure that needs to be maintained;
- Modified runoff characteristics from hardened surfaces that have the potential to result in erosion or sedimentation of the watercourses; and
- Possible increase in water consumption and potential for water quality impacts (such as contamination from sewage generated on-site) as a result of the operation of the site.

During the decommissioning phase, the potential impacts would largely be associated with an increased disturbance of aquatic habitat due to the increased activity on the site. Increased sedimentation and risks of contamination of surface water runoff may also occur.

By implementing suitable buffers as indicated in Figure 12 adjacent to the watercourses and minimising the disturbance within the watercourse corridors, the impact of the proposed project activities would be low and unlikely to impact the integrity of the aquatic ecosystems. The recommended buffers are deemed adequate, irrespective of the proposed infrastructure. It is however highly recommended that there also be an attempt to reduce the erosion potential at the site through some reshaping and rehabilitation of the watercourse corridors by revegetating with suitable indigenous vegetation and removal of invasive alien species.

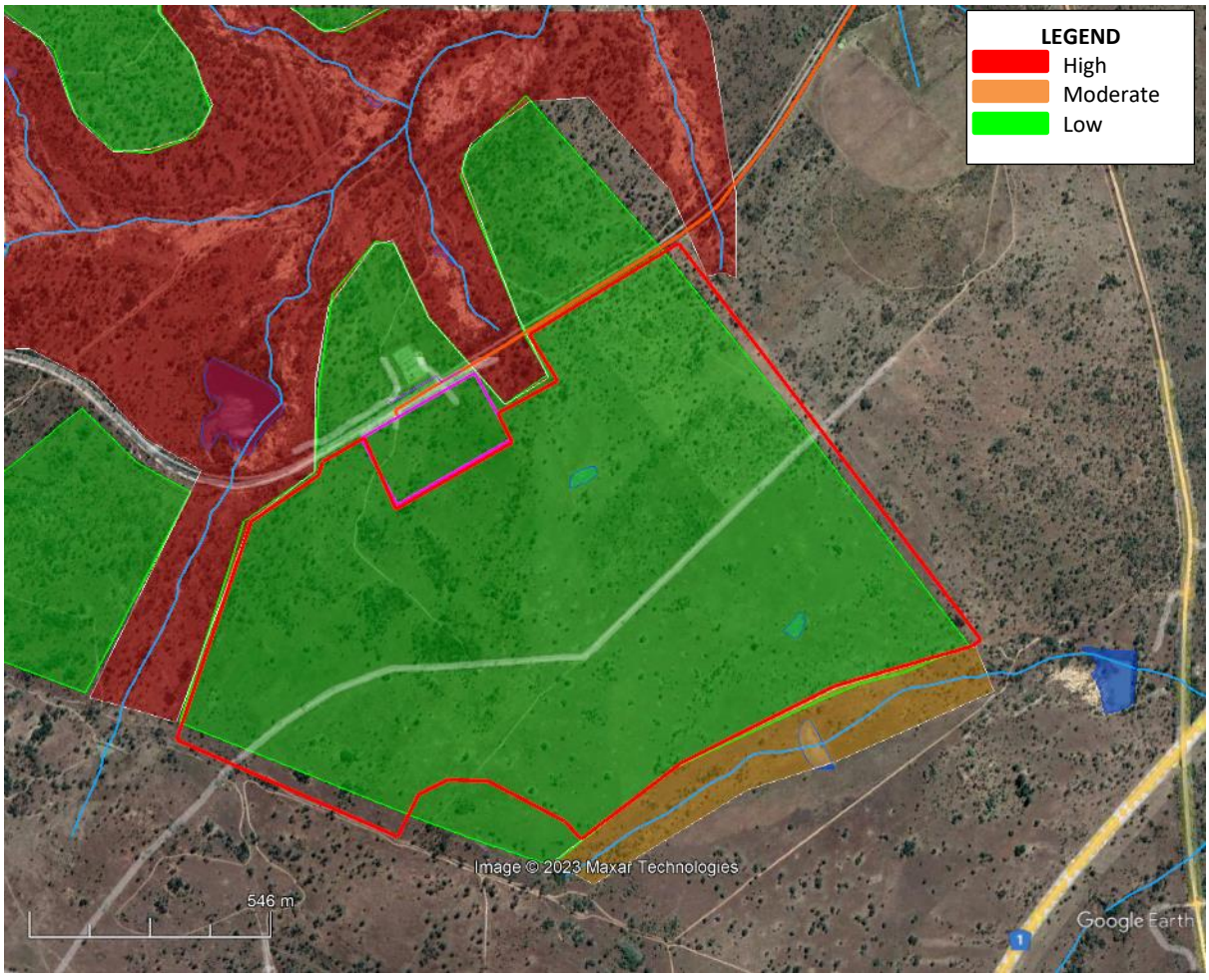

Figure 12. Mapped sensitivity of aquatic features within the project area, shown in Google Earth.